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04

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

NOTICE TO BIDDERS

AND

SPECIAL PROVISIONS

FOR BUILDING CONSTRUCTION ADJACENT TO ALAMEDA COUNTY AT THE SAN FRANCISCO - OAKLAND BAY BRIDGE MAINTENANCE YARD

In District 04 On Route 80

Under

Bid book dated November 13, 2012	**Standard Specifications dated 2006**
Project Plans approved October 22, 2012	**Standard Plans dated 2006**

Identified by

Contract No. 04-014084

04-Ala-80-2.2

Project ID 0412000666

Electronic Advertising Contract

Bids open Wednesday, December 19, 2012 OSD

Dated November 13, 2012 IH

****

SPECIAL NOTICES

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- Effective July 6, 2010, the Department will receive bids for projects in Districts 1 through 6, 9, and 10 at 1727 30th Street, Bidders' Exchange, MS 26, Sacramento, CA 95816. Refer to the Notice to Bidders for this project's bid opening date, time, and location.

- Refer to Section 8-1.07, "Liquidated Damages," of the Amendments to the Standard Specifications for your project-specific liquidated damages based on your total bid.

- The Department has changed its DVBE requirements. Refer to section titled "Disabled Veteran Business Enterprises" in Section 2, "Bidding," of these special provisions.

- The Department is providing an electronic Information Handout for this project. Refer to Section 2-1.03B, "Supplemental Project Information," in the Amendments to the Standard Specifications for the location of this information.

- See Section 2, "Bidding," of these special provisions regarding a mandatory prebid meeting.

- The contract award period has been extended for this project.

- The Department is allowing contractors to submit electronic payroll records to the District Labor Compliance Office. Refer to section titled "Electronic Submission of Payroll Records" under Section 5, "General," of these special provisions.

- Attention is directed to Section 4, "Beginning of Work, Time of Completion and Liquidated Damages," of the special provisions regarding special requirements for beginning of work and revised definition of "working day."

CONTRACT NO. 04-014084

The special provisions contained herein have been prepared by or under the direction of the following Registered Persons.

MECHANICAL

Solomon Wong 8/6/12
REGISTERED MECHANICAL ENGINEER

MECHANICAL

Chris Faria 8/7/12
REGISTERED MECHANICAL ENGINEER

WASTEWATER

Jerome R. Marcotte 8/6/12
REGISTERED CIVIL ENGINEER

CONTRACT NO. 04-014084

The special provisions contained herein have been prepared by or under the direction of the following Registered Persons.

ARCHITECT

8/6/12

LICENSED ARCHITECT

STRUCTURES

8/6/12

REGISTERED CIVIL ENGINEER

ELECTRICAL

Christine H. Mamaril 8/6/12

REGISTERED ELECTRICAL ENGINEER

MECHANICAL

8/6/12

REGISTERED MECHANICAL ENGINEER

CONTRACT NO. 04-014084

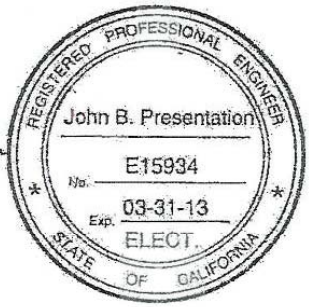
The special provisions contained herein have been prepared by or under the direction of the following Registered Persons.

LANDSCAPE

LICENSED LANDSCAPE ARCHITECT

ELECTRICAL

REGISTERED ELECTRICAL ENGINEER



MATERIALS

REGISTERED CIVIL ENGINEER

STRUCTURES

11/2/2012
REGISTERED CIVIL ENGINEER

CONTRACT NO. 04-014084

The special provisions contained herein have been prepared by or under the direction of the following Registered Persons.

HIGHWAY

REGISTERED CIVIL ENGINEER

ENVIRONMENTAL (Hazardous Material)

Charles D Smith 9-18 12

REGISTERED CIVIL ENGINEER

GEOTECHNICAL

M. Momenjadeh

REGISTERED GEOTECHNICAL ENGINEER

WATER POLLUTION CONTROL

REGISTERED CIVIL ENGINEER

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STANDARD PLANS LIST

The Standard Plan sheets applicable to this contract include, but are not limited to those indicated below. Applicable Revised Standard Plans (RSPs) and New Standard Plans (NSPs) indicated below are included in the project plans as Standard Plan sheets.

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A10B	Acronyms and Abbreviations (Sheet 2 of 2)
A10C	Symbols (Sheet 1 of 2)
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RSP A24A	Pavement Markings – Arrows
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RSP T1B	Temporary Crash Cushion, Sand Filled (Bidirectional)
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ES-13B	Electrical Systems (Wiring Details and Fuse Ratings)

CANCELED STANDARD PLANS LIST

The Standard Plan sheets listed below are canceled and not applicable to this contract.

NSP P31	Canceled on June 5, 2009
D97B	Canceled on June 6, 2008
NSP H54	Canceled on July 31, 2009
ES-8	Canceled on January 20, 2012
ES-10	Canceled on July 20, 2012

NOTICE TO BIDDERS

Bids open Wednesday, December 19, 2012

Dated November 13, 2012

General work description: Construct the SFOBB Maintenance complex.

The Department will receive sealed bids for BUILDING CONSTRUCTION ADJACENT TO ALAMEDA COUNTY AT THE SAN FRANCISCO - OAKLAND BAY BRIDGE MAINTENANCE YARD.

District-County-Route-Post Mile: 04-Ala-80-2.2

Contract No. 04-014084

The Contractor must have either a Class A license or Class B license or a combination of Class C licenses which constitutes a majority of the work.

The Department establishes no DVBE Contract goal but encourages bidders to obtain DVBE participation.

Bids must be on a unit price basis.

Complete the work, including plant establishment work, within 800 working days.

The estimated cost of the project is $41,000,000.

A mandatory prebid meeting is scheduled for this project at 10 am, on November 19, 2012, at the auditorium located at 111 Grand Avenue, Oakland, CA 94612.

The Department will receive bids until 2:00 p.m. on the bid open date at 1727 30th Street, Bidders' Exchange, MS 26, Sacramento, CA 95816. Bids received after this time will not be accepted. Department staff will direct the bidders to the bid opening.

The Department will open and publicly read the bids at the above location immediately after the specified closing time.

District office addresses are provided in the Standard Specifications.

Present bidders' inquiries to the Department and view the Department's responses at:

http://www.dot.ca.gov/hq/esc/oe/project_status/bid_inq.html

Questions about alleged patent ambiguity of the plans, specifications, or estimate must be asked before bid opening. After bid opening, such questions will not be treated as bid protests.

Submit your bid with bidder's security equal to at least 10 percent of the bid.

Under Govt Code § 14835 et seq. and 2 CA Code of Regs § 1896 et seq., the Department gives preference to certified small businesses and non-small businesses who commit to 25 percent certified small business participation.

Under Pub Cont Code § 6107, the Department gives a reciprocal preference to a California company for bid comparison purposes over a nonresident contractor from any state that provides a preference to contractors from that state on construction contracts.

Prevailing wages are required on this Contract. The Director of the California Department of Industrial Relations determines the general prevailing wage rates. Obtain the wage rates at the DIR Web site, http://www.dir.ca.gov, or from the Department's Labor Compliance Office of the district in which the work is located.

The Department has made available Notices of Suspension and Proposed Debarment from the Federal Highway Administration. For a copy of the notices go to http://www.dot.ca.gov/hq/esc/oe/contractor_info. Additional information is listed in the Excluded Parties List System at https://www.epls.gov.

DEPARTMENT OF TRANSPORTATION

LLS

COPY OF BID ITEM LIST

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
1	070030	LEAD COMPLIANCE PLAN	LS	LUMP SUM
2	074016	CONSTRUCTION SITE MANAGEMENT	LS	LUMP SUM
3	025048	DEWATERING AND NON-STORMWATER DISCHARGE CONTROL	LS	LUMP SUM
4	080050	PROGRESS SCHEDULE (CRITICAL PATH METHOD)	LS	LUMP SUM
5	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
6	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
7	120165	CHANNELIZER (SURFACE MOUNTED)	EA	110
8	130300	PREPARE STORM WATER POLLUTION PREVENTION PLAN	LS	LUMP SUM
9	130330	STORM WATER ANNUAL REPORT	EA	3
10	130530	TEMPORARY HYDRAULIC MULCH (BONDED FIBER MATRIX)	SQYD	600
11	130570	TEMPORARY COVER	SQYD	1,000
12	130620	TEMPORARY DRAINAGE INLET PROTECTION	EA	5
13	130640	TEMPORARY FIBER ROLL	LF	8,000
14	130680	TEMPORARY SILT FENCE	LF	2,000
15	130710	TEMPORARY CONSTRUCTION ENTRANCE	EA	2
16	130730	STREET SWEEPING	LS	LUMP SUM
17	130900	TEMPORARY CONCRETE WASHOUT	LS	LUMP SUM
18	141001	HEALTH AND SAFETY PLAN	LS	LUMP SUM
19	150204	ABANDON CULVERT (LF)	LF	20
20	150221	ABANDON INLET	EA	1

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
21	150608	REMOVE CHAIN LINK FENCE	LF	5,740
22	150620	REMOVE GATE	EA	1
23	150714	REMOVE THERMOPLASTIC TRAFFIC STRIPE	LF	140
24	150715	REMOVE THERMOPLASTIC PAVEMENT MARKING	SQFT	25
25	150742	REMOVE ROADSIDE SIGN	EA	4
26	025033	REMOVE STEEL POLE	EA	1
27	025034	REMOVE BOLLARD	EA	3
28	025035	REMOVE HIGH MAST LIGHT POLE	EA	2
29	025036	REMOVE HIGH MAST LIGHT POLE FOUNDATION	EA	4
30	024037	REMOVE WATER VALVE	EA	4
31	150860	REMOVE BASE AND SURFACING	CY	8,600
32	152320	RESET ROADSIDE SIGN	EA	1
33	152390	RELOCATE ROADSIDE SIGN	EA	3
34	025049	VIBRATION MONITORING	LS	LUMP SUM
35	025050	SEWER VIDEO SURVEY	LS	LUMP SUM
36	153121	REMOVE CONCRETE (CY)	CY	30
37	160102	CLEARING AND GRUBBING (LS)	LS	LUMP SUM
38	025038	ROADWAY EXCAVATION (CLASS 2)	CY	8,080
39	025039	ROADWAY EXCAVATION (TYPE H)	CY	18,910
40	198011	IMPORTED BORROW (TON)	TON	17,800

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
41	025040	LIGHTWEIGHT CELLULAR CONCRETE	CY	1,140
42	200001	HIGHWAY PLANTING	LS	LUMP SUM
43	204099	PLANT ESTABLISHMENT WORK	LS	LUMP SUM
44	208000	IRRIGATION SYSTEM	LS	LUMP SUM
45	208301	IRRIGATION CONTROLLER ENCLOSURE CABINET	EA	1
46	208310	IRRIGATION SLEEVE	LF	97
47	025041	6" CORRUGATED HIGH DENSITY POLYTHEYLENE PIPE CONDUIT	LF	770
48	208739	10" CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONDUIT	LF	280
49	210110	IMPORTED TOPSOIL (CY)	CY	7,710
50	260303	CLASS 3 AGGREGATE BASE (CY)	CY	4,630
51	390132	HOT MIX ASPHALT (TYPE A)	TON	17,100
52	393004	GEOSYNTHETIC PAVEMENT INTERLAYER (PAVING FABRIC)	SQYD	2,710
53	394050	RUMBLE STRIP	STA	4.4
54	394076	PLACE HOT MIX ASPHALT DIKE (TYPE E)	LF	150
55	395000	LIQUID ASPHALT (PRIME COAT)	TON	67
56	044121	DRIVE PILE (CLASS 140 ALTERNATIVE X)	EA	8
57	044122	DRIVE PILE (CLASS 90 ALTERNATIVE X)	EA	260
58	044123	DRIVE INDICATOR PILE (CLASS 90 ALTERNATIVE X)	EA	6
59	044124	FURNISH INDICATOR PILING (CLASS 90 ALTERNATIVE X)	LF	650
60	044125	FURNISH PILING (CLASS 140 ALTERNATIVE X)	LF	826

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
61	044126	FURNISH PILING (CLASS 90 ALTERNATIVE X)	LF	35,717
62 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	CY	95
63	560248	FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-UNFRAMED)	SQFT	81
64	566011	ROADSIDE SIGN - ONE POST	EA	18
65	620060	12" ALTERNATIVE PIPE CULVERT	LF	1,250
66	620100	18" ALTERNATIVE PIPE CULVERT	LF	820
67	620140	24" ALTERNATIVE PIPE CULVERT	LF	520
68	700617	DRAINAGE INLET MARKER	EA	5
69	721410	CONCRETE (GUTTER LINING)	CY	120
70	730020	MINOR CONCRETE (CURB) (CY)	CY	170
71	735000	PARKING BUMPER (PRECAST CONCRETE)	EA	67
72 (F)	750001	MISCELLANEOUS IRON AND STEEL	LB	5,370
73	800103	TEMPORARY FENCE (TYPE CL6)	LF	2,320
74	800360	CHAIN LINK FENCE (TYPE CL-6)	LF	39
75	025042	SECURITY METAL FENCE	LF	4,390
76	025043	18' SECURITY METAL SLIDING GATE	EA	2
77	025044	35' SECURITY METAL SLIDING GATE	EA	1
78	025045	3' SECURITY METAL SWING GATE	EA	1
79	840504	4" THERMOPLASTIC TRAFFIC STRIPE	LF	7,600
80	840515	THERMOPLASTIC PAVEMENT MARKING	SQFT	260

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
81	850111	PAVEMENT MARKER (RETROREFLECTIVE)	EA	67
82	025051	ELECTRICAL DUCT BANK AND CONDUIT LAYOUT	LS	LUMP SUM
83	860797	ELECTRIC SERVICE (IRRIGATION)	LS	LUMP SUM
84	025046	REMOVE PULL BOX	EA	2
85	025047	REMOVE ELECTRICAL CABINET	EA	3
86	994650	BUILDING WORK	LS	LUMP SUM

SPECIAL PROVISIONS

SECTION 1. (BLANK)

SECTION 2. BIDDING

2-1.01 MANDATORY PREBID MEETING

The Department will conduct a mandatory prebid meeting for this contract. The purpose of the meeting is to provide small businesses the opportunity to meet and interact with prospective bidders and increase participation in the performance of contracts.

Prospective bidders must attend the mandatory prebid meeting. The bidder's representative must be a company officer, project superintendent, or project estimator. For a joint venture, one of the parties must attend the mandatory prebid meeting. The Department will not accept bids from bidders who do not attend the mandatory prebid meeting.

A sign-up sheet will be used to identify all prospective bidders including name and title of the company representative attending the mandatory prebid meeting. The Department may hold a single prebid meeting for more than one contract. Make sure you sign the sign-up sheet for the contract you intend to bid on. If bidding multiple contracts, sign each sign-up sheet for each contract you intend to bid on.

The successful bidder will be required to report small businesses hired to work on this contract as a result of the mandatory prebid meeting.

2-1.02 SMALL BUSINESS AND NON–SMALL BUSINESS SUBCONTRACTOR PREFERENCES

General

The Department applies Small Business Preference or Non–Small Business Preference under Govt Code § 14835 et seq. and 2 CA Code of Regs § 1896 et seq.

Contractors, subcontractors, suppliers, and service providers who qualify as small businesses are encouraged to apply for certification as a small business by submitting their application to the Department of General Services, Office of Small Business and DVBE Services.

Contract award is based on the total bid, not the reduced bid.

Small Business Preference

The Department allows a bidder certified as a small business by the Office of Small Business and DVBE Services, Department of General Services, a preference if:

1. The bidder submitted a completed Request for Small Business Preference or Non–Small Business Preference form with its bid
2. The low bidder did not request the preference or is not certified as a small business

The bidder's signature on the Request for Small Business Preference or Non–Small Business Preference form certifies that the bidder is certified as a small business at the time and day of bid or has submitted a complete application to the Department of General Services. The complete application and any required substantiating documentation must be received by the Department of General Services by 5:00 p.m. on bid opening date.

The Department of General Services determines if a bidder was certified on bid opening date. The Department confirms the bidder's status as a small business before applying the small business preference.

The small business preference is a reduction for bid comparison in the total bid submitted by the small business contractor by the lesser of:

1. 5 percent of the verified total bid of the low bidder
2. $50,000

If after the application of the small business preference the Department determines that a certified small business bidder is the low bidder, the Department does not consider a request for non–small business preference.

Non–Small Business Subcontractor Preference

The Department allows a bidder not certified as a small business by the Office of Small Business and DVBE Services, Department of General Services, a preference if:

1. The bidder submitted a completed Request for Small Business Preference or Non–Small Business Preference form with its bid.
2. The Certified Small Business Listing for the Non–Small Business Preference form shows that you are subcontracting at least 25 percent to certified small businesses. You may submit this information with your bid. If you do not, submit it so that it is received by the Office Engineer no later than 4:00 p.m. on the 2nd business day after bid opening.

Each listed subcontractor and supplier must be certified as a small business at the time and day of bid or must have submitted a complete application to the Department of General Services. The complete application and any required substantiating documentation must be received by the Department of General Services by 5:00 p.m. on bid opening date.

The non–small business subcontractor preference is a reduction for bid comparison in the total bid submitted by the non–small business contractor requesting the preference by the lesser of:

1. 5 percent of the verified total bid of the low bidder
2. $50,000

2-1.03 DISABLED VETERAN BUSINESS ENTERPRISES

General

Take necessary and reasonable steps to ensure that DVBEs have opportunity to participate in the contract.

Comply with Mil & Vet Code § 999 et seq.

The Department encourages bidders to obtain DVBE participation in order to ensure the Department achieves its State-mandated overall DVBE goal.

If you obtain DVBE participation:

1. Complete and submit the Certified DVBE Summary form. List all DVBE participation on this form.
2. List each 1st tier DVBE subcontractor on the Subcontractor List form regardless of percentage of the total bid.

DVBE Incentive

The Department grants a DVBE incentive to each bidder who achieves a DVBE participation of 1 percent or greater (Mil & Vet Code 999.5 and Code of Regs § 1896.98 et seq).

To receive this incentive, submit the Certified DVBE Summary form. If you do not submit this form with your bid and you are the low bidder or the 2nd or 3rd low bidder, submit it so that it is received by the Office Engineer no later than 4:00 p.m. on the 4th business day after bid opening. If a DVBE joint venture is used, submit the joint venture agreement with the Certified DVBE Summary form. Other bidders may be required to submit this form if bid ranking changes.

Incentive Evaluation

The Department applies the Small Business and Non–Small Business preference during bid verification and proceeds with the following evaluation for DVBE incentive.

The DVBE incentive is a reduction, for bid comparison only, in the total bid submitted by the lesser of:

1. Percentage of DVBE achievement, rounded to 2 decimal places, of the verified total bid of the low bidder
2. 5 percent of the verified total bid of the low bidder
3. $250,000

The Department applies DVBE incentive and determines if bid ranking changes.

A non-small business bidder cannot displace a small business bidder. However, a small business bidder with higher DVBE achievement can displace another small business bidder.

The Department proceeds with awarding the contract to the new low bidder and posts the new verified bid results at its Office Engineer Web site.

2-1.04 CALIFORNIA COMPANIES

Under Pub Cont Code § 6107, the Department gives preference to a "California company," as defined, for bid comparison purposes over a nonresident contractor from any state that gives or requires a preference to be given to contractors from that state on its public entity construction contracts.

Complete a California Company Preference form.

The California company reciprocal preference amount is equal to the preference amount applied by the state of the nonresident contractor with the lowest responsive bid unless the California company is eligible for a small business preference or a non–small business subcontractor preference; in which case the preference amount is the greater of the two, but not both.

If the low bidder is not a California company and a California company's bid with reciprocal preference is equal to or less than the lowest bid, the Department awards the contract to the California company on the basis of its total bid.

2-1.05 TIE BID RESOLUTION

If a small business bidder and a non–small business bidder request preferences and the reductions result in a tied bid, the Department awards the contract to the small business bidder.

If a DVBE small business bidder and a non-DVBE small business bidder request preferences and the reduction results in a tied bid, the Department awards the contract to the DVBE small business bidder.

After bid verification, if there is a tie between 2 or more bidders, the Department breaks the tie by tossing a coin.

2-1.06 OPT OUT OF PAYMENT ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS

You may opt out of the payment adjustments for price index fluctuations as specified in "Payment Adjustments for Price Index Fluctuations" of these special provisions. If you elect to opt out of the provisions of this specification, you must complete the "Opt Out of Payment Adjustments for Price Index Fluctuations" form. The completed form must be submitted with your bid.

SECTION 3. CONTRACT AWARD AND EXECUTION

3-1.01 CONTRACT AWARD

If the Department awards the Contract, the award is made to the lowest responsible bidder within 60 days.

3-1.02 SMALL BUSINESS PARTICIPATION REPORT

The Department has established an overall 25 percent small business participation goal. To determine if the goal is achieved, the Department is tracking small business participation on all contracts.

Complete and sign the Small Business (SB) Participation Report form included in the contract documents even if no small business participation is reported. Submit it with the executed contract.

SECTION 4. BEGINNING OF WORK, TIME OF COMPLETION, AND LIQUIDATED DAMAGES

The 1st working day is the earlier of (1) the 15th day after contract approval or (2) the day you start work other than the measurement of controlling field dimensions or the location of utilities.

Do not start work at the job site until the Engineer approves your submittal for:

1. Baseline Progress Schedule (Critical Path Method)
2. Storm Water Pollution Prevention Plan (SWPPP)
3. Notification of Dispute Resolution Advisor (DRA) or Dispute Review Board (DRB) nominee and disclosure statement as specified in Section 5-1.15, "Dispute Resolution," of the Standard Specifications
4. LEED Manager's qualification statement in compliance with "LEED Requirements," of these special provisions

You may enter the job site only to measure controlling field dimensions and locating utilities. Do not start other work activities until all the submittals from the above list are approved and the following information is submitted:

1. Notice of Materials To Be Used.
2. Written statement from the vendor that the order for the sign panels has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.

3. Written statement from the vendor that the order for electrical material has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.
4. Written statement from the vendor that the order for structural steel has been received and accepted by the vendor. The statement must show the dates that the materials will be shipped.

You may start work at the job site before the 15th day after contract approval if:

1. You obtain required approval for each submittal before the 15th day
2. The Engineer authorizes it in writing

The Department grants a time extension if a delay is beyond your control and prevents you from starting work at the job site on the 1st working day.

Complete the work, except plant establishment work, within 550 working days.

Complete the work, including plant establishment work, within 750 working days.

For this contract, a working day is defined as:

working day: Time measure unit for work progress. A working day is any day except when you cannot perform work on the controlling activity for at least 50 percent of the day with at least 50 percent of the normal labor and equipment due to any of the following:

1. Maintaining traffic under the contract
2. The Engineer's direction to suspend the controlling activities for reasons unrelated to your performance
3. An unanticipated event not caused by either party such as:

    3.1. Act of God (Pub Cont Code § 7105)
    3.2. Act of a public enemy
    3.3. Epidemic
    3.4. Fire
    3.5. Flood
    3.6. Governor-declared state of emergency
    3.7. Landslide
    3.8. Quarantine restriction

4. An issue involving a third-party, including:

    4.1. Industry or area-wide labor strike
    4.2. Material shortage
    4.3. Freight embargo
    4.4. Jurisdictional requirement of a law enforcement agency
    4.5. Workforce labor dispute of a utility or non-highway facility owner resulting in a utility or non-highway facility reconstruction not described and not solely for the Contractor's convenience

SECTION 5. GENERAL

5-1.01 EMISSIONS REDUCTION

Contract execution constitutes submittal of the following certification:

> I am aware of the emissions reduction regulations being mandated by the California Air Resources Board. I will comply with such regulations before commencing the performance of the work and maintain compliance throughout the duration of this contract.

5-1.02 NON–SMALL BUSINESSES

Use each subcontractor as shown on the Certified Small Business Listing for the Non–Small Business Preference form unless you receive authorization for a substitution.

The requirement that small businesses be certified by the bid opening date does not apply to small business substitutions after contract award.

Maintain records of subcontracts made with certified small business subcontractors and records of materials purchased from certified small business suppliers. Include in the records:

1. Name and business address of each business
2. Total amount paid to each business

For the purpose of determining compliance with 2 CA Code of Regs § 1896 et seq.:

1. Provide the Department relevant information requested.
2. Upon reasonable notice and during normal business hours, permit access to its premises for the purpose of:

    2.1. Interviewing employees
    2.2. Inspecting and copying books, records, accounts and other material that may be relevant to a matter under investigation

5-1.03 DISABLED VETERAN BUSINESS ENTERPRISES

Use each DVBE as shown on the Certified DVBE Summary form unless you receive authorization for a substitution.

The requirement that DVBEs be certified by the bid opening date does not apply to DVBE substitutions after contract award.

Maintain records of subcontracts made with certified DVBEs. Include in the records:

1. Name and business address of each business
2. Total amount paid to each business

For the purpose of determining compliance with Pub Cont Code § 10115 et seq.:

1. Upon contract completion, complete and submit Final Report - Utilization of Disabled Veteran Business Enterprises (DVBE) State Funded Projects Only form
2. Upon reasonable notice and during normal business hours, permit access to its premises for the purpose of:

    2.1. Interviewing employees
    2.2. Inspecting and copying books, records, accounts and other material that may be relevant to a matter under investigation

5-1.04 PARTNERING DISPUTE RESOLUTION

The Department encourages the project team to exhaust the use of partnering in dispute resolution before engagement of an objective third party. Comply with Section 5-1.012, "Partnering," of the Standard Specifications.

For certain disputes, facilitated partnering session or facilitated dispute resolution session may be appropriate and effective in clarifying issues and resolving all or part of a dispute.

To afford the project team enough time to plan and hold the session, a maximum of 20 days may be added to the dispute resolution board (DRB) referral time following the Engineer's written response to a supplemental potential claim record as specified in Section 5-1.15, "Dispute Resolution," of the Standard Specifications.

To allow this additional referral time, the project team must document its agreement and intention in the dispute resolution plan of the partnering charter. The team may further document agreement of any associated criteria to be met for use of the additional referral time.

If the session is not held, the DRB referral time remains in effect as specified in Section 5-1.15, "Dispute Resolution," of the Standard Specifications.

5-1.05 PAYMENT ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS

GENERAL

Summary

This section applies to asphalt contained in materials for pavement structural sections and pavement surface treatments such as hot mix asphalt (HMA), tack coat, asphaltic emulsions, bituminous seals, asphalt binders, and modified asphalt binders placed in the work. This section does not apply if you opted out of payment adjustment for price index fluctuations at the time of bid.

The Engineer adjusts payment if the California Statewide Crude Oil Price Index for the month the material is placed is more than 5 percent higher or lower than the price index at the time of bid.

The California Statewide Crude Oil Price Index is determined each month on or about the 1st business day of the month by the Department using the average of the posted prices in effect for the previous month as posted by Chevron, ExxonMobil, and ConocoPhillips for the Buena Vista, Huntington Beach, and Midway Sunset fields.

If a company discontinues posting its prices for a field, the Department determines the index from the remaining posted prices. The Department may include additional fields to determine the index.

For the California Statewide Crude Oil Price Index, go to:

http://www.dot.ca.gov/hq/construc/crudeoilindex/

If the adjustment is a decrease in payment, the Department deducts the amount from the monthly progress payment.

The Department includes payment adjustments for price index fluctuations when making adjustments under Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

If you do not complete the work within the contract time, payment adjustments during the overrun period are determined using the California Statewide Crude Oil Price Index in effect for the month in which the overrun period began.

If the price index at the time of placement increases:

1. 50 percent or more over the price index at bid opening, notify the Engineer.
2. 100 percent or more over the price index at bid opening, do not furnish material containing asphalt until the Engineer authorizes you to proceed with that work. The Department may decrease Bid item quantities, eliminate Bid items, or terminate the contract.

Submittals

Before placing material containing asphalt, submit the current sales and use tax rate in effect in the tax jurisdiction where the material is to be placed.

Submit certified weight slips for HMA, tack coat, asphaltic emulsions, and modified asphalt binders, including those materials not paid for by weight, as specified in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications. For slurry seals, submit certified weight slips separately for the asphaltic emulsion.

ASPHALT QUANTITIES

General

Interpret the term "ton" as "tonne" for projects using metric units.

Hot Mix Asphalt

The Engineer calculates the quantity of asphalt in HMA using the following formula:

$$Qh = HMATT \times [Xa / (100 + Xa)]$$

where:

Qh =	quantity in tons of asphalt used in HMA
HMATT =	HMA total tons placed
Xa =	theoretical asphalt content from job mix formula expressed as percentage of the weight of dry aggregate

Rubberized Hot Mix Asphalt

The Engineer calculates the quantity of asphalt in rubberized HMA (RHMA) using the following formula:

$$Qrh = RHMATT \times 0.80 \times [Xarb / (100 + Xarb)]$$

where:

Qrh =	quantity in tons of asphalt in asphalt rubber binder used in RHMA
RHMATT =	RHMA total tons placed
Xarb =	theoretical asphalt rubber binder content from the job mix formula expressed as percentage of the weight of dry aggregate

Modified Asphalt Binder in Hot Mix Asphalt

The Engineer calculates the quantity of asphalt in modified asphalt binder using the following formula:

Qmh = MHMATT x [(100 - Xam) / 100] x [Xmab / (100 + Xmab)]

where:

Qmh =	quantity in tons of asphalt in modified asphalt binder used in HMA
MHMATT =	modified asphalt binder HMA total tons placed
Xam =	specified percentage of asphalt modifier
Xmab =	theoretical modified asphalt binder content from the job mix formula expressed as percentage of the weight of dry aggregate

Hot Mix Asphalt Containing Reclaimed Asphalt Pavement (RAP)

The Engineer calculates the quantity of asphalt in HMA containing RAP using the following formulas:

Qrap = HMATT x [Xaa / (100 + Xaa)]

where:

Xaa = Xta - [(100 -Xnew) x (Xra / 100)]

and

Qrap =	quantity in tons of asphalt used in HMA containing RAP
HMATT =	HMA total tons placed
Xaa =	asphalt content of HMA adjusted to account for the asphalt content in RAP expressed as percentage of the weight of dry aggregate
Xta =	total asphalt content of HMA expressed as percentage of the weight of dry aggregate
Xnew =	theoretical percentage of new aggregate in the HMA containing RAP determined from RAP percentage in the job mix formula
Xra =	asphalt content of RAP expressed as percentage

Tack Coat

The Engineer calculates the quantity of asphalt in tack coat (Qtc) as either:

1. Asphalt binder using the asphalt binder total tons placed as tack coat
2. Asphaltic emulsion by applying the formula in "Asphaltic Emulsion" to the asphaltic emulsion total tons placed as tack coat

Asphaltic Emulsion

The Engineer calculates the quantity of asphalt in asphaltic emulsions, including fog seals and tack coat, using the following formula:

Qe = AETT x (Xe / 100)

where:

Qe =	quantity in tons of asphalt used in asphaltic emulsions
AETT =	undiluted asphaltic emulsions total tons placed
Xe =	minimum percent residue specified in Section 94, "Asphaltic Emulsions," of the Standard Specifications based on the type of emulsion used

You may, as an option, determine "Xe" by submitting actual daily test results for asphalt residue for the asphaltic emulsion used. If you choose this option, you must:

1. Take 1 sample every 200 tons but not less than 1 sample per day in the presence of the Engineer from the delivery truck, at midload from a sampling tap or thief, and in the following order:

    1.1. Draw and discard the 1st gallon
    1.2. Take two separate 1/2-gallon samples

2. Submit 1st sample at the time of sampling

3. Provide 2nd sample within 3 business days of sampling to an independent testing laboratory that participates in the AASHTO Proficiency Sample Program
4. Submit test results from independent testing laboratory within 10 business days of sample date

Slurry Seal

The Engineer calculates the quantity of asphalt in slurry seals (Qss) by applying the formula in "Asphaltic Emulsion" to the actual quantity of asphaltic emulsion used in producing the slurry seal mix.

Modified Asphalt Binder

The Engineer calculates the quantity of asphalt in modified asphalt binder using the following formula:

Qmab = MABTT x [(100 - Xam) / 100]

where:

Qmab = quantity in tons of asphalt used in modified asphalt binder
MABTT = modified asphalt binder total tons placed
Xam = specified percentage of asphalt modifier

Other Materials

For other materials containing asphalt not covered above, the Engineer determines the quantity of asphalt (Qo).

PAYMENT ADJUSTMENTS

The Engineer includes payment adjustments for price index fluctuations in progress pay estimates. If material containing asphalt is placed within 2 months during 1 estimate period, the Engineer calculates 2 separate adjustments. Each adjustment is calculated using the price index for the month in which the quantity of material containing asphalt subject to adjustment is placed in the work. The sum of the 2 adjustments is used for increasing or decreasing payment in the progress pay estimate.

The Engineer calculates each payment adjustment as follows:

PA = Qt x A

where:

PA = Payment adjustment in dollars for asphalt contained in materials placed in the work for a given month.

Qt = Sum of quantities of asphalt (Qh + Qrh + Qmh + Qrap + Qtc + Qe + Qss + Qmab + Qo).

A = Adjustment in dollars per ton of asphalt used to produce materials placed in the work rounded to the nearest $0.01.

For US Customary projects, use:

A = [(Iu / Ib) - 1.05] x Ib x [1 + (T / 100)] for an increase in the crude oil price index exceeding 5 percent
A = [(Iu / Ib) - 0.95] x Ib x [1 + (T / 100)] for a decrease in the crude oil price index exceeding 5 percent

For metric projects, use:

A = 1.1023 x [(Iu / Ib) - 1.05] x Ib x [1 + (T / 100)] for an increase in the crude oil price index exceeding 5 percent
A = 1.1023 x [(Iu / Ib) - 0.95] x Ib x [1 + (T / 100)] for a decrease in the crude oil price index exceeding 5 percent

Iu = California Statewide Crude Oil Price Index for the month in which the quantity of asphalt subject to adjustment was placed in the work.
Ib = California Statewide Crude Oil Price Index for the month in which the bid opening for the project occurred
T = Sales and use tax rate, expressed as a percent, currently in effect in the tax jurisdiction where the material is placed. If the tax rate information is not submitted timely, the statewide sales and use tax rate is used in the payment adjustment calculations until the tax rate information is submitted.

5-1.06 SURFACE MINING AND RECLAMATION ACT

Imported borrow or aggregate material must come from a surface mine permitted under the Surface Mining and Reclamation Act of 1975 (SMARA), Pub Res Code § 2710, et seq., or from an exempt site.

The Department of Conservation, Office of Mine Reclamation maintains a list of permitted mine sites. For the list of permitted sites, go to:

http://www.conservation.ca.gov/omr/ab_3098_list

If you import borrow or aggregate material from a surface mine not on this list, submit proof the mine is exempt from SMARA.

5-1.07 ELECTRONIC SUBMISSION OF PAYROLL RECORDS

In lieu of submitting weekly payroll records to the Engineer as specified in Section 7-1.01A(3), "Payroll Records," of the Standard Specifications, you may submit weekly payroll records electronically.

Before submitting payroll records electronically, you must complete and sign the Contractor's Acknowledgement and submit it to the District where your project is located. Submit your signed acknowledgement to the corresponding District electronic mailbox shown in the following table:

Electronic Mailboxes

District	Address
1	district1.payrolls@dot.ca.gov
2	district2.payrolls@dot.ca.gov
3	district3.payrolls@dot.ca.gov
4	district4.payrolls@dot.ca.gov
5	district5.payrolls@dot.ca.gov
6	district6.payrolls@dot.ca.gov
7	district7.payrolls@dot.ca.gov
8	district8.payrolls@dot.ca.gov
9	district9.payrolls@dot.ca.gov
10	district10.payrolls@dot.ca.gov
11	district11.payrolls@dot.ca.gov
12	district12.payrolls@dot.ca.gov

The Department responds with an e-mail containing a Caltrans Internet Certificate to be used for the electronic submission of payroll records. You must agree to accept this certificate and reply to the e-mail. After you accept the certificate and reply to the e-mail, the Department is ready to accept your electronic submissions.

Each electronic submission must:

1. Include payroll records in a nonmodifiable PDF image format. No spreadsheets, word documents, or password protected documents are accepted.
2. Include payroll records with all data elements required by the Labor Code § 1776.
3. Include a signed Statement of Compliance form with each weekly record.
4. Be received by the Department by close of business on the 15th day of the month for the prior month's work.
5. Be encrypted before submission.
6. Contain the following information in the subject line:

    6.1. Contract number
    6.2. Week ending date as W/E mm/dd/yy

7. Contain 1 contract number and week ending date per submission.

For additional information on electronic submission of payroll records, go to:

http://www.dot.ca.gov/hq/construc/LaborCompliance/index.htm

5-1.08 PAYMENTS

In determining the partial payments to be made to the Contractor, only the following listed materials will be considered for inclusion in the payment as materials furnished but not incorporated in the work:

1. Precast prestressed concrete piles
2. Alternative pipe culverts
3. Miscellaneous iron and steel
4. Security metal fence and gates
5. Parking bumper
6. Control and neutral conductors
7. Pipe (Irrigation Systems)
8. Valves

5-1.09 SUPPLEMENTAL PROJECT INFORMATION

The Department makes the following supplemental project information available:

Supplemental Project Information

Means	Description
Included in the Information Handout	1. Foundation Recommendations, June 25, 2012. 2. Grid-Tie PV System Report Form 3. Non-Stormwater Information Package, June 2012 4. Storm Water Information Package, June 2012 5. Preliminary Site Investigation Report, May 2011 6. Initial Site Assessment, May 1999 7. Site Investigation Report, September 2012 8. Construction Vibration Monitoring Field Data Form
Available for inspection at: District 4 Office, 111 Grand Avenue, Oakland, CA 94612 Office of the Duty Senior Email: duty_senior_district04@dot.ca.gov Telephone no.: (510) 286-5209	Cross sections in electronic copy, pdf Format

5-1.10 GENERAL LEED REQUIREMENTS

GENERAL

This work includes general specifications for complying with and documenting compliance with requirements for prerequisites, credits, and certification required to obtain certification under LEED 2009 for New Construction and Major Renovations.

The Department is pursuing LEED-Gold certification. Comply with LEED 2009 for New Construction and Major Renovations and the LEED prerequisites, credits, and requirements specified in "Required LEED Credits" below.

Additional information about LEED requirements is described in the LEED 2009 for New Construction and Major Renovations Rating System; the LEED Reference Guide for Green Building Design and Construction, 2009 edition; LEED Online v3; and LEED 2009 supporting documents, including policies, guidance, credit interpretations, checklists, errata, and other reference documents at the U.S. Green Building Council Web site.

The LEED project boundary is shown and may or may not coincide with the overall job site boundary. Work within the LEED boundary must comply with LEED requirements.

Interpret a reference to LEED as LEED 2009 for New Construction and Major Renovations.

DEFINITIONS

Not Used

LEED COMPLIANCE

As necessary to achieve or demonstrate LEED compliance:

1. Prepare and maintain LEED documentation

2. Prepare and submit LEED submittals
3. Prepare and execute LEED action plans
4. Implement LEED compliance plans prepared by others
5. Complete LEED Online templates
6. Comply with LEED-related elements of the Contract

REQUIRED LEED CREDITS

Achieve the "Sustainable Sites" (SS) LEED prerequisite and credits as shown in the following table:

Sustainable Sites

Credit designation	Credit name	Level of compliance
Prerequisite 1	Construction Activity Pollution Prevention	--
Credit 1	Site Selection	--
Credit 3	Brownfield Redevelopment	Clean up soil and hazardous materials
Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	Bicycle racks for 5 percent of users and shower/changing areas for 0.5 percent of occupants
Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	Preferred parking (5 percent) or alternative fueling stations (3 percent)
		Transportation management plan (exemplary performance)
Credit 7.2	Heat Island Effect—Roof	75 percent coverage
Credit 8	Light Pollution Reduction	--

Achieve the "Water Efficiency" (WE) LEED prerequisite and credits as shown in the following table:

Water Efficiency

Credit designation	Credit name	Level of compliance
Prerequisite 1	Water Use Reduction—20 percent Reduction	--
Credit 1	Water Efficient Landscaping	No potable water use
Credit 2	Innovative Wastewater Technologies	Reduce by 100 percent (exemplary performance)
Credit 3	Water Use Reduction	Reduce by 45 percent (exemplary performance)

Achieve the "Energy and Atmosphere" (EA) LEED prerequisites and credits as shown in the following table:

Energy and Atmosphere

Credit designation	Credit name	Level of compliance
Prerequisite 1	Fundamental Commissioning of Building Energy Systems	--
Prerequisite 2	Minimum Energy Performance	--
Prerequisite 3	Fundamental Refrigerant Management	--
Credit 1	Optimize Energy Performance	Improve by 44 percent for new buildings
Credit 2	On-Site Renewable Energy	Meet 15 percent or more of energy needs (exemplary performance)
Credit 3	Enhanced Commissioning	Commission energy using systems and others as indicated in the commissioning section
Credit 4	Enhanced Refrigerant Management	--
Credit 5	Measurement and Verification	--
Credit 6	Green Power	35 percent green power

Achieve the "Materials and Resources" (MR) LEED prerequisite and credits as shown in the following table:

Materials and Resources

Credit designation	Credit name	Level of compliance
Prerequisite 1	Storage and Collection of Recyclables	--
Credit 2	Construction Waste Management	Divert 75 percent
Credit 4	Recycled Content	10 percent recycled
Credit 5	Regional Materials	10 percent regional
Credit 7	Certified Wood	50 percent certified wood

Achieve the "Indoor Environmental Quality" (IEQ) LEED prerequisites and credits as shown in the following table:

Indoor Environmental Quality

Credit designation	Credit name	Level of compliance
Prerequisite 1	Minimum Indoor Air Quality Performance	--
Prerequisite 2	Environmental Tobacco Smoke (ETS) Control	--
Credit 1	Outdoor Air Delivery Monitoring	--
Credit 2	Increased Ventilation	--
Credit 3.1	Construction Indoor Air Quality Management Plan—During Construction	--
Credit 3.2	Construction Indoor Air Quality Management Plan—Before Occupancy	--
Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	--
Credit 4.2	Low-Emitting Materials—Paints and Coatings	--
Credit 4.3	Low-Emitting Materials—Flooring Systems	--
Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	--
Credit 5	Indoor Chemical and Pollutant Source Control	--
Credit 6.1	Controllability of Systems—Lighting	--
Credit 6.2	Controllability of Systems—Thermal Comfort	
Credit 7.1	Thermal Comfort—Design	--
Credit 7.2	Thermal Comfort—Verification	--
Credit 8.1	Daylight and Views—Daylight	75 percent daylit

Achieve the "Innovation in Design" (ID) LEED credits as shown in the following table:

Innovation in Design

Credit designation	Credit name	Requirement description
Credit 1.1	Exemplary Performance	Renewable energy exceeds 15%
Credit 1.2	Exemplary Performance	Water use reduction > 45%
Credit 1.3	Exemplary Performance	WEC2 100% non-potable Water for waste conveyance.
Credit 1.4	Innovation in Design	Green Cleaning Program
Credit 1.5	Innovation in Design	LEED education program
Credit 2	LEED Accredited Professional	--

Achieve the "Regional Priority" (RP) LEED credits as shown in the following table:

Regional Priority

Credit designation	Requirement description
Credit 1.1	EA Credit 2 – 1% renewable energy
Credit 1.2	IEQ Credit 8.1 – daylight 75%
Credit 1.3	WE Credit 3 – 40% reduction in water use
Credit 1.4	WE Credit 2 – 50% reduction un water used for Waste

SUBMITTALS

General

Submit 5 sets of each LEED submittal to OSD, Documents Unit. Notify the Engineer of the submittal. Include in the notification the date and contents of the submittal. Submit them within 30 days of Contract approval. Allow 20 days for the review. Where schedules and other records are specified, resubmit final versions before Contract acceptance. In addition to specified submittals, submit any other submittal the Engineer requests.

Content

Comply with terms, categories, and calculations provided in the LEED Reference Guide. Where cost or value data is required, include applicable costs and exclude others as provided in the "LEED Reference Guide."

Qualification Statement

Within 15 days after Contract approval, submit a qualification statement for the LEED manager. Include experience and evidence of LEED accreditation. The LEED manager's qualification statement must be authorized before you submit LEED action plans and before you start work.

Materials Cost Data

To achieve the credits required, submit a statement of total materials cost, as defined for MR credits in the "LEED Reference Guide," for building materials used in project within the LEED limits shown. Break out costs of the following categories of materials that are included in total materials cost for LEED purposes:

1. Section 99-2, "Sitework"
2. Section 99-3, "Concrete and Reinforcement"
3. Section 99-5, "Metals"
4. Section 99-6, "Wood and Plastic"
5. Section 99-7, "Thermal and Moisture Protection"
6. Section 99-8, "Doors and Windows"
7. Section 99-9, "Finishes"
8. Section 99-10, "Specialties"
9. Section 99-12, "Furnishings"
10. Paving not specified in section 99-2
11. Site improvements not specified in section 99-2 except site utilities
12. Landscaping not specified in section 99-2 except landscape irrigation

Break out costs for the following categories that are excluded from total materials cost:

1. Section 99-15, "Mechanical"
2. Section 99-16, "Electrical"

LEED Action Plans

After authorization of a LEED manager and within 30 days after Contract award, submit plans demonstrating how requirements will be achieved. Allow 20 days for the review. Revise and resubmit within 15 days after receipt of Engineer's comments. Submit updated reports with as-built data before contract acceptance.

To achieve the credit designation shown in the following table for LEED category "Sustainable Sites," submit the document shown and comply with the corresponding requirement for the document:

Sustainable Sites

Credit designation	Credit name	Document	Requirement
Prerequisite 1	Construction Activity Pollution Prevention	WPCP or SWPPP	Comply with Section 13.

To achieve the credit designation shown in the following table for LEED category "Materials and Resources," submit the document shown and comply with the corresponding requirement for the document:

Materials and Resources

Credit designation	Credit name	Document	Requirement
Credit 2	Construction Waste Management	Waste management plan	Comply with "Construction Waste Management" of these special provisions."
Credit 4	Recycled Content	List of proposed materials with recycled content	Show cost, postconsumer recycled content, preconsumer recycled content, and recycled content value based on weight. Count preconsumer recycled content at half the actual value. Calculate the total recycled content value as a percentage of the total materials cost.
Credit 5	Regional Materials	List of proposed regional materials	Show the material's source location, manufacture location, distance of each from job site, percentage by weight that is considered regional, and cost. Calculate total regional materials cost as a percentage of total materials cost.
Credit 7	Certified Wood	List of proposed wood-based construction materials	Show percentages by weight and cost that comply with certified wood requirements. Show proposed suppliers.

For each credit designation shown in the following table for LEED category "Indoor Environmental Quality," submit the document shown and comply with the corresponding requirement for the document:

Indoor Environmental Quality

Credit designation	Credit name	Document	Requirement
Credit 3.1	Construction Indoor Air Quality Management Plan—During Construction	Construction indoor air quality (IAQ) management plan	Show IAQ measures taken during construction under "Indoor Air Quality Management" of these special provisions.
Credit 3.2	Construction Indoor Air Quality Management Plan—Before Occupancy	Construction indoor air quality (IAQ) management plan	Show IAQ measures taken before occupancy under "Indoor Air Quality Management" of these special provisions..
Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	List of proposed adhesives and sealants to be applied on-site and inside the building weatherproofing system,	Show by type, brand, and product name, showing VOC content, VOC content limit allowed under this credit, VOC content limit allowed under current rules of the local air district, and quantity used.

Credit 4.2	Low-Emitting Materials—Paints and Coatings	List of proposed paints and coatings to be applied on-site and inside the building weatherproofing system	Show by intended application, MPI category, brand, and product name, showing VOC content, VOC content limit allowed under this credit, VOC content limit allowed under current rules of the local air district, and quantity used.
Credit 4.3	Low-Emitting Materials—Flooring Systems	List of proposed products for flooring systems.	Show by intended application, generic type, brand, and product name. Show compliance with LEED requirements under this credit and with current rules of the local air district. Include any of the following items that apply: 1. Carpet approved under the Carpet and Rug Institute Green Label Plus program 2. Carpet pad approved under the Carpet and Rug Institute Green Label program 3. Carpet adhesive with a VOC limit of 50 g/L 4. The following hard-surface flooring products certified under the FloorScore testing program: 4.1. Vinyl 4.2. Ceramic 4.3. Rubber 4.4. Wallbase 5. The following floor sealers, stains, and finishes complying with South Coast Air Quality Management District (SCAQMD) rule 1113 with an effective date of January 1, 2004: 5.1. Concrete 6. The following tile-setting products complying with SCAQMD Rule 1168 as amended on January 7, 2005 with the effective date of July 1, 2005: 6.1. Adhesives 6.2. Grout
Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	List of proposed composite wood and agrifiber products	Show by intended application, generic type, brand, and product identifier. Show amount of added urea-formaldehyde resins in products and in laminating adhesives. Include any of the following items that apply: 1. Particleboard 2. Medium-density fiberboard. 3. Plywood 4. Panel substrates 5. Door cores Do not include fixtures, furniture, and equipment.

Progress Reports

Submit on or before the last day of each month reports comparing actual purchasing and construction activities with LEED action plans. Include 12 or more digital photographs showing compliance with LEED requirements, including dates and descriptions. Submit them on a read-only compact disc.

LEED Document Submittals

To document compliance with specific LEED credits and prerequisites, submit documents required by the *LEED Reference Guide*, LEED 2009 supporting documents, and LEED Online submittal templates and as specified in "LEED Document Submittals."

To achieve the credit designation shown in the following table for LEED category "Sustainable Sites," submit the document shown and comply with the corresponding requirement for the document:

Sustainable Sites

Credit designation	Credit name	Document	Requirement
Credit 7.2	Heat Island Effect—Roof	Product data for roof covering materials.	Show solar reflectance index, initial thermal emittance, and initial solar reflectance.
Credit 8	Light Pollution Reduction	Product data for: 1. Light fixtures 2. Any automatic devices for reducing input power 3. Any shielding for building openings and automatic devices for nighttime activation	--

To achieve the credit designation shown in the following table for LEED category "Water Efficiency," submit the document shown and comply with the corresponding requirement for the document:

Water Efficiency

Credit designation	Credit name	Document	Requirement
Prerequisite 1	Water Use Reduction—20 percent Reduction	Product data for plumbing fixtures, including water closets, toilets, urinals, lavatory faucets, showers, kitchen sink faucets, and prerinse spray valves	Show water consumption.
Credit 1	Water Efficient Landscaping	Product data for irrigation emitters and controls	--
Credit 2	Innovative Wastewater Technologies	Product data for water closets or toilets and urinals	Show water consumption.
Credit 3	Water Use Reduction	Product data for plumbing fixtures, including water closets, toilets, urinals, lavatory faucets, showers, kitchen sink faucets, and prerinse spray valves	Show water consumption.

To achieve the credit designation shown in the following table for LEED category "Energy and Atmosphere," submit the document shown and comply with the corresponding requirement for the document:

Energy and Atmosphere

Credit designation	Credit name	Document	Requirement
Prerequisite 3	Fundamental Refrigerant Management	1. Product data for HVAC and refrigeration systems and certification of absence of CFC refrigerants. 2. Phase-out plan for existing HVAC and refrigeration systems containing CFC refrigerants 3. Refrigerant recovery technician's signed and dated statement that all refrigerant was recovered and that recovery was performed according to EPA regulations	--
Credit 2	On-Site Renewable Energy	Product data for on-site renewable energy systems	--
Credit 4	Enhanced Refrigerant Management	Product data for: 1. New HVAC and refrigeration systems 2. Clean-agent fire-extinguishing systems	For item 1, show specific type and charge of refrigerant per ton of gross cooling capacity for each equipment item for review and authorized based on requirements of "LEED Reference Guide." Refrigerants with high ozone-depleting potential or high global warming potential or that exceed LEED standards are rejected. For item 2, show absence of CFC, HCFC, and halon.
Credit 5	Measurement and Verification	Product data for meters and systems shown on plans	--

To achieve the credit designation shown in the following table for LEED category "Materials and Resources," submit the document shown and comply with the corresponding requirement for the document:

Materials and Resources

Credit designation	Credit name	Document	Requirement
Credit 2	Construction Waste Management	Submittals specified in "Construction Waste Management" of these special provisions."	As specified in "Construction Waste Management" of these special provisions."
Credit 4	Recycled Content	Product data and certification letter documenting postconsumer and preconsumer recycled content	For each item, show cost, postconsumer recycled content, preconsumer recycled content, and recycled content value based on weight. Count preconsumer recycled content at half the actual value.
Credit 5	Regional Materials	Product data for materials with regional content	Show location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include a statement showing cost for each regional material and the percentage by weight considered regional
Credit 7	Certified Wood	1. Product data and vendor invoices 2. Chain of custody certification 3. Spreadsheets calculating cost of wood-based construction materials qualifying as certified wood	Invoices must show: 1. Products on a line item basis with cost 2. FSC-certified products as FSC Pure, FSC Mixed Credit, or FSC Mixed (NN) percent

To achieve the credit designation shown in the following table for LEED category "Indoor Environmental Quality," submit the document shown and comply with the corresponding requirement for the document:

Indoor Environmental Quality

Credit designation	Credit name	Document	Requirement
Credit 1	Outdoor Air Delivery Monitoring	Product data for CO2 monitors and direct outdoor airflow measurement devices	--
Credit 3.1	Construction Indoor Air Quality Management Plan—During Construction	Submittals specified in "Indoor Air Quality Management" of these special provisions.	As specified in "Indoor Air Quality Management" of these special provisions.
Credit 3.2	Construction Indoor Air Quality Management Plan—Before Occupancy	Submittals specified in "Indoor Air Quality Management" of these special provisions.	As specified in "Indoor Air Quality Management" of these special provisions.
Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	Product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system	Show VOC content.
Credit 4.2	Low-Emitting Materials—Paints and Coatings	Product data for paints and coatings to be used on-site and inside the building weatherproofing system	Show product name, manufacturer's generic description, chemical composition, and VOC content.
Credit 4.3	Low-Emitting Materials—Flooring Systems	1. Product data for carpet, carpet cushion, carpet adhesive, hard surface flooring, including vinyl, linoleum, laminate, wood, ceramic, and rubber, wall base, clear floor finishes, and tile setting adhesives and grout 2. Certification of compliance with the referenced standard for: 2.1. Carpet: Carpet and Rug Institute Green Label Plus 2.2. Carpet Cushion: Carpet and Rug Institute Green Label. 2.3. Carpet Adhesive: Not exceeding 50 g/L VOC under IEQ Credit 4.1 2.4. Hard Surface Flooring: FloorScore 2.5. Floor Finishes (Sealer, Stain, Finish): SCAQMD rules under IEQ Credit 4.2. 2.6. Tile Setting Adhesives and Grout: SCAQMD rules under IEQ Credit 4.1.	--
		Test results and certificate of compliance with testing and product requirements of the CA Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda	
Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	Product data for composite wood and agrifiber products, including particleboard, medium density fiberboard, plywood, wheatboard, strawboard, panel substrates, and door cores, to be used inside the building weatherproofing system	Show no added urea formaldehyde in resins or laminating adhesives

Credit 5	Indoor Chemical and Pollutant Source Control	Product data for: 1. Entryway systems 2. MERV 13 HVAC filters to be installed before occupancy and certification that they were installed before occupancy for both return air and outside air delivered as supply air	--
Credit 6.1	Controllability of Systems—Lighting	Product data and shop drawings for task lighting, sensors, and lighting controls	--
Credit 6.2	Controllability of Systems—Thermal Comfort	Product data for thermal controls	--
Credit 8.1	Daylight and Views—Daylight	Product data including visual light transmittance factor for window and skylight glazing and for any skylight diffusers measured haze value under ASTM D 1003.	--

To achieve the credit designation shown in the following table for LEED category "Innovation in Design," submit the document shown and comply with the corresponding requirement for the document:

Innovation in Design

Credit designation	Credit name	Requirement description	Document
Credit 1.1	Exemplary Performance	Renewable energy exceeds 15%	Support for innovation in design credits required.
Credit 1.2	Exemplary Performance	Exceed 45% for Water use reduction (WEc3)	Support for innovation in design credits required.
Credit 1.3	Exemplary Performance	100% non potable water for WEc2.	Support for innovation in design credits required.
Credit 1.4	Innovation in Design	Green Cleaning Program	Support for innovation in design credits required.
Credit 1.5	Innovation in Design	LEED education program	Support for innovation in design credits required.

To achieve the credit designation shown in the following table for LEED category "Regional Priority," submit the document shown and comply with the corresponding requirement for the document:

Regional Priority

Credit designation	Requirement description	Document
Credit 1.1	EA Credit 2 – 1% renewable energy	Support for regional priority credits required.
Credit 1.2	IEQ Credit 8.1 – daylight 75%	Support for regional priority credits required.
Credit 1.3	WE Credit 2 – Innovative Wastewater Technologies	Support for regional priority credits required.
Credit 1.4	WE Credit 3 – 40% reduction	Support for regional priority credits required.

QUALITY CONTROL AND ASSURANCE

Designate a LEED manager. The LEED manager must:

1. Have at least 3 years of responsible construction experience on projects of similar size and scope.
2. Have experience with LEED requirements and documenting LEED compliance for new construction projects
3. Be a LEED Accredited Professional
4. Be conversant with LEED 2009 for New Construction

5. Be present full-time at the job site to oversee compliance with LEED requirements

Duties of the LEED manager include:

1. Conducting a LEED preconstruction meeting and the LEED portion of progress meetings
2. Monitoring implementation of the construction waste management plan
3. Implementing the IAQ management plans
4. Implementing and monitoring other LEED action plans
5. Evaluating progress toward LEED rating requirements
6. Coordinating work as necessary to meet LEED rating requirements
7. Training workers to comply with LEED requirements
8. Monitoring and documenting LEED procedures
9. Observing and coordinating with commissioning
10. Preparing and submitting LEED documents
11. Completing construction-related LEED Online templates
12. Responding to questions from the Engineer to complete the LEED application process

At the preconstruction meeting and at each progress meeting, the LEED manager must discuss:

1. LEED requirements and procedures
2. LEED documentation: data collection, organization, and submittal
3. LEED Online template status
4 Construction waste management
5 IAQ management
6 Other LEED action plans.

In training workers, the LEED manager must provide an overview of the project's LEED requirements, procedures, and documentation and review specific procedures for construction waste management and IAQ management.

To document LEED procedures, the LEED manager must photographically document site conditions before construction and weekly throughout construction to show LEED compliance.

LEED ONLINE TEMPLATES

The LEED manager must review the construction-phase templates and determine supporting data required for each credit under the "LEED Reference Guide." Maintain copies of supporting data for each construction-phase template in legible, orderly, current, and readily auditable form at the job site.

PROJECT-WIDE LEED REQUIREMENTS

The LEED-credit requirements in "Project-Wide LEED Requirements" apply to the project as a whole. Choose materials and methods that will, in the aggregate, achieve these requirements.

To achieve MR Credit 4, Recycled Content:

1. Furnish building materials with recycled content so that the sum of postconsumer recycled content plus one-half of preconsumer recycled content is at least 10 percent of the total material cost
2. Comply with LEED requirements for calculating eligible materials and costs as specified in "Materials Cost Data" in "Submittals" above.

To achieve MR Credit 5, Regional Materials:

1. Provide regional materials constituting at least 10 percent of the total materials cost. Regional materials are those extracted, harvested, or recovered, as well as manufactured, within 500 miles of the project site.
2. Comply with LEED requirements for calculating eligible materials and costs as specified in "Materials Cost Data" in "Submittals" above.

To achieve MR Credit 7, Certified Wood:

1. Furnish certified wood materials constituting at least 50 percent of the total cost of new wood building components. Certified wood is certified by the Forest Stewardship Council and has required chain-of-custody documentation.
2. Comply with LEED requirements for calculating eligible materials and costs as specified in "Materials Cost Data" in "Submittals" above.

To achieve IEQ Credit 3.1, comply with "Indoor Air Quality Management" of these special provisions.
To achieve IEQ Credit 3.2, comply with "Indoor Air Quality Management" of these special provisions.

MEASUREMENT AND PAYMENT

Full compensation for the work specified in "General LEED Requirements" is included in the payment for the bid items involved.

5-1.11 CONSTRUCTION WASTE MANAGEMENT

GENERAL

This work includes salvaging, recycling, and disposing of nonhazardous construction and demolition waste.
"Construction Waste Management" applies to LEED MR Credit 2.

DEFINITIONS

construction and demolition waste: Building and site improvement materials and other solid waste resulting from construction, renovation, repair, deconstruction, or demolition. Construction and demolition waste includes packaging. It does not include land-clearing debris or hazardous waste. Comply with the terms, categories, and calculations in the "LEED Reference Guide."

disposal: Removal of construction and demolition waste from the job site and subsequent disposal in landfill under regulations of authorities having jurisdiction.

recycling: Recovery of construction and demolition waste for subsequent processing in preparation for use in a different form.

reuse: Reuse of salvaged items in substantially the same form within the limits specified by the "LEED Reference Guide." For purposes of construction waste management, "reuse" refers to items found on-site that were fixed components before construction began

salvage: Recovery of construction and demolition waste for subsequent reuse. For LEED purposes, "salvage" includes removal by you for reuse by you or others and keeping and storage by the Department for future reuse.

SUBMITTALS

General

Not Used

Quality Control and Assurance Submittals

Submit a qualification statement for your waste management coordinator.
Submit a waste management plan within 30 days after Contract approval.

Closeout Submittals

Submit calculated end-of-project rates for salvage, recycling, and disposal as a percentage of total waste generated by the work.

Submit records of donations and sales of salvageable waste to individuals or organizations. Include receipts with itemized descriptions. Show whether organization is tax exempt.

Submit records showing receipt and acceptance of recyclable wastes by recycling facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

Submit records indicating receipt and acceptance of wastes by landfills licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

Submit a LEED template for MR Credit 2, (1) completed by you, (2) tabulating total waste material, quantities diverted, and means of diversion with supporting records, and (3) a signed certificate of compliance stating that requirements for the credit have been met as specified.

QUALITY CONTROL AND ASSURANCE

Designate a waste management coordinator to implement, monitor, and report on the waste management plan. The coordinator must be present full time at the job site to fully oversee compliance with waste management requirements. The coordinator must be conversant with LEED requirements related to materials and resources and specifically related to MR Credit 2, Construction Waste Management. The LEED manager may serve as the waste management coordinator.

Conduct a waste management conference at job site before work starts and as necessary during the work. Require attendance by superintendents, supervisors, subcontractors, and your workers; invite Engineer. Include a review of:

1. Waste management plan and related responsibilities of waste management coordinator
2. How to document the quantity of each type of waste and its disposition
3. Procedures for materials separation and available containers and bins
4. Waste collection and transport to recycling and disposal facilities
5. Waste management requirements for each trade

PERFORMANCE GOALS

Recycle or salvage from the waste stream at least 75 percent by weight or volume of total nonhazardous construction and demolition waste generated by the work.

The Department's goal is to salvage and recycle as much nonhazardous construction and demolition waste as possible, including any of the following materials:

1. PCC and asphalt concrete
2. Structural steel and miscellaneous steel, metal studs, reinforcing steel
3. Wood
4. Cabinets
5. Roofing
6. Insulation
7. Doors and frames
8. Windows
9. Glazing
10. Hardware
11. Gypsum board
12. Acoustical tile and panels
13. Carpet and pad
14. Equipment
15. Piping
16. Conduit
17. Copper wiring
18. Supports and hangers
19. Valves
20. Sprinklers
21. Plumbing fixtures
22. Mechanical equipment
23. Lighting fixtures
24. Lamps and ballasts
25. Electrical devices
26. Switchgear and panelboards
27. Transformers
28. The following packaging materials:

    28.1. Paper
    28.2. Cardboard
    28.3. Boxes
    28.4. Plastic sheet and film
    28.5. Polystyrene packaging
    28.6. Wood crates
    28.7. Plastic pails

Salvage or recycle 100 percent of any uncontaminated packaging materials listed above.

Recycle beverage containers and clean paper used by workers.

WASTE MANAGEMENT PLAN

Develop a waste management plan that includes waste identification and waste reduction work plan. Distinguish between demolition and construction waste. Measure quantities by either weight in tons or volume in cubic yards. Use the same units of measure for all materials.

Identify a waste management coordinator.

Identify anticipated types of demolition and construction waste generated by the work. Include estimated quantities and assumptions for estimates.

List each type of waste and whether it will be salvaged, recycled, or disposed of. Include total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials: List names, addresses, and telephone numbers of individuals or organizations to which materials will be sold or donated for reuse.
2. Recycled Materials: List local receivers and processors and types of recycled materials each will accept. Include names, addresses, and phone numbers.
3. Disposed Materials: Provide name, address, and phone number of landfill where materials will be disposed of.
4. Handling and Transportation Procedures: Describe method that will be used for separating recyclable waste, including sizes of containers, container labeling, and designated job site location where materials will be separated. Indicate whether recyclable or salvageable materials will be segregated onsite or commingled for sorting offsite. Include provisions for complying with section 13-4.

To identify recyclers, salvage operators, disposal locations, and waste disposal restrictions, at a minimum coordinate with City of Oakland, Facilities & Environment, http://www2.oaklandnet.com/Government/o/PWA/o/FE/s/GAR/index.htm.

WASTE MANAGEMENT PLAN IMPLEMENTATION

Implement the waste management plan.

Train workers, subcontractors, and suppliers on proper waste management procedures. Distribute the waste management plan to responsible staff, subcontractors, and suppliers immediately after authorization by the Department and to new firms when they start work at the job site. Review procedures and locations for salvage, recycling, and disposal.

You will keep revenues and other incentives received for recycling and salvaging waste materials.

GENERAL RECYCLING AND SALVAGE PROCEDURES

Separate recyclable and salvageable waste from other waste materials, trash, and debris. Separate recyclable and salvageable waste by type at the job site to the greatest extent possible.

Furnish appropriately marked containers or bins. Submit a list of acceptable and unacceptable materials at each container and bin. Inspect containers and bins for contamination daily and remove unacceptable materials if found. Presence of unacceptable materials may cause the entire load to be rejected by the recycler or salvager and thus prevent achievement of waste diversion goals.

Keep recyclable materials free from dirt, adhesives, solvents, petroleum, and other deleterious substances, including nonrecyclable wastes.

Transport recyclable waste to recycler.

SALVAGE PROCEDURES

Clean salvaged items, pack in labeled containers, and store in a secure area until removal or reuse.

Salvage materials under the corresponding procedures shown in the following table:

Salvaging Procedures

Material	Procedure
Doors and hardware	Brace open end of door frames. Except for door closers, leave door hardware attached to doors.
Equipment	Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
Plumbing fixtures	Separate by type and size.
Lighting fixtures	Separate lamps by type and protect from breakage.
Electrical devices	Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

MATERIAL-SPECIFIC RECYCLING PROCEDURES

Recycle materials under the corresponding procedures shown in the following table:

Recycling Procedures

Material	Procedure
Packaging	
Cardboard and boxes	Break down packaging into flat sheets. Bundle and store in a dry location.
Polystyrene packaging	Separate and bag materials.
Pallets	As much as possible, require deliverers using pallets to remove pallets from the job site for reuse. Break down remaining pallets into component pieces and recycle as wood.
Crates	Break down crates into component pieces and recycle as wood.
Asphalt concrete	Break up and transport paving to asphalt-recycling facility.
Concrete	Remove reinforcement and other metals from concrete and sort with other metals. Break up and dispose of concrete.
Wood	Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
Metals	Separate metals by type. Remove bolts, nuts, washers, and other rough hardware.
Structural steel	Stack members according to size, type of member, and length.
Ceiling suspension systems	Disassemble to convenient size.
Gypsum board, large pieces	Stack clean pieces on wood pallets and store in a dry location.
Acoustical ceiling panels and tile, large pieces	Stack clean pieces on wood pallets and store in a dry location.
Carpet and pad	Roll large pieces tightly after removing debris, trash, adhesive, and tack strips. Store in a closed container or trailer provided by carpet recycler.
Piping	Reduce piping to straight lengths and sort by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
Conduit	Reduce conduit to straight lengths. Sort by type and size.

MEASUREMENT AND PAYMENT

Full compensation for the work specified in "Construction Waste Management" is included in the payment for the bid items involved.

5-1.12 DEPARTMENT COMMISSIONING

GENERAL

This work includes commissioning of the following building and site systems:

1. HVAC and refrigeration systems, mechanical and passive, and associated controls, including:

    1.1 Combination heating/cooling rooftop unit

1.2 Split system heat pump
1.3 Split system air conditioner
1.4 Exhaust fans systems
1.5 Declassification fan systems
1.6 Exhaust evacuation hose reel and fan systems
1.7 Low intensity radiant heaters
1.8 Supply fan (with duct heater) systems
1.9 Dust collector system
1.10 Mobile fume extractor
1.11 HVAC controls

2. Electrical systems and associated controls, including:

2.1 Lighting including area lighting standards
2.2 Fuel dispensing and monitoring systems
2.3 Closed circuit television system
2.4 Communication system including uninterruptible power supply (UPS) and battery storage cabinet
2.5 Intrusion alarm system and access control system
2.6 Fire alarm and detection system

3. Other devices and systems, including all controls and associated equipment:

3.1 Instant hot water heating (electric) systems
3.2 Hot water heating (gas) systems
3.3 Plumbing fixture sensors
3.4 Bridge crane and hoist
3.5 Air compressorsystems (including refrigerated air dryer)
3.6. Photovoltaic system
3.7 Paint mixing room systems
3.8 Overhead coiling doors and grille
3.9 Standby generator (including transfer switch) system
3.10 Hydraulic elevator
3.11 Sectional overhead grille
3.12 Sand-oil separator and clarifier tank sensors
3.13 Industrial vacuum system
3.14 Digital gas meters
3.15 Water meters
3.16 High pressure washer (portable)
3.17 Sewage pumping station equipment

"Department Commissioning," applies to EA Prerequisite 1 and EA Credit 3.
Comply with the commissioning plan.

DEFINITIONS

Commissioning: Comprehensive and systematic process to verify that systems perform as designed to comply with the Department's requirements. Commissioning is intended to ensure that:

1. Equipment is installed and started under the Contract.
2. Equipment and systems receive a complete operational check by installing subcontractors and are verified by the Commissioning Authority (CxA) and Department's personnel.
3. Equipment and systems perform as intended
4. Operation and maintenance materials are complete
5. Department's personnel are trained in operation and maintenance of equipment and systems
6. Documentation is complete for all construction commissioning processes.

Commissioning authority (CxA): The commissioning authority (CxA) has been contracted directly with the Department for this project. You have the overall responsibility for planning and coordinating the commissioning process with the CxA. Commissioning for construction involves all parties participating in

the construction process, including the Contractor's forces, Department's personnel, and the CxA. The Cx Plan shall be referenced to define the responsibilities of all parties involved in the Commissioning process.

Commissioning plan (Cx plan): The Commissioning Plan (Cx Plan) is a living document that defines and manages the commissioning process. It outlines the organization, schedule, sequence, and responsibility, allocation of resources, and documentation requirements of the commissioning process. The complete Cx Plan shall be provided by the CxA and shall be reviewed by the Contractor.

The commissioning team (as described below and in the commissioning plan that shall be provided by the CxA) shall work together to achieve commissioning requirements, including all general tasks in the Commissioning Process section of these specifications.

COORDINATION

Coordinate with CxA to facilitate an effective commissioning process. Ensure that subcontractors, manufacturers, and vendors participate as required.

Include commissioning activities in the construction progress schedule and coordinate construction activities to facilitate commissioning activities.

COMMISSIONING TEAM

The commissioning team includes Contractor's forces, the CxA, and the Department's personnel. The Contractor's forces includes you, the subcontractors, manufacturers' representatives, vendors, and other engineers, and specifically includes those with qualifications and responsibility for mechanical, plumbing, and electrical systems and all other commissioned systems, including testing and balancing, controls, and design and installation of commissioned systems. The Department's personnel include the resident engineer, field personnel, design engineers and Architects and other specialists as required.

COMMISSIONING PROCESS

Commissioning includes the following general tasks:

1. Meetings: Arrange team meetings. The commissioning team shall have a scoping meeting to agree on the scope of work, tasks, schedules, deliverables, and responsibilities for implementation of the commissioning process. Additional meeting information is provided in the Meetings section below.
2. Submittals: Submit complete equipment documentation for review. In addition to system descriptions there shall be installation checklists, pre-functional check sheets and functional performance test plans included which either match the informational handouts or are manufacturer supplied.
3. Installation Checklist: The CxA will provide installation checklist for each system to be commissioned. The checklists are part of the informational handouts. The informational handouts shall be followed, or equally comprehensive manufacturer supplied installation checklist shall be submitted for review and used in lieu of the installation checklist provided by the CxA.
4. Pre-functional Check sheets: The CxA will provide template pre-functional check sheets for all systems and equipment to be commissioned. Pre-functional check sheets shall be submitted and followed, or equally comprehensive manufacturer pre-functional check sheets shall be submitted for review and used in lieu of the pre-functional check sheets provided by the CxA.
5. Functional Performance Test Plans: Functional Performance Test Plans will be provided by the CxA for each system to be commissioned. Functional performance test plans shall be submitted and followed, or equally comprehensive manufacturer functional performance test plans shall be submitted for review and acceptance.
6. Startup and Testing Process: Verify installation checklists are completed and any issues resolved, then execute pre-functional check sheets and procedures. Perform and document startup and system operational testing procedures.
7. Functional Performance Tests: After completion of installation checklist and pre-functional testing, startup, andadjustments have been completed perform functional performance testing, in accordance with the Functional Performance Test Plans. The testing shall be performed in the presence of the Department's personnel and the CxA.

    a. Test Methods: Conduct tests by direct manipulation of system inputs and by manipulation of system inputs and outputs.
    b. Setup: Perform tests under conditions that simulate normal operating conditions.

c. Test Values: If failures are still present after three attempts, retesting is at the Contractor's expense.
d. Coordination and Scheduling: Provide 10 days' notice to the Engineer and the CxA of the completion schedule for pre-functional checklists and startup of equipment and systems. Functional testing does not begin until pre-functional, startup, and testing, adjusting, and balancing is completed for a given system. Controls testing will not be considered as functionally tested until points have been calibrated and pre-functional checklists are complete.

8. The CxA will provide a field commissioning notebook to identify and track all pertinent commissioning documentation required during construction. Maintain the notebook on site and make it available to all subcontractors, CxA and engineer. The notebook provides a central location for commissioning (Cx) documents including; Cx meeting minutes, construction schedule showing Cx milestones, Issues/Observations log entries, installation checklists, pre-functional checklists, functional tests, and other procedures and tests approved by the CxA. Completed forms shall be put in the Notebook.
9. The CxA will provide an observation and issue log to be used for recording observations made during the commissioning process by the CxA, Department or other members of the Cx team. Entries shall include unique tracking number, date, observing party, description of the issue, recommended action, responsibility to resolve, item closed date and name of person verifying closure. As construction progresses the commissioning team enters commissioning information into the field commissioning notebook and Observation and Issue log section as required to track all aspects of commissioning. Items of noncompliance in materials, installation, or operation shall be corrected. Correct items and coordinate re-testing at your expense.
10. Provide completed field commissioning notebook (that includes commissioning documents including the observation and issue log) to CxA and Department's personnel as required for creating the Commissioning Report.
11. Operation and Maintenance Documentation: The Engineer and the CxA review for completeness.
12. Training: Coordinate and provide training to the Department's personnel to cover all modes of operation, including manual, shut-down and preventative maintenance for all pieces of equipment. Training shall occur after functional testing is complete, unless otherwise approved by the Engineer. Training shall be conducted by the manufacturer's representative. For complete training requirements of each system, refer to corresponding systems training requirements specified elsewhere in these special provisions.
13. Building operation review: A complete building operation testing shall be conducted by the CxA from 6 to 8 months after project acceptance. This testing includes re-verifying all systems that were commissioned are still functioning.
14. Commissioning report: To be completed by the CxA.

MEETINGS

Arrange the following meetings. At all meetings attendance shall include the CxA, the appropriate Contractor's forces, and Department's personnel, involved in work to be commissioned. Provide the meeting agenda 3 days before meetings.

1. Scoping Meeting: Initial meeting to review commissioning scope of work, tasks, schedule, deliverables, and responsibilities for implementation of the Cx Plan.
2. Controls Integration Meetings: Arrange meetings to discuss commissioning for controls.
3. Additional Meetings: Arrange additional meetings as necessary to discuss commissioning details, proper forms, testing procedures for systems soon to be commissioned.

REPORTING

Progress Reports: Furnish weekly reportsto the commissioning team that describe progress and any schedule changes.

Commissioning Report: The CxA will compile a final report which summarizes tasks, findings, and documentation of commissioning process. Report includes Cx documents (OPR and BOD), completed installation checklists, pre-functional check sheets, functional performance testing records, identified deficiencies, recommendations, training evaluation, Operation and Maintenance (O&M) documentation, summary of commissioning activities, and plan for resolution of any issues after Building Operation Review within 6 to 8 months.

SUBMITTALS

Submit 3 additional copies of items to be reviewed by the CxA, including all standard submittals relating to equipment or systems to be commissioned.

The CxA reviews submittals related to commissioned equipment and systems. The Engineer may submit written requests for additional information from you. Submit any additional information requested.

Product Data: For commissioned systems, any system submitted that vary from specifications will require manufacturer supplied installation checklist, pre functional check sheets, and full functional test plans (and not follow the contract supplied check sheets and functional test plans). See Commissioning Process for additional information.

Submit authorized changes to the work and revised submittals related to commissioning to the CxA.

Submit start-up plans for equipment to be commissioned.

Submit a prefunctional check certification that the system is ready for start-up. Include nameplate data, installation checklist, and a list of any incomplete work. Use forms provided by the informational handouts.

Only individuals who have completed or witnessed a line item task may initial or check the item on the forms.

Submit start-up and checkout reports for each item or system to be commissioned. Include a completed checklist and a list of any start-up procedures not successfully completed. Use forms approved by the CxA. Submit the documents within 2 days after the test.

Submit operations narratives for controls if requested by the CxA.

Submit draft operation and maintenance manuals for completeness review before close-out.

Submit final operation and maintenance manuals. Include updating of original sequences of operation to record as-built conditions.

Submit training manuals for review before close-out.

Submit complete and detailed temperature control sequences of operation for each piece of equipment. Include:

1. Narrative description of system, describing its purpose, components, and function
2. Interactions and interlocks with other systems
3. Delineation of control interactions between packaged controls and building automation system, including list of monitored points, controlled points, and adjustable points
4. Written sequences of control for packaged controlled equipment
5. Sequences of control for modes of operation, including start-up, warm-up, cooldown, normal occupied, unoccupied, and emergency shutdown
6. Capacity control sequences and equipment staging
7. Temperature and pressure control sequences, including setbacks and resets
8. Sequences for control strategies, including economizer control, optimum start/stop, optimization, and demand limiting
9. Effects of power or equipment failure with standby component functions
10. Sequences for alarms and emergency shutdowns
11. Seasonal operational requirements

Submit control drawings. Include:

1. Key to abbreviations
2. Graphic schematic depictions of systems and each component
3. Schematics, including system and component layout of equipment that control system monitors, enables, or controls, even if equipment is primarily controlled by packaged or integral controls
4. Full points list, including for each point:

    4.1 Controlled system
    4.2 Point abbreviation
    4.3 Point description.
    4.4 Point type, either digital/analog or input/output.
    4.5 Display unit
    4.6 Control point or setpoint (yes/no)
    4.7 Monitoring point (yes/no)
    4.8 Intermediate point (yes/no)
    4.9 Calculated point (yes/no)

Submit as-built control drawings and sequences of operation, to be included in final controls operation and maintenance manual submittal.

Submit written step-by-step procedures to test, checkout, and adjust control system before functional performance testing starts.

Submit upon completion of control system checkout.

Training: Submit proposed training materials and procedures. Training shall include all necessary materials needed by those being trained.

FUNCTIONAL PERFORMANCE TESTING

Demonstrate that each system is operating under the construction documents. The CxA and the Department's personnel directs, witnesses, and documents verification procedures.

Conduct tests by direct manipulation of system inputs, by manipulation of system inputs and outputs in accordance with the approved test procedures.

Test under conditions that simulate normal operating conditions.

If failures are still present after 3 attempts, the Department does not pay for retesting.

Provide 10-day notice to the Engineer and the CxA regarding completion schedule for pre-functional checklists and start-up of equipment and systems. Functional testing does not start until pre-functional, start-up, and TAB are completed for a given system. Controls are not functionally tested until points have been calibrated and prefunctional checklists are complete.

TEST EQUIPMENT

Furnish testing equipment and tools required to perform start-up and initial checkout and required functional performance testing.

Include special equipment, tools, and vendor-specific instruments required for testing and keep them at the job site.

Testing equipment must be of sufficient quality and accuracy to test and measure system performance within the tolerances specified. At a minimum:

1. Temperature sensors and digital thermometers must have been calibrated within the preceding year to an accuracy of 0.5 degrees F and a resolution of ±0.1 degree F. The calibration must be NIST traceable.
2. Pressure sensors must have been calibrated within the preceding year and must be accurate within ±2.0 percent of the range of the reading being measured.
3. Equipment must be calibrated under the manufacturer's recommended intervals and when dropped or damaged. Calibration tags must be affixed or certificates readily available.

MEASUREMENT AND PAYMENT

Full compensation for the work specified in "Department Commissioning" is included in the payment for the bid items involved.

5-1.13 INDOOR AIR QUALITY MANAGEMENT

This work includes complying with LEED IEQ Credit 3.1 and 3.2 for reducing or avoiding construction impacts on IAQ.

For IEQ Credit 3.1, submit:

1. Construction IAQ management plan addressing control measures to be used during construction
2. Schedule of temporary air filtration media, including manufacturer, model no., MERV rating, and location of installed filter
3. Documentation as to whether HVAC system was used during construction
4. Documentation that each installed filter was replaced before occupancy
5. Product data for temporary and permanent filtration media
6. 6 photographs taken at 3 different occasions during construction to document control measures used with a brief description of the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) approaches used

For IEQ Credit 3.2, submit:

1. Construction IAQ management plan addressing measures before occupancy

2. Documentation describing building air flush-out procedures used, including starting and ending dates and documentation that filtration media were replaced after flush-out
3. Product data for filtration media used during flush-out and installed before occupancy

For IEQ Credit 3.1, prepare a construction IAQ management plan covering measures to be used during construction. The measures must include:

1. Achieving or exceeding the recommended control measures of SMACNA "IAQ Guidelines for Occupied Buildings Under Construction," 2nd Edition 2007, chapter 3. Include measures for HVAC protection, source control, pathway interruption, housekeeping, and scheduling
2 Protecting stored on-site and installed absorptive materials from moisture damage
3. Not using permanently installed air handlers during construction
4. Installing MERV 13 filtration media immediately before occupancy as required under IEQ Credit 5, Indoor Chemical and Pollutant Source Control

For IEQ Credit 3.2, prepare a construction IAQ management plan covering measures before occupancy. Include the following alternate compliance methods from which the Department may choose:

1. After construction ends and before occupancy and with all interior finishes installed, conduct baseline IAQ testing using testing protocols and methods as described in the "LEED Reference Guide." Conduct sampling, testing, flush-out, and additional testing until the maximum concentrations given in the "LEED Reference Guide" are not exceeded for the following contaminants: formaldehyde, particulates (PM10), total volatile organic compounds (TVOCs), 4-phenylcyclohexene (4-PCH), and carbon monoxide.

Implement construction IAQ management plans as authorized by the Department.

Full compensation for the work specified in "Indoor Air Quality Management" is included in the payment for the bid items involved.

5-1.14 RELATIONS WITH CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

This project lies within the boundaries of the San Francisco Bay Region (2) Regional Water Quality Control Board (RWQCB).

The State Water Resources Control Board (SWRCB) has issued to the Department a permit that governs storm water and non-storm water discharges from the Department's properties, facilities, and activities. The Department's permit is entitled "Order No. 99 - 06 - DWQ, NPDES No. CAS000003, National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation (Caltrans)." Copies of the Department's permit are available for review from the SWRCB, Division of Water Quality, 1001 "I" Street, P.O. Box 100, Sacramento, California 95812-0100, Telephone fax: (916) 341-5463 and may also be obtained at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater/caltrans.shtml

The Department's permit references and incorporates by reference the current statewide general permit issued by the SWRCB entitled "Order No. 2009-0009-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction and Land Disturbance Activities" that regulates discharges of storm water and non-storm water from construction activities disturbing one acre or more of soil in a common plan of development. Copies of the statewide permit and modifications thereto are available for review from the SWRCB, Division of Water Quality, 1001 "I" Street, P.O. Box 100, Sacramento, California 95812-0100, Telephone fax: (916) 341-5463 and may also be obtained at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml

The NPDES permits that regulate this project, as referenced above, are collectively referred to in this section as the "permits."

This project shall conform to the permits and modifications thereto. The Contractor shall maintain copies of the permits at the project site and shall make them available during construction.

The Contractor shall know and comply with provisions of Federal, State, and local regulations and requirements that govern the Contractor's operations and storm water and non-storm water discharges from the project site and areas of disturbance outside the project limits during construction. Attention is directed to Sections 7-1.01, "Laws to

be Observed," 5-1.18, "Property and Facility Preservation," 7-1.12, "Indemnification and Insurance," and 9-1.07E(5), "Penalty Withholds," of the Standard Specifications.

The Contractor shall notify the Engineer immediately upon request from the regulatory agencies to enter, inspect, sample, monitor, or otherwise access the project site or the Contractor's records pertaining to water pollution control work. The Contractor and the Department shall provide copies of correspondence, notices of violation, enforcement actions, or proposed fines by regulatory agencies to the requesting regulatory agency.

5-1.15 NONHIGHWAY FACILITIES (INCLUDING UTILITIES)

During the progress of the work under this Contract, the utility owner will relocate a utility shown in the following table within the corresponding number of days shown. Notify the Engineer before you work within the approximate location of a utility shown. The days start on the notification date.

Utility Relocation and Department-Arranged Time for the Relocation

Utility	Location	Days
Guy Wire (PG&E Wood Pole) To be relocated by Others.	Rt, Station M 3+80	10

The utilities shown in the following table may interfere with pile driving, drilling activities, or subsurface construction and surface construction , but the utility owner will not rearrange them.

Utilities Not Rearranged for Pile Driving, Drilling Activities, or Subsurface Construction and Surface Construction

Utility	Location
108-inches RCP Sewer Outfall (EBMUD)	Between Rt., Stations N13+00 and 28+00
12-inches Gas main (PG&E)	Between Rt., StationsN13+00 and Lt., Station 28+00
12- inches, 15-inches, 18-inches combine sewer	Between Rt., Stations N13+00 and 28+00

5-1.16 DAMAGE REPAIR

Attention is directed to Section 7-1.16, "Contractor's Responsibility for the Work and Materials," and Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications and these special provisions.

Damage to slopes, plants, irrigation systems and other highway facilities occurring as a result of rain during the plant establishment period shall be repaired by the Contractor, when directed by the Engineer. The cost of the repairs which exceed the accumulated sum of $2,000.00 will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost of repairs in conformance with the provisions in Section 9-1.03, "Force Account Payment," of the Standard Specifications, and paying to the Contractor one-half of the cost which exceeds the sum of $2,000.00.

When as a result of freezing conditions (as defined herein) during the plant establishment period, plants have died or, in the opinion of the Engineer, have deteriorated to a point beyond which the plants will not mature as typical examples of their species, the Engineer may direct replacement of the affected plants. The total cost of ordered plant replacement work will be paid for as extra work as provided in Section 4-1.03D,"Extra Work," of the Standard Specifications. A freezing condition, for the purpose of this specification, occurs when the temperature at or near the affected area has been officially recorded below 32° F and plants have been killed or damaged to the degree described above.

When, as a result of drought conditions (as defined herein) during the plant establishment period, plants have died or, in the opinion of the Engineer, have deteriorated to a point beyond which the plants will not mature as typical examples of their species, the Engineer may direct replacement of the affected plants. The total cost of ordered plant replacements, after water has been restricted or stopped, will be paid for as extra work as provided in Section 4-1.03D,"Extra Work," of the Standard Specifications. Restriction or shutoff of available water shall not relieve the Contractor from performing other contract work. A drought condition occurs when the Department, or its supplier, restricts or stops delivery of water to the Contractor to the degree that plants have died or deteriorated as described above.

When the provisions in Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications are applicable, the provisions above for payment of costs for repair of damage due to rain, freezing conditions and drought shall not apply.

5-1.17 RELIEF FROM MAINTENANCE AND RESPONSIBILITY

The Contractor may be relieved of the duty of maintenance and protection for those items not directly connected with plant establishment work in conformance with the provisions in Section 7-1.15, "Relief From Maintenance and Responsibility," of the Standard Specifications. Water pollution control, maintain existing planted areas, maintain existing irrigation facilities, transplant trees, and transplant palm trees shall not be relieved of maintenance.

5-1.18 AREAS FOR CONTRACTOR'S USE

Attention is directed to the requirements specified in Section 7-1.19, "Rights in Land and Improvements," of the Standard Specifications, plans and these special provisions.

The highway right of way shall be used only for purposes that are necessary to perform the required work. The Contractor shall not occupy the right of way, or allow others to occupy the right of way, for purposes which are not necessary to perform the required work.

No area is available within the contract limits for the exclusive use of the Contractor. However, temporary storage of equipment and materials on State property may be arranged with the Engineer, subject to the prior demands of State maintenance forces and to other contract requirements. Use of the Contractor's work areas and other State-owned property shall be at the Contractor's own risk. The State shall not be held liable for damage to or loss of materials or equipment located within these areas.

Toll plaza parking lots shall not be used for the Contractor's employees private vehicles and the Contractor's equipment and vehicles.

The Contractor shall remove the equipment, materials, and rubbish from the work areas and other State-owned property which the Contractor occupies and shall leave the areas in a presentable condition, in conformance with the provisions in Section 4-1.02, "Final Cleaning Up," of the Standard Specifications.

The Contractor shall secure, at the Contractor's own expense, areas required for storage of plant, equipment, and materials, or for other purposes if sufficient area is not available to the Contractor within the contract limits.

5-1.19 UTILITIES

The Contractor shall make arrangements to obtain electrical power, water or compressed air or other utilities required for the Contractor's operations and shall make and maintain the necessary service connections at the Contractor's own expense.

5-1.20 SANITARY PROVISIONS

State sanitary facilities will not be available for use by the Contractor's employees.

5-1.21 BRIDGE TOLLS

Toll-free passage on the San Francisco-Oakland Bay Bridge will be granted only for cars, trucks and special construction equipment which are clearly marked on the exterior with the Contractor's identification and which are being operated by the Contractor exclusively for the project, and which are used for the purpose of transporting materials and workers directly to and from the project site.

The Contractor shall make application to the Engineer in advance for toll-free passage. The Contractor will be held accountable for the proper use of passes issued, and upon completion of the work, shall return unused passes to the Engineer.

Attention is directed to Section 23302, "Evasion of Toll," of the Vehicle Code.

5-1.22 ACCESS TO PROJECT SITE

Prospective bidders may make arrangements to visit the project site by contacting the Duty Senior, District 04 Office, 111 Grand Avenue, Oakland, CA 94612, email: duty_senior_district04@dot.ca.gov, telephone number (510) 286-5209.

5-1.23 DRAWINGS

Attention is directed to Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions.

When working drawings are required by these special provisions, the drawings shall be submitted in conformance with the provisions in Section 55-1.02, "Drawings," of the Standard Specifications and the following:

A. Working drawings shall be submitted to the Engineer.
B. Working drawings shall not exceed 22" x 34" in size.

C. Microfilms are required of approved shop drawings and shall be only a 24x reduction.

5-1.24 PERMITS AND LICENSES

Attention is directed to Section 7-1.04, "Permits, Licenses, Agreements, and Certifications" of the Standard Specifications.

SECTION 6. (BLANK)

SECTION 7. (BLANK)

SECTION 8. MATERIALS

SECTION 8-1. MISCELLANEOUS

8-1.01 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS

The Department maintains the following list of Prequalified and Tested Signing and Delineation Materials. The Engineer shall not be precluded from sampling and testing products on the list of Prequalified and Tested Signing and Delineation Materials.

The manufacturer of products on the list of Prequalified and Tested Signing and Delineation Materials shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each type of traffic product supplied.

For those categories of materials included on the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included on the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the Standard Specifications.

Materials and products may be added to the list of Prequalified and Tested Signing and Delineation Materials if the manufacturer submits a New Product Information Form to the New Product Coordinator at the Transportation Laboratory. Upon a Departmental request for samples, sufficient samples shall be submitted to permit performance of required tests. Approval of materials or products will depend upon compliance with the specifications and tests the Department may elect to perform.

PAVEMENT MARKERS, PERMANENT TYPE

Retroreflective With Abrasion Resistant Surface (ARS)

("length along the direction of travel" x "marker width")

1. Apex, Model 921AR (4" x 4")
2. Ennis-Flint, Models C88 (4" x 4"), 911 (4" x 4") and C80FH (3.1" x 4.5")
3. Ray-O-Lite, Models "AA" ARC II (4" x 4") and ARC Round Shoulder (4" x 4")
4. 3M Series 290 (3.5" x 4")
5. 3M Series 290 PSA
6. Glowlite, Inc Model 988AR (4" x 4")

Retroreflective With Abrasion Resistant Surface (ARS)

(for recessed applications only)

1. Ennis-Flint, Model 948 (2.3" x 4.7")
2. Ennis-Flint, Model 944SB (2" x 4")*
3. Ray-O-Lite, Model 2002 (2" x 4.6")
4. Ray-O-Lite, Model 2004 (2" x 4")*

*For use only in 4.5 inch wide (older) recessed slots

Non-Reflective, 4-inch Round

1. Apex Universal (Ceramic)
2. Apex Universal, Models 929 (ABS) and 929PP (Polypropylene)
3. Glowlite, Inc. (Ceramic) and PP (Polypropylene)
4. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
5. Interstate Sales, "Diamond Back" (Polypropylene)
6. Novabrite Models Cdot (White) Cdot-y (Yellow), Ceramic

7. Novabrite Models Pdot-w (White) Pdot-y (Yellow), Polypropylene
8. Three D Traffic Works TD10000 (ABS), TD10500 (Polypropylene)
9. Ray-O-Lite, Ray-O-Dot (Polypropylene)

PAVEMENT MARKERS, TEMPORARY TYPE

Temporary Markers For Long Term Day/Night Use (180 days or less)

1. Vega Molded Products "Temporary Road Marker" (3" x 4")
2. Pexco LLC, Halftrack model 25, 26 and 35

Temporary Markers For Short Term Day/Night Use (14 days or less)

(For seal coat or chip seal applications, clear protective covers are required)

1. Apex Universal, Model 932
2. Pexco LLC, Models T.O.M., T.R.P.M., and "HH" (High Heat)
3. Hi-Way Safety, Inc., Model 1280/1281
4. Glowlite, Inc., Model 932

STRIPING AND PAVEMENT MARKING MATERIAL

Permanent Traffic Striping and Pavement Marking Tape

1. Advanced Traffic Marking, Series 300 and 400
2. Brite-Line, Series 1000
3. Brite-Line, "DeltaLine XRP"
4. Swarco Industries, "Director 35" (For transverse application only)
5. Swarco Industries, "Director 60"
6. 3M, "Stamark" Series 380 and 270 ES
7. 3M, "Stamark" Series 420 (For transverse application only)

Temporary (Removable) Striping and Pavement Marking Tape (180 days or less)

1. Advanced Traffic Marking, Series 200
2. Brite-Line, "Series 100", "Deltaline TWR"
3. Garlock Rubber Technologies, Series 2000
4. Tape 4, Aztec, Grade 102
5. Swarco Industries, "Director-2", "Director 2-Wet Reflective"
6. Trelleborg Industries, R140 Series
7. 3M Series 620 "CR", Series 780 and Series 710
8. 3M Series A145, Removable Black Line Mask
   (Black Tape: for use only on Hot mix asphalt surfaces)
9. Advanced Traffic Marking Black "Hide-A-Line"
   (Black Tape: for use only on Hot mix asphalt surfaces)
10. Brite-Line "BTR" Black Removable Tape
    (Black Tape: for use only on Hot mix asphalt surfaces)
11. Trelleborg Industries, RB-140
    (Black Tape: for use only on Hot mix asphalt surfaces)

Preformed Thermoplastic (Heated in place)

1. Ennis-Flint, "Hot Tape"
2. Ennis-Flint, "Premark Plus"
3. Ennis-Flint, "Flametape"

Ceramic Surfacing Laminate, 6" x 6"

1. Highway Ceramics, Inc.

CLASS 1 DELINEATORS

One Piece Driveable Flexible Type, 66-inch

1. Pexco LLC, "Flexi-Guide Models 400 and 566"
2. Carsonite, Curve-Flex CFRM-400
3. Carsonite, Roadmarker CRM-375

4. FlexStake, Model 654 TM
5. GreenLine Model CGD1-66

Special Use Type, 66-inch

1. Pexco LLC, Model FG 560 (with 18-inch U-Channel base)
2. Carsonite, "Survivor" (with 18-inch U-Channel base)
3. Carsonite, Roadmarker CRM-375 (with 18-inch U-Channel base)
4. FlexStake, Model 604
5. GreenLine Model CGD (with 18-inch U-Channel base)
6. Impact Recovery Model D36, with #105 Driveable Base
7. Safe-Hit with 8-inch pavement anchor (SH248-GP1)
8. Safe-Hit with 15-inch soil anchor (SH248-GP2) and with 18-inch soil anchor (SH248-GP3)
9. Safe-Hit RT 360 Post with Soil Mount Anchor (GPS)
10. Shur-Tite Products, Shur-Flex Drivable

Surface Mount Type, 48-inch

1. Bent Manufacturing Company, Masterflex Model MFEX 180-48
2. Carsonite, "Channelizer"
3. FlexStake, Models 704, 754 TM, and EB4
4. Impact Recovery Model D48, with #101 Fixed (Surface-Mount) Base
5. Three D Traffic Works "Channelflex" ID No. 522248W
6. Flexible Marker Support, Flexistiff Model C-9484
7. Safe-Hit, SH 248 SMR

CHANNELIZERS

Surface Mount Type, 36-inch

1. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) MF-180-36 (Flat) and MFEX 180—36
2. Pexco LLC, Flexi-Guide Models FG300PE, FG300UR, and FG300EFX
3. Carsonite, "Super Duck" (Round SDR-336)
4. Carsonite, Model SDCF03601MB "Channelizer"
5. FlexStake, Models 703, 753 TM, and EB3
6. GreenLine, Model SMD-36
7. Hi-way Safety, Inc. "Channel Guide Channelizer" Model CGC36
8. Impact Recovery Model D36, with #101 Fixed (Surface-Mount) Base
9. Safe-Hit, Guide Post, Model SH236SMA and Dura-Post, Model SHL36SMA
10. Three D Traffic Works "Boomerang" 5200 Series
11. Flexible Marker Support, Flexistiff Model C-9484-36
12. Shur-Tite Products, Shur-Flex

Lane Separation System

1. Pexco LLC, "Flexi-Guide (FG) 300 Curb System"
2. Qwick Kurb, "Klemmfix Guide System"
3. Dura-Curb System
4. Tuff Curb
5. FG 300 Turnpike Curb
6. Shur-Tite Products, SHUR-Curb , Model No. SF0200

CONICAL DELINEATORS, 42-inch

(For 28-inch Traffic Cones, see Standard Specifications)

1. Bent Manufacturing Company "T-Top", TDSC Series
2. Plastic Safety Systems "Navigator-42"
3. TrafFix Devices "Grabber"
4. Three D Traffic Works "Ringtop" TD7000, ID No. 742143
5. Three D Traffic Works, TD7500
6. Work Area Protection Corp. C-42
7. Custom-Pak 4600 (Part No. 93005-0001)

8. Plasticade, Navicade, 650 RI

OBJECT MARKERS

Type "K", 18-inch

1. Pexco LLC, Model FG318PE
2. Carsonite, Model SMD 615
3. FlexStake, Model 701 KM
4. Safe-Hit, Model SH718SMA
5. Impact Recover Systems, Model 282-K

Type "Q" Object Markers, 24-inch

1. Bent Manufacturing "Masterflex" Model MF-360-24
2. Pexco LLC, Model FG324PE
3. Carsonite, "Channelizer"
4. FlexStake, Model 701KM
5. Safe-Hit, Models SH824SMA_WA and SH824GP3_WA
6. Three D Traffic Works ID No. 531702W and TD 5200
7. Three D Traffic Works ID No. 520896W
8. Safe-Hit, Dura-Post SHLQ-24"
9. Flexible Marker Support, IMC 9484-24
10. Impact Recover Systems, Model 282-Q

CONCRETE BARRIER MARKERS AND
TEMPORARY RAILING (TYPE K) REFLECTORS

Impactable Type

1. ARTUK, "FB"
2. Pexco LLC, Models PCBM-12 and PCBM-T12, PCBM 912
3. Duraflex Corp., "Flexx 2020" and "Electriflexx"
4. Hi-Way Safety, Inc., Model GMKRM100
5. Plastic Safety Systems "BAM" Models OM-BARR and OM-BWAR
6. Three D Traffic Works "Roadguide" Model TD 9300

Non-Impactable Type

1. ARTUK, JD Series
2. Plastic Safety Systems "BAM" Models OM-BITARW and OM-BITARA
3. Vega Molded Products, Models GBM and JD
4. Plastic Vacuum Forming, "Cap-It C400"

METAL BEAM GUARD RAIL POST MARKERS

(For use to the left of traffic)

1. Pexco LLC, "Mini" (3" x 10"), I-Flex
2. Creative Building Products, "Dura-Bull, Model 11201"
3. Duraflex Corp., "Railrider"
4. Plastic Vacuum Forming, "Cap-It C300"

CONCRETE BARRIER DELINEATORS, 16-inch

(For use to the right of traffic)

1. Pexco LLC, Model PCBM T-16
2. Safe-Hit, Model SH216RBM
3. Three D Traffic Works "Roadguide" Model 9400

CONCRETE BARRIER-MOUNTED MINI-DRUM (10" x 14" x 22")

1. Stinson Equipment Company "SaddleMarker"

GUARD RAILING DELINEATOR

(Place top of reflective element at 48 inches above plane of roadway)

Wood Post Type, 27-inch

1. Pexco LLC, FG 427 and FG 527
2. Carsonite, Model 427
3. FlexStake, Model 102 GR
4. GreenLine GRD 27
5. Safe-Hit, Model SH227GRD
6. Three D Traffic Works "Guardflex" TD9100
7. New Directions Mfg, NDM27
8. Shur-Tite Products, Shur-Tite Flat Mount
9. Glasforms, Hiway-Flex, GR-27-00
10. Impact Recover Systems, 200-GRP

Barrier, Guardrail Visibility Enhancement

1. UltraGuard Safety System, Potters Industries, Inc.
2. Worldwide Safety and Irwin Hodson, Monarch Butterfly Reflective Device (MBGR only)

Steel Post Type

1. Carsonite, Model CFGR-327

RETROREFLECTIVE SHEETING

Channelizers, Barrier Markers, and Delineators

1. Avery Dennison T-6500 Series (For rigid substrate devices only)
2. Avery Dennison WR-7100 Series and WR-6100
3. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
4. Reflexite, PC-1000 Metalized Polycarbonate
5. Reflexite, AC-1000 Acrylic
6. Reflexite, AP-1000 Metalized Polyester
7. Reflexite, Conformalight, AR-1000 Abrasion Resistant Coating
8. 3M, High Intensity

Traffic Cones, 4-inch and 6-inch Sleeves

1. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
2. Reflexite, Vinyl, "TR" (Semi-transparent) or "Conformalight", C85
3. 3M Series 3840, Series 3340
4. Avery Dennison S-9000C

Drums

1. Avery Dennison WR-6100 Series
2. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
3. Reflexite, "Conformalight", "Super High Intensity" or "High Impact Drum Sheeting"
4. 3M Series 3810

BARRICADE SHEETING

Type I, Medium-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Nippon Carbide Industries, CN8117
2. Avery Dennison, W 1100 series
3. 3M Series CW 44

Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Avery Dennison, W-2100 Series

Type IV, High Intensity (Typically Unmetalized Microprismatic Retroreflective Element)

1. 3M Series 3334/3336

Vertical Clearance Signs: Structure Mounted

1. 3M Model 4061, Diamond Grade DG3, Fluorescent Yellow

Signs: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Avery Dennison, T-2500 Series
2. Nippon Carbide Industries, Nikkalite 18000

Signs: Type III, High-Intensity (Typically Encapsulated Glass-Bead Element)

1. Avery Dennison, T-5500A and T-6500 Series
2. Nippon Carbide Industries, Nikkalite Brand Ultralite Grade II
3. 3M 3870 and 3930 Series
4. Changzhou Hua R Sheng, Series TM 1200
5. Oracal, Oralite Series 5800

Signs: Type IV, High-Intensity (Typically Unmetallized Microprismatic Element)

1. Avery Dennison, T-6500 Series
2. Nippon Carbide Industries, Crystal Grade, 94000 Series
3. Nippon Carbide Industries, Model No. 94847 Fluorescent Orange
4. 3M Series 3930 and Series 3924S

Signs: Type VI, Elastomeric (Roll-Up) High-Intensity, without Adhesive

1. Avery Dennison, WU-6014
2. Novabrite LLC, "Econobrite"
3. Reflexite "Vinyl"
4. Reflexite "SuperBright"
5. Reflexite "Marathon"
6. 3M Series RS20

Signs: Type VIII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)

1. Avery Dennison, T-7500 Series
2. Avery Dennison, T-7511 Fluorescent Yellow
3. Avery Dennison, T-7513 Fluorescent Yellow Green
4. Avery Dennison, W-7514 Fluorescent Orange
5. Nippon Carbide Industries, Nikkalite Crystal Grade Series 92800
6. Nippon Carbide Industries, Nikkalite Crystal Grade Model 92847 Fluorescent Orange

Signs: Type IX, Very-High-Intensity (Typically Unmetallized Microprismatic Element)

1. 3M VIP Series 3981 Diamond Grade Fluorescent Yellow
2. 3M VIP Series 3983 Diamond Grade Fluorescent Yellow/Green
3. 3M VIP Series 3990 Diamond Grade
4. Avery Dennison T-9500 Series
5. Avery Dennison, T9513, Fluorescent Yellow Green
6. Avery Dennison, W9514, Fluorescent Orange
7. Avery Dennison, T-9511 Fluorescent Yellow

Signs: Type XI, Very High Intensity (Typically Unmetallized Microprismatic Element)

1 3M Diamond Grade, DG3, Series 4000
2. 3M Diamond Grade, DG3, Series 4081, Fluorescent Yellow
3. 3M Diamond Grade, DG3, Series 4083, Fluorescent Yellow/Green
4. 3M Diamond Grade, DG3, Series 4084, Fluorescent Orange
5. Avery Dennison, OmniCube, T-11500 Series
6. Avery Dennison, OmniCube, T-11511, Fluorescent Yellow
7. Avery Dennison, OmniCube, T-11513, Fluorescent Yellow Green
8. Avery Dennison, OmniCube, W-11514 Fluorescent Orange

SPECIALTY SIGNS

1. Reflexite "Endurance" Work Zone Sign (with Semi-Rigid Plastic Substrate)

ALTERNATIVE SIGN SUBSTRATES

Fiberglass Reinforced Plastic (FRP) and Expanded Foam PVC

1. Fiber-Brite (FRP)
2. Sequentia, "Polyplate" (FRP)
3. Inteplast Group "InteCel" (0.5 inch for Post-Mounted CZ Signs, 48-inch or less)(PVC)

Aluminum Composite, Temporary Construction Signs and Permanent Signs up to 4 foot, 7 Inches

1. Alcan Composites "Dibond Material, 80 mils"
2. Mitsubishi Chemical America, Alpolic 350
3. Bone Safety Signs, Bone Light ACM (temporary construction signs only)
4. Kommerling, USA, KomAlu 3 mm

8-1.02 STATE-FURNISHED MATERIALS

The State furnishes you with:

1. Seven hundred gallons of Bio Diesel 5 for testing fuel storage and dispensing equipment
2. Five hundred gallons of Unleaded Gasoline for testing fuel storage and dispensing equipment
3. Five hundred gallons of E-85 Gasoline for testing fuel storage and dispensing equipment
4. Drum and lubricating material for testing lubrication system as follows:

    4.1 Chassis Lubricant
    4.2 Motor oil (light weight)
    4.3 Motor Oil (heavy weight)
    4.4 Automatic Transmission Fluid
    4.5 Gear Oil
    4.6 Hydraulic Fluid
    4.7 Anti-freeze

5 Galvanized chain to lock the main shutoff in the open position during automatic fire sprinkler system testing
6. Padlocks for backflow preventer assembly enclosures, irrigation controller enclosure cabinets, and lock for the main water shutoff

Notify the Engineer not less than 15 days before you pick up and when you pick up the State-furnished material. Provide a full description of the material and the time the material will be picked up.

SECTION 8-2. CONCRETE

8-2.01 PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

LEED SUBMITTALS

MR Credit 4, Recycled Content

For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials

For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

STRENGTH DEVELOPMENT TIME

The time allowed to obtain the minimum required compressive strength as specified in Section 90-1.01, "Description," of the Standard Specifications will be 56 days when the Contractor chooses cementitious material that satisfies the following equation:

$$\frac{(41 \times UF) + (19 \times F) + (11 \times SL)}{TC} \geq 7.0$$

Where:

F = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N, including the amount in blended cement, pounds per cubic yard. F is equivalent to the sum of FA and FB as defined in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials," of the Standard Specifications

SL = GGBFS, including the amount in blended cement, pounds per cubic yard

UF = Silica fume, metakaolin, or UFFA, including the amount in blended cement, pounds per cubic yard

TC = Total amount of cementitious material used, pounds per cubic yard

For concrete satisfying the equation above, the Contractor shall test for the modulus of rupture or compressive strength specified for the concrete involved, at least once every 500 cubic yards, at 28, 42, and 56 days. The Contractor shall submit test results to the Engineer and the Transportation Laboratory, Attention: Office of Concrete Materials.

SUPPLEMENTARY CEMENTITIOUS MATERIALS

The Contractor may use rice hull ash as a supplementary cementitious material (SCM) to make minor concrete. Rice hull ash shall conform to the requirements in AASHTO Designation: M 321 and the following chemical and physical requirements:

Chemical Requirements	Percent
Silicon Dioxide (SiO_2) [a]	90 min.
Loss on ignition	5.0 max.
Total Alkalies (as Na_2O) equivalent	3.0 max.

Physical Requirements	Percent
Particle size distribution Less than 45 microns Less than 10 microns	 95 50
Strength Activity Index with portland cement [b] 7 days 28 days	 95 (minimum % of control) 110 (minimum % of control)
Expansion at 16 days when testing job materials in conformance with ASTM C 1567 [c]	0.10 max.
Surface Area when testing by nitrogen adsorption in conformance with ASTM D 5604	40.0 m^2/g min.

Notes:

[a] A maximum of 1.0% of the SiO_2 may exist in crystalline form.

[b] When tested in conformance with the requirements for strength activity testing of silica fume in AASHTO Designation: M 307

[c] In the test mix, Type II or Type V portland cement shall be replaced with at least 12% RHA by weight.

For the purposes of calculating cementitious material requirements in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials," of the Standard Specifications and these special provisions, rice hull ash is considered to be represented by the variable *UF*.

8-2.02 CORROSION CONTROL FOR PORTLAND CEMENT CONCRETE

Portland cement concrete at SFOBB Maintenance Complex is considered to be in a corrosive environment and shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions, except the specifications for supplementary cementitious material content in Section 90-2.01C, "Required Use Of Supplementary Cementitious Materials," of the Standard Specifications shall not apply.

Cementitious material to be used in portland cement concrete shall conform to the provisions in Section 90-2, "Materials," of the Standard Specifications, and shall be a combination of either Type II or Type V portland cement and supplementary cementitious material.

Concrete in a corrosive environment shall contain not less than 675 pounds of cementitious material per cubic yard.

Reduction in the cementitious material content specified or ordered in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," of the Standard Specifications, is not permitted for concrete in a corrosive environment.

For precast prestressed concrete piling at SFOBB Maintenance Complex, the cementitious material shall be comprised of one of the following:

A. 20 percent by weight of either fly ash or natural pozzolan with a CaO content of up to 10 percent, 5 percent by weight of silica fume, and 75 percent by weight of portland cement
B. 12 percent by weight of either silica fume, metakaolin, or UFFA; and 88 percent by weight of portland cement
C. 50 percent by weight of ground granulated blast furnace slag and 50 percent by weight of portland cement

For all other concrete in a corrosive environment, the cementitious material shall be comprised of one of the following:

A. 25 percent by weight of either fly ash or natural pozzolan with a CaO content of up to 10 percent, and 75 percent by weight of portland cement
B. 20 percent by weight of either fly ash or natural pozzolan with a CaO content of up to 10 percent, 5 percent by weight of silica fume, and 75 percent by weight of portland cement
C. 12 percent by weight of either silica fume, metakaolin, or UFFA; and 88 percent by weight of portland cement
D. 50 percent by weight of ground granulated blast furnace slag, and 50 percent by weight of portland cement

For the concrete at SFOBB Maintenance Complex, the ratio of the amount of free water to the amount of cementitious material used in concrete in a corrosive environment shall not exceed 0.40.

Full compensation for conforming to the above requirements shall be considered as included in the contract prices paid for the various contract items of work, and no additional compensation will be allowed therefor.

8-2.03 PRECAST CONCRETE QUALITY CONTROL

GENERAL

Precast concrete quality control shall conform to these special provisions.

Unless otherwise specified, precast concrete quality control shall apply when any precast concrete members are fabricated in conformance with the provisions in Section 49, "Piling," or Section 51, "Concrete Structures," of the Standard Specifications.

Precast concrete quality control shall not apply to precast concrete members that are fabricated from minor concrete.

Quality Control (QC) shall be the responsibility of the Contractor. The Contractor's QC inspectors shall perform inspection and testing prior to precasting, during precasting, and after precasting, and as specified in this section and additionally as necessary to ensure that materials and workmanship conform to the details shown on the plans, and to the specifications.

Quality Assurance (QA) is the prerogative of the Engineer. Regardless of the acceptance for a given precast element by the Contractor, the Engineer will evaluate the precast element. The Engineer will reject any precast element that does not conform to the approved Precast Concrete Quality Control Plan (PCQCP), the details shown on the plans, or to these special provisions.

The Contractor shall designate in writing a precast Quality Control Manager (QCM) for each precasting facility. The QCM shall be responsible directly to the Contractor for the quality of precasting, including materials and workmanship, performed by the Contractor and all subcontractors. The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and

reports to and from the Engineer. The QCM shall not be employed or compensated by any subcontractor, or other persons or entities hired by subcontractors, or suppliers, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Prior to submitting the PCQCP required herein, a meeting between the Engineer, the Contractor's QCM, and a representative from each entity performing precast concrete operations for this project, shall be held to discuss the requirements for precast quality control.

QC Inspectors shall either be 1) licensed as Civil Engineers in the State of California, or 2) have a current Plant Quality Personnel Certification, Level II, from the Precast/Prestressed Concrete Institute. A QC Inspector shall witness all precast concrete operations.

PRECAST CONCRETE QUALIFICATION AUDIT

Unless otherwise specified, no Contractors or subcontractors performing precast concrete operations for the project shall commence work without having successfully completed the Department's Precast Fabrication Qualification Audit, hereinafter referred to as the audit. Copies of the audit form, along with procedures for requesting and completing the audit, are available at:

http://www.dot.ca.gov/hq/esc/Translab/OSM/smbresources.htm

An audit that was previously approved by the Department no more than 3 years before the award of this contract will be acceptable for the entire period of this contract, provided the Engineer determines the audit is for the same type of work that is to be performed on this contract.

A list of facilities who have successfully completed the audit and are authorized to provide material for this contract is available at:

http://www.dot.ca.gov/hq/esc/Translab/OSM/smdocuments/Internet_auditlisting.pdf

Successful completion of an audit shall not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and as shown on the plans.

PRECAST CONCRETE QUALITY CONTROL PLAN

Prior to performing any precasting operations, the Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 3 copies of a separate PCQCP for each item of work to be precast. A separate PCQCP shall be submitted for each facility. As a minimum, each PCQCP shall include the following:

A. The name of the precasting firm, the concrete plants to be used, and any concrete testing firm to be used;
B. A manual prepared by the precasting firm that includes equipment, testing procedures, safety plan, and the names, qualifications, and documentation of certifications for all personnel to be used;
C. The name of the QCM and the names, qualifications, and documentation of certifications for all QC inspection personnel to be used;
D. An organizational chart showing all QC personnel and their assigned QC responsibilities;
E. The methods and frequencies for performing all required quality control procedures, including all inspections, material testing, and any required survey procedures for all components of the precast elements including prestressing systems, concrete, grout, reinforcement, steel components embedded or attached to the precast member, miscellaneous metal, and formwork;
F. A system for identification and tracking of required precast element repairs, and a procedure for the reinspection of any repaired precast element. The system shall have provisions for a method of reporting nonconforming precast elements to the Engineer; and
G. Forms to be used for Certificates of Compliance, daily production logs, and daily reports.

The Engineer shall have 4 weeks to review the PCQCP submittal after a complete plan has been received. No precasting shall be performed until the PCQCP is approved in writing by the Engineer.

A PCQCP that was previously approved by the Engineer no more than 1 year prior to the beginning of work on this contract will be acceptable for the entire period of this contract, provided the Engineer determines the PCQCP is for the same type of work that is to be performed on this contract.

An amended PCQCP or addendum shall be submitted to, and approved in writing by the Engineer, for any proposed revisions to the approved PCQCP. An amended PCQCP or addendum will be required for any revisions to the PCQCP, including but not limited to changes in concrete plants or source materials, changes in material testing

procedures and testing labs, changes in procedures and equipment, changes in QC personnel, or updated systems for tracking and identifying precast elements. The Engineer shall have 2 weeks to complete the review of the amended PCQCP or addendum, once a complete submittal has been received. Work that is affected by any of the proposed revisions shall not be performed until the amended PCQCP or addendum has been approved.

After final approval of the PCQCP, amended PCQCP, or addendum, the Contractor shall submit 7 copies to the Engineer of each of these approved documents.

It is expressly understood that the Engineer's approval of the Contractor's PCQCP shall not relieve the Contractor of any responsibility under the contract for the successful completion of the work in conformance with the requirements of the plans and specifications. The Engineer's approval shall neither constitute a waiver of any of the requirements of the plans and specifications nor relieve the Contractor of any obligation thereunder; and defective work, materials, and equipment may be rejected notwithstanding approval of the PCQCP.

REPORTING

The QC Inspector shall provide reports to the QCM on a daily basis for each day that precasting operations are performed.

A daily production log for precasting shall be kept by the QCM for each day that precasting operations, including setting forms, placing reinforcement, setting prestressing steel, casting, curing, post tensioning, and form release, are performed. The log shall include the facility location, and shall include a specific description of casting or related operations, any problems or deficiencies discovered, any testing or repair work performed, and the names of all QC personnel and the specific QC inspections they performed that day. The daily report from each QC Inspector shall also be included in the log. This daily log shall be available for viewing by the Engineer, at the precasting facility.

All reports regarding material tests and any required survey checks shall be signed by the person who performed the test or check, and then submitted directly to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or type-written next to all signatures.

The Engineer shall be notified immediately in writing when any precasting problems or deficiencies are discovered and of the proposed repair or process changes required to correct them. The Engineer shall have 4 weeks to review these procedures. No remedial work shall begin until the Engineer approves these procedures in writing.

The following items shall be included in a precast report that is to be submitted to the Engineer following the completion of any precast element:

A. Reports of all material tests and any required survey checks;
B. Documentation that the Contractor has evaluated all tests and corrected all rejected deficiencies, and all repairs have been re-examined with the required tests and found acceptable; and
C. A daily production log.

At the completion of any precast element, and if the QCM determines that element is in conformance with these special provisions, the QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. This Certificate of Compliance shall be submitted with the precast report. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans and the provisions of the Standard Specifications and these special provisions.

PAYMENT

In the event the Engineer fails to complete the review of 1) a PCQCP, 2) an amended PCQCP or addendum, or 3) a proposed repair or process change, within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

All required repair work or process changes required to correct precasting operation deficiencies, whether discovered by the QCM, QC Inspector, or by the Engineer, and any associated delays or expenses to the Contractor caused by performing these repairs, shall be at the Contractor's expense.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

8-2.04 SELF-CONSOLIDATING CONCRETE FOR PRECAST ELEMENTS

GENERAL

Summary

This section includes specifications for self-consolidating concrete (SCC).
You may use SCC for only the following cases:

1. For precast concrete
2. Where the specifications allow the use of SCC

Definitions

self-consolidating concrete: Flowing concrete capable of spreading to a level state without segregation and without the use of internal or external vibrators.

Submittals

Submit the following for approval before placing SCC:

1. SCC mix design and placement procedures
2. Trial batch test report

Quality Control and Assurance

General

Prepare SCC specimens for compressive strength testing under California Test 540 except fabricate test specimens as follows:

1. Place test molds on a firm, flat surface to prevent distortion of the bottom surface. When more than 1 specimen is to be made from the same batch, make all specimens simultaneously. Fill the mold in 1 lift, pouring the concrete from a larger container. Pat sides of the mold lightly by hand, or jig by rocking the mold from side to side.
2. Strike off the surface of the concrete even with the top edge of the mold. Wipe the sides of the mold free of excess concrete and press the lid on.

Prequalification of SCC Mix Design

Prequalify the SCC mix design with a trial batch using the same materials, mix proportions, mixing equipment, procedures, and size of batch to be used in the production of SCC. The trial batch test report for the SCC mix design must include the following tests and results:

SCC Mix Design Requirements

Property	Requirement	Test Method
Slump Flow	At least 20 inches	ASTM C 1611
Flow Rate - T_{50}	Between 2 and 7 seconds	ASTM C 1611
Visual Stability Index	1 or less	ASTM C 1611
J-Ring Flow	The difference between J-Ring flow and the slump flow must not exceed 2 inches	ASTM C 1621
Column Segregation	Static segregation must not exceed 15%	ASTM C 1610
Bleeding	Bleeding capacity must not exceed 2.5%	ASTM C 232
Compressive Strength	The average of 5 test cylinders must be at least 600 psi greater than the specified strength.[a]	California Test 521
Minimum Compressive Strength	The minimum for an individual test cylinder must not be less than the specified strength.[a]	California Test 521

Note:
[a] At the maximum age specified or allowed

Field Quality Control

Determine the fine aggregate moisture content for each batch of SCC.

Determine slump flow and visual stability index (VSI) under ASTM C 1611 at the beginning of SCC placement and whenever a set of concrete cylinders is prepared. The slump flow must not vary by more than 3 inches from the mix design slump flow, and the minimum allowable slump flow is 20 inches. VSI must be 1.0 or less. If the Engineer rejects SCC for slump flow and VSI, make corrective changes in the SCC mix design or placement procedures before placing additional SCC. Submit revised SCC mix design or placement procedures for approval.

MATERIALS

SCC must comply with Section 90, "Portland Cement Concrete," of the Standard Specifications except Section 90-3, "Aggregate Gradings," of the Standard Specifications does not apply.

PAYMENT

The Department measures and pays for SCC under the specifications requiring or allowing its use.

SECTION 8-3. WELDING

8-3.01 WELDING

GENERAL

Unless otherwise specified, Section 8-3, "Welding," shall apply to any welding that is specified to conform to an AWS welding code.

Requirements of the AWS welding codes shall apply unless otherwise specified in the Standard Specifications, on the plans, or in these special provisions. Wherever the abbreviation AWS is used, it shall be equivalent to the abbreviations ANSI/AWS or AASHTO/AWS.

Wherever reference is made to the following AWS welding codes in the Standard Specifications, on the plans, or in these special provisions, the year of adoption for these codes shall be as listed:

AWS Code	Year of Adoption
D1.1	2008
D1.3	2008
D1.4	2005
D1.5	2008
D1.6	2007
D1.8	2009

Flux cored welding electrodes conforming to the requirements of AWS A5.20 E6XT-4 or E7XT-4 shall not be used to perform welding for this project.

Unless otherwise specified, Clause 6.1.3 of AWS D1.1, paragraph 1 of Section 7.1.2 of AWS D1.4, and Clause 6.1.1.2 of AWS D1.5, are replaced with the following:

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all welding.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

The QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship.

When the term "Inspector" is used without further qualification, it shall refer to the QC Inspector.

Inspection and approval of all joint preparations, assembly practices, joint fit-ups, welding techniques, and the performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day welding is performed. For each inspection, including fit-up, Welding Procedure Specification (WPS) verification, and final weld inspection, the QC Inspector shall confirm and document compliance with the requirements of the AWS or other specified code criteria and the requirements of these special provisions on all welded joints before welding, during welding, and after the completion of each weld.

The Engineer shall have the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means approved by the Engineer.

When joint weld details that are not prequalified to the details of Clause 3 of AWS D1.1 or to the details of Figure 2.4 or 2.5 of AWS D1.5 are proposed for use in the work, the joint details, their intended locations, and the proposed welding parameters and essential variables, shall be approved by the Engineer. The Contractor shall allow the Engineer 15 days to complete the review of the proposed joint detail locations.

In addition to the requirements of AWS D1.1, welding procedure qualifications for work welded in conformance with this code shall conform to the following:

When a nonstandard weld joint is to be made using a combination of WPSs, a single test may be conducted combining the WPSs to be used in production, provided the essential variables, including weld bead placement, of each process are limited to those established in Table 4.5.

Upon approval of the proposed joint detail locations and qualification of the proposed joint details, welders and welding operators using these details shall perform a qualification test plate using the WPS variables and the joint detail to be used in production. The test plate shall have the maximum thickness to be used in production and a minimum length of 18 inches. The test plate shall be mechanically and radiographically tested. Mechanical and radiographic testing and acceptance criteria shall be as specified in the applicable AWS codes.

The Engineer will witness all qualification tests for WPSs that were not previously approved by the Department.

In addition to the requirements specified in the applicable code, the period of effectiveness for a welder's or welding operator's qualification shall be a maximum of 3 years for the same weld process, welding position, and weld type. If welding will be performed without gas shielding, then qualification shall also be without gas shielding. Excluding welding of fracture critical members, a valid qualification at the beginning of work on a contract will be acceptable for the entire period of the contract, as long as the welder's or welding operator's work remains satisfactory.

The Contractor shall notify the Engineer 7 days prior to performing any procedure qualification tests. Witnessing of qualification tests by the Engineer shall not constitute approval of the intended joint locations,

welding parameters, or essential variables. The Contractor shall notify the Engineer using the "Standard TL-38 Inspection Form" located at:

http://www.dot.ca.gov/hq/esc/Translab/OSM/smbforms.htm

Clause 6.14.6, "Personnel Qualification," of AWS D1.1, Section 7.8, "Personnel Qualification," of AWS D1.4, and Clause 6.1.3.4, "Personnel Qualification," of AWS D1.5 are replaced with the following:

Personnel performing nondestructive testing (NDT) shall be qualified and certified in conformance with the requirements of the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. The Written Practice of the NDT firm shall meet or exceed the guidelines of the ASNT Recommended Practice No. SNT-TC-1A. Individuals who perform NDT, review the results, and prepare the written reports shall be either:

A. Certified NDT Level II technicians, or;
B. Level III technicians who hold a current ASNT Level III certificate in that discipline and are authorized and certified to perform the work of Level II technicians.

Clause 6.6.5, "Nonspecified NDT Other than Visual," of AWS D1.1, Section 7.6.5 of AWS D1.4 and Clause 6.6.5 of AWS D1.5 shall not apply.

For any welding, the Engineer may direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS or other specified welding codes, in the Standard Specifications, or in these special provisions. Except as provided for in these special provisions, additional NDT required by the Engineer, and associated repair work, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. Prior to release of welded material by the Engineer, if testing by NDT methods other than those originally specified discloses an attempt to defraud or reveals a gross nonconformance, all costs associated with the repair of the deficient area, including NDT of the weld and of the repair, and any delays caused by the repair, shall be at the Contractor's expense. A gross nonconformance is defined as the sum of planar type rejectable indications in more than 20 percent of the tested length.

When less than 100 percent of NDT is specified for any weld, it is expected that the entire length of weld meet the specified acceptance-rejection criteria. Should any welding deficiencies be discovered by additional NDT directed or performed by the Engineer that utilizes the same NDT method as that originally specified, all costs associated with the repair of the deficient area, including NDT of the weld and of the weld repair, and any delays caused by the repair, shall be at the Contractor's expense.

Repair work to correct welding deficiencies discovered by visual inspection directed or performed by the Engineer, and any associated delays or expenses caused to the Contractor by performing these repairs, shall be at the Contractor's expense.

WELDING QUALITY CONTROL

Welding quality control shall conform to the requirements in the AWS or other specified welding codes, the Standard Specifications, and these special provisions.

Unless otherwise specified, welding quality control shall apply to work welded in conformance with the provisions in the following:

A. Section 49, "Piling," Section 52, "Reinforcement," Section 55, "Steel Structures," and Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications
B. "Structural Steel for Building Work" of these special provisions

Unless otherwise specified, Clauses 6.1.4.1 and 6.1.4.3 of AWS D1.1, paragragh 2 of Section 7.1.2 of AWS D1.4, and Clauses 6.1.3.2 through 6.1.3.3 of AWS D1.5 are replaced with the following:

The QC Inspector shall be currently certified as an AWS Certified Welding Inspector (CWI) in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors."

The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector (CAWI) in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors." The Assistant QC Inspector may perform inspection under the direct supervision of the QC Inspector provided the assistant is always within visible and audible range of the QC Inspector. The QC Inspector shall be responsible for signing all reports and for

determining if welded materials conform to workmanship and acceptance criteria. The ratio of QC Assistants to QC Inspectors shall not exceed 5 to 1.

The Contractor shall designate in writing a welding Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of welding, including materials and workmanship, performed by the Contractor and subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, reviewing, and approving all correspondence, required submittals, and reports to and from the Engineer. The QCM shall be a registered professional engineer or shall be currently certified as a CWI.

Unless the QCM is hired by a subcontractor providing only QC services, the QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

The QCM shall sign and furnish to the Engineer, a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each item of work for which welding was performed. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans, the Standard Specifications, and these special provisions.

Welding inspection personnel or NDT firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

A. The work is welded in conformance with AWS D1.5 and is performed at a permanent fabrication or manufacturing facility that is certified under the AISC Quality Certification Program, Category CBR, Major Steel Bridges and Fracture Critical endorsement F, when applicable.
B. Structural steel for building work is welded in conformance with AWS D1.1 and is performed at a permanent fabrication or manufacturing facility that is certified under the AISC Quality Certification Program, Category STD, Standard for Steel Building Structures.

For welding performed at such facilities, the inspection personnel or NDT firms may be employed or compensated by the facility performing the welding provided the facility maintains a QC program that is independent from production.

Unless otherwise specified, an approved independent third party will witness the qualification tests for welders or welding operators. The independent third party shall be a current CWI and shall not be an employee of the contractor performing the welding. The Contractor shall allow the Engineer 15 days to review the qualifications and copy of the current certification of the independent third party.

Prior to submitting the Welding Quality Control Plan (WQCP) required herein, a prewelding meeting between the Engineer, the Contractor's QCM, and a representative from each entity performing welding or inspection for this project, shall be held to discuss the requirements for the WQCP.

Information regarding the contents, format, and organization of a WQCP, is available at the Transportation Laboratory and at:

http://www.dot.ca.gov/hq/esc/Translab/OSM/smbresources.htm

The Contractor shall submit to the Engineer, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, 2 copies of a separate WQCP for each subcontractor or supplier for each item of work for which welding is to be performed.

The Contractor shall allow the Engineer 15 days to review the WQCP submittal after a complete plan has been received. No welding shall be performed until the WQCP is approved in writing by the Engineer.

An amended WQCP or any addendum to the approved WQCP shall be submitted to, and approved in writing by the Engineer, for proposed revisions to the approved WQCP. An amended WQCP or addendum will be required for revisions to the WQCP, including but not limited to a revised WPS; additional welders; changes in NDT firms, QC, or NDT personnel or procedures; or updated systems for tracking and identifying welds. The Engineer shall have 7 days to complete the review of the amended WQCP or addendum. Work affected by the proposed revisions shall not be performed until the amended WQCP or addendum has been approved.

After final approval of the WQCP, amended WQCP, or addendum, the Contractor shall submit 7 copies to the Engineer of the approved documents. A copy of the Engineer approved document shall be available at each location where welding is to be performed.

All welding will require inspection by the Engineer. The Contractor shall request inspection at least 3 business days prior to the beginning of welding for locations within California and 5 business days for locations outside of California. The Contractor shall request inspection at:

http://www.dot.ca.gov/hq/esc/Translab/OSM/smbforms.htm

Continuous inspection shall be provided when any welding is being performed. Continuous inspection, as a minimum, shall include having a QC Inspector within such close proximity of all welders or welding operators so that inspections by the QC Inspector of each welding operation at each welding location does not lapse for a period exceeding 30 minutes.

A daily production log for welding shall be kept for each day that welding is performed. The log shall clearly indicate the locations of all welding. The log shall include the welders' names, amount of welding performed, any problems or deficiencies discovered, and any testing or repair work performed, at each location. The daily report from each QC Inspector shall also be included in the log.

The following items shall be included in a Welding Report that is to be submitted to the Engineer within 15 days following the performance of any welding:

A. A daily production log.
B. Reports of all visual weld inspections and NDT.
C. Radiographs and radiographic reports, and other required NDT reports.
D. A summary of welding and NDT activities that occurred during the reporting period.
E. Reports of each application of heat straightening.
F. A summarized log listing the rejected lengths of weld by welder, position, process, joint configuration, and piece number.
G. Documentation that the Contractor has evaluated all radiographs and other nondestructive tests and corrected all rejectable deficiencies, and that all repaired welds have been reexamined using the required NDT and found acceptable.

The following information shall be clearly written on the outside of radiographic envelopes: name of the QCM, name of the nondestructive testing firm, name of the radiographer, date, contract number, complete part description, and all included weld numbers, report numbers, and station markers or views, as detailed in the WQCP. In addition, all interleaves shall have clearly written on them the part description and all included weld numbers and station markers or views, as detailed in the WQCP. A maximum of 2 pieces of film shall be used for each interleave.

Reports of all visual inspections and NDT shall be signed by the inspector or technician and submitted daily to the QCM for review and signature prior to submittal to the Engineer. Corresponding names shall be clearly printed or typewritten next to all signatures. Reports of all NDT, whether specified, additional, or informational, performed by the Contractor shall be submitted to the Engineer.

The Engineer will review the Welding Report to determine if the Contractor is in conformance with the WQCP. Except for field welded steel pipe piling, the Engineer shall be allowed 15 days to review the report and respond in writing after the complete Welding Report has been received. Prior to receiving notification from the Engineer of the Contractor's conformance with the WQCP, the Contractor may encase in concrete or cover welds for which the Welding Report has been submitted. However, should the Contractor elect to encase or cover those welds prior to receiving notification from the Engineer, it is expressly understood that the Contractor shall not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection.

For field welded steel pipe piling, including bar reinforcement in the piling, the Contractor shall allow the Engineer 2 business days to review the Welding Report and respond in writing after the required items have been received. No field welded steel pipe piling shall be installed, and no reinforcement in the piling shall be encased in concrete until the Engineer has approved the above requirements in writing.

In addition to the requirements in AWS D1.1 and AWS D1.5, third-time excavations of welds or base metal to repair unacceptable discontinuities, regardless of NDT method, and all repairs of cracks require prior approval of the Engineer.

The Engineer shall be notified immediately in writing when welding problems, deficiencies, base metal repairs, or any other type of repairs not submitted in the WQCP are discovered, and also of the proposed repair procedures to correct them. For requests to perform third-time excavations or repairs of cracks, the Contractor shall include an engineering evaluation of the proposed repair. The engineering evaluation, at a minimum, shall address the following:

A. What is causing each defect?

B. Why the repair will not degrade the material properties?
C. What steps are being taken to prevent similar defects from happening again?

The Contractor shall allow the Engineer 7 days to review these procedures. No remedial work shall begin until the repair procedures are approved in writing by the Engineer.

Clause 6.5.4 of AWS D1.5 is replaced with the following:

The QC Inspector shall inspect and approve each joint preparation, assembly practice, welding technique, joint fit-up, and the performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved Welding Procedure Specification (WPS) are met. The QC Inspector shall examine the work to make certain that it meets the requirements of Clauses 3 and 6.26. The size and contour of all welds shall be measured using suitable gages. Visual inspection for cracks in welds and base metal, and for other discontinuities shall be aided by strong light, magnifiers, or such other devices as may be helpful. Acceptance criteria different from those specified in this code may be used when approved by the Engineer.

In addition to the requirements of AWS D1.5, Clause 5.12 or 5.13, welding procedures qualification for work welded in conformance with that code shall conform to the following requirements:

A. Unless considered prequalified, fillet welds shall be qualified in each position. The fillet weld soundness test shall be conducted using the essential variables of the WPS as established by the Procedure Qualification Record (PQR).
B. For qualification of joints that do not conform to Figures 2.4 and 2.5 of AWS D1.5, a minimum of 2 WPS qualification tests are required. The tests shall be conducted using both Figure 5.1 and Figure 5.3. The test conforming to Figure 5.1 shall be conducted in conformance with AWS D1.5, Clause 5.12 or 5.13. The test conforming to Figure 5.3 shall be conducted using the welding electrical parameters that were established for the test conducted conforming to Figure 5.1. The ranges of welding electrical parameters established during welding per Figure 5.1 in conformance with AWS D1.5, Clause 5.12, shall be further restricted according to the limits in Table 5.3 during welding per Figure 5.3.
C. Multiple zones within a weld joint may be qualified. The travel speed, amperage, and voltage values that are used for tests conducted per AWS D1.5 Clause 5.13 shall be consistent for each pass in a weld joint, and shall in no case vary by more than ±10 percent for travel speed, ±10 percent for amperage, and ±7 percent for voltage as measured from a predetermined target value or average within each weld pass or zone. The travel speed shall in no case vary by more than ±15 percent when using submerged arc welding.
D. For a WPS qualified in conformance with AWS D1.5 Clause 5.13, the values to be used for calculating ranges for current and voltage shall be based on the average of all weld passes made in the test. Heat input shall be calculated using the average of current and voltage of all weld passes made in the test for a WPS qualified in conformance with Clause 5.12 or 5.13.
E. Macroetch tests are required for WPS qualification tests, and acceptance shall be per AWS D1.5 Clause 5.19.3.
F. When a nonstandard weld joint is to be made using a combination of WPSs, a test conforming to Figure 5.3 may be conducted combining the WPSs to be used in production, provided the essential variables, including weld bead placement, of each process are limited to those established in Table 5.3.
G. Prior to preparing mechanical test specimens, the PQR welds shall be inspected by visual and radiographic tests. Backing bar shall be 3 inches in width and shall remain in place during NDT testing. Results of the visual and radiographic tests shall comply with AWS D1.5 Clause 6.26.2, excluding Clause 6.26.2.2. Test plates that do not comply with both tests shall not be used.

WELDING FOR OVERHEAD SIGN AND POLE STRUCTURES

The Contractor shall meet the following requirements for any work welded in conformance with the provisions in Section 56-1, "Overhead Sign Structures," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

Welding inspection personnel or NDT firms to be used in the work shall not be employed or compensated by any subcontractor or by other persons or entities hired by subcontractors who will provide other services or materials for the project except for when the welding is performed at a permanent fabrication or manufacturing facility that is certified under the AISC Quality Certification Program. The AISC Certification category for overhead sign structures shall be Simple Steel Bridge Structures (SBR), and the AISC Certification category for pole structures shall be Simple Steel Bridge Structures (SBR) or Standard for Steel Building Structures (STD).

Welding Qualification Audit

Contractors or subcontractors performing welding operations for overhead sign and pole structures shall have successfully completed the Department's "Manufacturing Qualification Audit for Overhead Sign and Pole Structures." Copies of the audit form and procedures for requesting and completing the audit are available at:

http://www.dot.ca.gov/hq/esc/Translab/OSM/smbresources.htm

An audit that was approved by the Engineer no more than 3 years prior to the award of the contract will be acceptable for the entire period of this contract provided the Engineer determines the audit was for the same type of work that is to be performed on this contract.

A list of facilities that have successfully completed the audit and are authorized to provide material for this contract is available at:

http://www.dot.ca.gov/hq/esc/Translab/OSM/smdocuments/Internet_auditlisting.pdf

Successful completion of an audit shall not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and as shown on the plans.

Welding Report

For work welded in conformance with the provisions in Section 56-1, "Overhead Sign Structures," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, a Welding Report shall be submitted in conformance with the provisions in "Welding Quality Control" of these special provisions.

PAYMENT

Full compensation for conforming to the requirements of "Welding" shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

SECTION 9. (BLANK)

SECTION 10. CONSTRUCTION DETAILS

SECTION 10-1. GENERAL

10-1.01 ORDER OF WORK

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work," of the Standard Specifications and these special provisions.

Prior to driving piles at Fuel Island, above ground fuel tank submittals must be approved by the Engineer.

Stockpiling of imported borrow and excavated materials in significant height shall not allowed, due to potential consolidation settlement of Young Bay Mud. Obtain a writing approval from the Engineer, before stockpiling material on site.

Existing 108 inches RCP Sewer Outfall (EBMUD) is subjected to zero load. No construction equipment is allowed to cross the EBMUD sewer outfall or to be within 12.5-foot from the centerline of the EBMUD sewer outfall, except at the existing accesses as shown on the plans. No stockpiling or dumping material within the utility easement limits as shown on the plans. Submit the work plan for the Engineer's approval 20 days in advance prior to start the following work within the easement of the 108 inches RCP Sewer Outfall (EBMUD): the fence installation, removal of existing fences, clearing and grubbing, excavation, trenching and installation of irrigation system, planting including the placement of topsoil, mulch and seeding. The work plan must include means and method, and the equipment location during construction to perform the specified work.

The first order of work shall be to place the order for the electrical equipment. The Engineer shall be furnished a statement from the vendor that the order for the electrical equipment has been received and accepted by the vendor.

The uppermost layer of new pavement shall not be placed until all underlying conduits and loop detectors have been installed.

Attention is directed to "Maintaining Traffic" of these special provisions and to the stage construction sheets of the plans.

The work shall be performed in conformance with the stages of construction shown on the plans. Nonconflicting work in subsequent stages may proceed concurrently with work in preceding stages, provided satisfactory progress is maintained in the preceding stages of construction.

Prior to applying hot mix asphalt paving, the Contractor shall cover all manholes, valve and monument covers, grates, or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured to the facility being covered by tape or adhesive. The covered facilities shall be referenced by the Contractor, with a sufficient number of control points to relocate the facilities after the hot mix asphalt paving has been placed. After completion of the hot mix asphalt paving operation, all covers shall be removed and disposed of in a manner satisfactory to the Engineer. Full compensation for covering manholes, valve and monument covers, grates, or other exposed facilities, referencing, and removing temporary cover shall be considered as included in the contract price paid per ton for hot mix asphalt, and no additional compensation will be allowed therefor.

10-1.02 HEALTH AND SAFETY PLAN

GENERAL

This work includes preparing, submitting, and implementing a detailed Health and Safety Plan that addresses the health and safety of all field personnel, including State personnel.

The plan must identify potential health and safety hazards associated with existing hazardous substances and specifies work practices that must be used to protect workers from those hazards in conformance with the Department of Toxic Substances Control and CAL-OSHA regulations. At a minimum, the Health and Safety Plan must:

1. Identify key site safety personnel
2. Describe risks associated with the work
3. Describe training requirements
4. Describe appropriate personal protective equipment
5. Describe any site-specific medical surveillance requirements
6. Describe any periodic air monitoring requirements
7. Define appropriate site work zones
8. Describe any decontamination requirements

The Health and Safety Plan must be submitted at least 15 business days before beginning work that may expose personnel to hazardous substances for review and acceptance by the Engineer. Before submittal, you must have the Health and Safety Plan approved by an industrial hygienist certified by the American Board of Industrial Hygiene.

SAFETY TRAINING

Before performing work that may expose personnel to hazardous substances, all personnel, including State personnel, must complete a safety training program that communicates the potential health and safety hazards associated with work on the site and instructs the personnel in procedures for doing the work safely. The level of training provided must be consistent with the personnel's job function and conform to CAL-OSHA regulations. Do not start safety training until the Health and Safety Plan is accepted by the Engineer. Provide subsequent refresher training required until completion of the project. Provide a certification of completion of the safety training program to all personnel who successfully complete the training. Provide personal protective equipment required by State personnel to inspect the work. The number of State personnel requiring the above mentioned safety training program and personal protective equipment is 5.

PAYMENT

The contract lump sum price paid for health and safety plan includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparing and implementing the Health and Safety Plan, complete in place, including safety training and personal protective equipment, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.03 DEWATERING AND NON-STORM WATER DISCHARGE CONTROL

GENERAL

Summary

This work includes collection, conveyance, treatment, and disposal of accumulated precipitation and groundwater encountered during excavations. Groundwater may be encountered during excavations of building foundation and utility trenching. Groundwater is contaminated with petroleum hydrocarbons and subject to regulatory restrictions. This work includes designing, implementing, monitoring, maintaining, and later removing a dewatering and non-storm water discharge system. Comply with "Water Pollution Control," and "Construction Site

Management," of these special provisions. Maintenance includes disposal of sediments and other material removed from the collection, conveyance and treatment systems.

The Department's "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual" (Preparation Manual) are available at:

http://www.dot.ca.gov/hq/construc/stormwater/SWPPP_Prep_ManualJune2011.pdf

The "Field Guide to Construction Site Dewatering" (Dewatering Guide) provides guidance on this work and is available at:

http://www.dot.ca.gov/hq/construc/stormwater/DewateringGuide.htm

If groundwater is observed seeping into excavations and that this water is comingled with storm water, it is assumed that all discharged water is contaminated and must be treated and discharged according to the provisions of these special provisions).

Discharge groundwater, impounded construction site water, or both, using any of the following methods.

1. Discharge into a Publicly Owned Treatment Works (POTW) facility (sanitary sewer) under a batch discharge permit. Apply for and comply with the provisions contained in the permit and pay all fees assessed by the POTW facility in connection with the discharge.
2. Discharge into a storm drain system under Order No. R2-2012-0012 adopted by the San Francisco Bay Regional Water Quality Control Board (RWQCB). Comply with "Relations with California Regional Water Quality Control Board," of these special provisions for discharges to the storm drain system. If the discharge is to the storm drain system, comply with the provisions of Order No. R2-2012-0012 (Discharge or Reuse of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Volatile Organic Compounds, Fuel Leaks and Other Related Wastes) and pay all fees in connection with obtaining coverage under the Order No. R2-2012-0012 for dust control.
3. Use water treated under Order No. R2-2012-0012 for dust control.
4. Percolate water treated under Order No. R2-2012-0012 into soil in inactive work areas.

Maintain copies of the permits at the job site and make them available during construction.

Submittals

Before discharging submit:

1. Dewatering and discharge plan.
2. POTW permit, if applicable.
3. Notice of Intent (NOI) of discharge under Order No. R2-2012-0012, if applicable
4. A report describing each component of the planned Groundwater Treatment System and an Operation and Maintenance Manual in conformance with Order No. R2-2012-0012 and these special provisions, if applicable.

Dewatering and Discharge Plan

The dewatering and discharge plan (DDP) must include:

1. Title sheet
2. Table of contents
3. Certification and approval sheet (Section 100 of the Preparation Manual)
4. Amendment log and format (Section 200 of the Preparation Manual)
5. Description and schedule of the dewatering and discharge operations
6. Discharge alternatives, including dust control, percolation, storm sewers, and surface waters
7. Treatment system description, components

8. If you use chemical coagulants, in-line flocculants, or both, in the treatment system, submit a Coagulant Pollution Prevention Plan (CPPP) with the DDP. Chemical coagulants and flocculants proposed for use in the treatment of non-stormwater must comply with all provisions under "Active Treatment System (ATS) Requirements" within Attachment F Provisions D and E, in the National Pollutant Discharge Elimination System (NPDES) General Permit For Storm Water Discharges, associated with Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ, NPDES No. CAS000002, available at:

   http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml

   The CPPP must include:

   8.1. Description of the best management practices (BMPs) to prevent:

      8.1.1. Accidental spillage
      8.1.2. Overfeeding into the treatment system
      8.1.3. Other mishandling of coagulant agents

   8.2. Coagulant monitoring plan that complies with Provision E "Residual Chemical and Toxicity Requirements" within Attachment F in Order No. 2009-0009-DWQ
   8.3. Description of the agent (chemical and trade name description)
   8.4. Pure product freshwater and marine aquatic toxicity data for the agent

9. Estimated flow rates
10. Operation and system maintenance procedures and example maintenance log
11. Field-recorded data, visual inspection, and calibration procedures and example logs
12. Measuring equipment descriptions
13. Working drawings of dewatering and discharge operations showing:

   13.1. Section and plan views of effluent treatment systems
   13.2. Location of sampling points for water quality measurements
   13.3. Flow path and placement of pipes, hoses, pumps, holding tanks, and other equipment used to convey water
   13.4. General position of treatment dewatering and discharge components relative to excavations or other operations requiring dewatering
   13.5. Point of discharge

Within 15 days after contract approval, submit 3 copies of the DDP to the Engineer. Allow 15 days for the Engineer's review. If revisions are required, the Engineer will provide comments and specify the date that the review stopped. Revise and resubmit the DDP within 7 days of receipt of the Engineer's comments. The Engineer's review will resume when the complete DDP is resubmitted. When the Engineer approves the DDP, submit 4 copies of the approved DDP to the Engineer. After approval, the Engineer will submit one copy of the approved DDP to the RWQCB for their review and comment. If the RWQCB provides comments to the DDP, the Contractor must amend the DDP. Construction activities may begin no sooner than 30 days after the Engineer approves the DDP. If the Engineer fails to complete the review within the time allowed and if, in the opinion of the Engineer, completion of the work is delayed or interfered with because of the Engineer's or the RWQCB's review, you will be compensated for resulting losses, and an extension of time will be granted, as provided for in Section 8-1.09, "Delays," of the Standard Specifications.

A Non-Stormwater Information Package (Information Package) has been prepared for this contract and is available as described in "Supplemental Project Information," of these special provisions. This Information Package includes:

1. Estimated groundwater seepage rates in the project area
2. RWQCB General Waste Discharge Requirements for Order No. R2-2012-0012, NPDES General Permit No. CAG912002
3. Local POTW facility information
4. Site Investigation Report, San Francisco-Oakland Bay Bridge Maintenance Complex Project, Alameda, California

MATERIALS

Non-Storm Water Treatment and Discharge System

Design and implement an appropriate water treatment system for the site conditions and your estimated flow rate to achieve and maintain compliance with receiving water limitations and discharge effluent limitations. System components may include:

1. Treatment system
2. Collection and conveyance system
3. Temporary holding tanks
4. Discharge attenuator

Treatment Systems

Treatment systems must be designed to remove turbidity-producing suspended solids and petroleum hydrocarbon constituents found in the groundwater that are listed in "Site Investigation Report, San Francisco-Oakland Bay Bridge Maintenance Complex Project, Alameda, California."

Primary and secondary treatment may be required, or the design of the treatment system may require combined use of the various treatment components in series to achieve effective treatment. Ensure that the treatment system components are steam cleaned to remove any residual contaminants. Treatment system components may include:

1. Desilting basins
2. Weir tanks
3. Settling tanks
4. Sediment traps
5. Gravity bag filters
6. Sand media filters
7. Pressurized bag filters
8. Cartridge filters
9. In-line chemical coagulants and flocculants
10. Activated clay filters
11. Activated carbon filters
12. A combination of these systems to provide primary and secondary treatment

Chemical coagulants and flocculants proposed for use in the treatment of groundwater must be approved by the RWQCB. You are fully and solely responsible for securing approval from the RWQCB. Written approval from the RWQCB must be submitted to the Engineer for review prior to any use of flocculants on this project. The Information Package includes an outline of the information required by the RWQCB for approval of the chemical coagulants and flocculants for use in the Treatment System.

Disposal of sediments removed during maintenance of the Treatment System must comply with Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

If necessary, treat water discharged to surface water or storm water drainage systems to adjust the pH and dissolved oxygen. Treatment for water with high pH may include the addition of carbon dioxide, sulfuric acid, phosphoric acid, citric acid, or nitric acid in conformance with the supplier's specifications. Treatment for water with low pH may include filtration through a limestone bed or the addition of sodium hydroxide. Treatment for water with low dissolved oxygen may include aeration.

The various components must be maintained to prevent leaks and provide proper function. If a component of the dewatering equipment is not functioning properly, the dewatering operation must be discontinued and the component must be repaired or replaced.

Collection and Conveyance System

Provide all pumps and piping to convey the water to temporary holding tanks and the point of discharge.

Use a flow meter, as described in "Flow Rate Monitoring" of this section, to measure all discharges from dewatering operations.

Materials must conform to the provisions in Section 6, "Control of Materials," Section 7-1.16, "Contractor's Responsibility for the Work and Materials," and Section 74-2, "Drainage Pumping Equipment," of the Standard Specifications and these special provisions.

Temporary Holding Tanks

Water pumped during dewatering operations must be stored in temporary holding tanks placed at the work area for treatment to remove sediment.

Use temporary holding tanks including transportable closed top holding tanks or tanker trucks. A sufficient number of holding tanks must be provided based on the following:

1. Anticipated flow rate
2. Pumping rates
3. Capacity inefficiencies due to sediment retention within the holding tanks
4. Sediment settling rates
5. Sediment removal frequency
6. Anticipated water loss or reuse rates

Provide temporary holding tanks with a holding capacity sufficient to handle the water removed from dewatering operations, and prevent delay of work.

Each temporary holding tank must have an inlet and outlet capable of receiving and discharging flows at a sufficient rate to dewater the excavation.

Maintain a minimum freeboard of 1 foot in each of the temporary holding tanks at all times. Clean the holding tanks when 25 percent of the tank's volume is filled with sediments.

CONSTRUCTION

Discharging Water

Use discharged treated water or uncontaminated ground or surface water for dust control in active work areas when possible, or discharge the water to an inactive area where the grade prevents sheet flow and the soil allows percolation. The discharge point in the inactive area must include a velocity dissipater. The discharge volume must not exceed the area's capacity for percolation.

Do not discharge into a body of water where erosion, scour, or sedimentary deposits could occur that impact natural bedding or aquatic life. Monitor the water at the discharge point using water quality measurements and visual observation in conformance with the regulatory permit and these special provisions.

Storm water must be diverted away from excavations that would require dewatering.

Inspection, Monitoring, and Reporting

If treated groundwater is discharged to the storm drain system, perform compliance monitoring in conformance with the Monitoring and Reporting Program (MRP) included in Attachment E of the Order No. R2-2012-0012. If a batch discharge permit is obtained from a POTW, comply with the provisions contained in the batch discharge permit including all monitoring and reporting requirements.

During periods when the dewatering and non-storm water discharge operations occur, document the results in a Daily Inspection Report (DIR). The DIR form must include the discharge volume records and water quality monitoring records. In developing the DIR, refer to the Department's Dewatering Guide. The DIR form must be approved by the Engineer before use. The DIR must be provided weekly or as directed to the Engineer.

All information and recorded data collected or submitted as part of the DIR must be certified as true and accurate and signed by those who gather the information.

Visual Inspection

During each day of discharge, perform daily inspection of the effluent at the discharge site and include, in the DIR, observations of:

1. Date and Time
2. Weather conditions
3. Wind direction and velocity
4. The presence or absence of water fowl or aquatic wildlife
5. The color and clarity of the effluent discharge
6. Erosion or ponding downstream of the discharge site

The DIR must include photographs of the discharge point and areas downstream of the discharge location. These photographs must be labeled with the time, date, and location.

Flow Rate Monitoring

A flow meter that has been approved by the Engineer for exclusive use in dewatering during construction must be used to measure all excavation discharges. All calibrations must be done in conformance with the manufacturer's instructions in the presence of the Engineer.

Record the flow-meter totalizer readings and compute average daily volumes for every day that dewatering is conducted.

Penalties and Withholdings

Know and comply with provisions of Federal, State, and local regulations and requirements that govern the work and storm water and non-storm water discharges from the job site and areas of disturbance outside the project limits during construction under Section 7-1.01, "Laws to be Observed," Section 7-1.11, "Preservation of Property," and Section 7-1.12, "Indemnification and Insurance," of the Standard Specifications.

You are responsible for all penalties assessed as a result of your failure to comply with the provisions in "Water Pollution Control" of these special provisions or with the applicable provisions of the Federal, State, and local regulations and requirements.

Penalties include fines, penalties, and damages, whether proposed, assessed, or levied against the Department or you, including those levied under the Federal Clean Water Act and the State Porter-Cologne Water Quality Control Act, by governmental agencies or as a result of citizen suits. Penalties also include payments made or costs incurred in settlement for alleged violations of applicable laws, regulations, or requirements. Costs incurred could include sums spent instead of penalties, in mitigation or to remediate or correct violations.

The Department withholds payment, in an amount estimated by the Department, to include the full amount of penalties and mitigation costs proposed, assessed, or levied as a result of a violation of the permits, or Federal or State law, regulations, or requirements. Funds will be withheld until final disposition of these costs has been made. You remain liable for the full amount until the potential liability is finally resolved with the entity seeking the penalties. Instead of the withhold, you may provide a suitable bond in favor of the Department to cover the highest estimated liability for any disputed penalties proposed as a result of the violation of the permits, law, regulations, or requirements.

If a regulatory agency identifies a violation of the permits and modifications thereto, or other Federal, State, or local requirements, the Department will withhold payment as follows:

1. The Department will give you 30 days notice of the Department's intention to withhold funds from payments that may become due before acceptance of the contract. After acceptance of the contract, funds will be withheld without prior notice.
2. If the amount being withheld from partial payments under Section 9-1.06, "Partial Payments," of the Standard Specifications exceeds the amount to be withheld for violations, no additional payment will be withheld.
3. If the Department withholds funds and it is subsequently determined that the Department is not subject to the entire amount of the costs and liabilities assessed or proposed in connection with the matter for which the withhold was made, the Department will return the excess amount withheld in the progress payment following the determination. If the matter is resolved for less than the amount withheld, the Department will pay interest at a rate of 6 percent per year on the excess withhold.

Notify the Engineer immediately upon request from a regulatory agency to enter, inspect, sample, monitor, or otherwise access the job site or obtain records pertaining to water pollution control work. Provide copies of correspondence, notices of violation, enforcement actions, or proposed fines by regulatory agencies to the requesting regulatory agency.

PAYMENT

The contract lump sum price paid for dewatering and non-storm water discharge control includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in dewatering and non-storm water discharge control, complete in place, including preparing the dewatering and discharge plan, implementing the Monitoring and Reporting Program, obtaining all required permits, payment of fees for all permits and payment for discharge fees for disposal of treated water and sediments removed during maintenance of the treatment system, as specified in the standard specifications and these special provisions, and as directed by the Engineer.

10-1.04 WATER POLLUTION CONTROL

GENERAL

Summary

This work includes developing and implementing a storm water pollution prevention plan (SWPPP).

This project is risk level 1.

A storm water information handout has been prepared for this contract and is available as described in "Supplemental Project Information" of these special provisions.

Discharges of stormwater from the project must comply with National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ, NPDES No. CAS000002) referred to herein as "Permit."

Information on forms, reports, and other documents can be found in the following Department manuals:

1. Field Guide for Construction Site Dewatering
2. Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual
3. Construction Site Best Management Practices (BMP) Manual

For the above-referenced manuals, go to the Department's Web site for the Division of Construction, Storm Water and Water Pollution Control Information, or the Department's Publication Distribution Unit.

Do not start job site activities until:

1. The SWPPP is approved.
2. The waste discharge identification number is issued.
3. SWPPP review requirements have been fulfilled. If the Regional Water Quality Control Board (RWQCB) requires time for review, allow 30 days for the review. For projects in the Lake Tahoe Hydrologic Unit and the Mammoth Lakes Hydrologic Unit, the Lahontan RWQCB will review the SWPPP.

The following RWQCBs will review the approved SWPPP:

1. San Francisco Bay Region (2)

If you operate a Contractor-support facility, protect stormwater systems and receiving waters from the discharge of potential pollutants by using water pollution control practices.

Contractor-support facilities include:

1. Staging areas
2. Storage yards for equipment and materials
3. Mobile operations
4. Batch plants for PCC and HMA
5. Crushing plants for rock and aggregate
6. Other facilities installed for your convenience, such as haul roads

Discharges from manufacturing facilities, such as batch plants and crushing plants, must comply with the general waste discharge requirements for Order No. 97-03-DWQ, NPDES General Permit No. CAS000001, issued by the State Water Resources Control Board (SWRCB) for "Discharge of Storm Water Associated with Industrial Activities Excluding Construction Activities" and referred to herein as "General Industrial Permit." For the General Industrial Permit, go to the Web site for the SWRCB.

If you operate a batch plant to manufacture PCC, HMA, or other material or a crushing plant to produce rock or aggregate, obtain coverage under the General Industrial Permit. You must be covered under the General Industrial Permit for batch plants and crushing plants located:

1. Outside of the job site
2. Within the job site that serve 1 or more contracts

If you obtain or dispose of material at a noncommercially operated borrow or disposal site, prevent water pollution due to erosion at the site during and after completion of your activities. Upon completion of your work, leave the site in a condition such that water will not collect or stand therein.

The Department does not pay for water pollution control practices at Contractor-support facilities and noncommercially operated borrow or disposal sites.

Definitions

active area: Area where soil-disturbing work activities have occurred at least once within 15 days.

construction phase: Includes (1) highway construction phase for building roads and structures, (2) plant establishment and maintenance phase for placing vegetation for final stabilization, and (3) suspension phase for suspension of work activities or winter shutdown. The construction phase continues from the start of work activities to contract acceptance.

inactive area: Area where soil-disturbing work activities have not occurred within 15 days.

normal working hours: Hours you normally work on the project.

qualifying rain event: Storm that produces at least 0.5 inch of precipitation with a 48-hour or greater period between rain events.

storm event: Storm that produces or is forecasted to produce at least 0.10 inch of precipitation within a 24-hour period.

Submittals

Storm Water Pollution Prevention Plan

General

Within 20 days of contract approval:

1. Submit 3 copies of your SWPPP for review. Allow 20 days for the Department's review. The Engineer provides comments and specifies the date when the review stopped if revisions are required.
2. Resubmit a revised SWPPP within 15 days of receiving the Engineer's comments. The Department's review resumes when a complete SWPPP has been resubmitted.
3. When the Engineer approves the SWPPP, submit an electronic copy and 4 printed copies of the approved SWPPP.
4. If the RWQCB requires review of the approved SWPPP, the Engineer submits the approved SWPPP to the RWQCB for its review and comment.
5. If the Engineer requests changes to the SWPPP based on the RWQCB's comments, amend the SWPPP within 10 days.

LEED Submittals: Submit 2 additional copies of the approved SWPPP (WPCP) to the Engineer for LEED purposes. Include a CD or DVD with an electronic copy of the SWPPP, including drawings, in PDF format.

A qualified SWPPP developer (QSD) must develop the SWPPP.

The SWPPP must comply with the Department's Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual. Include the following in the SWPPP:

1. Description of the work involved in the installation, maintenance, repair, and removal of temporary and permanent water pollution control practices.
2. Maps showing:

    2.1. Locations of disturbed soil areas
    2.2. Water bodies and conveyances
    2.3. Locations and types of water pollution control practices that will be used for each Contractor-support facility
    2.4. Locations and types of temporary water pollution control practices that will be used in the work for each construction phase
    2.5. Locations and types of water pollution control practices that will be installed permanently under the contract
    2.6. Pollutant sampling locations
    2.7. Locations planned for storage and use of potential nonvisible pollutants
    2.8. Receiving water sampling locations

3. Copy of permits obtained by the Department, including Fish & Game permits, US Army Corps of Engineers permits, RWQCB 401 certifications, aerially deposited lead variance from the Department of Toxic Substance Control, aerially deposited lead variance notification, and RWQCB waste discharge requirements for aerially deposited lead reuse.

Include the following items in the SWPPP:

1. For all projects:

    1.1. Schedule
    1.2. Construction site monitoring program (CSMP)

2. For risk level 2 projects add:

    2.1. Adherence to effluent standards for numeric action levels (NALs)
    2.2. Rain event action plan (REAP)

3. For risk level 3 projects add:

    3.1. Adherence to effluent standards for NALs and numeric effluent levels (NELs)
    3.2. REAP

Schedule

The SWPPP schedule must show when:

1. Work activities will be performed that could cause the discharge of pollutants into stormwater
2. Water pollution control practices associated with each construction phase will be implemented
3. Soil stabilization and sediment control practices for disturbed soil areas will be implemented

Construction Site Monitoring Program

A QSD must prepare the CSMP. Change the program to reflect current job site activities as needed. The CSMP must include the following:

1. For all projects:

    1.1. Visual monitoring procedures
    1.2. Sampling and analysis plan (SAP) for nonvisible pollutants
    1.3. SAP for nonstormwater discharges
    1.4. SAP for monitoring required by RWQCB

2. For risk level 2 projects add SAP for pH and turbidity
3. For risk level 3 projects add:

    3.1. SAP for pH and turbidity
    3.2. SAP for temporary active treatment systems

Sampling and Analysis Plan

Include a SAP in the CSMP.
Describe the following water quality sampling procedures in the SAP:

1. Sampling equipment
2. Sample preparation
3. Collection
4. Field measurement methods
5. Analytical methods
6. Quality assurance and quality control
7. Sample preservation and labeling
8. Collection documentation
9. Sample shipping
10. Chain of custody
11. Data management and reporting
12. Precautions from the construction site health and safety plan

13. Laboratory selection and certifications

The SAP must identify the State-certified laboratory, sample containers, preservation requirements, holding times, and analytical method. For a list of State-certified laboratories go to the CDPH Web site.

The SAP must include procedures for sample collection during precipitation.

The SAP must list conditions when you will not be required to physically collect samples such as:

1. Dangerous weather
2. Flooding or electrical storms
3. Times outside of normal working hours

Amend the SAP whenever discharges or sampling locations change because of changed work activities or knowledge of site conditions.

For a risk level 2 or risk level 3 project, include procedures in the SAP for collecting and analyzing at least 3 samples for each day of each qualifying rain event. Describe the collection of effluent samples at all locations where the stormwater is discharged off-site.

The SAP for nonvisible pollutants must describe the sampling and analysis strategy for monitoring nonvisible pollutants.

The SAP for nonvisible pollutants must identify potential nonvisible pollutants present at the job site associated with any of the following:

1. Construction materials and wastes
2. Existing contamination due to historical site usage
3. Application of soil amendments, including soil stabilization materials, with the potential to change pH or contribute toxic pollutants to stormwater

The SAP for nonvisible pollutants must include sampling procedures for the following conditions when observed during a stormwater visual inspection. Include a procedure for collecting at least 1 sample for each storm event for:

1. Materials or wastes containing potential nonvisible pollutants not stored under watertight conditions
2. Materials or wastes containing potential nonvisible pollutants stored under watertight conditions at locations where a breach, leak, malfunction, or spill occurred and was not cleaned up before the precipitation
3. Chemical applications occurring within 24 hours before precipitation or during precipitation that could discharge pollutants to surface waters or drainage systems, including fertilizer, pesticide, herbicide, methyl methacrylate concrete sealant, or nonpigmented curing compound
4. Applied soil amendments, including soil stabilization materials that could change pH levels or contribute toxic pollutants to stormwater runoff and discharge pollutants to surface waters or drainage systems, unless independent test data is available to indicate acceptable concentrations of nonvisible pollutants in the material
5. Stormwater runoff from an area contaminated by historical usage of the site that could discharge pollutants to surface waters or drainage systems

The SAP for nonvisible pollutants must provide sampling procedures and a schedule for:

1. Sample collection during the first 2 hours of rain events that generate runoff
2. Sample collection during normal working hours
3. Each nonvisible pollutant source
4. Uncontaminated control sample

The SAP for nonvisible pollutants must identify locations for sampling downstream and control samples and the reasons for selecting those locations. Select locations for control samples where the sample does not come in contact with materials, wastes, or areas associated with potential nonvisible pollutants or disturbed soil areas.

Amendments

Amend and resubmit the SWPPP:

1. Annually before July 15th

2. Whenever:

    2.1. Changes in work activities could affect the discharge of pollutants
    2.2. Water pollution control practices are added by Contract Change Order
    2.3. Water pollution control practices are added at your discretion
    2.4. Changes in the quantity of disturbed soil are substantial
    2.5. Objectives for reducing or eliminating pollutants in stormwater discharges have not been achieved
    2.6. You receive a written notice of a permit violation for the project from the RWQCB or any other regulatory agency

Allow the same review time for amendments to the SWPPP as for the original SWPPP.

Training Records

Submit water pollution control training records for all employees and subcontractors who will be working at the job site. Include the training subjects, training dates, ongoing training, and tailgate meetings with your submittal. Submit records for:

1. Existing employees within 5 business days of obtaining SWPPP approval
2. New employees within 5 business days of receiving the training
3. A subcontractor's employees at least 5 business days before the subcontractor starts work

Contractor-Support Facility

At least 5 business days before operating any Contractor-support facility, submit:

1. A plan showing the location and quantity of water pollution control practices associated with the Contractor-support facility
2. A copy of the notice of intent approved by the RWQCB and the SWPPP approved by the RWQCB if you will be operating a batch plant or a crushing plant under the General Industrial Permit

Annual Certification

Submit an annual certification of compliance as described in the Department's Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual before July 15th of each year.

Site Inspection Reports

The water pollution control (WPC) manager must submit the following within 24 hours of completing a weekly inspection:

1. Completed Stormwater Site Inspection Report form.
2. Best management practices (BMP) status report. The WPC manager must oversee the preparation of the report. The report must include:

    2.1. Location and quantity of installed water pollution control practices
    2.2. Location and quantity of disturbed soil for active and inactive areas

Visual Monitoring Reports

Submit a visual monitoring report for:

1. Each storm event. Include:

    1.1. Date, time, and rain gauge reading
    1.2. Visual observations:

        1.2.1. Within 2 business days before the storm for:

            1.2.1.1. Spills, leaks, and uncontrolled pollutants in drainage areas
            1.2.1.2. Proper implementation of water pollution control practices
            1.2.1.3. Leaks and adequate freeboard in storage areas

1.2.2. Every 24 hours during the storm for:

1.2.2.1. Effective operation of water pollution control practices
1.2.2.2. Water pollution control practices needing maintenance and repair

1.2.3. Within 2 business days after a qualifying rain event for:

1.2.3.1. Stormwater discharge locations
1.2.3.2. Evaluation of design, implementation, effectiveness, and locations of water pollution control practices including locations where additional water pollution control practices may be needed

2. Nonstormwater discharges during each of the following periods:

2.1. January through March
2.2. April through June
2.3. July through September
2.4. October through December

Use the Stormwater Site Inspection Report form to document visual monitoring. A visual monitoring report must include:

1. Name of personnel performing the inspection, inspection date, and date the inspection report is completed
2. Storm and weather conditions
3. Location of any:

3.1. Floating and suspended material, sheen on the surface, discoloration, turbidity, odor, and source of observed pollutants for flowing and contained stormwater systems
3.2. Nonstormwater discharges and their sources

4. Corrective action taken

Retain visual monitoring reports at the job site as part of the SWPPP.

Sampling and Analysis

Whenever sampling is required, submit a printed copy and electronic copy of water quality analysis results, and quality assurance and quality control reports within 48 hours of field sampling, and within 30 days of laboratory analysis. Electronic copies must be in one of the following formats: (1) xls, (2) .txt, (3) .cvs, (4) .dbs, or (5) .mdb. Include an evaluation of whether the downstream samples show levels of the tested parameter that are higher than the control sample. The evaluation must include:

1. Sample identification number
2. Contract number
3. Constituent
4. Reported value
5. Analytical method
6. Method detection limit
7. Reported limit

Numeric Action Level Exceedance Reports

Whenever a NAL is exceeded for a risk level 2 or risk level 3 project, notify the Engineer and submit a NAL exceedance report within 48 hours after conclusion of a storm event. The report must include:

1. Field sampling results and inspections, including:

1.1. Analytical methods, reporting units, and detection limits
1.2. Date, location, time of sampling, visual observations, and measurements

1.3. Quantity of precipitation from the storm event

2. Description of BMP and corrective actions taken to manage NAL exceedance

Numeric Effluent Limit Violation Reports

Whenever a NEL is exceeded for a risk level 3 project, notify the Engineer and submit a NEL violation report within 6 hours. The report must include:

1. Field sampling results and inspections, including:

   1.1. Analytical methods, reporting units, and detection limits
   1.2. Date, location, time of sampling, visual observation and measurements
   1.3. Quantity of precipitation from the storm event

2. Description of BMP and corrective actions taken to manage NEL exceedance

Rain Event Action Plan

For a risk level 2 or risk level 3 project, submit a REAP whenever the National Weather Service is predicting a storm event with at least 50 percent probability of precipitation within 72 hours.

The WPC manager must submit the REAP at least 48 hours before a forecasted storm event.

The REAP must include:

1. Site location
2. Project risk level
3. Contact information including 24-hour emergency phone numbers for:

   3.1. WPC manager
   3.2. Erosion and sediment control providers or subcontractors
   3.3. Stormwater sampling providers or subcontractors

4. Storm information
5. Description of:

   5.1. Construction phase, including active and inactive areas
   5.2. Active work areas and activities
   5.3. Subcontractors and trades on the job site
   5.4. Prestorm activities including:

      5.4.1. Responsibilities of the WPC manager
      5.4.2. Responsibilities of the crew and crew size
      5.4.3. Stabilization practices for active and inactive disturbed soil areas
      5.4.4. Stockpile management practices
      5.4.5. Corrective actions taken for deficiencies identified during prestorm visual inspections

   5.5. Activities to be performed during storm events, including:

      5.5.1. Responsibilities of the WPC manager
      5.5.2. Responsibilities of the crew and crew size
      5.5.3. BMP for maintenance and repair

6. Flood contingency measures

Storm Water Annual Report

Submit 2 copies of a storm water annual report that covers the preceeding period from July 1st to June 30th. The report must be submitted before July 15th if construction occurs from July 1st to June 30th or within 15 days after contract acceptance if construction ends before June 30th. Allow 10 days for the Engineer's review. The Engineer provides comments and specifies the date when the review stopped if revisions are required.

Obtain approval for the format of the storm water annual report. The report must include:

1. Project information such as description and work locations
2. Stormwater monitoring information, including:

    2.1. Summary and evaluation of sampling and analysis results and laboratory reports
    2.2. Analytical methods, reporting units, and detections limits for analytical parameters
    2.3. Summary of corrective actions taken
    2.4. Identification of corrective actions taken and compliance activities not implemented
    2.5. Summary of violations
    2.6. Names of individuals performing stormwater inspections and sampling
    2.7. Logistical information for inspections and sampling, including location, date, time, and precipitation
    2.8. Visual observations and sample collection records

3. Documentation of training for individuals responsible for:

    3.1. Permit compliance
    3.2. BMP installation, inspection, maintenance, and repair
    3.3. Preparing, revising, and amending the SWPPP

Submit a revised storm water annual report within 5 business days of receiving the Engineer's comments. The Engineer's review resumes when a complete report has been resubmitted.

When the storm water annual report is approved, submit 1 electronic copy and 2 printed copies of the report signed by the WPC manager.

Information After Storm Event

Within 48 hours after the conclusion of a storm event resulting in a discharge, after a nonstormwater discharge, or after receiving a written notice or an order from the RWQCB or another regulatory agency, the WPC manager must submit the following information:

1. Date, time, location, and nature of the activity and the cause of the notice or order
2. Type and quantity of discharge
3. Water pollution control practices in use before the discharge or before receiving the notice or order
4. Description of water pollution control practices and corrective actions taken to manage the discharge or cause of the notice

Quality Control and Assurance

Training

Employees must receive initial water pollution control training before starting work at the job site.

For your project managers, supervisory personnel, subcontractors, and employees involved in water pollution control work:

1. Provide stormwater training in the following subjects:

    1.1. Water pollution control rules and regulations
    1.2. Implementation and maintenance for:

        1.2.1. Temporary soil stabilization
        1.2.2. Temporary sediment control
        1.2.3. Tracking control
        1.2.4. Wind erosion control
        1.2.5. Material pollution prevention and control
        1.2.6. Waste management
        1.2.7. Nonstormwater management

2. Conduct weekly training meetings covering:

    2.1. Deficiencies and corrective actions for water pollution control practices

2.2. Water pollution control practices required for work activities during the week
2.3. Spill prevention and control
2.4. Material delivery, storage, usage, and disposal
2.5. Waste management
2.6. Nonstormwater management procedures

Training for personnel who collect water quality samples must include:

1. CSMP review
2. Health and safety review
3. Sampling simulations

Water Pollution Control Manager

General

The WPC manager must be a QSD. Assign 1 WPC manager to implement the SWPPP. You may assign a QSD other than the WPC manager to develop the SWPPP.

Qualifications

A QSD must:

1. Have completed stormwater management training described in the Department's Web site for the Division of Construction, Storm Water and Water Pollution Control Information
2. Be one or more of the following:

    2.1. California registered civil engineer
    2.2. California registered professional geologist or engineering geologist
    2.3. California licensed landscape architect
    2.4. Professional hydrologist registered through the American Institute of Hydrology
    2.5. Certified Professional in Erosion and Sediment Control (CPESC)™ registered through Enviro Cert International, Inc.
    2.6. Certified Professional in Storm Water Quality (CPSWQ)™ registered through Enviro Cert International, Inc.
    2.7. Professional in erosion and sediment control registered through the National Institute for Certification in Engineering Technologies (NICET)

3. Have completed SWRCB approved QSD training and passed the QSD exam

Responsibilities

The WPC manager must:

1. Be responsible for water pollution control work
2. Be the primary contact for water pollution control work
3. Oversee:

    3.1. Maintenance of water pollution control practices
    3.2. Inspections of water pollution control practices identified in the SWPPP
    3.3. Inspections and reports for visual monitoring
    3.4. Preparation and implementation of REAPs
    3.5. Sampling and analysis
    3.6. Preparation and submittal of:

        3.6.1. NAL exceedance reports
        3.6.2. NEL violation reports
        3.6.3. SWPPP annual certification
        3.6.4. Annual reports
        3.6.5. BMP status reports

4. Oversee and enforce hazardous waste management practices including spill prevention and control measures
5. Have authority to mobilize crews to make immediate repairs to water pollution control practices
6. Ensure that all employees have current water pollution control training
7. Implement the approved SWPPP
8. Amend the SWPPP if required
9. Be at the job site within 2 hours of being contacted
10. Have the authority to stop construction activities damaging water pollution control practices or causing water pollution

Sampling and Analysis

Assign trained personnel to collect water quality samples. Document the personnel and training in the SAP.

Samples taken by assigned field personnel must comply with the equipment manufacturer's instructions for collection, analytical methods, and equipment calibration.

Samples taken for laboratory analysis must comply with water quality sampling procedures and be analyzed by a State-certified laboratory under 40 CFR part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants.

Whenever downstream samples show increased levels of pollutants, assess water pollution control practices, site conditions, and surrounding influences to determine the probable cause for the increase.

For a risk level 2 or risk level 3 project, obtain samples of pH and turbidity by the test methods shown in the following table:

Parameter	Test method	Detection limit (min)	Unit
pH	Field test with calibrated portable instrument	0.2	pH units
Turbidity	Field test with calibrated portable instrument	1	NTU

Whenever the turbidity NEL is exceeded for a risk level 3 project, obtain samples and analyze the suspended sediment concentration by the test method shown in the following table:

Parameter	Test method	Detection limit (min)	Unit
Suspended sediment concentration	ASTM D 3977	5	Mg/L

For a risk level 3 project, obtain samples of pH and turbidity from representative and accessible locations upstream of the discharge point and downstream of the discharge point.

For multiple discharge points, obtain samples from a single upstream and a single downstream location.

Numeric Action Levels

For a risk level 2 or risk level 3 project, NALs must comply with the values shown in the following table:

Numeric Action Levels

Parameter	Test method	Detection limit (min)	Unit	Value
pH	Field test with calibrated portable instrument	0.2	pH	Lower NAL = 6.5 Upper NAL = 8.5
Turbidity	Field test with calibrated portable instrument	1	NTU	250 NTU max

The storm event daily average must not exceed the NAL for pH.
The storm event daily average must not exceed the NAL for turbidity.

Numeric Effluent Limits

For a risk level 3 project, NELs must comply with the values shown in the following table:

Numeric Effluent Limits

Parameter	Test method	Detection limit (min)	Unit	Value
pH	Field test with calibrated portable instrument	0.2	pH	Lower NEL = 6.0 Upper NEL = 9.0
Turbidity	Field test with calibrated portable instrument	1	NTU	500 NTU max

The storm event daily average for storms up to the 5-year, 24-hour storm must not exceed the NEL for turbidity.
The daily average sampling results must not exceed the NEL for pH.

MATERIALS

Not Used

CONSTRUCTION

General

Manage work activities to reduce the discharge of pollutants to surface waters, groundwater, and municipal separate storm sewer systems.

Retain a printed copy of the approved SWPPP at the job site.

Install facilities and devices used for water pollution control practices before performing work activities. Install soil stabilization materials for water pollution control practices in all inactive areas or before storm events.

Repair or replace water pollution control practices within 24 hours of discovering any damage, unless a longer period is authorized.

The Department does not pay for the cleanup, repair, removal, disposal, or replacement of water pollution control practices due to improper installation or your negligence.

You may request changes to the water pollution control work or the Engineer may order changes to water pollution control work. Changes may include additional or new water pollution control practices. Additional water pollution control work is paid for as extra work under Section 4-1.03D, "Extra Work," of the Standard Specifications.

You may request or the Engineer may order laboratory analysis of stormwater samples. If ordered, laboratory analysis of stormwater samples is paid for as extra work under Section 4-1.03D, "Extra Work," of the Standard Specifications.

Continue SWPPP implementation during any suspension of work activities.

Monitoring

Monitor the National Weather Service's forecast on a daily basis. For the National Weather Service's forecast, go to the Web site for the National Weather Service.

Obtain, install, and maintain a rain gauge at the job site. Observe and record daily precipitation.

Inspections

Use the Stormwater Site Inspection Report form for documenting site inspections.
The WPC manager must oversee:

1. Inspections of water pollution control practices identified in SWPPP:

    1.1. Before a forecasted storm event
    1.2. After a qualifying rain event that produces site runoff

1.3. At 24-hour intervals during extended storm events
1.4. On a predetermined schedule of at least once a week

2. Daily inspections of:

2.1. Storage areas for hazardous materials and waste
2.2. Hazardous waste disposal and transporting activities
2.3. Hazardous material delivery and storage activities

3. Inspections of:

3.1. Vehicle and equipment cleaning facilities:

3.1.1. Daily if vehicle and equipment cleaning occurs daily
3.1.2. Weekly if vehicle and equipment cleaning does not occur daily

3.2. Vehicle and equipment maintenance and fueling areas:

3.2.1. Daily if vehicle and equipment maintenance and fueling occurs daily
3.2.2. Weekly if vehicle and equipment maintenance and fueling does not occur daily

3.3. Vehicles and equipment at the job site for leaks and spills on a daily schedule. Verify that operators are inspecting vehicles and equipment each day of use.
3.4. Demolition sites within 50 feet of storm drain systems and receiving waters daily.
3.5. Pile driving areas for leaks and spills:

3.5.1. Daily if pile driving occurs daily
3.5.2. Weekly if pile driving does not occur daily

3.6. Temporary concrete washouts:

3.6.1. Daily if concrete work occurs daily
3.6.2. Weekly if concrete work does not occur daily

3.7. Paved roads at job site access points for street sweeping:

3.7.1. Daily if earthwork and other sediment or debris-generating activities occur daily
3.7.2. Weekly if earthwork and other sediment or debris-generating activities do not occur daily
3.7.3. Within 24 hours of precipitation forecasted by the National Weather Service

3.8. Dewatering work:

3.8.1. Daily if dewatering work occurs daily
3.8.2. Weekly if dewatering work does not occur daily

3.9. Temporary active treatment system:

3.9.1. Daily if temporary active treatment system activities occur daily
3.9.2. Weekly if temporary active treatment system activities do not occur daily

3.10. Work over water:

3.10.1. Daily if work over water occurs daily
3.10.2. Weekly if work over water does not occur daily

Deficiencies

Whenever you or the Engineer identify a deficiency in the implementation of the approved SWPPP, correct the deficiency:

1. Immediately, unless a later date is authorized
2. Before precipitation occurs

The Department may correct the deficiency and deduct the cost of correcting the deficiency from payment if you fail to correct the deficiency by the agreed date or before the onset of precipitation.

Rain Event Action Plan

For a risk level 2 or risk level 3 project, have the REAP at the job site at least 24 hours before a forecasted storm event. The WPC manager must submit the REAP on the following forms:

1. Rain Event Action Plan Highway Construction Phase
2. Rain Event Action Plan Plant Establishment Phase
3. Rain Event Action Plan For Inactive Project

Retain a printed copy of each REAP at the job site as part of the SWPPP.

Implement the REAP, including mobilizing crews to complete activities, within 24 hours before precipitation occurs.

Sampling and Analysis

Perform sample collection during:

1. Normal working hours
2. Each qualifying rain event
3. First 2 hours of each storm event

Do not physically collect samples during dangerous weather conditions, such as flooding or electrical storms.

Document sample collection during precipitation.

Whenever downstream samples show increased levels of pH, turbidity, and other constituents, assess water pollution control practices, site conditions, and surrounding influences to determine the probable cause for the increase.

Collect samples:

1. During a storm event for:

    1.1. Each nonvisible pollutant source and a corresponding uncontaminated control sample
    1.2. All locations identified on the Storm Event Sampling and Analyses Plan form

2. During a qualifying rain event for:

    2.1. Each nonvisible pollutant source and a corresponding uncontaminated control sample
    2.2. pH, turbidity, and other constituents as required
    2.3. At least 3 samples for each day of a qualifying rain event
    2.4. All locations identified on the Qualifying Rain Event Sampling and Analyses Plan form

Collect receiving-water samples for a risk level 3 project and whenever a direct discharge to receiving waters occurs and NELs are violated.

Retain documentation of water quality sampling and analysis results with the SWPPP at the job site.

The Department does not pay for the preparation, collection, laboratory analysis, and reporting of stormwater samples for nonvisible pollutants if water pollution control practices are not implemented before precipitation or if you fail to correct a water pollution control practice before precipitation.

MEASUREMENT AND PAYMENT

The contract lump sum price for prepare storm water pollution prevention plan includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in developing

and implementing a SWPPP, including providing a WPC manager, conducting water pollution control training, and monitoring, inspecting and correcting water pollution control practices at the job site, as shown on the plans, as specified in the Standard Specifications and these special provisions, and directed by the Engineer.

For projects with 60 working days or less, the Department pays you for prepare stormwater pollution prevention plan as follows:

1. A total of 75 percent of the item total upon approval of the SWPPP
2. A total of 100 percent of the item total upon contract acceptance

For projects with more than 60 working days, the Department pays you for prepare stormwater pollution prevention plan as follows:

1. A total of 50 percent of the item total upon approval of the SWPPP
2. A total of 90 percent of the item total over the life of the contract
3. A total of 100 percent of the item total upon contract acceptance

If risk level 2 or 3, the Department pays $500 for each rain event action plan submitted. The contract unit price paid for rain event action plan includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparing REAPs, including preparing and submitting REAP forms, and monitoring weather forecasts, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The Department does not adjust payment for an increase or decrease in the quantity of rain event action plan. Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications does not apply.

The Department pays $2,000 for each storm water annual report submitted. The contract unit price paid for storm water annual report includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in preparing and submitting storm water annual reports, including annual certifications, monitoring reports, inspection, and sampling results, and obtaining acceptance of storm water annual reports, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The Department does not adjust payment for an increase or decrease in the quantity of storm water annual report. Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications does not apply.

The work to complete the final storm water annual report contract item is excluded from Section 7-1.17, "Acceptance of Contract," of the Standard Specifications.

If risk level 2 or 3, the contract unit price paid for storm water sampling and analysis day includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in reporting on stormwater quality per storm events and qualifying rain events, including preparation, collection, analysis of stormwater samples for pH, turbidity, and other constituents, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer. A single day of sampling is counted as 1 unit.

The Department does not adjust payment for an increase or decrease in the quantity of storm water sampling and analysis day. Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications does not apply.

The Department does not pay for the preparation, collection, laboratory analysis, and reporting of stormwater samples for nonvisible pollutants if water pollution control practices are not implemented before precipitation or if you fail to correct a water pollution control practice before precipitation.

For each failure to submit a completed storm water annual report, the Department withholds $10,000. This withhold is in addition to other withholds under Section 9-1.07E(3) "Performance Failure Withholds," of the Standard Specifications.

Each failure to comply with any part of these special provisions and each failure to implement water pollution control practices are considered separate performance failures.

10-1.05 CONSTRUCTION SITE MANAGEMENT

GENERAL

Summary

This work includes preventing and controlling spills, dewatering, and managing materials, waste, and nonstormwater.

Implement effective handling, storage, usage, and disposal practices to control material pollution and manage waste and nonstormwater at the job site before they come in contact with storm drain systems and receiving waters.

The following abbreviations are used in this special provision:

DTSC: Department of Toxic Substance Control.
ELAP: Environmental Laboratory Accreditation Program.
WPC: Water Pollution Control.

Waste material removed shall be handled in accordance with "Construction Waste Management" in Section 5 of these special provisions.

Submittals

Before you start dewatering, submit a dewatering and discharge work plan under Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and "Water Pollution Control" of these special provisions. The dewatering and discharge work plan must include:

1. Title sheet and table of contents
2. Description of dewatering and discharge activities detailing locations, quantity of water, equipment, and discharge point
3. Estimated schedule for dewatering and discharge start and end dates of intermittent and continuous activities
4. Discharge alternatives, such as dust control or percolation
5. Visual monitoring procedures with inspection log
6. Copy of written approval to discharge into a sanitary sewer system at least 5 business days before starting discharge activities

Submit the following:

1. Material Safety Data Sheet at least 5 business days before material is used or stored
2. Monthly inventory records for material used or stored

Submit written approval from the local health agency, city, county, and sewer district before discharging from a sanitary or septic system directly into a sanitary sewer system.

MATERIALS

Not Used

CONSTRUCTION

Spill Prevention and Control

General

Keep material or waste storage areas clean, well organized, and equipped with enough cleanup supplies for the material being stored.

Implement spill and leak prevention procedures for chemicals and hazardous substances stored on the job site. Whenever you spill or leak chemicals or hazardous substances at the job site, you are responsible for all associated cleanup costs and related liability.

Report minor, semi-significant, and significant or hazardous spills to the WPC manager. The WPC manager must notify the Engineer immediately.

As soon as it is safe, contain and clean up spills of petroleum materials and sanitary and septic waste substances listed under 40 CFR, Parts 110, 117, and 302.

Minor Spills

Minor spills consist of quantities of oil, gasoline, paint, or other materials that are small enough to be controlled by a 1st responder upon discovery of the spill.

Clean up a minor spill using the following procedures:

1. Contain the spread of the spill
2. Recover the spilled material using absorption
3. Clean the contaminated area

4. Dispose of the contaminated material and absorbents promptly and properly under "Waste Management" of these special provisions

Semi-Significant Spills

Semi-significant spills consist of spills that can be controlled by a 1st responder with help from other personnel. Clean up a semi-significant spill immediately using the following procedures:

1. Contain the spread of the spill.
2. On paved or impervious surfaces, encircle and recover the spilled material with absorbent materials. Do not allow the spill to spread widely.
3. If the spill occurs on soil, contain the spill by constructing an earthen dike and dig up the contaminated soil for disposal.
4. If the spill occurs during precipitation, cover the spill with 10-mil plastic sheeting or other material to prevent contamination of runoff.
5. Dispose of the contaminated material promptly and properly under "Waste Management" of these special provisions.

Significant or Hazardous Spills

Significant or hazardous spills consist of spills that cannot be controlled by job site personnel. Immediately notify qualified personnel of a significant or hazardous spill. Take the following steps:

1. Do not attempt to clean up the spill until qualified personnel have arrived
2. Notify the Engineer and follow up with a report
3. Obtain the immediate services of a spill contractor or hazardous material team
4. Notify local emergency response teams by dialing 911 and county officials by using the emergency phone numbers retained at the job site
5. Notify the California Emergency Management Agency State Warning Center at (916) 845-8911
6. Notify the National Response Center at (800) 424-8802 regarding spills of Federal reportable quantities under 40 CFR 110, 119, and 302
7. Notify other agencies as appropriate, including:

    7.1. Fire Department
    7.2. Public Works Department
    7.3. Coast Guard
    7.4. Highway Patrol
    7.5. City Police or County Sheriff's Department
    7.6. Department of Toxic Substances
    7.7. California Division of Oil and Gas
    7.8. Cal/OSHA
    7.9. Regional Water Resources Control Board

Prevent a spill from entering stormwater runoff before and during cleanup activities. Do not bury or wash the spill with water.

Material Management

General

Minimize or eliminate discharge of material into the air, storm drain systems, and receiving waters while taking delivery of, using, or storing the following materials:

1. Hazardous chemicals, including acids, lime, glues, adhesives, paints, solvents, and curing compounds
2. Soil stabilizers and binders
3. Fertilizers
4. Detergents
5. Plaster
6. Petroleum materials, including fuel, oil, and grease
7. Asphalt and concrete components
8. Pesticides and herbicides

Employees trained in emergency spill cleanup procedures must be present during the unloading of hazardous materials or chemicals.

Use less hazardous materials if practicable.

The following activities must be performed at least 100 feet from concentrated flows of stormwater, drainage courses, and inlets if within the floodplain and at least 50 feet if outside the floodplain, unless otherwise approved by the Engineer:

1. Stockpiling materials
2. Storing pile-driving equipment and liquid waste containers
3. Washing vehicles and equipment in outside areas
4. Fueling and maintaining vehicles and equipment

Material Storage

If materials are stored:

1. Store liquids, petroleum materials, and substances listed in 40 CFR 110, 117, and 302 and place them in secondary containment facilities as specified by US DOT for storage of hazardous materials.
2. Secondary containment facilities must be impervious to the materials stored there for a minimum contact time of 72 hours.
3. Cover secondary containment facilities during non-working days and whenever precipitation is forecasted. Secondary containment facilities must be adequately ventilated.
4. Keep secondary containment facilities free of accumulated rainwater or spills. After precipitation, or in the event of spills or leaks, collect accumulated liquid and place it into drums within 24 hours. Handle the liquid as hazardous waste under "Waste Management" of these special provisions unless testing confirms that the liquid is nonhazardous.
5. Do not store incompatible materials, such as chlorine and ammonia, in the same secondary containment facility.
6. Store materials in their original containers with the original material labels maintained in legible condition. Immediately replace damaged or illegible labels.
7. Secondary containment facilities must have the capacity to contain precipitation from a 24-hour-long, 25-year storm, plus 10 percent of the aggregate volume of all containers or the entire volume of the largest container within the facility, whichever is greater.
8. Store bagged or boxed material on pallets. Protect bagged or boxed material from wind and rain during non-working days and whenever precipitation is forecasted.
9. Provide sufficient separation between stored containers to allow for spill cleanup or emergency response access. Storage areas must be kept clean, well organized, and equipped with cleanup supplies appropriate for the materials being stored.
10. Repair or replace perimeter controls, containment structures, covers, and liners as necessary. Inspect storage areas before and after precipitation and at least weekly during other times.

Stockpile Management

Minimize stockpiling of materials at the job site.

Implement water pollution control practices within 72 hours of stockpiling material or before a forecasted storm event, whichever occurs first. If stockpiles are being used, do not allow soil, sediment, or other debris to enter storm drains, open drainages, and watercourses.

Active and inactive soil stockpiles must be:

1. Covered with soil stabilization material or a temporary cover
2. Surrounded with a linear sediment barrier

Stockpiles of asphalt concrete and PCC rubble, HMA, aggregate base, or aggregate subbase must be:

1. Covered with a temporary cover
2. Surrounded with a linear sediment barrier

Stockpiles of pressure-treated wood must be:

1. Placed on pallets

2. Covered with impermeable material

Stockpiles of cold mix asphalt concrete must be:

1. Placed on an impervious surface
2. Covered with an impermeable material
3. Protected from stormwater run-on and runoff

Control wind erosion year round under Section 14-9.02, "Dust Control," of the Standard Specifications.

Repair or replace linear sediment barriers and covers as needed to keep them functioning properly. Whenever sediment accumulates to 1/3 of the linear sediment barrier height, remove the accumulated sediment.

Waste Management

Solid Waste

Do not allow litter, trash, or debris to accumulate anywhere on the job site, including storm drain grates, trash racks, and ditch lines. Pick up and remove litter, trash, and debris from the job site at least once a week. The WPC manager must monitor solid waste storage and disposal procedures on the job site.

If practicable, recycle nonhazardous job site waste and excess material. If recycling is not practicable, dispose of it under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way," of the Standard Specifications.

Furnish enough closed-lid dumpsters of sufficient size to contain the solid waste generated by work activities. When refuse reaches the fill line, empty the dumpsters. Dumpsters must be watertight. Do not wash out dumpsters at the job site. Furnish additional containers and pick up dumpsters more frequently during the demolition phase of construction.

Solid waste includes:

1. Brick
2. Mortar
3. Timber
4. Metal scraps
5. Sawdust
6. Pipe
7. Electrical cuttings
8. Nonhazardous equipment parts
9. Styrofoam and other packaging materials
10. Vegetative material and plant containers from highway planting
11. Litter and smoking material, including litter generated randomly by the public
12. Other trash and debris

Furnish and use trash receptacles in the job site yard, field trailers, and locations where workers gather for lunch and breaks.

Hazardous Waste and Contamination

If hazardous waste is, or will be, generated on the job site, the WPC manager must be thoroughly familiar with proper hazardous waste handling and emergency procedures under 40 CFR § 262.34(d)(5)(iii) and must have successfully completed training under 22 CA Code of Regs § 66265.16.

The WPC manager must:

1. Oversee and enforce hazardous waste management practices
2. Inspect all hazardous waste storage areas daily, including all temporary containment facilities and satellite collection locations
3. Oversee all hazardous waste transportation activities on the job site

Submit a copy of uniform hazardous waste manifest forms to the Engineer within 24 hours of transporting hazardous waste.

Submit receiving landfill documentation of proper disposal to the Engineer within 5 business days of hazardous waste transport from the project.

Unanticipated Discovery of Asbestos and Hazardous Substances

Upon discovery of asbestos or a hazardous substance, comply with Section 14-11.02 "Asbestos and Hazardous Substances," of the Standard Specifications.

Hazardous Waste Management Practices

Handle, store, and dispose of hazardous waste under 22 CA Code of Regs Div 4.5.
Use the following storage procedures:

1. Store hazardous waste and potentially hazardous waste separately from nonhazardous waste at the job site.
2. For hazardous waste storage, use metal containers approved by the United States Department of Transportation for the transportation and temporary storage of hazardous waste.
3. Store hazardous waste in sealed, covered containers labeled with the contents and accumulation start date under 22 CA Code of Regs, Div 4.5. Labels must comply with the provisions of 22 CA Code of Regs, Div 4.5.§ 66262.31 and § 66262.32. Immediately replace damaged or illegible labels.
4. Handle hazardous waste containers such that no spillage occurs.
5. Store hazardous waste away from storm drains, watercourses, moving vehicles, and equipment.
6. Furnish containers with adequate storage volume at convenient satellite locations for hazardous waste collection. Immediately move these containers to secure temporary containment facilities when no longer needed at the collection location or when full.
7. Store hazardous waste and potentially hazardous waste in secure temporary containment enclosures having secondary containment facilities impervious to the materials stored there for a minimum contact-time of 72 hours. Temporary containment enclosures must be located away from public access. Acceptable secure enclosures include a locked chain link fenced area or a lockable shipping container located within the project limits.
8. Design and construct secondary containment facilities with a capacity to contain precipitation from a 24-hour-long, 25-year storm; and 10 percent of the aggregate volume of all containers, or the entire volume of the largest container within the facility, whichever is greater.
9. Cover secondary containment facilities during non-working days and if a storm event is predicted. Secondary containment facilities must be adequately ventilated.
10. Keep secondary containment facility free of accumulated rainwater or spills. After a storm event, or in the event of spills or leaks, collect accumulated liquid and place into drums within 24 hours. Handle these liquids as hazardous waste unless testing determines them to be nonhazardous.
11. Do not store incompatible wastes, such as chlorine and ammonia, in the same secondary containment facility.
12. Provide sufficient separation between stored containers to allow for spill cleanup or emergency response access. Storage areas must be kept clean, well organized, and equipped with cleanup supplies appropriate for the wastes being stored.
13. Repair or replace perimeter controls, containment structures, covers, and liners as necessary. Inspect storage areas before and after a storm event, and at least weekly during other times.

Do not:

1. Overfill hazardous waste containers
2. Spill hazardous waste or potentially hazardous waste
3. Mix hazardous wastes
4. Allow hazardous waste or potentially hazardous waste to accumulate on the ground

Dispose of hazardous waste within 90 days of the start of generation. Use a hazardous waste manifest and a transporter registered with the DTSC and in compliance with the CA Highway Patrol Biennial Inspection of Terminals Program to transport hazardous waste to an appropriately permitted hazardous waste management facility.

Dust Control for Hazardous Waste or Contamination

Excavation, transportation, and handling of material containing hazardous waste or contamination must result in no visible dust migration. Have a water truck or tank on the job site at all times while clearing and grubbing and performing earthwork operations in work areas containing hazardous waste or contamination.

Stockpiling of Hazardous Waste or Contamination

Do not stockpile material containing hazardous waste or contamination unless ordered. Stockpiles of material containing hazardous waste or contamination must not be placed where affected by surface run-on or run-off. Cover stockpiles with 13 mils minimum thickness of plastic sheeting or 1 foot of nonhazardous material. Do not place stockpiles in environmentally sensitive areas. Stockpiled material must not enter storm drains, inlets, or waters of the State.

Contractor-Generated Hazardous Waste

You are the generator of hazardous waste generated as a result of materials you bring to the job site. Use hazardous waste management practices if you generate waste on the job site from the following substances:

1. Petroleum materials
2. Asphalt materials
3. Concrete curing compound
4. Pesticides
5. Acids
6. Paints
7. Stains
8. Solvents
9. Wood preservatives
10. Roofing tar
11. Road flares
12. Lime
13. Glues and adhesives
14. Materials classified as hazardous waste under 22 CA Code of Regs, Div 4.5

If hazardous waste constituent concentrations are unknown, use a laboratory certified by the ELAP under the California Department Of Public Health to analyze a minimum of 4 discrete representative samples of the waste to determine whether it is a hazardous waste and to determine safe and lawful methods for storage and disposal. Perform sampling and analysis in compliance with US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) and under 22 CA Code of Regs, Div 4.5.

Use your US EPA Generator Identification Number and sign hazardous waste manifests for the hazardous waste you generate.

Identify contaminated soil resulting from spills or leaks by noticing discoloration, or differences in soil properties. Immediately notify the Engineer of spills or leaks. Clean up spills and leaks under the Engineer's direction and to the satisfaction of the Engineer. Soil with evidence of contamination must be sampled and analysis performed by a laboratory certified by ELAP.

If sampling and analysis of contaminated soil demonstrates that it is a hazardous waste, handle and dispose of the soil as hazardous waste. You are the generator of hazardous waste created as the result of spills or leaks for which you are responsible.

Prevent the flow of water, including ground water, from mixing with contaminated soil by using one or a combination of the following measures:

1. Berms
2. Cofferdams
3. Grout curtains
4. Freeze walls
5. Concrete seal course

If water mixes with contaminated soil and becomes contaminated, sample and analyze the water using a laboratory certified by the ELAP. If analysis results demonstrate that the water is a hazardous waste, manage and dispose of the water as hazardous waste.

Department-Generated Hazardous Waste

If the Department is the generator of hazardous waste during the work performed on this project, use hazardous waste management practices.

Labels must comply with the provisions of 22 CA Code of Regs § 66262.31 and § 66262.32. Mark labels with:

1. Date the hazardous waste is generated
2. The words "Hazardous Waste"
3. Composition and physical state of the hazardous waste (for example, asphalt grindings with thermoplastic or paint)
4. The word "Toxic"
5. Name, address, and telephone number of the Engineer
6. Contract number
7. Contractor or subcontractor name

Handle the containers such that no spillage occurs.

Hazardous Waste Transport and Disposal

Dispose of hazardous waste within California at a disposal site operating under a permit issued by the DTSC.

The Engineer will obtain the US EPA Generator Identification Number for hazardous waste disposal.

The Engineer will sign all hazardous waste manifests. Notify the Engineer 5 business days before the manifests are to be signed.

The Department will not consider you a generator of the hazardous waste and you will not be obligated for further cleanup, removal, or remedial action for such material if handled or disposed of under these specifications and the appropriate State and federal laws and regulations and county and municipal ordinances and regulations regarding hazardous waste.

Paint Waste

Clean water-based and oil-based paint from brushes or equipment within a contained area in a way that does not contaminate soil, receiving waters, or storm drain systems. Handle and dispose of the following as hazardous waste: paints, thinners, solvents, residues, and sludges that cannot be recycled or reused. When thoroughly dry, dispose of the following as solid waste: dry latex paint, paint cans, used brushes, rags, absorbent materials, and drop cloths.

Concrete Waste

Use practices to prevent the discharge of asphalt concrete, PCC, and HMA waste into storm drain systems and receiving waters.

Collect and dispose of asphalt concrete, PCC, and HMA waste generated at locations where:

1. Concrete material, including grout, is used
2. Concrete dust and debris result from demolition
3. Sawcutting, coring, grinding, grooving, or hydro-concrete demolition creates a residue or slurry
4. Concrete trucks or other concrete-coated equipment is cleaned at the job site

Sanitary and Septic Waste

Do not bury or discharge wastewater from a sanitary or septic system within the highway. A sanitary facility discharging into a sanitary sewer system must be properly connected and free from leaks. Place a portable sanitary facility at least 50 feet away from storm drains, receiving waters, and flow lines.

Comply with local health agency provisions if using an on-site disposal system.

Liquid Waste

Use practices that will prevent job-site liquid waste from entering storm drain systems and receiving waters. Liquid waste include the following:

1. Drilling slurries or fluids
2. Grease-free and oil-free wastewater and rinse water
3. Dredgings, including liquid waste from cleaning drainage systems
4. Liquid waste running off a surface, including wash or rinse water
5. Other nonstormwater liquids not covered by separate permits

Hold liquid waste in structurally sound, leak-proof containers, such as roll-off bins or portable tanks.

Liquid waste containers must be of sufficient quantity and volume to prevent overflow, spills, and leaks.

Store containers at least 50 feet from moving vehicles and equipment.

Remove and dispose of deposited solids from sediment traps unless the Engineer approves another method.

Liquid waste may require testing to determine hazardous material content before disposal.

Dispose of drilling fluids and residue.

If a location approved by the Engineer is available within the job site, fluids and residue exempt under 23 CA Code of Regs § 2511(g) may be dried by evaporation in a leak-proof container. Dispose of the remaining as solid waste.

Nonstormwater Management

Water Control and Conservation

Manage water used for work activities in a way that will prevent erosion and the discharge of pollutants into storm drain systems and receiving waters. Obtain authorization before washing anything at the job site with water that could discharge into a storm drain system or receiving waters. Report discharges immediately.

Implement water conservation practices if water is used at the job site. Inspect irrigation areas. Adjust watering schedules to prevent erosion, excess watering, or runoff. Shut off the water source to broken lines, sprinklers, or valves and repair breaks within 24 hours. Reuse water from waterline flushing for landscape irrigation if practicable. Sweep and vacuum paved areas. Do not wash paved areas with water.

Direct runoff water, including water from water line repair, from the job site to areas where it can infiltrate into the ground. Do not allow runoff water to enter storm drain systems and receiving waters. Do not allow spilled water to escape filling areas for water trucks. Direct water from off-site sources around the job site if practicable. Minimize the contact of off-site water with job site water.

Illegal Connection and Discharge Detection and Reporting

Before starting work, inspect the job site and the job site's perimeter for evidence of illicit connections, illegal discharges, and dumping. After starting work, inspect the job site and perimeter on a daily schedule for illicit connections and illegal dumping and discharges.

Whenever illegal connections, discharges, or dumping are discovered, notify the Engineer immediately. Do not take further action unless ordered. Assume that unlabeled or unidentifiable material is hazardous.

Look for the following evidence of illicit connections, illegal discharges, and dumping:

1. Debris or trash piles
2. Staining or discoloration on pavement or soils
3. Pungent odors coming from drainage systems
4. Discoloration or oily sheen on water
5. Stains and residue in ditches, channels, or drain boxes
6. Abnormal water flow during dry weather
7. Excessive sediment deposits
8. Nonstandard drainage junction structures
9. Broken concrete or other disturbances at or near junction structures

Vehicle and Equipment Cleaning

Limit vehicle and equipment cleaning or washing at the job site except what is necessary to control vehicle tracking or hazardous waste. Notify the Engineer before cleaning vehicles and equipment at the job site with soap, solvents, or steam. Contain and recycle or dispose of resulting waste under "Waste Management" of these special provisions, whichever is applicable. Do not use diesel to clean vehicles or equipment. Minimize the use of solvents.

Clean or wash vehicles and equipment in a structure equipped with disposal facilities. You may wash vehicles in an outside area if the area is:

1. Paved with asphalt concrete, HMA, or PCC
2. Surrounded by a containment berm
3. Equipped with a sump to collect and dispose of wash water

Use as little water as practicable whenever washing vehicles and equipment with water. Hoses must be equipped with a positive shutoff valve.

Discharge liquid from wash racks to a recycling system or to another system approved by the Engineer. Remove liquids and sediment as necessary.

Vehicle and Equipment Fueling and Maintenance

If practicable, perform maintenance on vehicles and equipment off-site.

If fueling or maintenance must be done at the job site, assign a site or sites, and obtain authorization before using them. Minimize mobile fueling and maintenance activities. Fueling and maintenance activities must be performed on level ground in areas protected from stormwater run-on and runoff.

Use containment berms or dikes around fueling and maintenance areas. Keep adequate quantities of absorbent spill-cleanup material and spill kits in the fueling or maintenance area and on fueling trucks. Dispose of spill-cleanup material and kits immediately after use under "Waste Management" of these special provisions. Use drip pans or absorbent pads during fueling or maintenance.

Do not leave fueling or maintenance areas unattended during fueling and maintenance activities. Fueling nozzles must be equipped with an automatic shutoff control. Nozzles must be equipped with vapor-recovery fueling nozzles where required by the Air Quality Management District. Secure nozzles in an upright position when not in use. Do not top off fuel tanks.

Recycle or properly dispose of used batteries and tires under "Waste Management" of these special provisions.

If leaks cannot be repaired immediately, remove the vehicle or equipment from the job site.

Material and Equipment Used Over Water

Place drip pans and absorbent pads under vehicles and equipment used over water. Keep an adequate supply of spill-cleanup material with vehicles and equipment. Place drip pans or plastic sheeting under vehicles and equipment on docks, barges, or other surfaces over water whenever vehicles or equipment will be idle for more than 1 hour.

Furnish watertight curbs or toe boards on barges, platforms, docks, or other surfaces over water to contain material, debris, and tools. Secure material to prevent spills or discharge into the water due to wind.

Report discharges to receiving waters immediately upon discovery. Submit a discharge notification to the Engineer.

Structure Removal Over or Adjacent to Water

Do not allow demolished material to enter storm drain systems and receiving waters. Use covers and platforms approved by the Engineer to collect debris. Use attachments on equipment to catch debris during small demolition activities. Empty debris-catching devices daily.

Paving, Sealing, Sawcutting, Grooving, and Grinding Activities

Prevent material from entering storm drain systems and receiving waters including:

1. Cementitious material
2. Asphaltic material
3. Aggregate or screenings
4. Sawcutting, grooving, and grinding residue
5. Pavement chunks
6. Shoulder backing
7. Methacrylate
8. Sandblasting residue

Cover drainage inlets and use linear sediment barriers to protect downhill receiving waters until paving, sealing, sawcutting, grooving, and grinding activities are completed and excess material has been removed. Cover drainage inlets and manholes during the application of seal coat, tack coat, slurry seal, or fog seal.

Whenever precipitation is forecasted, limit paving, sawcutting, and grinding to places where runoff can be captured.

Do not start seal coat, tack coat, slurry seal, or fog seal activities whenever precipitation is forecasted during the application and curing period. Do not excavate material from existing roadways during precipitation.

Use a vacuum to remove slurry immediately after slurry is produced. Do not allow the slurry to run onto lanes open to traffic or off the pavement.

Collect the residue from PCC grooving and grinding activities with a vacuum attachment on the grinding machine. Do not leave the residue on the pavement or allow the residue to flow across pavement.

You may stockpile material excavated from existing roadways under "Material Management" of these special provisions if approved by the Engineer.

Do not coat asphalt trucks and equipment with substances that contain soap, foaming agents, or toxic chemicals.

Park paving equipment over drip pans or plastic sheeting with absorbent material to catch drips if the paving equipment is not in use.

Thermoplastic Striping and Pavement Markers

Do not preheat, transfer, or load thermoplastic within 50 feet of drainage inlets and receiving waters.

Do not unload, transfer, or load bituminous material for pavement markers within 50 feet of drainage inlets and receiving waters.

Collect and dispose of bituminous material from the roadway after removing markers under "Waste Management" of these special provisions.

Pile Driving

Keep spill kits and cleanup materials at pile driving locations. Park pile driving equipment over drip pans, absorbent pads, or plastic sheeting with absorbent material. Protect pile driving equipment by parking on plywood and covering with plastic whenever precipitation is forecasted.

Store pile driving equipment on level ground and protect it from stormwater run-on when not in use. Use vegetable oil instead of hydraulic fluid if practicable.

Concrete Curing

Do not overspray chemical curing compounds. Minimize the drift by spraying as close to the concrete as practicable. Do not allow runoff of curing compounds. Cover drainage inlets before applying the curing compound.

Minimize the use and discharge of water by using wet blankets or similar methods to maintain moisture when concrete is curing.

Concrete Finishing

Collect and dispose of water and solid waste from high-pressure water blasting under "Waste Management" of these special provisions. Collect and dispose of sand and solid waste from sandblasting under "Waste Management" of these special provisions. Before sandblasting, cover drainage inlets within 50 feet of sandblasting. Minimize the drift of dust and blast material by keeping the nozzle close to the surface of the concrete. If the character of the blast residue is unknown, test it for hazardous materials and dispose of it properly.

Inspect containment structures for concrete finishing for damage before each day of use and before forecasted precipitation. Remove liquid and solid waste from containment structures after each work shift.

Sweeping

Sweep by hand or mechanical methods, such as vacuuming. Do not use methods that use only mechanical kick brooms.

Sweep paved roads at construction entrance and exit locations and paved areas within the job site:

1. During clearing and grubbing activities
2. During earthwork activities
3. During trenching activities
4. During roadway structural-section activities
5. When vehicles are entering and leaving the job site
6. After soil-disturbing activities
7. After observing off-site tracking of material

Monitor paved areas and roadways within the project. Sweep within:

1. 1 hour whenever sediment or debris is observed during activities that require sweeping
2. 24 hours whenever sediment or debris is observed during activities that do not require sweeping

Remove collected material, including sediment, from paved shoulders, drain inlets, curbs and dikes, and other drainage areas. You may stockpile collected material at the job site under "Material Management" of these special provisions. If stockpiled, dispose of collected material at least once per week under "Waste Management" of these special provisions.

You may dispose of sediment within the job site collected during sweeping activities. Protect the disposal areas against erosion.

Keep dust to a minimum during street sweeping activities. Use water or a vacuum whenever dust generation is excessive or sediment pickup is ineffective.

Remove and dispose of trash collected during sweeping under "Waste Management" of these special provisions.

Dewatering

Dewatering consists of discharging accumulated stormwater, groundwater, or surface water from excavations or temporary containment facilities.

Perform dewatering work as specified for the work items involved, such as temporary active treatment system or dewatering and discharge.

If dewatering and discharging activities are not specified under a work item and you perform dewatering activities:

1. Conduct dewatering activities under the Department's Field Guide for Construction Site Dewatering.
2. Ensure that any dewatering discharge does not cause erosion, scour, or sedimentary deposits that could impact natural bedding materials.
3. Discharge the water within the project limits. If the water cannot be discharged within project limits due to site constraints or contamination, dispose of the water as directed by the Engineer.
4. Do not discharge stormwater or nonstormwater that has an odor, discoloration other than sediment, an oily sheen, or foam on the surface. Notify the Engineer immediately upon discovering any such condition.

MEASUREMENT AND PAYMENT

The contract lump sum price paid for construction site management includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in spill prevention and control, material management, waste management, nonstormwater management, and dewatering activities, including identifying, sampling, testing, handling, and disposing of hazardous waste resulting from your activities, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as ordered by the Engineer.

10-1.06 STREET SWEEPING

GENERAL

Summary

This work includes street sweeping using machine-operated sweepers.

Street sweeping must comply with the specifications for sweeping in the Section titled, "Construction Site Management," of these special provisions except a machine-operated sweeper must be used.

Street sweeping does not void specifications for main residue collection included in other work activities, such as grooving, grinding, or asphalt concrete planing.

The SWPPP must describe and include the use of street sweeping as a water pollution control practice for sediment control and tracking control.

Submittals

At least 5 business days before you start clearing and grubbing, earthwork, or other activities with the potential for tracking sediment or debris, submit:

1. Number of machine-operated sweepers described in the SWPPP
2. Type of sweeper technology

Quality Control and Assurance

Retain and submit records of street sweeping, including:

1. Quantity of disposed sweeping waste
2. Sweeping times and locations

MATERIALS

Machine-operated sweepers must use one of the following technologies:

1. Mechanical sweeper followed by a vacuum-assisted sweeper
2. Vacuum-assisted dry (waterless) sweeper
3. Regenerative-air sweeper

CONSTRUCTION

At least 1 machine-operated sweeper must be on the job site at all times when street sweeping work is required. The sweeper must be in good working order.

MEASUREMENT AND PAYMENT

The contract lump sum price paid for street sweeping includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in street sweeping, including disposal of collected material, as shown on the plans, as specified in the Standard Specifications, these special provisions, and as directed by the Engineer.

10-1.07 TEMPORARY HYDRAULIC MULCH (BONDED FIBER MATRIX)

GENERAL

Summary

This work includes applying, maintaining, and removing temporary hydraulic mulch (bonded fiber matrix). Hydraulic mulch uses a mixture of fiber, tackifier, and water to stabilize active and nonactive disturbed soil areas.

The SWPPP must describe and include the use of temporary hydraulic mulch (bonded fiber matrix) as a water pollution control practice for soil stabilization.

Submittals

At least 5 business days before applying hydraulic mulch, submit:

1. Material Safety Data Sheet for the tackifier.
2. Product label describing the tackifier as an erosion control product.
3. List of pollutant indicators and potential pollutants for the use of temporary hydraulic mulch. Pollutant indicators are described under "Sampling and Analysis Plan for Non-Visible Pollutants" in the Preparation Manual.
4. Determination of acute and chronic toxicity for aquatic organisms conforming to EPA methods for the tackifier.
5. Composition of ingredients including chemical formulation.

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for:

1. Tackifier
2. Fiber

LEED Submittals:

1. MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

Quality Control and Assurance

Retain and submit records of temporary hydraulic mulch applications including:

1. Compliance with specified rates
2. Application area
3. Application time
4. Quantity

MATERIALS

Tackifier

The tackifier must be:

1. Nonflammable
2. Nontoxic to aquatic organisms

3. Free from growth or germination inhibiting factors
4. Bonded to the fiber or prepackaged with the fiber by the manufacturer
5. At least 10 percent of the weight of the dry fiber and include the weight of the activating agents and additives
6. Organic, high viscosity colloidal polysaccharide with activating agents, or a blended hydrocolloid-based binder

Fiber

Fiber must be:

1. Long strand, whole wood fibers, thermo-mechanically processed from clean, whole wood chips
2. Not made from sawdust, cardboard, paper, or paper byproducts
3. At least 25 percent of fibers 3/8 inch long
4. At least 50 percent held on a No. 25 sieve
5. Free from lead paint, printing ink, varnish, petroleum products, seed germination inhibitors, or chlorine bleach
6. Free from synthetic or plastic materials
7. At most 7 percent ash

Coloring Agent

Use a biodegradable nontoxic coloring agent free from copper, mercury, and arsenic to ensure the hydraulic mulch contrasts with the application area.

CONSTRUCTION

Application

Apply temporary hydraulic mulch when an area is ready to receive temporary erosion control under "Move-in/Move-out (Temporary Erosion Control)."

Dilute hydraulic mulch with water to spread the mulch evenly.

Use hydroseeding equipment to apply hydraulic mulch.

Apply hydraulic mulch:

1. In the proportions indicated in the table below. Successive applications or passes may be needed to achieve the required proportion rate:

Material	Application Rate lbs/acre
Bonded Fiber (includes fiber and tackifier material)	4,000

2. To form a continuous mat with no gaps between the mat and the soil surface.
3. From 2 or more directions to achieve a continuous mat.
4. In layers to avoid slumping and to aid drying.
5. During dry weather or at least 24 hours before predicted rain.

Do not apply hydraulic mulch if:

1. Water is standing on or moving across the soil surface
2. Soil is frozen
3. Air temperature is below 40 ºF during the tackifier curing period unless allowed by the tackifier manufacturer and approved by the Engineer

Do not over-spray hydraulic mulch onto the traveled way, sidewalks, lined drainage channels, or existing vegetation.

Maintenance

Reapply hydraulic mulch within 24 hours of discovering visible erosion unless the Engineer approves a longer period.

Removal

Remove hydraulic mulch by mechanically blending it into the soil with track laying equipment, disking, or other approved method.

Temporary hydraulic mulch disturbed or displaced by your vehicles, equipment, or operations must be reapplied at your expense.

Cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence are not included in the cost for performing maintenance.

MEASUREMENT AND PAYMENT

Temporary hydraulic mulch (bonded fiber matrix) is measured by the square yard from measurements along the slope of the areas covered by the hydraulic mulch.

The contract price paid per square yard for temporary hydraulic mulch (bonded fiber matrix) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying temporary hydraulic mulch, complete in place, including removal of hydraulic mulch, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The State and you share the cost of maintaining the temporary hydraulic mulch. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

10-1.08 TEMPORARY COVER

GENERAL

Summary

This work includes constructing, maintaining, and removing temporary cover.

The SWPPP must describe and include the use of temporary cover as a water pollution control practice for soil stabilization and stockpile management.

Submittals

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for:

1. Gravel-filled bag fabric
2. Temporary cover fabric

If you substitute a material in the following list, submit a sample of the alternative material for approval at least 5 business days before installation:

1. Alternative restrainer
2. Alternative linear sediment barrier

LEED Submittals:

1 MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

2 MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MATERIALS

Geosynthetic Fabrics

Geosynthetic fabrics must consist of one of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Sample under ASTM D 4354, Procedure C.
Test under ASTM D 4759. All properties are based on Minimum Average Roll Value (MARV).
Identify, store, and handle under ASTM D 4873.
Protect geosynthetics from moisture, sunlight and damage during shipping and storage. Label each unit with the manufacturer's name, identifying information and product identification.
Gravel-filled bag fabric must comply with:

Specification	Requirements
Grab breaking load 1-inch grip, lb, min. in each direction	205
Apparent elongation percent, min., in each direction	50
Water Flow Rate max. average roll value, gallons per minute/square foot	80-150
Permittivity 1/sec., min	1.2
Apparent opening size max. average roll value, U.S. Standard sieve size	40-80
Ultraviolet Degradation percent of original unexposed grab breaking load 500 hr, minimum	70

The temporary cover fabric must be geosynthetic cover fabric, plastic sheeting, or a combination of both.
Temporary cover fabric must be either:

1. Plastic sheeting consisting of a single-ply geomembrane material, 10 mils thick, that complies with ASTM D 5199
2. Geosynthetic cover fabric that complies with the following properties:

Specification	Requirements
Grab breaking load 1-inch grip, lb, min. in each direction	200
Apparent elongation percent, min., in each direction	50
Water Flow Rate max. average roll value, gallons per minute/square foot	75-120
Permittivity 1/sec., min	0.08
Apparent opening size max. average roll value, U.S. Standard sieve size	100
Ultraviolet Degradation percent of original unexposed grab breaking load 500 hr, minimum	70

Gravel

Gravel for gravel-filled bags must be:

1. From 3/8 to 3/4 inch in diameter
2. Clean and free from clay balls, organic matter, and other deleterious materials

Gravel-filled Bags

Gravel-filled bags must:

1. Be made from gravel-filled bag fabric.
2. Have inside dimensions from 24 to 32 inches in length, and from 16 to 20 inches in width.
3. Have the opening bound to retain the gravel. The opening must be sewn with yarn, bound with wire, or secured with a closure device.
4. Weigh from 30 to 50 pounds when filled with gravel.

Restrainers

Restrainers must be used to secure the cover fabric or plastic sheeting to the surface of the slope or stockpile.
Restrainers must be one of the following:

1. Made of gravel-filled bags that are roped together and spaced no more than a 6 feet apart
2. Made of wooden lath and anchor restrainers as shown on the plans and the following:

    2.1 Wooden lath must be 2" x 4" x 8', made from fir or pine, and comply with Section 88-2.12, "Lumber," of the Standard Specifications
    2.2 Anchor restrainers must be made from steel reinforcing bars and spaced no more than 4 feet apart along the wooden lath

3. An approved alternate method

Rope

Rope must be at least 3/8 inch in diameter.
Rope must be one of the following:

1. Biodegradable, such as sisal or manila
2. Nondegradable, such as polypropelene or nylon

Linear Sediment Barrier

Linear sediment barriers consist of one or more of the following:

1. Gravel bag berm
2. Earthen berm
3. Approved alternate method

CONSTRUCTION

Temporary Cover Fabric

Install temporary cover fabric by:

1. Placing the temporary cover fabric loosely on the slope or stockpile with the longitudinal edges perpendicular to the slope contours
2. Placing the temporary cover fabric on the upper portion of the slope to overlap cover fabric on the lower portion of the slope
3. Placing the temporary cover fabric on the side of the prevailing wind to overlap the cover fabric on the downwind side of the slope
4. Anchoring the perimeter edge of the temporary cover fabric in key trenches
5. Overlapping edges of the temporary cover fabric by at least 2 feet
6. Placing restrainers at the overlap area and along the toe of the slope. Between overlaps, the restrainers must be spaced a maximum of 8 feet on center.
7. Ensuring that, if anchor restraints are used, the leg of the steel reinforcing bar pierces the temporary cover fabric and holds the wooden lath firmly against the surface of the slope or stockpile.

Linear Sediment Barrier

Protect excavation and embankment slopes with linear sediment barrier by:

1. Preventing run-on and concentrated flows from damaging the slopes
2. Placing the barrier approximately parallel to the slope contour at the toe of the slope
3. Angling the last 6 feet of the barrier up-slope

Protect stockpiles with linear sediment barrier by:

1. Preventing run-on and concentrated flows from touching the stockpiled material
2. Surrounding the stockpile with a linear sediment barrier
3. Adding more linear sediment barrier within 24 hours of adding more material to the stockpile

If earthen berms are used as a linear sediment barrier, they must be:

1. At least 8 inches high and 36 inches wide
2. Compacted by hand or mechanical method

If gravel bag berms are used as a linear sediment barrier:

1. Place gravel bags as a single layer
2. Place gravel bags end-to-end to eliminate gaps

If you need to increase the height of the gravel bag berm:

1. Increase height by adding rows of gravel-filled bags
2. Stack bags in a way that the bags in the top row overlap the joints in the lower row
3. Stabilize berm by adding rows at the bottom

If you remove the temporary cover to do other work, replace and secure temporary cover within one hour.

MAINTENANCE

Maintain temporary cover to minimize exposure of the slopes or stockpile and prevent movement of the material beyond the linear sediment barrier.

Maintain temporary cover by:

1. Relocating and securring restrainers to keep the erosion control blankets in place. Temporary cover fabric that breaks free must be immediately secured.
2. Repairing or replacing the temporary cover fabric when the area covered by temporary cover becomes exposed or exhibits visible erosion.
3. Repairing or replacing the linear sediment barrier when washouts occur between joints or beneath the linear sediment barrier.
4. Repairing or replacing the temporary cover fabric when it becomes detached, torn, or unraveled.

Repair temporary cover within 24 hours of discovering damage unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace temporary cover, repair temporary cover at your expense.

REMOVAL

When the Engineer determines that temporary cover is not required, it must be removed and disposed of under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary cover must be backfilled and repaired under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT AND PAYMENT

Temporary cover is measured by the square yard of the actual area covered excluding overlaps.

The contract price paid per square yard for temporary cover includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing temporary cover, complete in place, including restrainers and removal of temporary cover, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.09 TEMPORARY CONCRETE WASHOUTS

GENERAL

Summary

This work includes the removal and disposal of concrete waste by furnishing, maintaining, and removing temporary concrete washouts. You may use any of the following systems for temporary concrete washouts:

1. Temporary concrete washout facility
2. Portable temporary concrete washout
3. Temporary concrete washout bin

The SWPPP must describe and include the use of temporary concrete washouts as a water pollution control practice for waste management and materials pollution control.

Submittals

At least 5 business days before concrete activities start, submit:

1. Location of each concrete washout system to be used
2. Name and location of the off-site concrete waste disposal plant licensed to receive the solid concrete waste, liquid concrete waste, or both
3. Copy of the permit issued by the RWQCB for the off-site commercial disposal plant
4. Copy of the permit issued by the state or local agency having jurisdiction over the disposal plant if the disposal site is located outside of the State

Retain and submit records of disposed concrete waste.
Submit a certificate of compliance for:

1. Gravel-filled bag
2. Plastic liner

MATERIALS

General

The sign for a concrete washout must comply with section 12-3.06B, "Portable Signs," of the Standard Specifications except the sign panel may be plywood. The sign panel must be at least 2' x 4' in size. The sign legend must read "Concrete Washout" in 6-inch high black letters on a white background.

Temporary Concrete Washout Facility

A temporary concrete washout facility must be constructed to be a watertight container with enough capacity to contain all liquid and concrete waste generated by washout activities without seepage or spills.
Stakes may be either wood or metal and must comply with one of the following:

1. Wood stakes must be:

    1.1. Untreated fir, redwood, cedar, or pine and cut from sound timber
    1.2. Straight and free of loose or unsound knots and other defects which would render stakes unfit for use
    1.3. Pointed on the end to be driven into the ground
    1.4. At least 2" x 2" x 48" in size

2. Metal stakes must be at least 0.5-inch diameter and 48 inches long. Tops of metal stakes must be bent at a 90-degree angle or capped with an orange or red plastic safety cap that fits snugly to the metal stake.

Straw bales must comply with Section 20-2.06, "Straw," of the Standard Specifications and be:

1. At least 14 inches wide, 18 inches high, 36 inches long, and weigh at least 50 pounds.
2. Composed entirely of vegetative matter, except for binding material.
3. Bound by wire, nylon, or polypropylene string. Do not use jute or cotton binding. Baling wire must be minimum 16 gauge. Nylon or polypropylene string must be approximately 0.08-inch in diameter with 80 pounds of breaking strength.

Gravel-filled bag fabric must comply with Section 88-1.05, "Water Pollution Control," of the Standard Specifications.

Gravel for gravel-filled bags must be:

1. 3/8 to 3/4 inch in diameter
2. Clean and free of clay balls, organic matter, and other deleterious materials

Gravel-filled bag must:

1. Be made of gravel-filled bag fabric.
2. Have inside dimensions from 24 to 32 inches long, and from 16 to 20 inches wide.
3. Have bound opening to retain gravel. Opening must be sewn with yarn, bound with wire, or secured with a closure device.
4. Weigh from 30 to 50 pounds when filled with gravel.

The plastic liner for a temporary concrete washout facility must be:

1. Single ply, new polyethylene sheeting, without seams or overlapping joints
2. At least 10 mils thick
3. Free of holes, punctures, tears, or other defects

Portable Temporary Concrete Washout

A portable temporary concrete washout must be a commercially available, watertight container with enough capacity to contain all liquid and concrete waste generated by washout activities without seepage or spills and be:

1. At least 55 gallons in capacity.
2. Labeled for exclusive use as a concrete waste and washout facility. Stencil "Concrete Waste Material" in 3-inch high black letters on white background where the top of stenciling is 12 inches from the top of the container.

Temporary Concrete Washout Bin

A temporary concrete washout bin must be a commercially available, watertight container with enough capacity to contain all liquid and concrete waste generated by washout activities without seepage or spills and be:

1. At least 5 cubic yards in capacity
2. Roll-off type with or without folding steel ramps
3. Labeled for exclusive use as a concrete waste and washout facility

CONSTRUCTION

Place temporary concrete washout at the job site:

1. Before concrete placement activities start
2. In the immediate area of concrete work where authorized
3. No closer than 50 feet from storm drain inlets, open drainage facilities, ESAs, and watercourses
4. Away from traffic or public access areas

Install a concrete washout sign adjacent to each concrete washout location.

Use concrete washout to collect:

1. Washout from concrete delivery trucks

2. Slurries containing PCC or HMA from sawcutting, coring, grinding, grooving, and hydro-concrete demolition
3. Concrete waste from mortar mixing stations

Do not fill a concrete washout higher than 6 inches below the upper rim.

Remove and dispose of concrete waste within 2 business days after a concrete washout becomes filled. Dispose of concrete waste material at the designated off-site concrete waste disposal plant.

Relocate a portable temporary concrete washout or bin as needed for concrete work.

The Department does not pay for relocating a portable temporary concrete washout or bin.

Secure a portable temporary concrete washout or bin to prevent spilling of concrete waste material whenever it is being relocated or transported within the job site. Whenever any spilled material is observed, clean up the spilled material and place it back into the concrete washout unit.

PAYMENT

The contract lump sum price paid for temporary concrete washout includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in the removal and disposal of concrete waste and furnishing, maintaining, and removing the temporary concrete washout, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.10 TEMPORARY FIBER ROLL

GENERAL

Summary

This work includes constructing, maintaining, and removing temporary fiber roll.

The SWPPP must describe and include the use of temporary fiber roll as a water pollution control practice for sediment control.

Submittals

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for fiber roll.

LEED Submittals:

1 MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

2 MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MATERIALS

Fiber Roll

Fiber roll must:

1. Last for at least one year after installation
2. Be Type 1 or Type 2

If specified, Type 1 fiber roll must be:

1. Made from an erosion control blanket:

    1.1. Classified by the Erosion Control Technology Council (ECTC) as ECTC 2D
    1.2. With a Universal Soil Loss Equation (USLE) C-Factor of not more than 0.20 at a 2:1 (horizontal:vertical) slope
    1.3. Capable to withstand a maximum shear stress of 1.75 pounds per square foot under ASTM D 6460
    1.4. With a minimum tensile strength of 75 pounds per foot under ASTM D 5035
    1.5. With top and bottom surfaces covered with lightweight non-synthetic netting

1.6. That complies with one of the following:

1.6.1. Double net straw and coconut blanket with 70 percent straw and 30 percent coconut fiber
1.6.2. Double net excelsior blanket with 80 percent of the wood excelsior fibers being 6 inches or longer

2. Rolled along the width
3. Secured with natural fiber twine every 6 feet and 6 inches from each end
4. Finished to be either:

4.1. From 8 to 10 inches in diameter, from 10 to 20 feet long, and at least 0.5 pounds per linear foot
4.2. From 10 to 12 inches in diameter, at least 10 feet long, and at least 2 pounds per linear foot

If specified, Type 2 fiber roll must:

1. Be filled with rice or wheat straw, wood excelsior, or coconut fiber
2. Be covered with a biodegradable jute, sisal, or coir fiber netting
3. Have the netting secured tightly at each end
4. Be finished to be either:

4.1. From 8 to 10 inches in diameter, from 10 to 20 feet long, and at least 1.1 pounds per linear foot
4.2. From 10 to 12 inches in diameter, at least 10 feet long, and at least 3 pounds per linear foot

Wood Stakes

Wood stakes must be:

1. Untreated fir, redwood, cedar, or pine and cut from sound timber
2. Straight and free of loose or unsound knots and other defects which would render the stakes unfit for use
3. Pointed on the end to be driven into the ground

For fiber roll, wood stakes must be at least:

1. 1" x 1" x 24" in size for Type 1 installation
2. 1" x 2" x 24" in size for Type 2 installation

Rope

For Type 2 installation, rope must:

1. Be biodegradable, such as sisal or manila
2. Have a minimum diameter of 1/4 inch

CONSTRUCTION

Before placing fiber roll, remove obstructions including rocks, clods, and debris greater than one inch in diameter from the ground.

If fiber roll is to be placed in the same area as erosion control blanket, install the blanket before placing the fiber roll. For other soil stabilization practices such as hydraulic mulch or compost, place the fiber roll and then apply the soil stabilization practice.

Place fiber roll on slopes at the following spacing unless the plans show a different spacing:

1. 10 feet apart for slopes steeper than 2:1 (horizontal:vertical)
2. 15 feet apart for slopes from 2:1 to 4:1 (horizontal:vertical)
3. 20 feet apart for slopes from 4:1 to 10:1 (horizontal:vertical)
4. 50 feet apart for slopes flatter than 10:1 (horizontal:vertical)

Place fiber roll approximately parallel to the slope contour. For any 20 foot section of fiber roll, do not allow the fiber roll to vary more than 5 percent from level.

Type 1 and Type 2 fiber roll may be installed using installation method Type 1, Type 2, or a combination:

For installation method Type 1, install fiber roll by:

1. Placing in a furrow that is from 2 to 4 inches deep
2. Securing with wood stakes every 4 feet along the length of the fiber roll
3. Securing the ends of the fiber roll by placing a stake 6 inches from the end of the roll
4. Driving the stakes into the soil so that the top of the stake is less than 2 inches above the top of the fiber roll

For installation method Type 2, install fiber roll by:

1. Securing with rope and notched wood stakes.
2. Driving stakes into the soil until the notch is even with the top of the fiber roll.
3. Lacing the rope between stakes and over the fiber roll. Knot the rope at each stake.
4. Tightening the fiber roll to the surface of the slope by driving the stakes further into the soil.

MAINTENANCE

Maintain temporary fiber roll to provide sediment holding capacity and to reduce runoff velocities.

Remove sediment deposits, trash, and debris from temporary fiber roll as needed or when directed by the Engineer. If removed sediment is deposited within project limits, it must be stabilized and not subject to erosion by wind or water. Trash and debris must be removed and disposed of as specified in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Maintain temporary fiber roll by:

1. Removing sediment from behind the fiber roll when sediment is 1/3 the height of the fiber roll above ground
2. Repairing or adjusting the fiber roll when rills and other evidence of concentrated runoff occur beneath the fiber roll.
3. Repairing or replacing the fiber roll when they become split, torn, or unraveled
4. Adding stakes when the fiber roll slump or sag
5. Replacing broken or split wood stakes

Repair temporary fiber roll within 24 hours of discovering damage unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace temporary fiber roll, repair temporary fiber roll at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

REMOVAL

When the Engineer determines that temporary fiber roll is not required, they must be removed and disposed of under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary fiber roll must be backfilled and repaired under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT AND PAYMENT

Temporary fiber roll is measured by the linear foot along the centerline of the installed roll. Where temporary fiber roll is joined and overlapped, the overlap is measured as a single installed roll.

The contract price paid per linear foot for temporary fiber roll includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the temporary fiber roll, complete in place, including removal of materials, cleanup and disposal of retained sediment and debris, and backfilling and repairing holes, depressions and other ground disturbance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer

The State and you share the cost of maintaining the temporary fiber roll. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

10-1.11 TEMPORARY SILT FENCE

GENERAL

Summary

This work includes installing, maintaining, and removing temporary silt fence.

The SWPPP must describe and include the use of temporary silt fence as a water pollution control practice for sediment control.

Submittals

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for silt fence fabric.

LEED Submittals:

1 MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

2 MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MATERIALS

Silt Fence Fabric

Geosynthetic fabric for temporary silt fence must consist of one of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Sample under ASTM D 4354, Procedure C.

Test under ASTM D 4759. All properties must be based on Minimum Average Roll Value (MARV).

Identify, store, and handle under ASTM D 4873.

Protect geosynthetics from moisture, sunlight, and damage during shipping and storage. Label each unit with the manufacturer's name, identifying information, and product identification.

Silt fence fabric must comply with:

Property	ASTM Designation	Specification	
		Woven	Non-woven
Grab breaking load 1-inch grip, lb, min. in each direction	D 4632	120	120
Apparent elongation percent, min., in each direction	D 4632	15	50
Water Flow Rate max. average roll value, gallons per minute/square foot	D 4491	10-50	100-150
Permittivity 1/sec., min.	D 4491	0.05	0.05
Apparent opening size max. average roll value, U.S. Standard sieve size	D 4751	30	30
Ultraviolet Degradation percent of original unexposed grab breaking load 500 hr, minimum	D 4595	70	

Posts

Posts must be wood or metal.
Wood posts must be:

1. Untreated fir, redwood, cedar, or pine and cut from sound timber
2. Straight and free of loose or unsound knots and other defects that would render the stakes unfit for use
3. Pointed on the end to be driven into the ground
4. At least 2" x 2" in size, and 4 feet long

Metal posts must:

1. Be made of steel.
2. Have a "U," "T," "L," or other cross sectional shape that can resist failure from lateral loads.
3. Be pointed on the end to be driven into the ground.
4. Weigh at least 0.75-pound per foot.
5. Be at least 4 feet long.
6. Have a safety cap attached to the exposed end. The safety cap must be orange or red plastic and fit snugly to the metal post.

CONSTRUCTION

Silt fence must be:

1. Constructed with silt fence fabric, posts, and fasteners
2. Prefabricated or assembled at the job site

Silt fence fabric must be attached to posts using these methods:

1. If prefabricated silt fence is used, posts must be inserted into sewn pockets
2. If assembled on the job site:

    2.1. If wood posts are used, fasteners must be staples or nails
    2.2. If steel posts are used, fasteners must be tie wires or locking plastic fasteners
    2.3. Spacing of the fasteners must be no more than 8 inches apart

Place silt fence approximately parallel to the slope contour. For any 50 foot section of silt fence, do not allow the elevation at the base of the fence to vary more than 1/3 of the fence height.
Install silt fence by:

1. Placing the bottom of the fabric in a trench that is 6 inches deep
2. Securing with posts placed on the downhill side of the fabric
3. Backfilling the trench with soil and hand or mechanically tamping to secure the fabric in the trench

If you reinforce the silt fence fabric with wire or plastic mesh, you may increase the post spacing to a maximum of 10 feet. The field-assembled reinforced silt fence must be able to retain saturated sediment without collapsing.
Connect silt fence sections by:

1. Joining separate sections of silt fence to form reaches that are no more than 500 feet long
2. Securing the end posts of each section by wrapping the tops of the posts with at least two wraps of 16-gage diameter tie wire
3. Ensuring that each reach is a continuous run of silt fence from end to end or from an end to an opening, including joined panels

If you mechanically push the silt fence fabric vertically through the soil, you must demostrate that the silt fence fabric will not be damaged and will not slip out of the soil, resulting in sediment passing under the silt fence fabric.

MAINTENANCE

Maintain temporary silt fence to provide sediment holding capacity and to reduce runoff velocities.

Remove sediment deposits, trash, and debris from temporary silt fence as needed or when directed by the Engineer. If removed sediment is deposited within project limits, it must be stabilized and not subject to erosion by wind or water. Trash and debris must be removed and disposed of as specified in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Maintain temporary silt fence by:

1. Removing sediment from behind the silt fence when sediment is 1/3 the height of the silt fence above ground
2. Repairing or adjusting the silt fence when rills and other evidence of concentrated runoff occur beneath the silt fence fabric
3. Repairing or replacing the silt fence fabric when it become split, torn, or unraveled

Repair temporary silt fence within 24 hours of discovering damage unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace temporary silt fence, repair temporary silt fence at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

REMOVAL

When the Engineer determines that temporary silt fence is not required, remove and dispose of fence under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary silt fence must be backfilled and repaired under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT AND PAYMENT

Temporary silt fence is measured by the linear foot along the centerline of the installed fence.

The contract price paid per linear foot for temporary silt fence includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the temporary silt fence, complete in place, including removal of materials, cleanup and disposal of retained sediment and debris, and backfilling and repairing holes, depressions and other ground disturbance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The State and you share the cost of maintaining the temporary silt fence. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

10-1.12 TEMPORARY FENCE

Temporary fence shall be furnished, constructed, maintained, and later removed as shown on the plans, as specified in these special provisions and as directed by the Engineer.

Except as otherwise specified in this section, temporary fence shall conform to the plan details and the specifications for permanent fence of similar character as provided in Section 80, "Fences," of the Standard Specifications.

Used materials may be installed provided the used materials are good, sound and are suitable for the purpose intended, as determined by the Engineer.

Materials may be commercial quality provided the dimensions and sizes of the materials are equal to, or greater than, the dimensions and sizes shown on the plans or specified herein.

Posts shall be either metal or wood at the Contractor's option.

Galvanizing and painting of steel items will not be required.

Treating wood with a wood preservative will not be required.

Concrete footings for metal posts will not be required.

Temporary fence that is damaged during the progress of the work shall be repaired or replaced by the Contractor at the Contractor's expense.

When no longer required for the work, as determined by the Engineer, temporary fence shall be removed. Removed facilities shall become the property of the Contractor and shall be removed from the site of the work, except as otherwise provided in this section.

Removed temporary fence materials that are not damaged may be constructed in the permanent work provided the materials conform to the requirements specified for the permanent work and such materials are new when used for the temporary fence.

Holes caused by the removal of temporary fence shall be backfilled in conformance with the provisions in the second paragraph of Section 15-1.02, "Preservation of Property," of the Standard Specifications.

The various types and kinds of temporary fence will be measured and paid for in the same manner specified for permanent fence of similar character as provided in Section 80, "Fences," of the Standard Specifications.

Full compensation for maintaining, removing, and disposing of temporary fence shall be considered as included in the contract prices paid per linear foot for the various types of temporary fence and no additional compensation will be allowed therefor.

10-1.13 TEMPORARY CONSTRUCTION ENTRANCE

GENERAL

Summary

This work includes constructing, maintaining, and removing temporary construction entrance to provide temporary access.

The SWPPP must describe and include the use of temporary construction entrance as a water pollution control practice for tracking control.

Temporary construction entrance must be Type 1, Type 2, or a combination.

Submittals

Submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for:

1. Temporary entrance fabric
2. Rock

Submit details for alternatives at least 5 business days before installation. You may propose alternatives for the following items:

1. Alternative sump
2. Alternative corrugated steel panels

If the Engineer approves, you may eliminate the sump.

LEED Submittals:

1 MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

2 MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MATERIALS

Temporary Entrance Fabric

Temporary entrance fabric must comply with the specifications for rock slope protection fabric (Class 8) in Section 88-1.06, "Channel and Shore Protection," of the Standard Specifications.

Rock

Rock must be Type A or Type B.

Rock (Type A) must comply with:

1. Requirements under Section 72-2.02, "Materials," of the Standard Specifications
2. Following sizes:

Square Screen Size (inch)	Percentage Passing	Percentage Retained
6	100	0
3	0	100

Rock (Type B) must be Railway Ballast Number 25. Do not use blast furnace slag. Railway Ballast Number 25 must comply with:

1. Description in AREMA Manual for Railway Engineering.
2. Following sizes:

Nominal Size Square Opening	Percentage Passing								
	3"	2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4
2-1/2"-3/8"	100	80-100	60-85	50-70	25-50	-	5-20	0-10	0-3

3. Following properties:

Specification	Requirements
Percent material passing No. 200 sieve, max. ASTM: C 117	1.0
Bulk specific gravity, min. ASTM: C 127	2.60
Absorption, percent min. ASTM: C 127	1.0
Clay lumps and friable particles, percent max. ASTM: C 142	0.5
Degradation, percent max. ASTM: C 535	30
Soundness (Sodium Sulfate), percent max. ASTM: C 88	5.0
Flat, elongated particles, or both, percent max. ASTM: D 4791	5.0

Corrugated Steel Panels

Corrugated steel panels must:

1. Be made of steel.
2. Be pressed or shop welded
3. Have a slot or hook for connecting panels together

CONSTRUCTION

Prepare location for temporary construction entrance by:

1. Removing vegetation to ground level and clear away debris
2. Grading ground to uniform plane
3. Grading ground surface to drain
4. Removing sharp objects that may damage fabric
5. Compacting the top 1.5 feet of soil to at least 90 percent relative compaction

If temporary entrance (Type 1) is specified, use rock (Type A).

If temporary construction entrance (Type 2) is specified, use Rock (Type B) under corrugated steel panels. Use at least 6 corrugated steel panels for each entrance. Couple panels together.

Install temporary construction entrance by:

1. Positioning fabric along the length of the entrance
2. Overlapping sides and ends of fabric by at least 12 inches

3. Spreading rock over fabric in the direction of traffic
4. Covering fabric with rock within 24 hours
5. Keeping a 6 inch layer of rock over fabric to prevent damage to fabric by spreading equipment

Do not drive on fabric until rock is spread.

Unless the Engineer eliminates the sump, install a sump within 20 feet of each temporary construction entrance.

Repair fabric damaged during rock spreading by placing a new fabric over the damaged area. New fabric must be large enough to cover damaged area and provide at least 18-inch overlap on all edges.

Maintenance

Maintain temporary construction entrance to minimize generation of dust and tracking of soil and sediment onto public roads. If dust or sediment tracking increases, place additional rock unless the Engineer approves another method.

Repair temporary construction entrance if:

1. Fabric is exposed
2. Depressions in the entrance surface develop
3. Rock is displaced

Repair temporary construction entrance within 24 hours of discovering damage unless the Engineer approves a longer period.

During use of temporary construction entrance, do not allow soil, sediment, or other debris tracked onto pavement to enter storm drains, open drainage facilities, or watercourses. When material is tracked onto pavement, remove it within 24 hours unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace the temporary construction entrance, repair it at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

Removal

When the Engineer determines that temporary construction entrance is not required, remove and dispose of it under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Backfill and repair ground disturbance, including holes and depressions, caused by installation and removal of temporary construction entrance under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT AND PAYMENT

Temporary construction entrance is determined from actual count in place. Temporary construction entrance is measured one time only and no additional measurement will be recognized.

The contract price paid for temporary construction entrance includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing temporary construction entrance, complete in place, including removal of temporary construction entrance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No additional compensation will be made if the temporary construction entrance is relocated during the course of construction.

The State and you share the cost of maintaining temporary construction entrance. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

10-1.14 TEMPORARY DRAINAGE INLET PROTECTION

GENERAL

Summary

This work includes constructing, maintaining, and removing temporary drainage inlet protection. Drainage inlet protection settles and filters sediment before stormwater runoff discharges into storm drainage systems.

The SWPPP must describe and include the use of temporary drainage inlet protection as a water pollution control practice for sediment control.

Provide temporary drainage inlet protection to meet the changing conditions around the drainage inlet. Temporary drainage inlet protection must be appropriate type to meet the conditions around the drainage inlet.

Submittals

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for:

1. Erosion control blanket
2. Fiber rolls
3. Safety cap for metal posts
4. Silt fence fabric
5. Sediment filter bag
6. Foam barrier
7. Rigid plastic barrier
8. Gravel-filled bag fabric

LEED Submittals:

1 MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

2 MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

If you substitute the steel wire staple with an alternative attachment device, submit a sample of the device for approval at least 5 business days before installation.

MATERIALS

Geosynthetic Fabrics

Geosynthetic fabrics for temporary drainage inlet protection must consist of one of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Geosynthetic fabrics for temporary drainage inlet must comply with the specifications for water pollution control in Section 88-1.05, "Water Pollution Control," of the Standard Specifications.

Foam barrier must comply with:

Foam Barrier

Property	ASTM Designation	Specification
Grab breaking load 1-inch grip, lb, min. in each direction	D 4632	200
Apparent elongation percent, min., in each direction	D 4632	15
Water Flow Rate max. average roll value, gallons per minute/square foot	D 4491	100-150
Permittivity 1/sec., min.	D 4491	0.05
Apparent opening size max. average roll value, U.S. Standard sieve size	D 4751	40
Ultraviolet Degradation percent of original unexposed grab breaking load 500 hr, minimum	D 4595	70

Sample under ASTM D 4354, Procedure C.
Test under ASTM D 4759. All properties are based on Minimum Average Roll Value (MARV).
Identify, store, and handle under ASTM D 4873.

Erosion Control Blanket

Erosion control blanket must be:

1. Described as a rolled erosion control product (RECP)
2. Classified as temporary and degradable or long-term and non-degradable
3. Machine-made mats
4. Provided in rolled strips
5. Classified by the Erosion Control Technology Council (ECTC)

Erosion control blanket classified as temporary and degradable must be one of the following:

1. Double net excelsior blanket:

    1.1. Classified as ECTC Type 2D
    1.2. Classified as an erosion control blanket
    1.3. Designed to last for at least one year after installation
    1.4. With a Universal Soil Loss Equation (USLE) C-Factor of not more than 0.20 at a 2:1 (horizontal:vertical) slope
    1.5. With 80 percent of the wood excelsior fibers being 6 inches or longer
    1.6. Capable to withstand a maximum shear stress of 1.75 pounds per square foot under ASTM D 6460
    1.7. With a minimum tensile strength of 75 pounds per foot under ASTM D 5035
    1.8. With top and bottom surfaces covered with lightweight non-synthetic netting

2. Double net straw and coconut blanket:

    2.1. Classified as ECTC Type 2D
    2.2. Classified as an erosion control blanket

2.3. Designed to last for at least one year after installation
2.4. With a USLE C-Factor of not more than 0.20 at a 2:1 (horizontal:vertical) slope
2.5. Comprised of 70 percent straw and 30 percent coconut fiber
2.6. Capable to withstand a maximum shear stress of 1.75 pounds per square foot under ASTM D 6460
2.7. With a minimum tensile strength of 75 pounds per foot under ASTM D 5035
2.8. With top and bottom surfaces covered with lightweight non-synthetic netting

3. Jute netting:

3.1. Classified as ECTC Type 3B
3.2. Classified as an open weave textile and have from 14 to 20 strands per foot in each direction
3.3. Designed to last for at least one year after installation
3.4. With a USLE C-Factor of not more than 0.25 at a 1.5:1 (horizontal:vertical) slope
3.5. Comprised of 100 percent unbleached and undyed spun yarn made of jute fiber
3.6. With an average open area from 63 to 70 percent
3.7. From 48 to 72 inches in width
3.8. Capable to withstand a maximum shear stress of 2.0 pounds per square foot under ASTM D 6460
3.9. With a minimum tensile strength of 100 pounds per foot under ASTM D 5035
3.10. From 0.90 to 1.20 pounds per square yard in weight

4. Coir netting:

4.1. Classified as ECTC Type 4
4.2. Classified as an open weave textile and from 13 to 18 strands per foot in each direction
4.3. Designed to last for at least three years after installation
4.4. With a USLE C-Factor of not more than 0.25 at a 1:1 (horizontal:vertical) slope
4.5. Comprised of 100 percent unbleached and undyed spun coir yarn made of coconut fiber
4.6. With an average open area from 63 to 70 percent
4.7. From 72 to 158 inches in width
4.8. Capable to withstand a maximum shear stress of 2.25 pounds per square foot under ASTM D6460
4.9. With a minimum tensile strength of 125 pounds per foot under ASTM D 5035
4.10. From 1.20 to 1.67 pounds per square yard in weight

Erosion control blanket classified as long-term and non-degradable must:

1. Be a geosynthetic fabric
2. Comply with the specifications for rock slope protection fabric (Class 8) in Section 88-1.06, "Channel and Shore Protection," of the Standard Specifications

Staples

You may use an alternative attachment device such as a geosynthetic pins or plastic pegs to install erosion control blanket.

Rock

Rock must comply with:

1. Requirements under Section 72-2.02, "Materials," of the Standard Specifications
2. Following sizes:

Square Screen Size (inch)	Percentage Passing	Percentage Retained
6	100	0
3	0	100

Rope

Rope for fiber rolls must be:

1. Biodegradable, such as sisal or manila

2. At least 1/4 inch in diameter

Fiber Rolls

Fiber rolls must:

1. Last for at least one year after installation
2. Be Type 1 or Type 2

For Type 1, fiber rolls must be:

1. Made from an erosion control blanket classified as temporary and degradable
2. Rolled along the width
3. Secured with natural fiber twine every 6'-6" from each end
4. Finished to be either:

    4.1. From 8 to 10 inches in diameter, from 10 to 20 feet long, and at least 0.5 pounds per linear foot
    4.2. From 10 to 12 inches in diameter, at least 10 feet long, and at least 2 pounds per linear foot

For Type 2, fiber rolls must:

1. Be filled with rice or wheat straw, wood excelsior, or coconut fiber
2. Be covered with biodegradable jute, sisal, or coir fiber netting
3. Have netting secured tightly at each end
4. Be finished to be either:

    4.1. From 8 to 10 inches in diameter, from 10 to 20 feet long, and at least 1.1 pounds per linear foot
    4.2. From 10 to 12 inches in diameter, at least 10 feet long, and at least 3 pounds per linear foot

Wood Stakes

Wood stakes must be:

1. Untreated fir, redwood, cedar, or pine and cut from sound timber
2. Straight and free of loose or unsound knots and other defects which would render the stakes unfit for use
3. Pointed on the end to be driven into the ground

For fiber rolls, wood stakes must be at least:

1. 1" x 1" x 24" in size for Type 1 installation
2. 1" x 2" x 24" in size for Type 2 installation

Posts

Posts must be wood or metal.
Wood posts must be:

1. Untreated fir, redwood, cedar, or pine and cut from sound timber
2. Straight and free of loose or unsound knots and other defects that would render the stakes unfit for use
3. Pointed on the end to be driven into the ground
4. At least 2" x 2" in size, and 4 feet long

Metal posts must:

1. Be made of steel.
2. Have a "U," "T," "L," or other cross sectional shape that can resist failure from lateral loads.
3. Be pointed on the end to be driven into the ground.
4. Weigh at least 0.75-pound per foot.
5. Be at least 4 feet long.
6. Have a safety cap attached to the exposed end. The safety cap must be orange or red plastic and fit snugly to the metal post.

Silt Fence

Silt fence must be:

1. Constructed with silt fence fabric, posts, and fasteners
2. Prefabricated or assembled at the job site

Silt fence fabric must be attached to posts using these methods:

1. If prefabricated silt fence is used, posts must be inserted into sewn pockets
2. If assembled on the job site:

    2.1. If wood posts are used, fasteners must be staples or nails
    2.2. If steel posts are used, fasteners must be tie wires or locking plastic fasteners
    2.3. Spacing of the fasteners must be at least 8 inches

Gravel-filled Bags

Gravel-filled bags must:

1. Be made from fabric.
2. Have inside dimensions from 24 to 32 inches in length, and from 16 to 20 inches in width.
3. Have the opening bound to retain the gravel. The opening must be sewn with yarn, bound with wire, or secured with a closure device.
4. Weigh from 30 to 50 pounds when filled with gravel.

Gravel for gravel-filled bags must be:

1. From 3/8 to 3/4 inch in diameter
2. Clean and free from clay balls, organic matter, and other deleterious materials

Sediment Filter Bag

Sediment filter bag must:

1. Be made of fabric
2. Be sized to fit the catch basin or drainage inlet
3. Include a high-flow bypass

Sediment filter bag may include a metal frame. Sediment filter bags that do not have a metal frame and are deeper than 18 inches must:

1. Include lifting loops and dump straps
2. Include a restraint cord to keep the sides of the bag away from the walls of the catch basin

Foam Barriers

Foam barriers must:

1. Be filled with a urethane foam core
2. Have a geosynthetic fabric cover and flap
3. Have a triangular, circular, or square shaped cross section
4. Have a vertical height of at least 5 inches after installation
5. Have a horizontal flap of at least 8 inches in width
6. Have a length of at least 4 feet per unit
7. Have the ability to interlock separate units into a longer barrier so that water does not flow between the units
8. Be secured to:

    8.1. Pavement with 1-inch concrete nails with 1-inch washers and solvent-free adhesive
    8.2. Soil with 6-inch nails with 1-inch washers

Rigid Plastic Barriers

Rigid plastic barriers must:

1. Have an integrated filter
2. Have a formed outer jacket of perforated high density polyethylene (HDPE) or polyethylene terephthalate (PET)
3. Have a flattened tubular shaped cross section
4. Be made from virgin or recycled materials
5. Be free from biodegradable filler materials that degrade the physical or chemical characteristics of the finished filter core or outer jacket
6. Have a length of at least 4 feet per unit
7. Have the ability to interlock separate units into a longer barrier so that water does not flow between the units
8. Be secured to:

    8.1 Pavement with 1-inch concrete nails with 1-inch washers and solvent-free adhesive, with gravel-filled bags, or a combination
    8.2 Soil with 6-inch nails with 1-inch washers and wood stakes

9. Comply with the following properties:

Specification	Requirements
Grab tensile strength of outer jacket material, pounds/square inch, min. in each direction ASTM D 4632*	4000
Break strength of outer jacket, pounds/square inch ASTM D 4632*	1300
Permittivity of filter core, 1/sec., min. ASTM D 4491	0.38
Flow rate of filter core, gallons per minute per square foot, ASTM D 4491	100 min. 200 max.
Filter core aperture size, max., Average Opening Size (AOS), microns	425
Ultraviolet stability (outer jacket & filter core), percent tensile strength retained after 500 hours, min. ASTM D 4355 (xenon-arc lamp and water spray weathering method)	90

* or appropriate test method for specific polymer

If used at a curb inlet without a grate, rigid plastic barriers must:

1. Have a horizontal flap of at least 6 inches with an under-seal gasket to prevent underflows
2. Include a high-flow bypass
3. Have a vertical height of at least 7 inches after installation
4. Be sized to fit the catch basin or drainage inlet

If used at a grated catch basin without a curb inlet, rigid plastic barriers must:

1. Cover the grate by at least 2 inches on each side and have an under-seal gasket to prevent underflows
2. Include a high-flow bypass
3. Have a vertical height of at least 1.5 inches after installation
4. Be sized to fit the catch basin or drainage inlet

If used at a curb inlet with a grate, rigid plastic barriers must:

1. Have a horizontal flap that covers the grate by at least 2 inches on the 3 sides away from the curb opening and have an under-seal gasket to prevent underflows
2. Include a high-flow bypass
3. Have a vertical section that covers the curb opening by at least 5 inches after installation

4. Be sized to fit the catch basin or drainage inlet

If used as a linear sediment barrier, rigid plastic barriers:

1. Must have an installed height of at least 6 inches
2. May have a horizontal flap of at least 4 inches

Linear Sediment Barrier

Linear sediment barriers must consist of one or more of the following:

1. Silt fence
2. Gravel-filled bags
3. Fiber roll
4. Rigid plastic barrier
5. Foam barrier

Flexible Sediment Barrier

Flexible sediment barriers consist of one or more of the following:

1. Rigid plastic barrier
2. Foam barrier

CONSTRUCTION

For drainage inlet protection at drainage inlets in paved and unpaved areas:

1. Prevent ponded runoff from encroaching on the traveled way or overtopping the curb or dike. Use linear sediment barriers to redirect runoff and control ponding.
2. Clear the area around each drainage inlet of obstructions including rocks, clods, and debris greater than one inch in diameter before installing the drainage inlet protection.
3. Install a linear sediment barrier up-slope of the existing drainage inlet and parallel with the curb, dike, or flow line to prevent sediment from entering the drainage inlet.

Erosion Control Blanket

To install erosion control blanket and geosynthetic fabric:

1. Secure blanket or fabric to the surface of the excavated sediment trap with staples and embed in a trench adjacent to the drainage inlet
2. Anchor the perimeter edge of the erosion control blanket in a trench

Silt Fence

If silt fence is used as a linear sediment barrier:

1. Place fence along the perimeter of the erosion control blanket, with the posts facing the drainage inlet
2. Install fence with the bottom edge of the silt fence fabric in a trench. Backfill the trench with soil and compact manually

Gravel Bag Berm

If gravel bag berm is used as a linear sediment barrier:

1. Place gravel-filled bags end-to-end to eliminate gaps
2. Stack bags in a way that the bags in the top row overlap the joints in the lower row

If gravel bag berms are used for Type 3A and Type 3B:

1. Place gravel-filled bags end-to-end to eliminate gaps
2. Stack bags in a way that the bags in the top row overlap the joints in the lower row
3. Arrange bags to create a spillway by removing one or more gravel-filled bags from the upper layer

If used within shoulder area, place gravel-filled bags behind temporary railing (Type K).

Fiber Rolls

If fiber rolls are used as a linear sediment barrier:

1. Place fiber rolls in a furrow.
2. Secure fiber rolls with stakes installed along the length of the fiber rolls. Stakes must be installed from 6 to 12 inches from the end of the rolls.

If fiber rolls are used as a linear sediment barrier for Type 4A, place them over the erosion control blanket.

Foam Barriers

If foam barriers are used as a linear sediment barrier:

1. Install barriers with the horizontal flap in a 3 inch deep trench and secured with nails and washers placed no more than 4 feet apart
2. Secure barriers with 2 nails at the connection points where separate units overlap
3. Place barriers without nails or stakes piercing the core

Flexible Sediment Barriers

If flexible sediment barriers are used:

1. Secure barriers to the pavement with nails and adhesive, gravel-filled bags, or a combination
2. Install barriers flush against the sides of concrete, asphalt concrete, or hot mix asphalt curbs or dikes
3. Place barriers to provide a tight joint with the curb or dike and anchored in a way that runoff cannot flow behind the barrier

If flexible sediment barriers are used for Type 4B:

1. Secure barriers to the pavement according to the angle and spacing shown on the plans
2. Place barriers to provide a tight joint with the curb or dike. Cut the cover fabric or jacket to ensure a tight fit

Rigid Sediment Barriers

If rigid sediment barriers are used at a grated catch basin without a curb inlet:

1. Place barriers using the gasket to prevent runoff from flowing under the barrier
2. Secure barriers to the pavement with nails and adhesive, gravel-filled bags, or a combination

If rigid sediment barriers are used for linear sediment barriers:

1. Install barriers in a trench. Backfill the trench with soil and compact manually
2. Place barrier with separate units overlapping at least 4 inches
3. Reinforce barriers with a wood stake at each overlap
4. Fasten barriers to the wood stakes with steel screws, 16 gauge galvanized steel wire, or with UV stabilized cable ties that are from 5 to 7 inches in length

Sediment Filter Bags

Install sediment filter bags for Type 5 by:

1. Removing the drainage inlet grate
2. Placing the sediment bag in the opening
3. Replacing the grate to secure the sediment filter bag in place

MAINTENANCE

Maintain temporary drainage inlet protection to provide sediment holding capacity and to reduce runoff velocities.

Remove sediment deposits, trash, and debris from temporary drainage inlet protection as needed or when directed by the Engineer. If removed sediment is deposited within project limits, it must be stabilized and not subject to erosion by wind or water. Trash and debris must be removed and disposed of as specified in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Maintain temporary drainage inlet protection by removing sediment from:

1. Behind flexible sediment barriers when sediment exceeds 1 inch in depth
2. Surface of the erosion control blanket when sediment exceeds 1 inch in depth
3. Sediment trap for Type 2 when the volume has been reduced by approximately one-half
4. Behind silt fence when the sediment is 1/3 the height of the silt fence fabric above ground
5. Sediment filter bags when filled or when the restraint cords are no longer visible

If rills and other evidence of concentrated runoff occur beneath the linear sediment barrier, repair or adjust the barrier.

If silt fence fabric becomes split, torn, or unraveled, repair or replace silt fence.

If geosynthetic fabric becomes split, torn, or unraveled, repair or replace foam barriers.

Repair or replace sagging or slumping linear sediment barriers with additional stakes. Replace broken or split wood stakes.

Reattach foam barriers and rigid plastic barriers that become detached or dislodged from the pavement.

Repair split or torn rigid plastic barriers with 16 gauge galvanized steel wire or UV stabilized cable ties that are from 5 to 7 inches in length.

For sediment filter bags without metal frames, empty by placing one inch steel reinforcing bars through the lifting loops and then lift the filled bag from the drainage inlet. For sediment filter bags with metal frames, empty by lifting the metal frame from the drainage inlet. Rinse before replacing in the drainage inlet. When rinsing the sediment filter bags, do not allow the rinse water to enter a drain inlet or waterway.

Repair temporary drainage inlet protection within 24 hours of discovering damage unless the Engineer approves a longer period.

If your vehicles, equipment, or activities disturb or displace temporary drainage inlet protection, repair temporary drainage inlet protection at your expense.

The Department does not pay maintenance costs for cleanup, repair, removal, disposal, or replacement due to improper installation or your negligence.

REMOVAL

When the Engineer determines that the temporary drainage inlet protection is not required, it must be removed and disposed of under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary drainage inlet protection must be backfilled and repaired under Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT AND PAYMENT

Quantities of temporary drainage inlet protection will be determined from actual count in place. The protection will be measured one time only and no additional measurement will be recognized.

The contract unit price paid for temporary drainage inlet protection includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the temporary drainage inlet protection, complete in place, including removal of materials, cleanup and disposal of retained sediment and debris, and backfilling and repairing holes, depressions and other ground disturbance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No additional compensation will be made if the temporary drainage inlet protection is relocated during the course of construction.

The State and you share the cost of maintaining the temporary drainage inlet protection. The State determines the maintenance cost under Section 9-1.03, "Force Account Payment," of the Standard Specifications and pays you one-half of that cost.

10-1.15 COOPERATION

It is anticipated that work by another contractor may be in progress adjacent to or within the limits of this project during progress of the work on this contract. The following table lists contracts anticipated to be in progress during this contract.

Contract No.	Co-Rte-PM	Location	Type of Work
04-0120M4	04-Ala-80- PM 1.0/PM 1.8	San Francisco-Oakland Bay Bridge Toll Plaza, in Oakland	Construct Oakland Touchdown westbound roadway and eastbound structures and roadway
04-013524	04-SF-80-PM 7.8/Ala-80-PM-2.0	SFOBB (East Span)	Demolish SFOBB (East Span) and Foundations
04-013534	04-SF-80-PM 7.8/Ala-80-PM-2.0	SFOBB (East Span)	Demolish Marine Foundations
04-0120F4	04-SF-80-PM 8.2/PM 8.6	Yerba Buena Island	Construct Self-Anchored Suspension Bridge Superstructure
04-0120S4	04-SF-80-PM 7.9/PM 8.2	Yerba Buena Island	Constructing Yerba Buena Island Transition Structures
04-0120T4	04-Ala-80 PM 7.8/8.6	Yerba Buena Island	Constructing Bridge, Roadways, Electrical, Buildings and Removing Bridges, at Yerba Buena Island
04-0120N4	04-SF-80-SF/Ala-PM 7.8/ PM 1.7	Yerba Buena Island	Install electrical systems
04-292264	04-Ala-80 PM 2.5/3.3	Oakland/Emeryvill	Construct Bike Path
04-292274	04-Ala-80 PM 1.7/2.5	Oakland	Construct Bike Path

Comply with Section 7-1.14, "Cooperation," of the Standard Specifications.

10-1.16 PROGRESS SCHEDULE (CRITICAL PATH METHOD)

SUMMARY

Comply with Section 8-1.04, "Progress Schedule," of the Standard Specifications except you must use computer software to prepare the schedule.

You are responsible for assuring that all activity sequences are logical and that each schedule shows a coordinated plan for complete performance of the work.

DEFINITIONS

contract completion date: Current extended date for completion of the contract shown on the Weekly Statement of Working Days furnished by the Engineer as specified in Section 8-1.06, "Time of Completion," of the Standard Specifications.

data date: Day after the date through which a schedule is current. Everything occurring earlier than the data date is as-built and everything on or after the data date is planned.

early completion time: Difference in time between an early scheduled completion date and the contract completion date.

float: Difference between the earliest and latest allowable start or finish times for an activity.

milestone: Event activity that has zero duration and is typically used to represent the beginning or end of a certain stage of the project.

narrative report: Document submitted with each schedule that discusses topics related to project progress and scheduling.

near critical path: Chain of activities with total float exceeding that of the critical path but having no more than 10 working days of total float.

State-owned float activity: Activity documenting time saved on the critical path by actions of the State. It is the last activity prior to the scheduled completion date.

time impact analysis: Schedule and narrative report developed specifically to demonstrate what effect a proposed change or delay has on the current scheduled completion date.

time-scaled network diagram: Graphic depiction of a CPM schedule comprised of activity bars with relationships for each activity represented by arrows. The tail of each arrow connects to the activity bar for the predecessor and points to the successor.

total float: Amount of time that an activity or chain of activities can be delayed before extending the scheduled completion date.

GENERAL REQUIREMENTS

Submit baseline, monthly updated, and final updated schedules, each consistent in all respects with the time and order of work requirements of the contract. Perform work in the sequence indicated on the current accepted schedule.

Each schedule must show:

1. Calculations using the critical path method to determine controlling activities.
2. Duration activities less than 20 working days.
3. At least 50 but not more than 500 activities, unless authorized. The number of activities must be sufficient to assure adequate planning of the project, to permit monitoring and evaluation of progress, and to do an analysis of time impacts.
4. Each required constraint. Constraints other than those required by the special provisions may be included only if authorized.
5. State-owned float as the predecessor activity to the scheduled completion date.
6. Activities with identification codes for responsibility, stage, work shifts, location, and contract pay item numbers.

You may show early completion time on any schedule provided that the requirements of the contract are met. Early completion time is considered a resource for your exclusive use. You may increase early completion time by improving production, reallocating resources to be more efficient, performing sequential activities concurrently, or by completing activities earlier than planned. You may also submit for approval a VECP as specified in Section 4-1.035B, "Value Engineering Change Proposal." of the Standard Specifications that will reduce time of construction.

You may show a scheduled completion date that is later than the contract completion date on an update schedule, after the baseline schedule is accepted. Provide an explanation for a late scheduled completion date in the narrative report that is included with the schedule.

State-owned float is considered a resource for the exclusive use of the State. The Engineer may accrue State-owned float by the early completion of review of any type of required submittal when it saves time on the critical path. Prepare a time impact analysis, when requested by the Engineer, to determine the effect of the action as specified in "Time Impact Analysis." The Engineer documents State-owned float by directing you to update the State-owned float activity on the next updated schedule. Include a log of the action on the State-owned float activity and include a discussion of the action in the narrative report. The Engineer may use State-owned float to mitigate past, present, or future State delays by offsetting potential time extensions for contract change orders.

The Engineer may adjust contract working days for ordered changes that affect the scheduled completion date as specified in Section 4-1.03, "Changes," of the Standard Specifications. Prepare a time impact analysis to determine the effect of the change as specified in "Time Impact Analysis" and include the impacts acceptable to the Engineer in the next updated schedule. Changes that do not affect the controlling operation on the critical path will not be considered as the basis for a time adjustment. Changes that do affect the controlling operation on the critical path will be considered by the Engineer in decreasing time or granting an extension of time for completion of the contract. Time extensions will only be granted if the total float is absorbed and the scheduled completion date is delayed 1 or more working days because of the ordered change.

The Engineer's review and acceptance of schedules does not waive any contract requirements and does not relieve you of any obligation or responsibility for submitting complete and accurate information. Correct rejected schedules and resubmit them within 7 days of notification by the Engineer, at which time a new review period of 7 days will begin.

Errors or omissions on schedules do not relieve you from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Engineer, either you or the Engineer discover that any aspect of the schedule has an error or omission, you must correct it on the next updated schedule.

COMPUTER SOFTWARE

Submit a description of your proposed schedule software for authorization. All software must be compatible with the current version of the Windows operating system in use by the Engineer. The schedule software must include the latest version of Oracle Primavera P6 Professional Project Management for Windows, or equivalent.

If schedule software equivalent to P6 is proposed, it must be capable of:

1. Generating files that can be imported into P6
2. Comparing 2 schedules and providing reports of changes in activity ID, activity description, constraints, calendar assignments, durations, and logic ties

NETWORK DIAGRAMS, REPORTS, AND DATA

Include the following with each schedule submittal:

1. 2 sets of originally plotted, time-scaled network diagrams
2. 2 copies of a narrative report
3. 1 read-only compact disk or floppy diskette containing the schedule data

The time-scaled network diagrams must conform to the following:

1. Show a continuous flow of information from left to right
2. Be based on early start and early finish dates of activities
3. Clearly show the primary paths of criticality using graphical presentation
4. Be prepared on 34" x 44"
5. Include a title block and a timeline on each page

The narrative report must be organized in the following sequence with all applicable documents included:

1. Transmittal letter
2. Work completed during the period
3. Identification of unusual conditions or restrictions regarding labor, equipment or material; including multiple shifts, 6-day work weeks, specified overtime or work at times other than regular days or hours
4. Description of the current critical path
5. Changes to the critical path and scheduled completion date since the last schedule submittal
6. Description of problem areas
7. Current and anticipated delays:

    7.1. Cause of delay
    7.2. Impact of delay on other activities, milestones, and completion dates
    7.3. Corrective action and schedule adjustments to correct the delay

8. Pending items and status thereof:

    8.1. Permits
    8.2. Change orders
    8.3. Time adjustments
    8.4. Noncompliance notices

9. Reasons for an early or late scheduled completion date in comparison to the contract completion date

Schedule submittals will only be considered complete when all documents and data have been submitted as described above.

PRECONSTRUCTION SCHEDULING CONFERENCE

Schedule a preconstruction scheduling conference with your project manager and the Engineer within 15 days after contract approval. The Engineer will conduct the meeting and review the requirements of this section with you.

Submit a general time-scaled logic diagram displaying the major activities and sequence of planned operations and be prepared to discuss the proposed work plan and schedule methodology that comply with the requirements of this section. If you propose deviations to the construction staging, then the general time-scaled logic diagram must also display the deviations and resulting time impacts. Be prepared to discuss the proposal.

At this meeting, also submit the alphanumeric coding structure and activity identification system for labeling work activities. To easily identify relationships, each activity description must indicate its associated scope or

location of work by including such terms as quantity of material, type of work, bridge number, station to station location, side of highway (such as left, right, northbound, southbound), lane number, shoulder, ramp name, ramp line descriptor, or mainline.

The Engineer reviews the logic diagram, coding structure, and activity identification system, and provide any required baseline schedule changes to you for implementation.

BASELINE SCHEDULE

Beginning the week following the preconstruction scheduling conference, meet with the Engineer weekly to discuss schedule development and resolve schedule issues until the baseline schedule is accepted.

Submit a baseline schedule within 20 days of contract approval. Allow 20 days for the Engineer's review after the baseline schedule and all support data are submitted.

The baseline schedule must include the entire scope of work and how you plan to complete all work contemplated. The baseline schedule must show the activities that define the critical path. Multiple critical paths and near-critical paths must be kept to a minimum. A total of not more than 50 percent of the baseline schedule activities must be critical or near critical, unless otherwise authorized.

The baseline schedule must not extend beyond the number of contract working days. The baseline schedule must have a data date of contract approval. If you start work before contract approval, the baseline schedule must have a data date of the 1st day you performed work at the job site.

If you submit an early completion baseline schedule that shows contract completion in less than 85 percent of the contract working days, the baseline schedule must be supplemented with resource allocations for every task activity and include time-scaled resource histograms. The resource allocations must be shown to a level of detail that facilitates report generation based on labor crafts and equipment classes for you and your subcontractors. Use average composite crews to display the labor loading of on-site construction activities. Optimize and level labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not duplicated in concurrent activities. The time-scaled resource histograms must show labor crafts and equipment classes to be used. The Engineer may review the baseline schedule activity resource allocations using Means Productivity Standards or equivalent to determine if the schedule is practicable.

UPDATED SCHEDULE

Submit an updated schedule and meet with the Engineer to review contract progress, on or before the 1st day of each month, beginning 1 month after the baseline schedule is accepted. Allow 15 days for the Engineer's review after the updated schedule and all support data are submitted, except that the review period will not start until the previous month's required schedule is accepted. Updated schedules that are not accepted or rejected within the review period are considered accepted by the Engineer.

The updated schedule must have a data date of the 21st day of the month or other date established by the Engineer. The updated schedule must show the status of work actually completed to date and the work yet to be performed as planned. Actual activity start dates, percent complete, and finish dates must be shown as applicable. Durations for work that has been completed must be shown on the updated schedule as the work actually occurred, including Engineer submittal review and your resubmittal times.

You may include modifications such as adding or deleting activities or changing activity constraints, durations, or logic that do not (1) alter the critical path(s) or near critical path(s) or (2) extend the scheduled completion date compared to that shown on the current accepted schedule. Justify in writing the reasons for any changes to planned work. If any proposed changes in planned work will result in (1) or (2) above, then submit a time impact analysis as specified in this section.

TIME IMPACT ANALYSIS

Submit a written time impact analysis (TIA) with each request for adjustment of contract time, or when you or the Engineer consider that an approved or anticipated change may impact the critical path or contract progress.

The TIA must illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate. The analysis must use the accepted schedule that has a data date closest to and before the event. If the Engineer determines that the accepted schedule used does not appropriately represent the conditions before the event, the accepted schedule must be updated to the day before the event being analyzed. The TIA must include an impact schedule developed from incorporating the event into the accepted schedule by adding or deleting activities, or by changing durations or logic of existing activities. If the impact schedule shows that incorporating the event modifies the critical path and scheduled completion date of the accepted schedule, the difference between scheduled completion dates of the two schedules must be equal to the adjustment of contract time. The Engineer may construct and use an appropriate project schedule or other recognized method to determine adjustments in contract time until you provide the TIA.

Submit 2 copies of your TIA within 20 days of receiving a written request for a TIA from the Engineer. Allow the Engineer 15 days after receipt to review the submitted TIA. All approved TIA schedule changes must be shown on the next updated schedule.

If a TIA you submit is rejected, meet with the Engineer to discuss and resolve issues related to the TIA. If clarification is still needed, you are allowed 15 days to submit a protest as specified in Section 5-1.011, "Protests," of the Standard Specifications. If agreement is not reached, you are allowed 5 days from the date you receive the Engineer's response to your protest to submit an Initial Potential Claim Record as specified in Section 5-1.146B, "Initial Potential Claim Record," of the Standard Specifications. Only show actual as-built work, not unapproved changes related to the TIA, in subsequent updated schedules. If agreement is reached at a later date, approved TIA schedule changes must be shown on the next updated schedule. The Engineer withholds remaining payment on the schedule bid item if a TIA is requested and not submitted within 20 days. The schedule item payment resumes on the next estimate after the requested TIA is submitted. No other contract payment is withheld regarding TIA submittals.

FINAL UPDATED SCHEDULE

Submit a final update, as-built schedule with actual start and finish dates for the activities, within 30 days after completion of contract work. Provide a written certificate with this submittal signed by your project manager or an officer of the company stating, "To my knowledge and belief, the enclosed final update schedule reflects the actual start and finish dates of the actual activities for the project contained herein." An officer of the company may delegate in writing the authority to sign the certificate to a responsible manager.

PAYMENT

Progress schedule (critical path method) will be paid for at a lump sum price. The contract lump sum price paid for progress schedule (critical path method) includes full compensation for furnishing all labor, material, tools, equipment, and incidentals, and for doing all the work involved in preparing, furnishing, and updating schedules, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payments for the progress schedule (critical path method) bid item will be made progressively as follows:

1. A total of 25 percent of the item amount will be paid upon achieving all of the following:

    1.1. Completion of 5 percent of all contract item work.
    1.2. Acceptance of all schedules and approval of all TIAs required to the time when 5 percent of all contract item work is complete.

2. A total of 50 percent of the item amount will be paid upon completion of 25 percent of all contract item work and acceptance of all schedules and approval of all TIAs required to the time when 25 percent of all contract item work is complete.
3. A total of 75 percent of the item amount will be paid upon completion of 50 percent of all contract item work and acceptance of all schedules and approval of all TIAs required to the time when 50 percent of all contract item work is complete.
4. A total of 100 percent of the item amount will be paid upon completion of all contract item work, acceptance of all schedules and approval of all TIAs required to the time when all contract item work is complete, and submittal of the certified final update schedule.

If you fail to complete any of the work or provide any of the schedules required by this section, the Engineer makes an adjustment in compensation as specified in Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications for the work not performed. Adjustments in compensation for schedules will not be made for any increased or decreased work ordered by the Engineer in submitting schedules.

10-1.17 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Flagging, signs, and temporary traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Category 1 temporary traffic control devices are defined as small and lightweight (less than 100 pounds) devices. These devices shall be certified as crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 temporary traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.

If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 temporary traffic control devices at least 5 business days before beginning any work using the devices or within 2 business days after the request if the devices are already in use. Self-certification shall be provided by the manufacturer or Contractor and shall include the following:

A. Date,
B. Federal Aid number (if applicable),
C. Contract number, district, county, route and post mile of project limits,
D. Company name of certifying vendor, street address, city, state and zip code,
E. Printed name, signature and title of certifying person; and
F. Category 1 temporary traffic control devices that will be used on the project.

The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 temporary traffic control devices are defined as small and lightweight (less than 100 pounds) devices that are not expected to produce significant vehicular velocity change, but may cause potential harm to impacting vehicles. Category 2 temporary traffic control devices include barricades and portable sign supports.

Category 2 temporary traffic control devices shall be on the Federal Highway Administration's (FHWA) list of Acceptable Crashworthy Category 2 Hardware for Work Zones. This list is maintained by FHWA and can be located at:

http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/listing.cfm?code=workzone

The Department also maintains this list at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdf/Category2.pdf

Category 2 temporary traffic control devices that have not received FHWA acceptance shall not be used. Category 2 temporary traffic control devices in use that have received FHWA acceptance shall be labeled with the FHWA acceptance letter number and the name of the manufacturer. The label shall be readable and permanently affixed by the manufacturer. Category 2 temporary traffic control devices without a label shall not be used.

If requested by the Engineer, the Contractor shall provide a written list of Category 2 temporary traffic control devices to be used on the project at least 5 business days before beginning any work using the devices or within 2 business days after the request if the devices are already in use.

Category 3 temporary traffic control devices consist of temporary traffic-handling equipment and devices that weigh 100 pounds or more and are expected to produce significant vehicular velocity change to impacting vehicles. Temporary traffic-handling equipment and devices include crash cushions, truck-mounted attenuators, temporary railing, temporary barrier, and end treatments for temporary railing and barrier.

Type III barricades may be used as sign supports if the barricades have been successfully crash tested, meeting the NCHRP Report 350 criteria, as one unit with a construction area sign attached.

Category 3 temporary traffic control devices shall be shown on the plans or on the Department's Highway Safety Features list. This list is maintained by the Division of Engineering Services and can be found at:

http://www.dot.ca.gov/hq/esc/approved_products_list/

Category 3 temporary traffic control devices that are not shown on the plans or not listed on the Department's Highway Safety Features list shall not be used.

Full compensation for providing self-certification for crashworthiness of Category 1 temporary traffic control devices and for providing a list of Category 2 temporary traffic control devices used on the project shall be considered as included in the prices paid for the various items of work requiring the use of the Category 1 or Category 2 temporary traffic control devices and no additional compensation will be allowed therefor.

10-1.18 CONSTRUCTION AREA SIGNS

Construction area signs for temporary traffic control shall be furnished, installed, maintained, and removed when no longer required in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to "Furnish Sign" of these special provisions.

Attention is directed to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels. Type III, IV, VII, VIII, or IX retroreflective sheeting shall be used for stationary mounted construction area sign panels.

Unless otherwise shown on the plans or specified in these special provisions, the color of construction area warning and guide signs shall have black legend and border on orange background, except W10-1 or W47(CA) (Highway-Rail Grade Crossing Advance Warning) sign shall have black legend and border on yellow background.

Repair to construction area sign panels will not be allowed, except when approved by the Engineer. At nighttime under vehicular headlight illumination, sign panels that exhibit irregular luminance, shadowing or dark blotches shall be immediately replaced at the Contractor's expense.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 business days, but not more than 14 days, prior to commencing excavation for construction area sign posts. The regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert	811

Excavations required to install construction area signs shall be performed by hand methods without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes. The post hole diameter, if backfilled with portland cement concrete, shall be at least 4 inches greater than the longer dimension of the post cross section.

Construction area signs placed within 15 feet from the edge of the travel way shall be mounted on stationary mounted sign supports as specified in "Construction Area Traffic Control Devices" of these special provisions.

The Contractor shall maintain accurate information on construction area signs. Signs that are no longer required shall be immediately covered or removed. Signs that convey inaccurate information shall be immediately replaced or the information shall be corrected. Covers shall be replaced when they no longer cover the signs properly. The Contractor shall immediately restore to the original position and location any sign that is displaced or overturned, from any cause, during the progress of work.

10-1.19 MAINTAINING TRAFFIC

Maintaining traffic shall conform to the provisions in Sections 7-1.08, "Public Convenience," Section 7-1.09, "Public Safety," and Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Closure is defined as the closure of a traffic lane or lanes, including shoulder, ramp or connector lanes, within a single traffic control system.

Closures shall conform to the provisions in "Traffic Control System for Lane Closure" of these special provisions.

The maximum length of a single stationary lane closure shall be 0.25 miles.

Not more than 1 separate stationary lane closures will be allowed in each direction of travel at one time.

The Contractor shall notify the Toll Collection Lieutenant at San Francisco-Oakland Bay Bridge at (510)286-1148 of the Contractor's intent to begin work at least 5 days before work is begun. The Contractor shall cooperate with local authorities to handle traffic through the work area and shall make arrangements to keep the work area clear of parked vehicles.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way or shoulders including sections closed to public traffic.

When work vehicles or equipment are parked within 6 feet of a traffic lane to perform active construction, the shoulder area shall be closed with fluorescent orange traffic cones or portable delineators placed on a taper in advance of the parked vehicles or equipment and along the edge of the pavement at 25-foot intervals to a point not less than 25 feet past the last vehicle or piece of equipment. A minimum of 9 traffic cones or portable delineators shall be used for the taper. A W20-1 (ROAD WORK AHEAD) or W21-5b (RIGHT/LEFT SHOULDER CLOSED AHEAD) or C24(CA) (SHOULDER WORK AHEAD) sign shall be mounted on a crashworthy portable sign support with flags. The sign shall be placed where designated by the Engineer. The sign shall be a minimum of 48" x 48" in size. The Contractor shall immediately restore to the original position and location a traffic cone or delineator that is displaced or overturned, during the progress of work.

A minimum of one paved traffic lane, not less than 10 feet wide on Maintenance Road, shall be open to traffic, during the installation and removal of concrete barrier railing.

At all times, except during the construction of Maintenance Road, and the approach roadway of the Toll Bridge Maintenance Road, a minimum of one paved traffic lane, not less than 10 feet wide, shall be open to traffic in each direction of travel on Maintenance Road.

Full compensation for maintaining for the above access shall be considered as included in the contract price paid for the various items of work involved and no additional compensation will be allowed therefor.

If minor deviations from the lane requirement charts are required, a written request shall be submitted to the Engineer at least 15 days before the proposed date of the closure. The Engineer may approve the deviations if there is no significant increase in the cost to the State and if the work can be expedited and better serve the public traffic.

Full compensation for furnishing, erecting, maintaining, and removing and disposing of the W20-1, and W21-5b, signs shall be considered as included in the contract lump sum price paid for construction area signs and no additional compensation will be allowed therefor.

10-1.20 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE

A traffic control system, on Maintenance Road in the Maintenance yard, shall consist of closing traffic lanes in conformance with the details shown on the plans, the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications, the provisions under "Maintaining Traffic" and "Construction Area Signs" of these special provisions, and these special provisions.

The provisions in this section will not relieve the Contractor from the responsibility to provide additional devices or take measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

Each vehicle used to place, maintain and remove components of a traffic control system on multilane highways shall be equipped with a Type II flashing arrow sign which shall be in operation when the vehicle is being used for placing, maintaining or removing components. Vehicles equipped with Type II flashing arrow sign not involved in placing, maintaining or removing components when operated within a stationary lane closure shall only display the caution display mode. The sign shall be controllable by the operator of the vehicle while the vehicle is in motion. The flashing arrow sign shown on the plans shall not be used on vehicles which are being used to place, maintain and remove components of a traffic control system and shall be in place before a lane closure requiring its use is completed.

If components in the traffic control system are displaced or cease to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the components to the original condition or replace the components and shall restore the components to the original location.

When lane closures are made for work periods only, at the end of each work period, components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations designated by the Engineer within the limits of the highway right of way.

The contract lump sum price paid for traffic control system shall include full compensation for furnishing all labor, materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in placing, removing, storing, maintaining, moving to new locations, replacing, and disposing of the components of the traffic control system shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the item of traffic control system. Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary. The adjustment will be made on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications for increased work and estimated on the same basis in the case of decreased work.

Traffic control system required by work which is classed as extra work, as provided in Section 4-1.03D of the Standard Specifications, will be paid for as a part of the extra work.

10-1.21 TEMPORARY PAVEMENT DELINEATION

Temporary pavement delineation shall be furnished, placed, maintained, and removed in conformance with the provisions in Section 12-3.01, "General," of the Standard Specifications and these special provisions. Nothing in these special provisions shall be construed as reducing the minimum standards specified in the California MUTCD or as relieving the Contractor from the responsibilities specified in Section 7-1.09, "Public Safety," of the Standard Specifications.

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When the work causes obliteration of pavement delineation, temporary or permanent pavement delineation shall be in place before opening the traveled way to public traffic. Laneline or centerline pavement delineation shall be provided for traveled ways open to public traffic.

Work necessary, including required lines or markers, to establish the alignment of temporary pavement delineation shall be performed by the Contractor. Surfaces to receive application of paint or removable traffic tape temporary pavement delineation shall be dry and free of dirt and loose material. Temporary pavement delineation

shall not be applied over existing pavement delineation or other temporary pavement delineation. Temporary pavement delineation shall be maintained until superseded or replaced with a new pattern of temporary pavement delineation or permanent pavement delineation, or as determined by the Engineer.

Temporary pavement markers and removable traffic tape that conflicts with a new traffic pattern or that is applied to the final layer of surfacing or existing pavement to remain in place shall be removed when no longer required for the direction of public traffic, as determined by the Engineer.

Temporary pavement delineation shall be used on or adjacent to lanes open to public traffic for a maximum of 14 days. Before the end of the 14 days, the permanent pavement delineation shall be placed. If the permanent pavement delineation is not placed within the 14 days, additional temporary pavement delineation shall be provided by the Contractor at no additional cost to the Department. The additional temporary pavement delineation to be provided shall be equivalent to the pattern specified for the permanent pavement delineation for the area, as determined by the Engineer.

Painted traffic stripe used for temporary delineation shall conform to Section 84-3, "Painted Traffic Stripes and Pavement Markings," of the Standard Specifications, except for payment. The number of coats shall be, at the option of the Contractor, either one or 2 coats. The quantity of painted traffic stripe used for temporary delineation will not be included in the quantities of paint traffic stripe to be paid for.

TEMPORARY LANELINE AND CENTERLINE DELINEATION

When lanelines or centerlines are obliterated, the minimum laneline and centerline delineation to be provided shall be temporary pavement markers placed at longitudinal intervals of not more than 24 feet. The temporary pavement markers shall be the same color as the laneline or centerline the markers replace. Temporary pavement markers shall be, at the option of the Contractor, one of the temporary pavement markers listed for short term day/night use (14 days or less) or long term day/night use (6 months or less) in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Temporary pavement markers shall be placed in conformance with the manufacturer's instructions and shall be cemented to the surfacing with the adhesive recommended by the manufacturer, except epoxy adhesive shall not be used to place pavement markers in areas where removal of the markers will be required.

Temporary laneline or centerline delineation consisting entirely of temporary pavement markers shall be placed on longitudinal intervals of not more than 24 feet.

Full compensation for furnishing, placing, maintaining, and removing temporary pavement markers used for temporary laneline and centerline delineation and for providing equivalent patterns of permanent traffic lines for these areas when required shall be considered as included in the contract prices paid for the items of work that obliterated the laneline and centerline pavement delineation and no separate payment will be made therefor.

Full compensation for furnishing, placing, and maintaining temporary painted laneline and centerline pavement delineation shall be considered as included in the contract prices paid for the items of work that obliterated the laneline and centerline pavement delineation and no separate payment will be made therefor.

TEMPORARY EDGELINE DELINEATION

When edgelines are obliterated on multilane roadways (freeways and expressways), the edgeline delineation to be provided for that area adjacent to lanes open to public traffic shall consist of, at the option of the Contractor, either solid 4-inch wide traffic stripe tape of the same color as the stripe it replaces, traffic cones, portable delineators or channelizers placed at longitudinal intervals not to exceed 100 feet. Where removal of the 4-inch wide traffic stripe will not be required, painted traffic stripe may be used.

Temporary removable construction grade striping and pavement marking tape shall be as listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Temporary removable construction grade striping and pavement marking tape when used shall be applied in conformance with the manufacturer's recommendations.

The lateral offset for traffic cones, portable delineators or channelizers used for temporary edgeline delineation shall be determined by the Engineer. If traffic cones or portable delineators are used as temporary pavement delineation for edgelines, the Contractor shall provide personnel to remain at the project site to maintain the cones or delineators during hours of the day that the cones or delineators are in use.

Channelizers used for temporary edgeline delineation shall be the surface mounted type and shall be orange in color. Channelizer bases shall be cemented to the pavement in the same manner provided for cementing pavement markers to pavement in "Pavement Markers" of these special provisions, except epoxy adhesive shall not be used to place channelizers on the top layer of pavement. Channelizers shall be, at the Contractor's option, one of the surface mount types (36 inch) listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Temporary edgeline delineation shall be removed when no longer required for the direction of public traffic, as determined by the Engineer.

Full compensation for furnishing, placing, maintaining, and removing temporary edgeline delineation shall be considered as included in the contract prices paid for the items of work that obliterated the edgeline pavement delineation and no separate payment will be made therefor. The quantity of channelizers used as temporary edgeline delineation will not be included in the quantity of channelizer (surface mounted) to be paid for.

10-1.22 CHANNELIZER

Channelizers shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Channelizers shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

LEED Submittals:

1 MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

2 MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

When no longer required for the work as determined by the Engineer, channelizers and underlying adhesive used to cement the channelizer bases to the pavement shall be removed. Removed channelizers and adhesive shall become the property of the Contractor and shall be removed from the site of work.

10-1.23 TEMPORARY CRASH CUSHION MODULE

This work shall consist of furnishing, installing, and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, as specified in these special provisions or where designated by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the details shown on the plans and these special provisions.

Temporary crash cushions shall be secured in place prior to commencing work for which the temporary crash cushions are required.

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 15 feet or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the Engineer, sand filled temporary crash cushions shall be removed from the site of the work.

Sand filled temporary crash cushion modules shall be one of the following, or equal, and be manufactured after March 31, 1997:

1. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., 35 East Wacker Drive, Suite 1100, Chicago, IL 60601:

    1.1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (800) 884-8274, FAX (916) 387-9734

    1.2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (800) 222-8274, FAX (714) 526-9501

2. TrafFix Sand Barrels, manufactured by TrafFix Devices, Inc., 220 Calle Pintoresco, San Clemente, CA 92672, telephone (949) 361-5663, FAX (949) 361-9205

2.1. Northern California: United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112, telephone (408) 287-4303, FAX (408) 287-1929

2.2. Southern California: Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448, telephone (800) 559-7080, FAX (805) 929-5786

3. CrashGard Model CC-48 Sand Barrels, manufactured by Plastic Safety Systems, Inc., 2444 Baldwin Road, Cleveland, OH 44104:

3.1. Northern California:

3.1.1. Capitol Barricade Safety & Sign, 6329 Elvas Ave, Sacramento, CA 95819, telephone (888) 868-5021, FAX (916) 451-5388

3.1.2. Sierra Safety, Inc., 9093 Old State Highway, New Castle, CA 95658, telephone (916) 663-2026, FAX (916) 663-1858

3.2. Southern California: Hi Way Safety Inc., 13310 5th Street, Chino, CA 91710, telephone (909) 591-1781, FAX (909) 627-0999

Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects. The modules need not be new. Good used undamaged modules conforming to color and quality of the types specified herein may be utilized. If used Fitch modules requiring a seal are furnished, the top edge of the seal shall be securely fastened to the wall of the module by a continuous strip of heavy duty tape.

Modules shall be filled with sand in conformance with the manufacturer's directions, and to the sand capacity in pounds for each module shown on the plans. Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water as determined by California Test 226.

Modules damaged due to the Contractor's operations shall be repaired immediately by the Contractor at the Contractor's expense. Modules damaged beyond repair, as determined by the Engineer, due to the Contractor's operations shall be removed and replaced by the Contractor at the Contractor's expense.

Temporary crash cushion modules may be placed on movable pallets or frames. Comply with dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement or bridge deck.

A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 12 feet of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the Engineer.

At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the Contractor and shall be removed from the site of the work. Temporary crash cushion modules shall not be installed in the permanent work.

Temporary crash cushion modules placed in conformance with Section 7-1.09, "Public Safety," of the Standard Specifications will not be measured nor paid for.

10-1.24 EXISTING HIGHWAY FACILITIES

The work performed in connection with various existing highway facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

ABANDON CULVERT

Existing culverts, where shown on the plans to be abandoned, shall be abandoned in place or, at the option of the Contractor, the culverts shall be removed and disposed of. Resulting openings into existing structures that are to remain in place shall be plugged with concrete conforming to the provisions in Section 90-10 "Minor Concrete," of the Standard Specifications. The concrete shall contain not less than 505 pounds of cementitious material per cubic yard.

Abandoning culverts in place shall conform to the following:

1. Culverts that intersect the side slopes shall be removed to a depth of not less than 3 feet measured normal to the plane of the finished side slope, before being abandoned.

2. Culverts 12 inches in diameter and larger, shall, at the Contractor's option, be backfilled with either sand, controlled low strength material or slurry cement backfill conforming to the provisions in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications by any method acceptable to the Engineer that completely fills the pipe. Sand backfill material shall be clean, free draining, and free from roots and other deleterious substances.
3. The ends of culverts shall be securely closed by a 0.5-foot thick tight fitting plug or wall of commercial quality concrete.

Culverts shall not be abandoned until their use is no longer required. The Contractor shall notify the Engineer in advance of any intended culvert or pipeline abandonment.

Controlled low strength material and slurry cement backfill, if used at the Contractor's option, will be measured and paid for by the cubic yard as sand backfill.

Full compensation for concrete plugs, pipe removal, structure excavation, and backfill (including sand, controlled low strength material or slurry cement backfill) shall be considered as included in the contract price paid per linear foot for abandon culvert and no additional compensation will be allowed therefor.

ABANDON INLET

Existing concrete drainage inlets, where shown on the plans to be abandoned, shall be abandoned.

The top portion of the inlets shall be removed to a depth of 3 feet below finished grade.

Removed frames and grates shall be disposed of.

REMOVE PAVEMENT MARKER

Existing pavement markers, including underlying adhesive, when no longer required for traffic lane delineation as determined by the Engineer, shall be removed and disposed of.

Full compensation for removing and disposing of pavement markers and underlying adhesive shall be considered as included in the contract price paid per ton for hot mix asphalt and no separate payment will be made therefor.

REMOVE TRAFFIC STRIPE AND PAVEMENT MARKING

This work includes removing existing traffic stripe and pavement marking at the locations shown on the plans.

Submit a lead compliance plan under Section 7-1.07, "Lead Compliance Plan," of the Standard Specifications.

Waste residue from removal of thermoplastic and painted traffic stripe and pavement marking is a non–hazardous waste residue and contains lead in average concentrations less than 1000 mg/kg total lead and 5 mg/L soluble lead. This waste residue does not contain heavy metals in concentrations that exceed thresholds established by the Health and Safety Code and 22 CA Code of Regs and is not regulated under the Federal Resource Conservation and Recovery Act (RCRA), 42 USC § 6901 et seq.

REMOVE WATER VALVE

Existing abandoned water valves where shown on the plans to be removed, shall be completely removed and disposed of.

REMOVE CHAIN LINK FENCE

Existing chain link fence, where shown on the plans to be removed, shall be removed and disposed of.

Existing chain link fence within the sidewalk of Burma Road, where shown on the plans to be removed, shall be removed and disposed of.

Posts shall be cut flush at the existing grade of sidewalk.

The post hole shall be filled with sand and plugged with mortar 4-inches thick to match the grade of the existing sidewalk.

REMOVE ROADSIDE SIGN

Existing roadside signs, at those locations shown on the plans to be removed, shall be removed and disposed of.

Existing roadside signs shall not be removed until replacement signs have been installed or until the existing signs are no longer required for the direction of public traffic, unless otherwise directed by the Engineer.

RESET ROADSIDE SIGN

Existing roadside signs, where shown on the plans to be reset, shall be removed and reset.

Each roadside sign shall be reset on the same day that the sign is removed.

Two holes shall be drilled in each existing post as required to provide the breakaway feature shown on the plans.

RELOCATE ROADSIDE SIGN

Existing roadside signs shall be removed and relocated to the new locations shown on the plans.

Each roadside sign shall be installed at the new location on the same day that the sign is removed from its original location.

Two holes shall be drilled in each existing post as required to provide the breakaway feature shown on the plans.

REMOVE BASE AND SURFACING

Existing base and bituminous surfacing shown on the plans to be removed, shall be removed to a depth of 8 inches below the grade of the existing surfacing.

The material removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 15-2.03, "Disposal," of the Standard Specifications.

Removing base and surfacing will be measured by the cubic yard in the same manner specified for roadway excavation in conformance with the provisions in Section 19, "Earthwork," of the Standard Specifications and will be paid for at the contract price per cubic yard for remove base and surfacing.

REMOVE STEEL POLE

Existing steel pole including foundation where shown on the plans to be removed, shall be removed.

The pole reinforced concrete foundation shall be removed to 3-foot below the finished grade.

Concrete removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

MEASUREMENT AND PAYMENT

The contract unit price paid for remove steel pole shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in removing steel pole including the removal of reinforced concrete foundation, complete in place, including structural backfilling and compacting the resulting holes, and depressions caused by the removal of the steel pole foundation, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

REMOVE HIGH MAST LIGHT POLE

High mast light poles including foundations and # guard steel posts<< Diam>> at each location, where shown on the plans to be removed, shall be removed.

The reinforced concrete foundations with #-foot in diameter, and guard steel posts shall be removed to 3-foot below the finished grade.

Excavated material resulting from the removal of reinforced concrete foundations, and guard steel posts shall be considered as contaminated material, and shall comply with "Handling, Transportation, and Disposal of Contaminated Material," of these special provisions.

Concrete removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

MEASUREMENT AND PAYMENT

The contract unit price paid for remove high mast pole shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in removing high mast arm pole including the removal of reinforced concrete foundation and guard steel post, complete in place, including structural backfilling and compacting the resulting holes, and depressions caused by the removal of the high mast pole foundation and guard steel posts, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Resulting contaminated material from the removal of the high mast pole foundation and guard steel posts is measured and paid for as roadway excavation (Class II).

REMOVE HIGH MAST LIGHT POLE FOUNDATION

High mast light pole foundations including # guard steel posts<< Diam>> at each location, where shown on the plans to be removed, shall be removed.

The reinforced concrete foundations with #-foot in diameter, and guard steel posts shall be removed to 3-foot below the finished grade.

Excavated material resulting from the removal of reinforced concrete foundations, and guard steel posts shall be considered as contaminated material, and shall comply with "Handling, Transportation, and Disposal of Contaminated Material," of these special provisions.

Concrete removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

MEASUREMENT AND PAYMENT

The contract unit price paid for high mast light pole foundation shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in removing high mast pole foundation and guard steel posts, complete in place, including structural backfilling and compacting the resulting holes, and depressions caused by the removal of the high mast pole foundation and guard steel posts, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Resulting contaminated material from the removal of the high mast pole foundation and guard steel posts is measured and paid for as roadway excavation (Class II).

REMOVE CONCRETE

Concrete, where shown on the plans to be removed, shall be removed.

The pay quantities of concrete to be removed will be measured by the cubic yard, measured before and during removal operations.

Concrete removed shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

10-1.25 VIBRATION MONITORING

This work shall consist of furnishing, installing and maintaining vibration-monitoring instrumentation; collecting vibration data; and interpreting and reporting the results of vibration monitoring as specified herein. This work shall include the implementation by the Contractor of any required remedial and precautionary measures, using the vibration monitoring data, to protect the following facilities from excess vibration during construction activities including driving of indicator piles:

1. 108" RCP Sewer Outfall (EBMUD)
2. 12" 240psi PG&E Gas Line

GENERAL

The Contractor shall be responsible for the following, including but not limited to:

1. Furnish and install vibration-monitoring instrumentation.
2. Protect from damage and maintain instruments installed by the Contractor and repair or replace damaged or inoperative instruments.
3. Collect, interpret and report data from instrumentation specified herein.
4. Implement response actions.

The Department is not responsible for the safety of the work based on vibration-monitoring data, and compliance with this Section does not relieve the Contractor of full responsibility for damage caused by the Contractor's operations.

VIBRATION MONITORING PERSONNEL

The Contractor's vibration-monitoring personnel shall have the qualifications specified herein. Vibration monitoring may be on the staff of the Contractor. However, they shall not be employed nor compensated by subcontractors, or by persons or entities hired by subcontractors, who will provide other services or material for the project.

The Contractor's vibration-monitoring personnel shall include a Vibration Instrumentation Engineer who meets one of the following minimum qualifications:

1. Registered Geophysicist or Professional Engineer in the State of California with at least 5 years of experience in the installation and use of vibration-monitoring instrumentation and data interpretation.

2. Graduate level degree from an accredited University in Physics or Acoustics with at least 5 years experience in the installation and use of vibration-monitoring instrumentation and data interpretation.

The Vibration Instrumentation Engineer shall:

1. Be on site and supervise the initial installation of each vibration-monitoring instrument.
2. Supervise interpretations of vibration-monitoring data.

The Contractor's vibration-monitoring personnel shall be subject to the Engineer's approval.

SUBMITTALS

Prior to any significant impact work and prior to performing any vibration monitoring, the Contractor shall submit to the Engineer a written vibration monitoring plan, vibration monitoring equipment manufacturer's product data and the resumes of the Vibration Instrumentation Engineer and any vibration monitoring technical support personnel.

The vibration monitoring equipment manufacturer's data shall describe in detail all vibration-monitoring instruments. Requests for consideration of substitutions, if any, together with product data and instruction manuals for requested substitutions.

The resumes of the Vibration Instrumentation Engineer and any vibration monitoring technical support personnel shall be sufficient to define details of relevant experience.

The written vibration monitoring plan shall detail the procedures for vibration monitoring. Such details shall include, but not limited to:

1. The name of the Firm providing the vibration monitoring services.
2. Description of the instrumentation and equipment to be used.
3. Measurement locations and methods for mounting the vibration sensors.
4. Procedures for data collection and analysis.
5. Means and methods of providing warning when the particle velocity equals or exceeds specified limits.
6. Generalized plans of action to be implemented in the event the particle velocity equals or exceeds specified limits. The generalized plans of action shall be positive measures by the Contractor to control vibrations (e.g. using alternative construction methods).
7. Name of the "responsible person" designated by the Contractor. The responsible person designated by the Contractor shall have the authority to stop the work causing the vibration.

Within 5 days of receipt of each instrument at the site, the Contractor shall submit to the Engineer a copy of the instruction manual and the laboratory calibration and test equipment certification.

In addition, the Contractor shall submit data and reports as specified in "Data Reduction, Processing, Plotting and Reporting" in these special provisions.

The review period shall be the same as those set forth in Section 51-1.06A, "Falsework Design and Drawings," of the Standard Specifications.

VIBRATION MONITORING EQUIPMENT

The Contractor shall provide portable seismographs for monitoring the velocities of ground vibrations resulting from construction activities. Seismographs shall be Model DS-477 Blastmate II as manufactured by Instantel Inc., Kanata (Ottawa), Ontario, Canada, Model VMS-500 as manufactured by Thomas Instruments, Inc., Spofford, NH, or Model NC5310/D, as manufactured by Nomis Inc., Birmingham, AL, or acceptable equivalent. The seismograph shall have the following minimum features:

1. Seismic range: 0.01 to 4 inches per second with an accuracy of +5 percent of the measured peak particle velocity or better at frequencies between 10 Hertz and 100 Hertz, and with a resolution of 0.01 inch per second or less.
2. Frequency response (+3 dB points): 2 to 200 Hertz.
3. Three channels for simultaneous time-domain monitoring of vibration velocities in digital format on three perpendicular axes.
4. Two power sources: internal rechargeable battery and charger and 115 volts (ac). Battery must be capable of supplying power to monitor vibrations continuously for up to 24 hours.
5. Capable of internal, dynamic calibration.

6. Direct writing to printer and capability to transfer data from memory to external device. Instruments must be capable of producing strip chart recordings of readings on site within one hour of obtaining the readings. Provide computer software to perform analysis and produce reports of continuous monitoring.
7. Continuous monitoring mode must be capable of recording single-component peak particle velocities, and frequency of peaks with an interval of one minute or less.
8. One seismograph must be water-proof and capable of downhole stationing.

Whenever any product is specified by brand name and model number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the product desired. The term "acceptable equivalent" shall be understood to indicate a product that is the same or better than the product named in the specifications in function, quality, performance, reliability, and general configuration. This procedure is not to be construed as eliminating other manufacturers' suitable products of equal quality.

The Contractor may request to substitute an "acceptable equivalent" vibration monitoring equipment and shall submit complete comparative data to the Engineer for consideration of another product. Any request from the Contractor for consideration of a substitution shall clearly state the nature of the deviation from the product specified. Substitute products shall not be used in the work unless accepted by the Engineer in writing. The Engineer will be the sole judge of the suitability and equivalency of the proposed substitution.

The Contractor's instrumentation personnel shall conduct regular maintenance of seismograph installations.

All seismographs shall have been calibrated by the manufacturer or certified calibration laboratory within one year of their use on site. A current certificate of calibration shall be submitted to the Engineer with the Contractor's data.

A record of laboratory calibration shall be provided for all vibration-monitoring instruments to be used on site. Certification shall be provided to indicate that the instruments are calibrated and maintained in accordance with the equipment manufacturer's calibration requirements and that calibrations are traceable to the U. S. National Institute of Standards and Technology (NIST).

VIBRATION MONITORING

The Contractor shall furnish all installation tools, materials, and miscellaneous instrumentation components for vibration monitoring. At the above listed locations, vibration monitoring and recording shall be performed during the course of all significant impact work, when that activity occurs within 100 feet of the said facility. The 100 feet shall be measured from the edge of the construction activity.

The Contractor shall notify the Engineer at least 24 hours prior to starting a new vibration-producing construction task, and shall have the seismographs in place and functioning properly prior to any work within 100 feet as defined above. No work occurring within this zone shall occur unless monitoring equipment is functioning properly.

The equipment shall be set up in a manner such that an immediate warning is given when particle velocity equal to or exceeding 0.2-inch per second is produced. The warning emitted by the vibration-monitoring equipment shall be instantaneously transmitted to the responsible person designated by the Contractor by means of warning lights, audible sounds or electronic transmission.

Monitoring equipment shall be stationed within 3 feet of the exterior of designated facilities on the side facing the Contractor's work site. For facilities whose frontage exceeds 200 feet, at least 2 monitors shall be utilized at that location.

The seismographs shall be installed such that the longitudinal and transverse directions of measurement are parallel and perpendicular to the feeder alignment, respectively.

A downhole waterproof seismograph (e.g., a downhole three-directional geophone calibrated to measure ground velocities) shall be installed on the centerline of each said facility and a minimum of three seismographs shall be deployed and stationed on the existing ground surface at zero, and 10 feet intervals from the centerline of the said facilities and normal to the axis of the alignment on the side closest to the Contractor's work. The seismographs shall be placed on a straight line normal to the axis of the said facilities coinciding with the centerline of the each pile. These four seismographs shall provide ground vibrations at a few locations to evaluate attenuation of the ground vibrations with distance from the source.

When any reading on monitoring equipment equals or exceeds 0.3-inch per second, work shall immediately cease and the Contractor shall immediately notify the Engineer. If directed by the Engineer, the Contractor shall submit within 24 hours a detailed specific plan of action so that the vibration limits are not violated. The Contractor shall take whatever action is necessary to reduce and maintain the monitoring equipment reading below a particle velocity of 0.3-inch per second.

The seismograph vibration sensors shall be firmly mounted on the surface slab of concrete or asphalt, or firmly set in undisturbed soil.

DATA COLLECTION

Prior to any vibration-producing construction activity, the Contractor shall collect seismograph data to document background vibrations at each monitoring location. This monitoring shall consist of a continuous recording of the maximum single-component peak particle velocities for one-minute intervals, which shall be printed on a strip chart. The background monitoring shall be performed for a minimum of two non-consecutive workdays, spanning the hours during which construction activities will take place.

The Contractor shall monitor vibration during significant vibration-producing construction activities. This monitoring shall consist of a continuous recording of the maximum single-component peak particle velocities for one-minute intervals, which shall be printed on a strip chart. During the monitoring, the Contractor shall document all events that are responsible for the measured vibration levels, and submit the documentation to the Engineer with the data as specified in section "Data Reduction, Processing, Plotting and Reporting" in these Special Provisions. A record form "Construction Vibration Monitoring Field Data Form" for documenting these events could be found in "Supplemental Project Information," of these special provisions.

All vibration monitoring data shall be recorded contemporaneously and plotted continuously on a graph by the data acquisition equipment. Each graph shall show time-domain wave traces (particle velocity versus time) for each transducer with the same vertical and horizontal axes scale.

DATA REDUCTION, PROCESSING, PLOTTING AND REPORTING

Within 10 working days after the completion of the background vibration monitoring, the Contractor shall submit to the Engineer a hard copy report documenting the results at each of the monitoring locations.

During bridge construction, the Contractor shall provide weekly, hard copy reports summarizing any vibration monitoring data collected at the specified vibration-monitoring locations. The reports for each week shall be submitted on or before the end of the following week.

All reports shall be signed by the approved Vibration Instrumentation Engineer, and shall include the following:

1. Project identification, including District, County, Route, Post Mile, Project Name and Bridge number as shown on the project plans.
2. Location of the monitoring equipment.
3. Location of vibration sources (e.g. traffic, demolition equipment, etc.)
4. Summary tables indicating the date, time and magnitude and frequency of maximum single-component peak particle velocity measured during each one-hour interval of the monitoring period.
5. Field data forms (construction vibration monitoring only).
6. Appendix graphs of the strip charts printed during the monitoring periods.

In addition to the hard copy data specified herein, the Contractor shall provide data on Compact Disc (CD) with each report. Electronic data files for all instrument data shall be provided in dBASE IV (.DBF) format.

The Contractor shall not disclose any instrumentation data to third parties and shall not publish data without prior written consent of the Department.

PAYMENT

The contract lump sum price paid for vibration monitoring shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for performing all work involving vibration monitoring, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.26 SEWER VIDEO SURVEY

GENERAL

Summary

This work includes performing a video survey and providing an inspection report on the condition of the interior of the existing East Bay Municipal Utility District (EBMUD) reinforced concrete outfall pipe before and after the driving piles(Class 90) (Alternative X).

Permits

The Contractor must apply for a Permit to Enter and an Underwater Operations Permit from the EBMUD Wastewater Planning Section (WPS), Telephone (510) 287-1141, at least 35 working days prior to initiating any work within the EBMUD outfall pipe easement. The Permit to Enter and the Underwater Operations Permit must be submitted with copies of the Operation and Safety Procedure Plan and Contingency Plan.

Submittals

Submit the following:

1. Operation and Safety Procedure Plan
   At least 20 working days prior to conducting the video survey of the EBMUD outfall pipe, submit to the Engineer for review and acceptance 4 copies of the operation and safety procedure plan. The Engineer will have 10 working days to review and accept the plan. If revisions are required, as determined by the Engineer, the Contractor must revise and resubmit the plan within 5 working days of receipt of the Engineer's comments. The Engineer will have 5 working days to review the revisions. Upon the Engineer's approval of the plan, 4 additional copies of the Operation and Safety Procedure plan incorporating the required changes must be submitted to the Engineer. Minor changes or clarifications to the initial submittal may be made and attached as amendments to the plan. In order to allow construction activities to proceed, the Engineer may conditionally approve the Operation and Safety Procedure plan while minor revisions or amendments are being completed.
2. Contingency Plan
   At least 20 working days prior to conducting the video survey of the EBMUD outfall pipe, submit to the Engineer for review and acceptance 4 copies of the contingency plan. The Engineer will have 10 working days to review and accept the plan. If revisions are required, as determined by the Engineer, the Contractor must revise and resubmit the plan within 5 working days of receipt of the Engineer's comments. The Engineer will have 5 working days to review the revisions. Upon the Engineer's approval of the plan, 4 additional copies of the Contingency plan incorporating the required changes must be submitted to the Engineer. Minor changes or clarifications to the initial submittal may be made and attached as amendments to the contingency plan. In order to allow construction activities to proceed, the Engineer may conditionally approve the Contingency plan while minor revisions or amendments are being completed.
3. Pre-Construction Inspection Report
   At least 10 working days before starting driving piles (Class 90 (Alternative X), submit 4 copies of the pre-construction inspection report to the Engineer for review and acceptance. The Engineer will have 5 working days to review and accept the report. If revisions are required, as determined by the Engineer, the Contractor must revise and resubmit the report within 5 working days of receipt of the Engineer's comments. Upon the Engineer's approval of the plan, 4 additional copies of the report incorporating the required changes must be submitted to the Engineer. After acceptance by the Engineer the contractor must provide 2 copies of the inspection report to the EBMUD (WPS). The Pre-Construction inspection report must include the following:

   3.1. The type, condition, and location of all structural deficiencies, including reduced cross sectional areas, protrusions, cracks, holes, exposed aggregates and reinforcing bars, honey combed areas, damaged or offset construction joints, deteriorated concrete surfaces, infiltrations, root intrusions, missing pieces, and the condition of the manholes and the manhole covers. The locations of all deficiencies found in the outfall pipe must be shown by distances with reference points agreed upon by the Contractor and the Engineer.
   3.2. Continuous voice recording describing defects and features found.
   3.3. A clear digital photo or video picture capture of all structural deficiencies found.
   3.4. The dimensions of all major structural deficiencies found.
   3.5. A copy of the outfall video survey in high quality electronic media. The video media must include the following information:

      3.5.1. Voice recording
      3.5.2. Recording number
      3.5.3. Inspection date
      3.5.4. Current distance along outfall (counter meter)
      3.5.5. Printed labels on video recording hard copy with location and date

4. Post-Construction Inspection Report
   At least 7 working days after the completion of driving piles(Class 90) (Alternative X), submit 4 copies of the post construction inspection report to the Engineer for review and acceptance. The Engineer will have 5 working days to review and accept the report. If revisions are required, as determined by the Engineer, the Contractor must revise and resubmit the report within 5 working days of receipt of the Engineer's comments. Upon the Engineer's approval of the plan, 4 additional copies of the report incorporating the required changes must be submitted to the Engineer. After acceptance by the Engineer provide 2 copies of

the inspection report to the EBMUD (WPS). The Post-Construction inspection report must include the following:

4.1. The type, condition, and location of all structural deficiencies, including reduced cross sectional areas, protrusions, cracks, holes, exposed aggregates and reinforcing bars, honey combed areas, damaged or offset construction joints, deteriorated concrete surfaces, infiltrations, root intrusions, missing pieces, and the condition of the manholes and the manhole covers. The locations of all deficiencies found in the outfall pipe must be shown by distances with reference points agreed upon by the Contractor and the Engineer.
4.2. Continuous voice recording describing defects and features found.
4.3. A clear digital photo or video picture capture of all structural deficiencies found.
4.4. The dimensions of all major structural deficiencies found.
4.5. A copy of the outfall video survey in high quality electronic media. The video media must include the following information:

4.5.1. Voice Recording
4.5.2. Recording number
4.5.3. Inspection date
4.5.4. Current distance along outfall (counter meter)
4.5.5. Printed labels on video recording hard copy with location and date

4.6. Comparison of findings between the pre and post construction surveys.
4.7. Possible cost effective solutions to remedy the major structural deficiencies identified and the serviceability of the existing EBMUD outfall pipe.

Quality Control and Assurance

Qualifications: Experienced Contractor's personnel trained in identifying and locating defects, breaks, and obstacles must perform the EBMUD outfall pipe video inspection.

MATERIALS

Closed-Circuit Television (CCTV) Inspection Equipment

CCTV equipment must include:

1. CCTV color camera with articulating head that pans and rotates 360 degrees.
2. Transporter adapted for conditions of the pipe
3. Television monitor
4. Lighting
5. Cables and power sources

CCTV equipment must:

1. Be specifically designed and constructed for pipe inspection
2. Be operative in 100% humidity conditions
3. Have camera lighting that allows a clear view of the entire periphery
4. Have adjustable focal distance range from 0.5-foot to infinity
5. Produce a minimum 356 lines of resolution for camera and monitor
6. Have remote reading meter counter accurate to 1 percent over the length of the particular section being inspected

Calibration

Verify the accuracy of the distance meter used in CCTV inspection with a Rollatape measuring wheel or other suitable device approved by the Engineer.

Electronic Media

CCTV recording must be made in high quality electronic media such as Compact Disk (CD) or Digital Video Disk (DVD).

CONSTRUCTION

General

The Contractor must inspect the outfall pipe either by human entry or CCTV equipment.

When using CCTV equipment for inspection, the Contractor must provide a full 360-degree view video survey of the interior of the outfall pipe. The CCTV inspection rate must not exceed 30 feet per minute.

When using human entry inspection, the Contractor must use a hand held video camera, lighting, voice recording and a digital photo camera to record the deficiencies in the outfall pipe. Lighting, video and picture quality must provide a clear, in focus view of the entire periphery of the outfall pipe, where possible, given water level conditions. Do not exceed the CCTV inspection rate of 30 feet per minute.

To gain access, the Contractor must inform and coordinate with the Engineer and EBMUD (WPS) 20 working days in advance of the planned outfall pipe video survey. The Contractor must not perform the video survey work without the presence of an EBMUD representative.

The EBMUD RCP sewer outfall pipe (EBMUD) can be accessed through manholes located within the State right of way between EBMUD 108-inches RCP sewer outfall (EBMUD) between Stations N 7+00 (Lt.) and N 30+00 (Lt.). Opening manhole covers will require lifting padeyes, eyebolts and a crane or other lifting equipment.

A shutdown of EBMUD's outfall pipe must take place in order to restrict flow in the outfall pipe for the video survey to take place. The outfall pipe can only be shut down during dry weather conditions, low tide and from 1:00 a.m. to 5:00 a.m. Shutdowns are also limited by the status of treatment plant functions and weather conditions, current and forecasted. The Contractor must ensure that all work is complete and manhole covers are properly secured in place before 6:00 p.m..

A written System Outage Request (SOR) must be submitted to the Engineer 10 working days in advance of the planned video survey. The SOR must be approved by the Engineer before each video inspection survey.

The EBMUD outfall pipe is subject to zero load. Neither contractor's vehicles nor equipment are allowed to cross or be within 12.5 feet from centerline of the EBMUD outfall pipe.

Video Survey Locations

The video survey must be conducted at the following location:

EBMUD 108-inches RCP sewer outfall (EBMUD) between Stations N 7+00 (Lt.) and N 30+00 (Lt.).

Safety Procedures

In addition to the requirements specified in this special provision, the Contractor must comply with all applicable Federal, State, and local safety and health requirements and standards.

Pre-entry and Confined Space Operations

Pre-entry and confined space operations must comply with the provisions of Article 108 of the General Industry Safety Orders, Section 1532 of the Construction Safety Orders of Title 8 of the California Code of Regulations, California Occupational Safety and Health Administration (CAL-OSHA) regulations, and the following requirements:

1. Testing for the existence of dangerous water and air contamination
2. Air ventilation requirements
3. Entry rate work within confined spaces

The Contractor must:

1. Provide air ventilation for the Contractor's personnel, and the Engineer as required by job conditions.
2. Provide personal protective equipment to Contractor's personnel, the Engineer, and EBMUD personnel as required by job conditions.
3. Coordinate lockout/tagout procedures with EBMUD as needed. The Contractor must be ready to apply locks and tags in conjunction with EBMUD during outfall pipe entry. The Contractor must be in constant contact with EBMUD and the Engineer during the duration of the outfall pipe shutdowns.
4. Provide safeguards, including traffic barriers, warning signs, barricades, temporary fences and other similar safeguards when required for the protection of all personnel during the outfall video survey.

Testing

Testing must take place for the following suspected conditions prior to entering the outfall pipe:

1. Combustible gases
2. Hydrogen sulfide (H2S)
3. Contaminated and infectious waste

Testing must take place for the following suspected conditions at all times during inspection:

1. Combustible gases
2. Hydrogen sulfide (H2S)
3. Oxygen deficiencies
4. Carbon dioxide
5. Carbon monoxide

PAYMENT

The contract lump sum price paid for sewer video survey includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in conducting the video survey, including preparing submittals, providing Pre and Post-Construction inspection reports, electronic media, inspection documentation, personal protective equipment, safety devices, testing, and cleaning as necessary to facilitate the video survey and inspection, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.27 CLEARING AND GRUBBING

Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the Standard Specifications and these special provisions.

Clearing and grubbing also includes removal of existing stockpiled materials located within the limits of clearing and grubbing. Comply with the provisions in "Health and Safety Plan," and "Handling, Transporting, and Disposal of Contaminated Material," of these special provisions.

Removal of contaminated material resulting from clearing and grubbing is measured and paid for as roadway excavation (Class II).

10-1.28 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

Surplus excavated material shall become the property of the Contractor and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Where a portion of the existing surfacing is to be removed, the outline of the area to be removed shall be cut on a neat line with a power-driven saw to a minimum depth of 0.17-foot before removing the surfacing. Full compensation for cutting the existing surfacing shall be considered as included in the contract price paid per cubic yard for roadway excavation and no additional compensation will be allowed therefor.

The portion of imported borrow placed within 4 feet of the finished grade shall have a Resistance (R-Value) of not less than 15.

Reinforcement or metal attached to reinforced concrete rubble placed in embankments shall not protrude above the grading plane. Prior to placement within 2 feet below the grading plane of embankments, reinforcement or metal shall be trimmed to no greater than 3/4 inch from the face of reinforced concrete rubble. Full compensation for trimming reinforcement or metal shall be considered as included in the contract prices paid per cubic yard for the types of excavation shown in the Engineer's estimate, or the contract prices paid for furnishing and placing imported borrow or embankment material, as the case may be, and no additional compensation will be allowed therefor.

Imported borrow shall be mineral material including rock, sand, gravel, or earth. The Contractor shall not use man-made refuse in imported borrow including:

A. Portland cement concrete
B. Asphalt concrete
C. Hot mix asphalt
D. Material planed from roadway surfaces
E. Residue from grooving or grinding operations

F. Metal
G. Rubber
H. Mixed debris
I. Rubble

10-1.29 HANDLING, TRANSPORTATION, AND DISPOSAL OF CONTAMINATED MATERIAL

GENERAL

Summary

This work includes temporary storage, confirmation testing, transportation, and disposal of contaminated material.

Comply with Section 19, "Earthwork," of the Standard Specifications.

Test results used to determine the nature and extent of contaminated material are provided as described in "Supplemental Project Information," of these special provisions.

Definitions

Class II waste: Contaminated material that is not regulated as a hazardous waste but requires handling as a designated waste under Water Code § 13173. Designated as roadway excavation (Class II). Does not include rock or pavement.

Resource Conservation and Recovery Act (RCRA): Federal law that provides guidelines for managing solid waste.

Non-RCRA hazardous waste: Contaminated material regulated as a hazardous waste under California law but not under RCRA. Also known as California hazardous waste. Designated as roadway excavation (Type H). Does not include rock or pavement.

Submittals

Work Plan: At least 20 days before starting clearing and grubbing or earthwork at the job site, submit a work plan that includes:

1. Schedule of activities
2. Method of excavation and equipment to be used
3. Dust control procedures
4. Storage methods and locations for contaminated material
5. Haul routes
6. Spill contingency plan

The Engineer reviews the work plan within 15 days. Resubmit required revisions within 5 days. Do not start clearing and grubbing or earthwork until the plan is approved by the Engineer. No adjustment for time or money is made if resubmittals of the work plan are required due to deficiencies in the plan.

Waste Disposal Documents: Submit a disposal facility waste disposal request for the Engineer's signature.

Before transporting hazardous waste, submit a copy of the transporter's valid hazardous waste transporter registration.

Submit completed waste shipment forms and disposal facility weight tickets within 35 days after shipment. The Department withholds payment until the completed forms are submitted.

Sampling and Analysis Plan: At least 20 days before starting material sampling, submit a sampling and analysis plan (SAP). The SAP must be signed by a California registered professional engineer or California registered professional geologist experienced in contaminated site characterization. The SAP must include:

1. Purpose and scope of the investigation, including:

    1.1. Additional disposal facility requirements
    1.2. Reclassification of material
    1.3. Characterization of material outside of the excavation pay limits

2. Sampling locations and methods
3. Analytical methods

4. Name, address, and Environmental Laboratory Accreditation Program certification number of the testing laboratory
5. Quality assurance/quality control procedures

Base the sampling and analysis procedures on guidelines in:

1. USEPA, SW 846, "Test Methods for Evaluating Solid Waste, Volume II: Field Manual Physical/Chemical Methods"
2. ASTM, D 1452, "Soil Investigation and Sampling by Auger Borings"
3. ASTM, D 1586, "Penetration Test and Split-Barrel Sampling of Soils"
4. ASTM, D 1587, "Thin-Walled Tube Sampling of Soils for Geotechnical Purposes"
5. ASTM, D 6282-98(2005), "Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations"

The Engineer reviews the SAP within 15 days. Resubmit required revisions within 5 days. Do not start sampling until the plan is approved by the Engineer. No adjustment for time or money is made if resubmittals of the SAP are required due to deficiencies in the plan.

Quality Control and Assurance

Regulatory Requirements: Laws and regulations that govern this work include:

1. Health and Safety Code, Div 20, Ch 6.5 (California Hazardous Waste Control Act)
2. 22 CA Code of Regs, Div 4.5 (Environmental Health Standards for the Management of Hazardous Waste)
3. 8 CA Code of Regs
4. Water Code § 13173

Permits and Licenses: Obtain all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying hazardous waste, under Section 7-1.04, "Permits and Licenses," of the Standard Specifications.

For hazardous waste disposal, the Engineer obtains the Environmental Protection Agency generator identification number and Board of Equalization identification number and signs all manifests as the generator. Notify the Engineer at least 5 days before starting waste transport and at least 24 hours before subsequent loads when there is a break in hauling of more than 5 days.

CONSTRUCTION

Apply water to control dust at all times while performing clearing and grubbing or earthwork activities in work areas containing contaminated material. Apply water under Section 17, "Watering," of the Standard Specifications. Excavation, transportation, storage, and handling of contaminated material must result in no visible dust migration off the job site.

Prevent mixing of contaminated material with uncontaminated material. No additional payment is made for material requiring reclassification because of failure to segregate the material after excavation.

Characterization and disposal of additional material from excavations performed outside of the pay limits are included in the contract price for excavation. Assume the material has the same handling, transportation and disposal requirements as adjacent material. Furnish replacement material suitable for the planned use under Section 19, "Earthwork," of the Standard Specifications.

Use material excavated to install individual (not duct bank) electrical and irrigation conduits to backfill the trenches.

Temporary Storage

Transfer contaminated material directly from the excavation to any of the following:

1. Transport vehicles
2. Storage containers
3. Stockpile locations approved by the Engineer

Construct stockpile locations as follows:

1. The stockpiled material must not contain free liquids that separate readily.

2. Furnish and place undamaged chemically resistant geomembrane liners.

    2.1. Non-reinforced liner must be at least 20-mil thick.
    2.2. Scrim-reinforced liner must have a minimum weight of 40 lbs/1000 square feet.

3. Furnish and place undamaged geomembrane covers.

    3.1. Non-reinforced liner must be at least 10-mil thick.
    3.2. Scrim-reinforced liner must have a minimum weight of 26 lbs/1000 square feet.

4. The dimensions of the geomembrane must exceed the dimensions of the stockpile at all times.
5. Seal the seams in multiple geomembrane liners to prevent leakage.
6. Cover stockpiles at the end of each day or before storm events to prevent windblown dispersion and precipitation run-off and run-on.
7. If more than one sheet is required to cover the material, overlap the sheets a minimum of 1.5 feet.
8. Secure the cover to keep it in place. Do not use driven anchors except at the perimeter of the stockpile. Inspection and maintenance must comply with "Water Pollution Control" of these special provisions.

These stockpiling requirements apply to temporary storage outside of an excavation or a transport container including:

1. Staging of excavated material next to the excavation before pick up by loading equipment
2. Accumulating material for full transport loads
3. Awaiting test results required by a disposal facility

Start removing storage containers and stockpiles containing hazardous waste within 90 days of accumulating any quantity of material. After final removal has occurred, complete any cleanup required by the Engineer.

Sampling and Analysis

Test the material for any additional acceptance requirements requested by the disposal facility or for confirmation of classifications specified on the plans or in the special provisions. Use sampling and analysis procedures approved by the Engineer and the disposal facility. Prepare and submit a sampling and analysis plan before starting any tests.

The Engineer makes the final decision on reclassification or characterization of material after review of the test results. Allow 5 business days for review of test results. Changes in classification of materials will comply with Section 4-1.03, "Changes," of the Standard Specifications.

Transportation

Prepare a non-hazardous waste manifest or other shipping form for each load of Class II waste. Prepare a uniform hazardous waste manifest for each load of hazardous waste using the appropriate waste code. Transport hazardous waste using a transporter registered with the Department of Toxic Substances Control.

Cover the cargo during transport to prevent spillage or dust release. You agree to indemnify the State from any cost or liability due to spillage during transport of contaminated material to a disposal facility.

Disposal

Dispose of contaminated material as follows:

1. Roadway excavation (Class II) – Haul and dispose of the material at a permitted Class II waste management facility.
2. Roadway excavation (Type H) – Haul and dispose of the material at a permitted non-RCRA hazardous waste management facility.

Dispose of hazardous waste within California at a disposal site operating under a permit issued by the Department of Toxic Substances Control.

Obtain waste disposal approval from the appropriate disposal facility. Type H material is eligible for an exemption from the Board of Equalization disposal fees as provided under Health and Safety Code §§ 25174.1 and 25174.7. Request a letter of exemption from the Engineer at least 5 days before transporting Type H material from within these limits to a disposal facility.

MEASUREMENT AND PAYMENT

Quantities of roadway excavation, of the types shown in the Engineer's Estimate, are measured in the same manner specified for roadway excavation in Section 19, "Earthwork," of the Standard Specifications.

Full compensation for handling, transportation, and disposal of Class II waste, including material excavated to construct structure foundations, structure foundation piles, drainage facilities, and utilities, is included in the contract price paid per cubic yard for roadway excavation (Class II), and no additional compensation will be allowed therefor.

Full compensation for handling, transportation, and disposal of non-RCRA hazardous waste, including material excavated to construct structure foundations, structure foundation piles, drainage facilities, and utilities, is included in the contract price paid per cubic yard for roadway excavation (Type H), and no additional compensation will be allowed therefor.

10-1.30 CONTROLLED LOW STRENGTH MATERIAL

Controlled low strength material shall consist of a workable mixture of aggregate, cementitious materials, and water and shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications and these special provisions.

At the option of the Contractor, controlled low strength material may be used as structure backfill for pipe culverts, except that controlled low strength material shall not be used as structure backfill for culverts having a diameter or span greater than 20 feet.

LEED:

1. MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).
2. MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

When controlled low strength material is used for structure backfill, the width of the excavation shown on the plans may be reduced so that the clear distance between the outside of the pipe and the side of the excavation, on each side of the pipe, is a minimum of 12 inches. This minimum may be reduced to 6 inches when the height of cover is less than or equal to 20 feet or the pipe diameter or span is less than 42 inches.

Controlled low strength material in new construction shall not be permanently placed higher than the basement soil. For trenches in existing pavements, permanent placement shall be no higher than the bottom of the existing pavement permeable drainage layer. If a drainage layer does not exist, permanent placement in existing pavements shall be no higher than one inch below the bottom of the existing asphalt concrete surfacing or no higher than the top of base below the existing portland cement concrete pavement. The minimum height that controlled low strength material shall be placed, relative to the culvert invert, is 0.5 diameter or 0.5 height for rigid culverts and 0.7 diameter or 0.7 height for flexible culverts.

When controlled low strength material is proposed for use, the Contractor shall submit a mix design and test data to the Engineer for approval prior to excavating the trench for which controlled low strength material is proposed for use. The test data and mix design shall provide for the following:

A. A 28-day compressive strength between 50 pounds per square inch and 100 pounds per square inch for pipe culverts having a height of cover of 20 feet or less and a minimum 28-day compressive strength of 100 pounds per square inch for pipe culverts having a height of cover greater than 20 feet. Compressive strength shall be determined in conformance with the requirements in ASTM Designation: D 4832.
B. Cement shall be any type of portland cement conforming to the requirements in ASTM Designation: C 150; or any type of blended hydraulic cement conforming to the requirements in ASTM Designation: C 595M or the physical requirements in ASTM Designation: C 1157M. Testing of cement will not be required.
C. Admixtures may be used in conformance with the provisions in Section 90-4, "Admixtures," of the Standard Specifications. Chemical admixtures containing chlorides as Cl in excess of one percent by weight of admixture, as determined in conformance with the requirements of California Test 415, shall not

be used. If an air-entraining admixture is used, the maximum air content shall be limited to 20 percent. Mineral admixtures shall be used at the Contractor's option.

Materials for controlled low strength material shall be thoroughly machine-mixed in a pugmill, rotary drum or other approved mixer. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Controlled low strength material shall be placed in the work within 3 hours after introduction of the cement to the aggregates.

When controlled low strength material is to be placed within the traveled way or otherwise to be covered by paving or embankment materials, the material shall achieve a maximum indentation diameter of 3 inches prior to covering and opening to public traffic. Penetration resistance shall be measured in conformance with the requirements in ASTM Designation: D 6024.

Controlled low strength material used as structure backfill for pipe culverts will be considered structure backfill for compensation purposes.

10-1.31 IRRIGATION CROSSOVERS

Irrigation crossovers shall conform to the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications and these special provisions.

Conduits shall be placed in open trenches in conformance with the provisions in Section 20-5.03B, "Conduit for Irrigation Crossovers," of the Standard Specifications.

Conduits shall be corrugated high density polyethylene (CHDPE) pipe. Corrugated high density polyethylene pipe shall conform to the requirements in ASTM Designation: F 405 or F 667, or AASHTO Designation: M 252 or M 294 and shall be Type S. Couplings and fittings shall be as recommended by the pipe manufacturer.

Water line crossovers shall conform to the provisions in Section 20-5.03C, "Water Line Crossovers," of the Standard Specifications.

Fittings for water line crossovers shall be Schedule 80.

Sprinkler control crossovers shall conform to the provisions in Section 20-5.027D, "Sprinkler Control Crossovers," of the Standard Specifications.

Installation of pull boxes shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduit and Pull Boxes," of the Standard Specifications. When no conductors are installed in electrical conduits, pull boxes for irrigation crossovers shall be installed on a foundation of compacted soil.

10-1.32 IRRIGATION SLEEVE

Irrigation sleeves shall be polyvinyl chloride (PVC) plastic pipe and shall conform to the provisions in Section 20-2.15B(1), "Plastic Pipe Supply Line," of the Standard Specifications and these special provisions.

Irrigation sleeves less than 6 inches in diameter shall have a pressure rating (PR) 315.

Irrigation sleeves 6 inches or larger in diameter shall be Schedule 40.

Fittings shall be Schedule 40.

Irrigation sleeves shall be installed where shown on the plans.

Irrigation sleeves shall be installed not less than 1.5 feet below finished grade measured to the top of the sleeve. Sleeves shall extend 6 inches beyond paving. The ends of the sleeve shall be capped until use.

10-1.33 IMPORTED TOPSOIL

GENERAL

Summary

This work includes applying and consolidating topsoil.

MATERIAL

Comply with Section 20-2.01, "Topsoil," of the Standard Specifications.

CONSTRUCTION

Comply with Section 20-3.02, "Preparation," of the Standard Specifications.

Spread topsoil to a uniform thickness.

10-1.34 AGGREGATE BASE

Aggregate base must comply with Section 26, "Aggregate Bases," of the Standard Specifications and these special provisions.

LEED:

1. MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).
2. MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

Aggregate base must be Class 3.

Do not store reclaimed asphalt concrete or aggregate base with reclaimed asphalt concrete within 100 feet measured horizontally of any culvert, watercourse, or bridge.

Class 3 aggregate base must comply with:

Grading (Percentage Passing)

Sieve Sizes	Maximum	
	Operating Range	Contract Compliance
2"		
1-1/2"		
1"	100	100
3/4"	90-100	87-100
No. 4	35-60	30-65
No. 30	10-30	5-35
No. 200	2-11	0-14

Quality

Tests	Operating Range	Contract Compliance
Sand Equivalent	25 Min.	22 Min.
Resistance (R-value)	---	78 Min.
Duribility Index	---	35 Min.

Do not treat aggregate with lime, cement, or other chemical material before the Department performs the Durability Index test. The Engineer does not consider any untreated reclaimed asphalt concrete and portland cement concrete to be treated with lime, cement, or other chemical material for purposes of performing the Durability Index test.

If tests show grading or sand equivalent does not comply with the "Operating Range" specifications but complies with the "Contract Compliance" specifications, you may place aggregate base for the remainder of that day. Do not start another day's work until tests or other information indicate the next day's material complies with the "Operating Range" specifications.

If tests show grading or sand equivalent does not comply with the "Contract Compliance" specifications, remove the aggregate base represented by the tests. If you request and the Engineer approves, that aggregate base may remain in place and the Department reduces payment by $2.25 per cubic yard for that aggregate base. If both the grading and sand equivalent do not comply with "Contract Compliance" specifications and the base remains in place, the Department only makes one payment reduction.

No single grading or sand equivalent test may represent more than the smaller of 500 cubic yards or one day's production.

10-1.35 HOT MIX ASPHALT

GENERAL

Summary

This work includes producing and placing hot mix asphalt (HMA) Type A using the Standard process.

Comply with Section 39, "Hot Mix Asphalt," of the Standard Specifications.

MATERIALS

Asphalt Binder

The grade of asphalt binder mixed with aggregate for HMA Type A must be PG 64-10.

LEED Submittals

1. MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).
2. MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

Aggregate

The aggregate for HMA Type A must comply with the 3/4-inch grading.

CONSTRUCTION

Vertical Joints

Before opening the lane to public traffic, pave shoulders and median borders adjacent to a lane being paved.
Do not leave a vertical joint more than 0.15 foot high between adjacent lanes open to public traffic.

Conform Tapers

Place additional HMA along the pavement's edge to conform to road connections and private drives. Hand rake, if necessary, and compact the additional HMA to form a smooth conform taper.

10-1.36 RUMBLE STRIP

GENERAL

Summary

This work includes constructing shoulder rumble strips by grinding indentations in existing asphat concrete surfacing.

CONSTRUCTION

Select the method and equipment for constructing ground-in indentations.

Do not construct rumble strips on structures or approach slabs.

Construct rumble strips within 2 inches of the specified alignment. The grinding equipment must be equipped with a sighting device enabling the operator to maintain the rumble strip alignment.

Indentations must comply with the specified dimensions within 0.06 inch in depth and 10 percent in length and width.

The Engineer orders grinding or removal and replacement of noncompliant rumble strips to bring them within specified tolerances. Ground surface areas must be neat and uniform in appearance.

The grinding equipment must be equipped with a vacuum attachment to remove residue from the roadbed.

Dispose of removed material under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

On ground areas, apply fog seal coat under Section 37-1, "Seal Coats," of the Standard Specifications.

MEASUREMENT AND PAYMENT

The contract item for rumble strip is measured by the station along the length of the rumble strips without deductions for gaps between indentations.

The contract price paid per station for rumble strip includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing rumble strip complete in place including furnishing and applying fog seal coat to the actual ground areas, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.37 PRIME COAT

GENERAL

Summary

This work includes applying liquid asphalt prime coat. The Engineer designates areas receiving prime coat.

Comply with Section 93, "Liquid Asphalts," of the Standard Specifications.

MATERIALS

Liquid asphalt for prime coat must be Grade SC-70.

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

CONSTRUCTION

Apply at least 0.20 gallon of prime coat per square yard of designated area. Do not apply more prime coat than can be absorbed completely by the aggregate base in 24 hours.

You may request in writing the Engineer's approval to modify prime coat application rates.

Before paving, prime coat must cure for 48 hours.

Close public traffic to areas receiving prime coat. Do not track prime coat onto pavement surfaces beyond the job site.

MEASUREMENT AND PAYMENT

The Engineer determines prime coat quantities under the specifications for liquid asphalt in Section 93-1.04, "Measurement," of the Standard Specifications.

The contract price paid per ton for liquid asphalt (prime coat) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in prime coat complete in place as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

If there is no contract item for liquid asphalt (prime coat), full compensation for furnishing and applying the prime coat is included in the contract price paid per ton for hot mix asphalt as designated in the Engineer's Estimate and no separate payment will be made therefor.

10-1.38 PRECAST PRESTRESSED INDICATOR PILING (CLASS 90) (ALTERNATIVE X), PRECAST PRESTRESSED PILING (CLASS 90) (ALTERNATIVE X), AND PRECAST PRESTRESSED PILING (CLASS 140) (ALTERNATIVE X)

GENERAL

Piling shall conform to the provisions in Section 49, "Piling," of the Standard Specifications, and these special provisions.

Unless otherwise specified, welding of any work performed in conformance with the provisions in Section 49, "Piling," of the Standard Specifications, shall be in conformance with the requirements in AWS D1.1.

Attention is directed to "Project Information," "Precast Concrete Quality Control," and "Welding" of these special provisions.

Difficult pile installation is anticipated due to the presence of dense silty sand, clayed sand, clayed gravel with sand and firm to hard clay, very soft to firm clay (Young Bay Mud), very stiff clay (Old Bay Mud), layer of very dense sand, high ground water influenced by marine environment and tidal impacts, paved asphalt, concrete overlays, abandon utility boxes, and local areas of riprap..

When a calculated nominal driving resistance is shown on the plans for piling, that value shall be utilized in lieu of nominal resistance in Section 49, "Piling," of the Standard Specifications, the plans, and these special provisions.

Driving System Submittal

Before installing production driven piles and non-production indicator driven piles, submit a driving system submittal.

The driving system submittal must comply with Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The same driving system used for the indicator piles shall be used for the production piles.

The driving system submittal must be sealed and signed by an engineer who is registered as a Civil Engineer with the State of California. Allow 15 days for the Department's review. Allow an additional 15 days for the review of any resubmittals.

Submit a revised driving system submittal if the hammers change from those shown in the submittal.

For the driving system submittal, perform driveability studies as follows:

1. Model the proposed driving system including hammers, cap blocks, and pile cushions based on a wave equation analysis.
2. Use a computer program approved by the Engineer.
3. If the driveability analysis hammers indicate that open-ended pipe pile and steel shell penetration rates are less than 1 foot per 200 blows and the driving stresses exceed 80 percent of the yield strength of the pipe and steel shell, include assumptions for drilling through the center of the piles and shells.
4. If a follower is used, include an analysis of the driving system with the follower and an analysis of the driving system without the follower.

Include in the driving system submittal:

1. Results of the driveability analysis showing that all proposed driving systems will install piles to the specified tip elevation and nominal driving resistance shown on the plans. Driving systems must generate sufficient energy to drive the piles with compressive and tensile stresses not more than 90 percent of the yield strength of the pile as driven. Results must include:

    1.1. Pile compressive stress versus blows per foot.
    1.2. Pile tensile stress vs. blows per foot.
    1.3. Nominal driving resistance vs. blows per foot.

2. Complete description of:

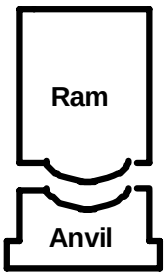
    2.1. Soil parameters used, including soil quake and damping coefficients, skin friction distribution, and ratio of shaft resistance to total resistance.
    2.2. Assumptions made regarding the formation of soil plugs, drilling through the center of open-ended steel shells, and the use of closure plates, shoes, and other tip treatment.

3. List of all hammer operation parameters assumed in the analysis, including fuel settings, stroke limitations, and hammer efficiency.
4. Copies of all test results from any previous pile load tests, dynamic monitoring, and all driving records used in the analyses.
5. Completed "Pile and Driving Data Form"

CALIFORNIA DEPARTMENT OF TRANSPORTATION
TRANSPORTATION LABORATORY

PILE AND DRIVING DATA FORM

Structure Name :_____ Contract No.:_____
_____ Project:_____
Structure No.:_____ Pile Driving Contractor or
Dist./Co./Rte./Post Mi:_____ Subcontractor_____(Pile Driven By)



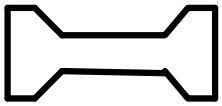
Hammer

Manufacturer:_____ Model:_____
Type:_____Serial No.:_____
Rated Energy:_____ at _____ Length of Stroke

Modifications: _____
_____
_____
_____
_____

Capblock (Hammer Cushion)

Material:_____
Thickness:_____in Area:_____in^2
Modulus of Elasticity - E:_____ksi
Coefficient of Restitution - e:_____



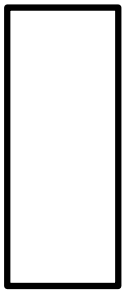
Pile Cap

Helmet
Bonnet
Anvil Block
Drivehead

Weight: kips

Pile Cushion

Material:_____
Thickness:_____in Area: _____in^2
Modulus of Elasticity - E:_____ksi
Coefficient of Restitution - e:_____



Pile

Pile Type:_____
Length (In Leads):_____ft
Lb/ft.:_____Taper:_____
Wall Thickness:_____in
Cross Sectional Area:_____in^2
Design Pile Capacity:_____kips
Description of Splice:_____
_____
Tip Treatment Description:_____
_____

DISTRIBUTE:

- ☐ Translab, Foundation Testing
- ☐ Translab, Geotechnical Design
- ☐ Resident Engineer

Note: If mandrel is used to drive the pile, attach separate manufacturer's detail sheet(s) including weight and dimensions.

Submitted By:_____
Date:_____Phone No.:_____

Jetting

Jetting to obtain the specified penetration in conformance with the provisions in Section 49-1.05, "Driving Equipment," of the Standard Specifications shall not be used for driven type piles.

Drilling

Drilling to obtain the specified penetration in conformance with the provisions in Section 49-1.05, "Driving Equipment," of the Standard Specifications shall only be used for driven type piles at the locations and to the bottom of hole elevations listed in the following table. Materials resulting from drilling holes are considered to be contaminated materials and shall comply with "Handling, Transportation, and Disposal of Contaminated Material," of these special provisions.

Bridge Number		Location	Elevation of Bottom of Hole
33M5746		SFOBB Maintenance Complex	-5.0

At the option of the Contractor, sonic drilling may be used for drilling in areas where riprap and concrete slabs are found in the upper fill.

Any gap remaining between the sides of the piles and pre-drilled hole shall be back filled with loose sand.

Redriving

Piles that do not attain the required bearing value when the pile tip has reached the specified tip elevation shall be allowed to stand for a "set period" without driving. The "set period" shall be at least 12 hours unless bearing has been obtained sooner. After the required "set period" has elapsed, 2 piles or 10 percent of such piles in a footing, whichever is greater, shall be redriven. The Engineer will designate which piles are to be redriven. Redriving shall consist of operating the driving hammer at full rated energy on the pile and then measuring the bearing value of the pile.

If the required bearing value has been attained for each pile designated to be redriven, then the remaining piles in that footing shall be considered satisfactory and further driving will not be required. If redriving said designated piles demonstrates that the required bearing value has not been attained, all piles in that footing shall be redriven until the required bearing value has been reached.

Full compensation for redriving and for conforming to the requirements for "set period" and any delays in connection therewith shall be considered as included in the contract unit price paid for driving the piles involved and no separate payment will be made therefor.

Indicator Piles

Indicator piles shall be driven as non-production piles at each control location shown in the following table:

Control Location	Location Description
Indicator 1	Center of Building 1A
Indicator 2	Northwest corner of Building 1B
Indicator 3	Middle of Building 1B
Indicator 4	Southeast corner of Building 1B
Indicator 5	Center of Building 3 - Washrack
Indicator 6	Center of Building 2 - Fuel Island

The exact location of of the indicator piles will be determined by the Engineer.

The indicator piles shall be driven to the same specified tip elevation as the closest design piles at the control location. Piles shall be driven with impact hammers.

From the driving behavior and test data, and the subsurface exploration data, the Engineer will determine the final length of production piles. Production piles shall not be fabricated before the indicator program is completed and final length is determined.

Indicator piles shall be monitored with a Pile Driven Analyzer during driving and re-tapping. Indicator piles shall be re-tapped after 7 days to allow set-up at a depth of 1 foot above the specified tip elevation. A cold hammer shall not be used for re-drive.

A record of indicator pile driving shall be prepared to include but not limit to these items:

A. The make, model, and energy rating of hammer.
B. The hammer blowcount per foot for the entire driven length.
C. The stroke associated with blowcount for the last 5 foot.
D. The results of monitoring by a Pile Driving Analyzer.
E. The cutoff elevation, the tip elevation, and any other permanent information.
F. For re-tap, the number of blowcount per inch of pile penetration for the first foot shall be recorded.

Dynamic Monitoring

Monitoring will be done by State forces using State-furnished dynamic pile analyzer monitoring instruments. These provisions do not apply to the dynamic monitoring of falsework piles by the Contractor.

The Engineer will determine which piles will receive dynamic monitoring from each control location. Piles to be dynamically monitored shall be made available to State forces 2 business days prior to driving. The piles shall be safely supported a minimum of 6 inches off the ground in a horizontal position on at least 2 support blocks. The pile shall be positioned so that State forces have safe access to the entire pile length and circumference for the installation of anchorages and control marks for monitoring. The Contractor shall rotate the piles on the blocks as directed by the Engineer.

Piles to be dynamically monitored shall be prepared and driven in the following sequence:

A. Prior to driving, the Contractor shall rotate and align the pile in the driving leads as directed by the Engineer.
B. The Contractor shall temporarily suspend driving operations for approximately 15 minutes when the pile tip is 25 feet above the elevation to which the tip is required to be finally driven.
C. During the 15 minute suspension, the Contractor shall bolt the one pound instrument package securely to plugs or expansion anchors previously installed in the pile by the State. The Contractor shall connect electrical cables to the instrument package as directed by the Engineer.
D. Driving operations shall resume as directed by the Engineer. Driving operations shall be suspended approximately one foot above the required tip elevation, as directed by the Engineer.
E. The Contractor shall remove the cables and instrument package from the pile and deliver them to the Engineer.
F. The following business day, the Contractor shall install the instrument package on the pile and attach the cables and resume driving the pile to the required tip elevation, as directed by the Engineer.
G. The Contractor shall remove the cables and instruments from the monitored pile and deliver them to the Engineer.

The Contractor shall be responsible for damage to the State's cables and instruments caused by the Contractor's operations and shall replace damaged cables or instruments in kind.

Wave Equation

The second paragraph of Section 49-1.03, "Determination of Length," and the third paragraph of Section 49-1.08, "Pile Driving Acceptance Criteria," of the Standard Specifications shall not apply to the pile types at the control locations shown on the plans. The Engineer will conduct a penetration and bearing analysis in conjunction with dynamic monitoring of the piles at these locations and develop bearing acceptance criteria curves for these piles. Penetration and bearing analyses will be based on a wave equation analysis.

The Engineer shall be allowed 30 days to complete dynamic monitoring, revise specified tip elevations, and to provide the bearing acceptance criteria curves for a given control location.

Should the Engineer fail to provide the bearing acceptance criteria curves for production piles within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in providing the bearing acceptance criteria curves, the delay will be considered a right of way delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Production piles shall not be installed until the bearing acceptance criteria curves for piles within the corresponding control location have been provided by the Engineer.

PRECAST PRESTRESSED CONCRETE PILES

Splicing

Splicing of precast prestressed concrete piling shall be done in conformance with the details shown on the plans and these special provisions.

At the option of the Contractor, piles in excess of 80 feet in length may be spliced to attain the length necessary to comply with contract requirements.

Splices shall be located at least one half the distance from the bottom of footing to the specified pile tip.

Splicing may be done by the dowel splice method.

Epoxy mortar for use with dowel splice shall consist of a mixture of epoxy binder and aggregate. The epoxy mortar shall conform to the provisions in Section 95-1, "General," and Section 95-2.01, "Binder (Adhesive), Epoxy Resin Base," of the Standard Specifications. The mix proportions of epoxy mortar shall be 1 part binder to 1 part aggregate by volume. Aggregate shall consist of a combination of 1 part material passing the No. 30 sieve and 3 parts material passing the No. 20 sieve.

Epoxy conforming to the provisions in Section 95-1 and Section 95-2.01, "Binder (Adhesive), Epoxy Resin Base," of the Standard Specifications may be substituted for the epoxy mortar specified for the dowel splice.

Forms for retention of epoxy mortar or epoxy for the dowel splice shall be of a material which will prevent the escape of the mortar or epoxy from the joint.

After insertion into the bottom portion of the pile, the top portion shall be held rigid until the epoxy has cured.

MEASUREMENT AND PAYMENT (PILING)

Measurement and payment for the various types and classes of piles shall conform to the provisions in Sections 49-6.01, "Measurement," and 49-6.02, "Payment," of the Standard Specifications and these special provisions.

Full compensation for the cost of splicing precast prestressed concrete piling, including furnishing of dowels, epoxy or epoxy mortar, and miscellaneous metal, shall be considered as included in the contract price paid per linear foot for furnish concrete piling, and no additional compensation will be allowed therefor.

Full compensation for redriving monitored piles, for dewatering during monitoring, and for installing and removing the instruments from the pile shall be considered as included in the contract unit price paid for drive pile, and no separate payment will be made therefor. The length of piling to be paid for as furnish piling of the classes listed in the Engineer's Estimate shall include the lengths that monitored piles are redriven.

Full compensation for driving system submittals shall be considered as included in the contract unit price paid for drive pile, and no additional compensation will be allowed therefor.

10-1.39 LIGHTWEIGHT CELLULAR CONCRETE

GENERAL

Summary

This work includes furnishing and placing lightweight cellular concrete to the lines, grades, and dimensions shown on the plans, in accordance with the Standard Specifications, these special provisions and as directed by the Engineer.

Submittals

The Contractor shall furnish a mix design, which will produce a cast density (at point of placement):

Minimum Cast Density	35pcf
Maximum Cast Density	40pcf

Minimum Compressive Strength at 28 days: 80 psi for trench backfill material, 120 psi for wall backfill and 160 psi for foundation pad below the wall or structural shallow footing.

The Contractor shall provide the Engineer with a Work Plan of the equipment and procedures proposed at least 30 working days prior to placement; items in the submittal shall include:

1. Material list of items; manufacturer’s specifications;
2. Mix design(s), including laboratory data using the mix design verifying mass and strength requirements.

MATERIALS

A foaming agent shall be used and shall be tested in accordance with ASTM C 796. Mixing water shall be potable and free of deleterious amounts of acids, alkali, salts, oils, and organic materials which would adversely affect the setting or strength of the cellular concrete.

Portland cement shall comply with ASTM C150, Types I, II, III or V. Pozzolans and other cementitious materials may be used when specifically approved by the manufacturer of the foaming agent. Fly ash and natural pozzolans, if used, shall comply with the requirements of ASTM C618. Ground granulated blast furnace slag, if used, shall comply with the requirements of ASTM C989, Grade 100 or 120.

Admixtures for accelerating the set time may be used in accordance with the manufacturer's recommendations.

CONSTRUCTION

At the point of placement, the density shall be in accordance with the specified cast density. A single cast density test shall represent the lesser of 300 cubic yards or one day's production.

The compressive strength shall be tested in accordance with ASTM C 495 except as follows:

1. Unless otherwise approved by the Engineer, the specimens shall be 3-inch by 6-inch cylinders. During molding, place the concrete in two approximately equal layers, and raise and drop the cylinders approximately 1 inch three times on a hard surface or lightly tap the side or bottom of the cylinder to close any accidental entrained air. Do not rod the material in the cylinder.
2. Specimens shall be covered and protected immediately after casting to prevent damage and loss of moisture. Specimens shall be moist cured in the molds for a period of 7 days and air dry a minimum of 24 hours and maximum of 3 days prior to the 28-day compressive strength test. Specimens shall not be oven dried.

Cellular concrete shall be placed to the designated dimensions as specified in Sections 19-1.03, "Grade Tolerance."

Lift thickness for lightweight cellular concrete shall not exceed 2-4 feet as directed by the Engineer. If more than one lift is required, the layer to receive the next lift shall be scarified with a broom or rake to provide surface roughness. After curing for 12 hours, any crumbling or weak area on the surface should be removed and scarified before the next layer is placed. Surface stepping shall be limited to 5 inches. Grades of up to 5 percent may be made by adding a thickening agent to the mix, in conformance with the manufacturer's recommendations. The lineal length of the lightweight cellular concrete shall not exceed 100 ft for each lift. The next adjacent cellular concrete section shall be placed after a minimum of 12 hours following the prior section is cured.

A minimum 12 hours waiting time between lifts shall be required as directed by the Engineer and in accordance with approved mix design. If ambient temperatures are anticipated to be below 40^{o} Fahrenheit within 24 hours after placement, the mixing water should be heated when specifically approved by the manufacturer of the foaming agent, or placement shall be prohibited during such period. Placement shall not be allowed on frozen ground.

Cellular concrete shall be job site batched, mixed with the foaming agent, and placed with specialized equipment certified by the manufacturer. Cement and water may be premixed and delivered to the site; and foam shall be added at the site. Slurry coats and multilayer casting are acceptable methods of installation. Subgrade to receive lightweight cellular concrete shall be free of all loose and extraneous material. Subgrade shall be uniformly moist, and any excess water standing on the surface shall be removed prior to placing cellular concrete.

After acceptance by the Engineer of the final lift of cellular concrete, the exposed surface of shall be covered with a prime coat to protect the material from damage. The prime coat shall conform to the requirements in Section 94, "Asphaltic Emulsions," of the Standard Specifications. A prime coat of SS-1 shall be applied uniformly at a rate of between 0.15 and 0.25 gallons per square-yard, with the exact rate determined by the Engineer.

MEASUREMENT AND PAYMENT

Quantities for lightweight cellular concrete will be measured by cubic yard, to the lines and grade shown on the plans and as directed by the Engineer.

The contract price paid per cubic yard for lightweight cellular concrete shall include full compensation for furnishing all labor, materials (including furnishing and applying the prime coat), tools, equipment, and incidentals, and for doing all the work involved in furnishing and placing, the cellular concrete, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for providing the work plan including the formwork involved in placing the lightweight cellular concrete shall be considered as included in the contract price paid per cubic yard for lightweight cellular concrete and no separate payment will be made therefore.

10-1.40 ROADSIDE SIGNS

Roadside signs shall be furnished and installed at the locations shown on the plans or where designated by the Engineer and in conformance with the provisions in Section 56-2, "Roadside Signs," of the Standard Specifications and these special provisions.

The Contractor shall furnish roadside sign panels in conformance with the provisions in "Furnish Sign" of these special provisions.

Wood posts shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications and AWPA Use Category System: UC4A, Commodity Specification A or B.

Type N (CA), Type P (CA), and Type R (CA) marker panels mounted on a post with a roadside sign shall be considered to be sign panels and will not be paid for as markers.

10-1.41 FURNISH SIGN

Signs shall be fabricated and furnished in accordance with details shown on the plans, the Traffic Sign Specifications, and these special provisions.

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional

Traffic Sign Specifications for California sign codes are available for review at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

Traffic Sign Specifications for signs referenced with Federal MUTCD sign codes can be found in Standard Highway Signs Book, administered by the Federal Highway Administration, which is available for review at:

http://mutcd.fhwa.dot.gov/ser-shs_millennium.htm

Information on cross-referencing California sign codes with the Federal MUTCD sign codes is available at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

Temporary or permanent signs shall be free from blemishes that may affect the serviceability and detract from the general sign color and appearance when viewing during daytime and nighttime from a distance of 25 feet. The face of each finished sign shall be uniform, flat, smooth, and free of defects, scratches, wrinkles, gel, hard spots, streaks, extrusion marks, and air bubbles. The front, back, and edges of the sign panels shall be free of router chatter marks, burns, sharp edges, loose rivets, delaminated skins, excessive adhesive over spray and aluminum marks.

QUALITY CONTROL FOR SIGNS

The requirements of "Quality Control for Signs" in this section shall not apply to construction area signs.

No later than 14 days before sign fabrication, the Contractor shall submit a written copy of the quality control plan for signs to the Engineer for review. The Engineer will have 10 days to review the quality control plan. Sign fabrication shall not begin until the Engineer approves the Contractor's quality control plan in writing. The Contractor shall submit to the Engineer at least 3 copies of the approved quality control plan. The quality control plan shall include, but not be limited to the following requirements:

A. Identification of the party responsible for quality control of signs,
B. Basis of acceptance for incoming raw materials at the fabrication facility,
C. Type, method and frequency of quality control testing at the fabrication facility,
D. List (by manufacturer and product name) of process colors, protective overlay film, retroreflective sheeting and black non-reflective film,
E. Recommended cleaning procedure for each product, and
F. Method of packaging, transport and storage for signs.

No legend shall be installed at the project site. Legend shall include letters, numerals, tildes, bars, arrows, route shields, symbols, logos, borders, artwork, and miscellaneous characters. The style, font, size, and spacing of the legend shall conform to the Standard Alphabets published in the FHWA Standard Highway Signs Book. The legend

shall be oriented in the same direction in accordance with the manufacturer's orientation marks found on the retroreflective sheeting.

On multiple panel signs, legend shall be placed across joints without affecting the size, shape, spacing, and appearance of the legend. Background and legend shall be wrapped around interior edges of formed panel signs as shown on plans to prevent delamination.

The following notation shall be placed on the lower right side of the back of each sign where the notation will not be blocked by the sign post or frame:

A. PROPERTY OF STATE OF CALIFORNIA,
B. Name of the sign manufacturer,
C. Month and year of fabrication,
D. Type of retroreflective sheeting, and
E. Manufacturer's identification and lot number of retroreflective sheeting.

The above notation shall be applied directly to the aluminum sign panels in 1/4-inch upper case letters and numerals by die-stamp and applied by similar method to the fiberglass reinforced plastic signs. Painting, screening, or engraving the notation will not be allowed. The notation shall be applied without damaging the finish of the sign.

Signs with a protective overlay film shall be marked with a dot of 3/8 inch in diameter. The dot placed on white border shall be black, while the dot placed on black border shall be white. The dot shall be placed on the lower border of the sign before application of the protective overlay film and shall not be placed over the legend and bolt holes. The application method and exact location of the dot shall be determined by the manufacturer of the signs.

For sign panels that have a minor dimension of 48 inches or less, no splice will be allowed in the retroreflective sheet except for the splice produced during the manufacturing of the retroreflective sheeting. For sign panels that have a minor dimension greater than 48 inches, only one horizontal splice will be allowed in the retroreflective sheeting.

Unless specified by the manufacturer of the retroreflective sheeting, splices in retroreflective sheeting shall overlap by a minimum of one inch. Splices shall not be placed within 2 inches from edges of the panels. Except at the horizontal borders, the splices shall overlap in the direction from top to bottom of the sign to prevent moisture penetration. The retroreflective sheeting at the overlap shall not exhibit a color difference under the incident and reflected light.

Signs exhibiting a significant color difference between daytime and nighttime shall be replaced immediately.

Repairing sign panels will not be allowed except when approved by the Engineer.

The Department will inspect signs at the Contractor's facility and delivery location, and in accordance with Section 6, "Control of Materials," of the Standard Specifications. The Engineer will inspect signs for damage and defects before and after installation.

Regardless of kind, size, type, or whether delivered by the Contractor or by a common carrier, signs shall be protected by thorough wrapping, tarping, or other methods to ensure that signs are not damaged by weather conditions and during transit. Signs shall be dry during transit and shipped on palettes, in crates, or tier racks. Padding and protective materials shall be placed between signs as appropriate. Finished sign panels shall be transported and stored by method that protects the face of signs from damage. The Contractor shall replace wet, damaged, and defective signs.

Signs shall be stored in dry environment at all times. Signs shall not rest directly on the ground or become wet during storage. Signs, whether stored indoor or outdoor, shall be free standing. In areas of high heat and humidity signs shall be stored in enclosed climate-controlled trailers or containers. Signs shall be stored indoor if duration of the storage will exceed 30 days.

Screen processed signs shall be protected, transported and stored as recommended by the manufacturer of the retroreflective sheeting.

When requested, the Contractor shall provide the Engineer test samples of signs and materials used at various stages of production. Sign samples shall be 12" x 12" in size with applied background, letter or numeral, and border strip.

The Contractor shall assume the costs and responsibilities resulting from the use of patented materials, equipment, devices, and processes for the Contractor's work.

SHEET ALUMINUM

Alloy and temper designations for sheet aluminum shall be in accordance with ASTM Designation: B 209.

The Contractor shall furnish the Engineer a Certificate of Compliance in conformance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the sheet aluminum.

Sheet aluminum shall be pretreated in accordance to ASTM Designation: B 449. Surface of the sheet aluminum shall be cleaned, deoxidized, and coated with a light and tightly adherent chromate conversion coating

free of powdery residue. The conversion coating shall be Class 2 with a weight between 10 milligrams per square foot and 35 milligrams per square foot, and an average weight of 25 milligrams per square foot. Following the cleaning and coating process, the sheet aluminum shall be protected from exposure to grease, oils, dust, and contaminants.

Sheet aluminum shall be free of buckles, warps, dents, cockles, burrs, and defects resulting from fabrication.

Base plate for standard route marker shall be die cut.

RETROREFLECTIVE SHEETING

The Contractor shall furnish retroreflective sheeting for sign background and legend in conformance with ASTM Designation: D 4956 and "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Retroreflective sheeting shall be applied to sign panels as recommended by the retroreflective sheeting manufacturer without stretching, tearing, and damage.

Class 1, 3, or 4 adhesive backing shall be used for Type II, III, IV, VII, VIII, and IX retroreflective sheeting. Class 2 adhesive backing may also be used for Type II retroreflective sheeting. The adhesive backing shall be pressure sensitive and fungus resistant.

When the color of the retroreflective sheeting determined from instrumental testing is in dispute, the Engineer's visual test will govern.

PROCESS COLOR AND FILM

The Contractor shall furnish and apply screened process color, non-reflective opaque black film, and protective overlay film of the type, kind, and product that are approved by the manufacturer of the retroreflective sheeting.

The Contractor shall furnish the Engineer a Certificate of Compliance in accordance to Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the screened process color, non-reflective opaque black film, and protective overlay film.

The surface of the screened process color shall be flat and smooth. When the screened process colors determined from the instrumental testing in accordance to ASTM Designation: D 4956 are in dispute, the Engineer's visual test will govern.

The Contractor shall provide patterns, layouts, and set-ups necessary for the screened process.

The Contractor may use green, red, blue, and brown reverse-screened process colors for background and non-reflective opaque black film or black screened process color for legend. The coefficient of retroreflection for reverse-screened process colors on white retroreflective sheeting shall not be less than 70 percent of the coefficient of retroreflection specified in ASTM Designation: D 4956.

The screened process colors and non-reflective opaque black film shall have the same outdoor weatherability as that of the retroreflective sheeting.

After curing, screened process colors shall withstand removal when tested by applying 3M Company Scotch Brand Cellophane Tape No. 600 or equivalent tape over the color and removing with one quick motion at 90° angle.

SINGLE SHEET ALUMINUM SIGN

Single sheet aluminum signs shall be fabricated and furnished with or without frame. The Contractor shall furnish the sheet aluminum in accordance to "Sheet Aluminum" of these special provisions. Single sheet aluminum signs shall be fabricated from sheet aluminum alloy 6061-T6 or 5052-H38.

Single sheet aluminum signs shall not have a vertical splice in the sheet aluminum. For signs with depth greater than 48 inches, one horizontal splice will be allowed in the sheet aluminum.

Framing for single sheet aluminum signs shall consist of aluminum channel or rectangular aluminum tubing. The framing shall have a length tolerance of ±1/8 inch. The face sheet shall be affixed to the frame with rivets of 3/16-inch diameter. Rivets shall be placed within the web of channels and shall not be placed less than 1/2 inch from edges of the sign panels. Rivets shall be made of aluminum alloy 5052 and shall be anodized or treated with conversion coating to prevent corrosion. The exposed portion of rivets on the face of signs shall be the same color as the background or legend where the rivets are placed.

Finished signs shall be flat within a tolerance of ±1/32 inch per linear foot when measured across the plane of the sign in all directions. The finished signs shall have an overall tolerance within ±1/8 inch of the detailed dimensions.

Aluminum channels or rectangular aluminum tubings shall be welded together with the inert gas shielded-arc welding process using E4043 aluminum electrode filler wires as shown on the plans. Width of the filler shall be equal to wall thickness of smallest welded channel or tubing.

MEASUREMENT AND PAYMENT

Furnishing signs (except for construction area signs) will be measured by the square foot and the quantity to be paid for will be the total area, in square feet, of the sign panel types installed in place.

The contract price paid per square foot for furnish sign of the types specified in the Engineer's estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in fabricating and furnishing the signs, including fastening hardware, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing and installing protective overlay on signs shall be considered as included in the contract price paid per square foot for furnish sign of the various types and no separate payment will be made therefor.

10-1.42 ALTERNATIVE PIPE

Alternative pipe culverts must comply with Section 62, "Alternative Culverts," of the Standard Specifications.

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

10-1.43 PLASTIC PIPE

Plastic pipe shall conform to the provisions in Section 64, "Plastic Pipe," of the Standard Specifications and these special provisions.

10-1.44 REINFORCED CONCRETE PIPE

Reinforced concrete pipe shall conform to the provisions in Section 65, "Reinforced Concrete Pipe," of the Standard Specifications and these special provisions.

GENERAL

Where embankment will not be placed over the top of the pipe, a relative compaction of not less than 85 percent shall be required below the pipe spring line for pipe installed using Method 1 backfill in trench, as shown on Standard Plan A62D. Where the pipe is to be placed under the traveled way, a relative compaction of not less than 90 percent shall be required unless the minimum distance between the top of the pipe and the pavement surface is the greater of 4 feet or one half of the outside diameter of the pipe.

Except as otherwise designated by classification on the plans or in the specifications, joints for culvert and drainage pipes shall conform to the plans or specifications for standard joints.

MATERIALS

The concrete for reinforced concrete pipe shall contain not less than 470 pounds of cementitious material per cubic yard and have a water–cementitious material ratio that does not exceed 0.40 by weight. Supplementary cementitious material is optional. Reinforcement shall have a minimum cover of 1 inch.

MEASUREMENT AND PAYMENT

The Department does not pay any additional cost for use of optional supplementary cementitious material.

The Department does not pay any additional cost for excess concrete cover over steel reinforcement.

10-1.45 DRAINAGE INLET MARKER

GENERAL

Summary

This work includes installing drainage inlet markers.

Use only the type of drainage inlet marker shown on the project plans. If the project plans do not show a specific type, choose one type from the following list:

1. Thermoplastic

2. Metal medallion
3. Plastic medallion
4. Stamped concrete

Submittals

If you are using a prefabricated drainage inlet marker such as thermoplastic, metal medallion, or plastic medallion, submit a sample of marker at least 5 business days before installation.

If you are using a concrete stamp for the drainage inlet marker, submit a sample of the stamp at least 5 business days before concrete activities start.

Submit a Certificate of Compliance as specified in Section 6-1.07, "Certificates of Compliance" of the Standard Specifications for prefabricated drainage inlet marker.

MATERIALS

Thermoplastic drainage inlet marker must:

1. Be free of lead and chromium
2. Comply with the following:

Property	Specifications	Requirements
Thickness, inches	Measured	0.080-0.160
Legend color (non-reflective)	Observed	Blue or Green
Background color (non-reflective)	AASHTO M 249	White
Skid Resistance	ASTM E 303	60 BPN

Metal drainage inlet marker must:

1. Be commercial grade stainless steel, aluminum, brass, or bronze
2. Be stamped from sheet metal or cast
3. Comply with the following:

Property	Specifications	Requirements
Thickness of metal, inches	Measured	0.055-0.138
Height of marker, inches	Measured	0.055-0.138
Skid Resistance	ASTM E 303	60 BPN

4. If metal marker is colored, it must comply with the following:

Property	Specifications	Requirements
Legend color (non-reflective)	Observed	Blue or Green
Background color (non-reflective)	Observed	White or bare metal

Plastic drainage inlet marker must:

1. Contain ultraviolet inhibitors
2. Comply with the following:

Property	Specifications	Requirements
Thickness, inches	Measured	0.025-0.060
Thickness (with dome), inches	Measured	0.055-0.120
Legend color (non-reflective)	Observed	Blue or Green
Background color (non-reflective)	Observed	White
Weathering Resistance	ASTM D1435	1 year without yellowing, fogging, or pitting

CONSTRUCTION

Install prefabricated drainage inlet markers by:

1. Mechanically cleaning and preparing the surface
2. Attaching the prefabricated drainage inlet markers to the surface with adhesives, fasteners, or heat as recommended by the manufacturer

Install stamped concrete drainage inlet markers by:

1. Imprinting uncured concrete with an approved drainage inlet marker concrete stamp
2. Producing stamped concrete surfaces that are free from blemishes

MEASUREMENT AND PAYMENT

Drainage inlet marker is measured as units determined from actual count in place.

The contract price paid for drainage inlet marker includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing drainage inlet markers, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.46 MISCELLANEOUS CONCRETE CONSTRUCTION

Concrete curb, and concrete apron and concrete transition apron shall conform to the provisions in Section 73, "Concrete Curbs and Sidewalks," of the Standard Specifications and these special provisions.

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional

10-1.47 MISCELLANEOUS IRON AND STEEL

Miscellaneous iron and steel shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

10-1.48 SECURITY METAL FENCE AND GATES

GENERAL

Summary

Security metal fence and gates shall conform to the details shown on the plans and the provisions in Section 80, "Fences," Section 75, "Miscellaneous Metal," and Section 90, "Portland Cement Concrete," of the Standard Specifications and Section 12-16, "Electrical" of these special provisions.

Submittals

Submit the following for the Engineer's approval:

1. Working drawings include:
    1.1. The layout, dimensions, spacing and layout of components inclusive of detector loops, digital card readers, electromagnetic lock sets, gate operators, interface with electric gate operator, interface with access control panel, gate programming, and anchorage and installation details.
    1.2. The detail of rollers, wheels, latches, guides, inverted "V" track, latch and locking components, and other required appurtenances
2. Sample: A minimum 8" x 10" sample of the fence panel with the color black coating.
3. Product data: Manufacturer's descriptive data and specifications, anchor details and installation instructions for products, electrical/electronic hardware and software, and accessories used in security metal fence and gates

4. Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the security metal fence and gates, which are the security metal swing gate, and security metal slide gate. The certificate shall state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in conformance with the details shown on the plans, the Standard Specifications, and these special provisions.

LEED Submittals

1. MR Credit 4.1 and 4.2, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).
2. MR Credit 5.1 and 5.2, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

Quality Control and Assurance

LEED:

MR Credit 4.1 and 4.2, Recycled Content: Use materials with recycled content, to contribute toward achieving MR Credit 4.1 and 4.2.

MATERIALS

The Contractor shall verify metal work dimensions by field measurements before fabrication.

Security metal fence and gate panels and posts

Security metal fence and gate panels and posts shall be hot-dip galvanized to 1.25 ounces per square foot minimum zinc coating in accordance with ASTM A123, shall be finished with a fused coating of electrostatically applied polyester powder paint not less than 2 mils, except large gate panels shall be coated with 2-part polyurethane coating.

The color shall be black.

Polyester Powder Coating

Powder coating shall be electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.

Property	Test Method	Performance Requirement
Minimum hardness	ASTM D3363	2H
Direct impact resistance	ASTM D2794:	Withstand 160 inch-pounds
Salt spray resistance	ASTM B117	No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 °F and 95 percent relative humidity and after 1000 hours less than 3/16 inch undercutting.
Weatherability	ASTM D822	No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.

Polyurethane Coating

Coating shall be 1.0 mil dry film thickness of coating of steel test panel cured 30 minutes at 180 degree F and aged 14 days shall resist the following test conditions without failure:

Test	Condition
5 percent salt spray	for 500 hours.
100 percent relative humidity	for 1000 hours.
Water immersion	for 100 hours
Exposure to chemicals	20 double rubs with cloth saturated with either lacquer thinner, acetone, MEK, gasoline, xylene.
Hardness	H to 2H
Flexibility	3 mm conical mandrel.
Temperature Differential	16 cycles of 24 hours at 100 percent humidity, 24 hours at 10 °F, and 24 hours at 77 degrees F.

Hinges, hasps, locks, and closing and locking hardware shall be preapproved by the Engineer

Grout shall be erosion control anchoring cement, factory packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at a project site to create pourable anchoring, patching and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended for exterior use.

Security Metal Gates

Hinges, hasps, locks, and closing and locking hardware shall be preapproved by the Engineer

The gate latch shall meet accessibility requirements of the Americans with Disabilities Act.

The cane bolts shall be stainless steel.

All metal fabrications shall be provided with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names or roughness.

All bolts and nuts shall be hot-dipped galvanized or stainless steel.

Gates shall be equipped with manufacturer's standard hardware as required for complete functional operation:

1. Security metal swing gate

    1.1. Hinged Swinging Gates: shall be welded frame fabricated from steel tubing with open grille steel panels to match fencing material. Nominal size shall be as indicated on the drawings.

    1.2. Hardware:

        2.1. Hinges: Size and type as determined by manufacturer. Provide 2 hinges for each leaf up to 6 feet high and one additional hinge for each additional 24 inches in height or fraction thereof.

        2.2. Latches: Latch shall be 3/4-inch diameter slide bolt to accommodate padlock. Double gates shall be provided with pad lockable, 5/8 inch diameter center cane bolt assembly and strike.

        2.3. Electromagnetic locking device for swing gate shall be vandal resistance electromagnetic lock with no moving parts for outdoor application complete with electromagnetic lock and armature mounting brackets. The electromagnetic lock shall be unlockable by an access card reader system. The electromagnetic lock shall meet the following requirements:

            2.3.1. 1200 Lb minimum holding force.
            2.3.2. Built-in electrical enclosure for electromagnetic locking device with predrilled and tapped conduit holes where required.
            2.3.3. Steel predrilled and tapped lock and armature mounting brackets.
            2.3.4. Operating voltage to match access control system supplied voltage.
            2.3.5. Suitable for face mounting using Z brackets.
            2.3.6. Quick release "pop" button on armature.
            2.3.7. Built-in signaling system to indicate the status of the electromagnetic lock; secure or unsecured.

2. Security Metal Sliding Gates:

2.1. Security Metal Sliding gates shall be a Cantilevered Horizontal Sliding Gate Type. Construction shall be of custom fabricated welded frame fabricated from steel tubing. Infill panels shall be fabricated from steel cold rolled perforated metal, cold-rolled steel sheet, (ASTM A 1008/A 1008M), in square, straight row hole pattern, 14-gage minimum thickness, with 56% maximum open area. Frame configuration shall be as indicated on approved working drawings. Nominal size, gate opening, and overhang distance shall be as indicated on drawings. Support posts with concrete footing shall be a pair of round tubular steel posts with solid cap meeting functional and aesthetic performance requirements.

2.2. Cantilever Mechanism: The cantilever mechanism shall be aluminum top track and wheeled carriers and bottom roller guides supported by brackets attached to support posts.

2.3. Sliding Gate Operator System: Sliding gate operator system shall consists of a gate operator with fully programmable microprocessor based control system inclusive of all hardware and software, printed circuit board for performing various functions, vehicle loop detectors, gate digital card reader with stand, and appurtenances not specified here but necessary for the sliding gate operation. The gate operator system shall communicate the gate open/close sequence and gate status and authorized/un-authorized entry to the access control panel as specified under Section 12-16, "Electrical," of these special provisions

2.4. Gate Operator: The gate operator shall consist of electrical motor, mechanical or hydraulic driver, fully programmable microprocessor based logic controller inclusive of astronomical time clock system and required electrical/electronic appurtenances and devices, weathertight housing and necessary hardware to engage operator to the cantilevered horizontal sliding gate at the location shown on the plans. The gate operator shall be mounted on a heavy duty pedestal mounting stand. The gate operator shall be enclosed in a weatherproof enclosure and shall meet the following requirements:

2.4.1. Reversible motor designed for heavy duty and high frequency usage (30 open/close cycles per hour, minimum).
2.4.2. 208VAC (nominal), single phase operation.
2.4.3. Mechanical, electrical and thermal overload protection with automatic reset.
2.4.4. Gate travel speed: 10 inches/sec minimum.
2.4.5. Internal switch to override gate operation (open, close and stop gate).
2.4.6. Emergency release mechanism to allow the gate to be opened manually and capable of being locked in the engaged or disengaged position.
2.4.7. Positive stops shall be provided on the gate tracks as a backup to the limit switches.
2.4.8. Entrapment protection using a non-contact sensor (photo sensor).
2.4.9. Knox electric switch key, Model 3500 series, single key, as manufactured by Knox Company, 1601 W. Deer Valley Rd, Phoenix, AZ 85027; or equal.

2.5. Gate Digital Card Reader Unit Stand: Gate digital card reader with stand shall consist of 4"x4" steel tubing, wiring access holes, card readers mounting mechanism, and two card readers arranged in an manner as shown on plans.

2.6. Digital Card Reader: Digital card readers shall be as specified under card readers, under "Intrusion Alarm System and Access Control System," in Section 12-16, "Electrical," of these Special Provisions

2.7. Vehicle Loop Detectors: Vehicle loop detectors and asphaltic concrete sealant for inductive detector loop for gate operators shall conform to the provisions in Section 86-5, "Detectors," of the Standard Specifications. Size and number of vehicle loop detectors shall be as required by the gate operator manufacturer.

2.8. Electromagnetic Lock: Electromagnetic locking device for sliding gate shall be vandal resistance electromagnetic lock with no moving parts for outdoor application complete with lock and armature mounting brackets. The electromagnetic lock shall meet the following requirements:

2.8.1. 1200 lbs minimum holding force.
2.8.2. Built-in electrical enclosure for electromagnetic locking device with predrilled and tapped conduit holes where required.
2.8.3. Steel predrilled and tapped lock and armature mounting brackets.
2.8.4. Voltage to match access control system supplied voltage.

2.8.5. Suitable for face mounting using Z brackets.
2.8.6. Quick release "pop" button on armature.
2.8.7. Built-in signaling system to indicate the status of the electromagnetic lock; secure or unsecured.
2.8.8. Compatible with the gate operator.

Fence and Gate Post Footing

Concrete post footings must be minor concrete and comply with the provisions under Section 90, "Portland Cement Concrete," of the Standard Specifications.

CONSTRUCTION

Security metal fence and gates shall be installed in accordance with approved working drawings and in conformance with the manufacturer's specifications.

Security Metal Fence

Fence posts shall be installed plumb and level by embedding post directly into concrete footing. Temporarily brace fence posts with 2 x 4 wood supports until concrete is set. Bent, bowed, or otherwise damaged panels shall not be used. Damaged components shall be removed from site and replaced. Fence panels shall be secured with stainless steel anti-intruder bolts to fence posts after posts have been set in footings.

Security Metal Swing Gate

Hinges, hasps, locks, and closing and locking hardware shall be installed per manufacturer's instructions

Gates shall be installed and hardware adjusted for smooth operation. Concrete surface for length of operation of V-wheeled rolling gate shall be provided. Track shall be anchored to concrete with countersunk fasteners. After installation, gates and gate operators shall be tested to ensure proper function. Gates shall be opened and closed a minimum of five times and deficiencies corrected and adjusted.

Electromagnetic lock set for swinging gates shall be securely fastened to the swinging gate post using the manufacturer supplied brackets. The armature is securely welded to the swinging gate frame and the electromagnetic lock set is securely welded to the stationary fence post. Card reader for the swing gate shall be installed in a manner as required by the manufacturer of the card reader and it must be accessible to pedestrian from both side of the travel way.

Security Metal Sliding Gates

The Contractor shall provide all necessary equipment and appurtenances not specified here but necessary for the sliding gate operation including foundations for the gate operator and install all equipment as recommended by the manufacturer for the complete operation of the gate operator system. Any driver sitting in their vehicle shall be able to use the gate digital card readers without exiting the vehicle.

Electromagnetic lock set shall be securely fastened to the sliding gate post using the manufacturer supplied brackets. The armature is securely welded to the moving gate frame and the magnetic lock set is securely welded to the stationary fence post.

The vehicle loop detectors installation shall be in accordance with Section 86-5.01(A), "Installation Details", of the standard specifications.

Operations

Sliding Gate Operator System

When an authorized access card is scanned on digital card reader and the entry loop detector is actuated, the sliding gate shall open for as long as the safety loops are occupied. Any following actuations of the entry loop detector while the sliding gate is open shall reset the closing timer. Once the sliding gate resumes its closing operation, only the actuation of the safety loop detector or the scanning of an authorized access cards shall reverse the sliding gate movement.

Exit from the facility by vehicle shall be automatic via exit loop detectors. Any subsequent actuations of the exit loop detector while the sliding gate is open shall reset the closing timer. Actuation of the safety loop detector shall reverse the sliding gate movement. If the exit loop is energized for an extended length of time (field adjustable time), then an alarm should sound to indicate such event for as long as the alarm is acknowledged and reset.

SwingGate System

When an authorized card only is slid in front of the digital card reader, the swing gate shall open by de-energizing the electromagnetic lock. Once the entry has taken place and gate is closed then magnetic lock holder shall keep the gate locked until the next entry.

Programming

The sliding gate and swing gate shall have the following pre-programmed scheduled operation into the gate system:

1 Schedule A to allow uncontrolled entries during regular business hours and controlled entries during non-working hours, holidays, and weekends.
2. Schedule B to allow controlled entries at all time.

The working hours, non-working hours, and holidays schedule will be provided to the contractor during construction. In addition, the preferred schedule of operation of the entry gate system will also be provided to the contractor during testing.

Testing

After completion, the entire entry gate system shall be tested for proper operation in the presence of the engineer. Both operating schedules shall be demonstrated for proper functioning and then the entry gate system shall be put into operation for acceptance testing with the preferred schedule as determined by the Engineer. The acceptance test shall consists of 5 days of trouble free operation. In the event the gate operating system fails for any reason, the problem shall be fixed and the system shall be tested again as described under acceptance testing above.

During both swingand sliding gate operation and for each authorized opening, both sliding and swing gates operating system shall provide feedback to the access control panel which will then generate an alarm for any un-authorized access and will keep history for all the authorized entries.

Touch-Up

All exposed welds shall be finished and surfaces smoothed and blended such that surfaces match those of adjacent surfaces.

After erecting all metal work, any abrasions of the galvanized or exposed steel including damaged finish shall be repaired and touched-up with paint supplied by manufacturer and matching original coating

MEASUREMENT AND PAYMENT

The contract price paid per linear foot for security metal fence shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing of security metal fence, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for security metal swing gate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing of the security metal swing gate including electrical/electronic hardware and software, and accessories, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for security metal sliding gate of various sizes as listed in the Bid Item List shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing of the security metal sliding gate including electrical/electronic hardware and software, and accessories, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.49 THERMOPLASTIC TRAFFIC STRIPE AND PAVEMENT MARKING

Thermoplastic traffic stripes (traffic lines) and pavement markings shall be applied in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

For each batch of thermoplastic material for traffic stripes and pavement markings, the Contractor shall submit to the Engineer:

1. Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications
2. Department's Materials Engineering and Testing Services notification letter stating that the material is approved for use
3. Material Safety Data Sheet

Thermoplastic material shall be free of lead and chromium, and shall conform to the requirements in State Specification PTH-02ALKYD.

Within 14 days of applying a thermoplastic traffic stripe or pavement marking, the retroreflectivity of the traffic stripe or pavement marking shall be a minimum of 250 millicandelas per square meter per lux for white, and 150 millicandelas per square meter per lux for yellow. The Contractor shall test the retroreflectivity under ASTM E 1710.

Where striping joins existing striping, as shown on the plans, the Contractor shall begin and end the transition from the existing striping pattern into or from the new striping pattern a sufficient distance to ensure continuity of the striping pattern.

Thermoplastic traffic stripes shall be applied at the minimum thickness and application rate as specified below. The minimum application rate is based on a solid stripe of 4 inches in width.

Minimum Stripe Thickness (inch)	Minimum Application Rate (lb/ft)
0.079	0.27

Thermoplastic traffic stripes and pavement markings shall be free of runs, bubbles, craters, drag marks, stretch marks, and debris.

At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of the thermoplastic traffic stripes and pavement markings specified herein. Permanent tape, if used, shall be installed in conformance with the manufacturer's specifications.

If permanent tape is placed instead of thermoplastic traffic stripes and pavement markings, the tape will be measured and paid for by the linear foot as thermoplastic traffic stripe and by the square foot as thermoplastic pavement marking.

10-1.50 PARKING BUMPER

Parking bumpers shall be furnished and installed at the locations and in the manner shown on the plans.

Parking bumpers shall be precast with concrete and reinforcing steel as shown on the plans. Concrete shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications. Concrete shall contain not less than 472 pounds of cementitious material per cubic yard. Parking bumpers may be commercially available precast concrete bumpers conforming to the details shown on the plans. Minor variations in cross section dimensions will be acceptable in commercially available units.

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional

Dowels shall be commercial quality reinforcing steel or mild steel rods.

Parking bumpers will be measured by the unit as determined from actual count in place.

The contract unit price paid for parking bumper (precast concrete) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing precast concrete parking bumpers, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

10-1.51 PAVEMENT MARKERS

Pavement markers shall be placed in conformance with the provisions in Section 85, "Pavement Markers," of the Standard Specifications and these special provisions.

The Contractor shall furnish the Engineer certificates of compliance for the pavement markers in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Retroreflective pavement markers shall be marked as abrasion resistant on the body of the markers.

SECTION 10-2 HIGHWAY PLANTING AND IRRIGATION SYSTEMS

10-2.01 GENERAL

The work performed in connection with highway planting and irrigation systems shall conform to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications and these special provisions.

The Contractor shall notify the Engineer not less than 72 hours prior to requiring initial access to the existing irrigation controllers. When the Engineer determines that access to the controllers is required at other times, arrangements will be made to provide this access.

When fluctuations of water pressure and water supply are encountered during normal working hours, plants shall be watered at other times, as often, and in sufficient amounts as conditions may require to keep the soil and plant roots moist during the life of the contract.

Full compensation for watering plants outside normal working hours shall be considered as included in the contract lump sum prices paid for highway planting and plant establishment work and no additional compensation will be allowed therefor.

PROGRESS INSPECTIONS

Progress inspections will be performed by the Engineer for completed highway planting and irrigation system work at designated stages during the life of the contract.

Progress inspections will not relieve the Contractor of responsibility for installation in conformance with the special provisions, plans and Standard Specifications. Work within an area shall not progress beyond each stage until the inspection has been completed, corrective work has been performed, and the work is approved, unless otherwise permitted by the Engineer.

The requirements for progress inspections will not preclude additional inspections of work by the Engineer at other times during the life of the contract.

The Contractor shall notify the Engineer, in writing, at least 4 working days prior to completion of the work for each stage of an area and shall allow a minimum of 3 working days for the inspection.

Progress inspections will be performed at the following stages of work:

A. During pressure testing of the pipelines on the supply side of control valves.
B. During testing of low voltage conductors.
C. Before planting begins and after completion of the work specified for planting in Section 20-4.03, "Preparing Planting Areas," of the Standard Specifications.
D. Before plant establishment work begins and after completion of the work specified for planting in Section 20-4.05, "Planting," of the Standard Specifications.
E. At intervals of one month during the plant establishment period.

COST BREAK-DOWN

The Contractor shall furnish the Engineer a cost break-down for the contract lump sum items of highway planting and irrigation system. Cost break-down tables shall be submitted to the Engineer for approval within 15 working days after the contract has been approved. Cost break-down tables will be approved, in writing, by the Engineer before any partial payment will be made for the applicable items of highway planting and irrigation system involved.

Cost break-downs shall be completed and furnished in the format shown in the samples of the cost break-downs included in this section. Line item descriptions of work shown in the samples are the minimum to be submitted. Additional line item descriptions of work may be designated by the Contractor. If the Contractor elects to designate additional line item descriptions of work, the quantity, value and amount for those line items shall be completed in the same manner as for the unit descriptions shown in the samples. The line items and quantities given in the samples are to show the manner of preparing the cost break-downs to be furnished by the Contractor.

The Contractor shall determine the quantities required to complete the work shown on the plans. The quantities and their values shall be included in the cost break-downs submitted to the Engineer for approval. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-downs submitted for approval.

The sum of the amounts for the line items of work listed in each cost break-down table for highway planting and for irrigation system work shall be equal to the contract lump sum price bid for Highway Planting and Irrigation

System, respectively. Overhead and profit shall be included in each individual line item of work listed in a cost break-down table.

No adjustment in compensation will be made in the contract lump sum prices paid for highway planting and irrigation system due to differences between the quantities shown in the cost break-downs furnished by the Contractor and the quantities required to complete the work as shown on the plans and as specified in these special provisions.

Individual line item values in the approved cost break-down tables will be used to determine partial payments during the progress of the work and as the basis for calculating an adjustment in compensation for the contract lump sum items of highway planting and irrigation system due to changes in line items of work ordered by the Engineer. When the total of ordered changes to line items of work increases or decreases the lump sum price bid for either Highway Planting or Irrigation System by more than 25 percent, the adjustment in compensation for the applicable lump sum item will be determined in the same manner specified for increases and decreases in the total pay quantity of an item of work in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

HIGHWAY PLANTING COST BREAK-DOWN

Contract No. 04-014084

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
ROADSIDE CLEARING	LS	LUMP SUM		
SOIL AMENDMENT	CY	795		
MULCH	CY	571		
COMMERCIAL FERTILIZER (SLOW RELEASE)	LB	204		
CULTIVATE	SQYD	7838		
PREPARE HOLE	EA	10202		
PLANT (GROUP A)	EA	2434		
PLANT (GROUP U)	EA	80		
PLANT (GROUP I)	EA	7688		
ROOT BARRIERS	EA	9		
STAKING - TREE	EA	160		
CONTROL AND NEUTRAL CONDUCTORS (ARMOR-CLAD)	LS	LUMP SUM		
1" ELECTRIC REMOTE CONTROL VALVE	EA	2		
1-1/4" ELECTRIC REMOTE CONTROL VALVE	EA	15		
1-1/2" ELECTRIC REMOTE CONTROL VALVE	EA	17		
40-STATION IRRIGTAION CONTROLLER (WALL MOUNTED)	EA	1		
IRRIGATION CONTROLLER ENCLOSURE CABINET	EA	1		
3/4" PLASTIC PIPE (SCH40) RECYCLED WATER SUPPLY LINE	LF	9042		
1" PLASTIC PIPE (SCH40) RECYCLED WATER SUPPLY LINE	LF	1185		
1-1/4" PLASTIC PIPE (SCH40) RECYCLED WATER SUPPLY LINE	LF	2019		
1-1/2" PLASTIC PIPE (SCH40) RECYCLED WATER SUPPLY LINE	LF	1340		
2" PLASTIC PIPE (PR315) RECYCLED WATER SUPPLY LINE	LF	2140		
3" PLASTIC PIPE (PR315) RECYCLED WATER SUPPLY LINE	LF	3153		
SPRINKLER (TYPE B-2)	EA	81		
SPRINKLER (TYPE B-4)	EA	2		

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
SPRINKLER (TYPE C-2)	EA	2577		
2" WYE STRAINER	EA	11		
1 1/4" BALL VALVE	EA	1		
2" BALL VALVE	EA	15		
3" GATE VALVE	EA	5		
3/4" QUICK COUPLING VALVE	EA	11		
VALVE BOX	EA	66		
SPRINKLER PROTECTOR (TYPE I)	EA	11		
RECYCLED WATER WARNING SIGNS	LS	LUMP SUM		

TOTAL _____

10-2.02 (BLANK)

10-2.03 EXISTING HIGHWAY PLANTING

In addition to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications, work performed in connection with existing highway planting shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

10-2.04 HIGHWAY PLANTING

The work performed in connection with highway planting shall conform to the provisions in Section 20-4, "Highway Planting," of the Standard Specifications and these special provisions.

10-2.05 MULCH

This work includes spreading mulch on embankment slopes, excavation slopes, and areas shown on the plans. Mulch must comply with Section 20-3, "Erosion Control," of the Standard Specifications.

If the slope on which the mulch is to be placed is finished during the rainy season as specified in "Water Pollution Control" of these special provisions, apply mulch immediately to the slope.

MATERIALS

Mulch

Mulch must be wood chips.

Commercial Fertilizer (Slow Release)

Commercial fertilizer (slow release) shall be a pelleted or granular form, shall be slow or controlled release with a nutrient release over an 8-month to 12-month period, and shall fall within the following guaranteed chemical analysis range:

Ingredient	Percentage
Nitrogen	16-21
Phosphoric Acid	6-8
Water Soluble Potash	4-10

ROADSIDE CLEARING

Before preparing planting areas, mulch areas, or commencing irrigation trenching operations for planting areas, trash and debris shall be removed from the entire highway right of way within the project limits as required under Construction Site Management of these special provisions.

The project area shall be cleared as specified herein:

A. Weeds shall be killed and removed within proposed ground cover areas and within the area extending beyond the outer limits of the proposed ground cover areas to the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, existing planting and fences. At those locations where proposed ground cover areas are 12 feet or more from the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, and fences, the clearing limit shall be 6 feet beyond the outer limits of the proposed ground cover areas.
B. Weeds shall be killed and removed within proposed mulch areas and within the area extending beyond the outer limits of the proposed mulch areas to the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, existing planting and fences. At those locations where proposed mulch areas are 12 feet or more from the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, and fences, the clearing limit shall be 6 feet beyond the outer limits of the proposed mulch areas.
C. Weeds shall be killed and removed within 2 feet of the edges of paved shoulders, dikes, curbs and sidewalks.
D. Weeds shall be killed and removed from within areas where asphalt concrete surfacing, portland cement concrete surfacing, rock blankets, graveled or decomposed granite areas are to be placed, and from within unpaved gore areas between the edge of pavement and planting areas as shown on the highway planting plans.
E. Disposal of weeds killed during the initial roadside clearing will not be required, unless otherwise directed by the Engineer. When directed by the Engineer, killed weeds shall be disposed of and the disposal will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

After the initial roadside clearing is complete, additional roadside clearing work shall be performed as necessary to maintain the areas, as specified above, in a neat appearance until the start of the plant establishment period. This work shall include the following:

A. Trash and debris shall be removed.
B. Rodents shall be controlled.
C. Weed growth shall be killed before the weeds reach the seed stage of growth or exceed 6 inches in length, whichever occurs first.
D. Weeds in plant basins, including basin walls, shall be removed by hand pulling, after the plants have been planted.

Weed Control

Weed control shall also conform to the following:

A. Stolon type weeds shall be killed with glyphosate.
B. Tumbleweeds shall be removed by hand pulling before the tumbleweeds reach a height of 6 inches.
C. Removed weeds and ground cover shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Roadside clearing work shall not include work required to be performed as clearing and grubbing as specified in Section 16, "Clearing and Grubbing," of the Standard Specifications.

PESTICIDES

Pesticides used to control weeds shall conform to the provisions in Section 20-4.026, "Pesticides," of the Standard Specifications. Except as otherwise provided in these special provisions, pesticide use shall be limited to the following materials:

Aminopyralid
Dithiopyr
Clopyralid MEA
Flumioxazin
Glyphosate
Imazapyr
Isoxaben (Preemergent)
Oryzalin (Preemergent)
Pendimethalin (Preemergent)

A granular preemergent may be used when applied to areas that will be covered with mulch, excluding plant basins. Granular preemergent shall be limited to the following material:

Oxadiazon

Granular preemergent shall be applied prior to the application of mulch. Mulch applications shall be completed in these areas on the same working day.

Glyphosate shall be used to kill stolon type weeds.

Prior to the application of preemergents, ground cover plants shall have been planted a minimum of 3 days and shall have been thoroughly watered.

A minimum of 100 days shall elapse between applications of preemergents.

Except for ground cover plants, preemergents shall not be applied within 18 inches of plants areas.

If the Contractor elects to request the use of other pesticides on this project, the request shall be submitted, in writing, to the Engineer not less than 15 days prior to the intended use of the other pesticides. Except for the pesticides listed in these special provisions, no pesticides shall be used or applied without prior written approval of the Engineer.

Pesticides shall not be applied within the limits of the plant basins. Pesticides shall not be applied in a manner that allows the pesticides to come in contact with the foliage and woody parts of the plants.

PREPARING PLANTING AREAS

Plants adjacent to drainage ditches shall be located so that after construction of the basins, no portion of the basin walls shall be less than the minimum distance shown on the plans for each plant involved.

CULTIVATE

Areas shown on the plans to be cultivated shall be cultivated.

Immediately prior to cultivation, soil amendment and commercial fertilizer shall be added to the areas to be cultivated. Soil amendment shall be added at the rate shown on the plans and commercial fertilizer shall be applied at the rate of 20 pounds per 1,000 square feet. Soil amendment and fertilizer shall be thoroughly mixed with the soil.

After cultivation is complete and the irrigation systems have been installed and the plant holes have been excavated and backfilled, no further planting work shall be done in the cultivated areas for a period of 15 days, except the soil shall be kept sufficiently moist to germinate weeds. Weeds that germinate shall be killed.

PLANTING

Backfill material for plant holes must be a mixture of soil and soil amendment. The quantity of soil amendment shall be as shown on the Plant List. Thoroughly mix backfill material and uniformly distribute throughout the entire depth of the plant hole without clods and lumps.

Apply or place commercial fertilizer (slow release) at the time of planting and at the rates shown on the Plant List.

Root protectors must conform to the provisions in "Root Protectors" of these special provisions.

Mulch placed in areas outside of plant basins shall be spread to a uniform depth.

Spread mulch from the outside of the proposed plant basin to the adjacent edges of shoulders, dikes, curbs, sidewalks, walls, fences, and existing plantings. If the proposed plant material is 12 feet or more from the adjacent

edges of shoulders, dikes, curbs, sidewalks, walls, fences, and other existing plantings, the mulch must be spread 6 feet beyond the outside edge of the proposed plant basins.

Do not place mulch within 4 feet of the centerline of earthen drainage ditches, within 4 feet of the edge of paved ditches, and within 4 feet of the centerline of drainage flow lines.

Attention is directed to "Irrigation Systems Functional Test" of these special provisions regarding functional tests of the irrigation systems. Do not perform planting in an area until the functional test has been completed for the irrigation system serving that area.

ROOT BARRIERS

Root barrier work shall consist of providing and installing root barriers for Plant (Group U) as shown on the plans and as specified in these special provisions.

Root barriers shall be an injection molded or extruded modular component made of high-density polypropylene or polyethylene plastic. Panels shall have a minimum thickness of 1/16 inch. Each panel shall have molded vertical ribs (four minimum) and locking strips or integral male/female sliding locks. Vertical root-deflecting ribs or channels shall be between 0.5 inch and 0.8 inch high, perpendicular to the panel, and between 6 inches and 8 inches apart. Panels shall be a minimum of 2 feet wide x 2 feet deep.

Root barriers shall be installed between proposed trees and curb as shown on the plans. Panels shall be installed flush with the finished grade and joined with locking strips or integral male/female sliding locks. Locking mechanism shall have a close tolerance to restrict slippage between panels. Barriers shall be installed with root deflectors facing inward.

PLANT ESTABLISHMENT WORK

The plant establishment period shall be Type 2 and shall not be less than 250 working days.

Attention is directed to "Relief From Maintenance and Responsibility" in these special provisions regarding relief from maintenance and protection.

Commercial fertilizer (slow release) shall be applied to trees, shrubs, vines and ground cover during the first week of March and October of each year. Commercial fertilizer shall be applied at the rates shown on the plans and shall be spread with a mechanical spreader wherever possible.

The center to center spacing of replacement plants for unsuitable ground cover plants shall be determined by the number of completed plant establishment working days at the time of replacement and the original spacing in conformance with the following:

ORIGINAL SPACING (Inches)	SPACING OF REPLACEMENT GROUND COVER PLANTS (Inches)		
	Number of Completed Plant Establishment Working Days		
	1-125	126-190	191-End of Plant Establishment
36	36	24	18

Weeds within plant basins, including basin walls and ground cover, shall be controlled by hand pulling.

Weeds within mulched and ground cover areas and outside of plant basins shall be controlled by killing.

Weeds within median areas, pavement, curbs, sidewalk, and other surfaced areas shall be controlled by killing.

Except as specified in these special provisions, disposal of mowed material will not be required unless ordered by the Engineer. Disposal of mowed material, as directed by the Engineer, will be paid for as extra work as provided in Section 4-1.03D,"Extra Work," of the Standard Specifications.

At the option of the Contractor, plants of a larger container size than those originally specified may be used for replacement plants during the first 125 working days of the plant establishment period.

After 125 working days of the plant establishment period have been completed, replacement of plants, except for ground cover plants, shall be one-gallon size for seedlings, pot and liner size plants; 5-gallon size for one-gallon size plants; 15-gallon size for 5-gallon size plants; and other plant replacement plants shall be the same size as originally specified.

When ordered by the Engineer, one application of a preemergent pesticide conforming to the provisions in "Pesticides" of these special provisions, shall be applied between 40 working days and 50 working days prior to completion of the plant establishment period. This work will be paid for as extra work as provided in Section 4-1.03D,"Extra Work," of the Standard Specifications.

Wye strainers shall be cleaned at least 15 days prior to the completion of the plant establishment period.

Previously installed filters shall be cleaned at least 15 days prior to the completion of the plant establishment period.

The final inspection shall be performed in conformance with the provisions in Section 5-1.13, "Final Inspection," of the Standard Specifications and shall be completed a minimum of 20 working days before the estimated completion of the contract.

10-2.06 IRRIGATION SYSTEMS

Irrigation systems shall be furnished and installed in conformance with the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications, except materials containing asbestos fibers shall not be used.

Method A pressure testing shall conform to the provisions in Section 20-5.03H(1), "Method A", of the Standard Specifications, except leaks that develop in the tested portion of the system shall be located and repaired after each test period when a drop of more than 5 pounds per square inch is indicated by the pressure gage. After the leaks have been repaired, the one hour pressure test shall be repeated and additional repairs made until the drop in pressure is 5 pounds per square inch or less.

Only pipeline trenches and excavation pits for supply lines being supplied from one water service point shall be open at one time. After pressure testing is complete, trenches and pits excavated for pipe supply lines, being supplied from one water service point, shall be backfilled prior to commencing excavations for pipe supply lines being supplied from another water service point.

VALVE BOXES

Valve boxes shall conform to the provisions in Section 20-2.24, "Valve Boxes," of the Standard Specifications, except as otherwise provided herein.

Valve boxes shall be precast portland cement concrete.

Covers for concrete valve boxes shall be glass fiber reinforced plastic.

Valve boxes shall be identified on the top surface of the covers by branding the appropriate abbreviations for the irrigation facilities contained in the valve boxes as shown on the plans. Valve boxes that contain remote control valves shall be identified by the appropriate letters and numbers (controller and station numbers). The letters and numbers shall be 2 inches in height.

BALL VALVES

Ball valves shall be furnished and installed as shown on the plans and in conformance with these special provisions.

Ball valves shall have a two-piece brass or bronze body, full port opening, and shall conform to the following:

Specification	Minimum Requirement
Non-shock cold water working pressure	400 psi
Seats	TFE (Teflon)
O-Ring Seals	TFE (Teflon)

Ball valves shall be of the same size as the pipeline which the valves serve, unless otherwise noted on the plans.

Ball valves shall be installed in a valve box.

GATE VALVES

Gate valves shall be as shown on the plans and in conformance with the provisions in Section 20-2.28, "Gate Valves," of the Standard Specifications and these special provisions.

Gate valves, smaller than 3 inches in size, shall be furnished with a cross-handle.

Gate valves, 3 inches and larger in size, shall be furnished with a square nut and 3 long shank keys that will operate the valve.

Gate valves, 3 inches and larger in size, shall be flanged type gate valves. Pipe flanges used to connect plastic or metal pipe to gate valves shall be plastic or metal.

Gate valves shall have a solid bronze or brass wedge.

ELECTRIC AUTOMATIC IRRIGATION COMPONENTS

Irrigation Controllers

Irrigation controllers shall be single, solid-state independent controllers conforming to the following:

A. Irrigation controllers shall be fully automatic and shall operate a complete 14-day or longer irrigation program.
B. A switch or switches shall be provided on the face of the control panel that will turn the irrigation controller "on" or "off" and provide for automatic or manual operation. Manual operation shall allow cycle start at the desired station and shall allow activation of a single station.
C. The watering time of each station shall be displayed on the face of the control panel.
D. The irrigation controller and the low voltage output source shall be protected by fuses or circuit breakers.
E. The irrigation controller mechanism, panel and circuit board shall be connected to the low voltage control and neutral conductors by means of plug and receptacle connectors located in the irrigation controller enclosure.
F. Each station shall have a variable or incremental timing adjustment with a range of 720 minutes to a minimum of one minute.
G. Irrigation controllers shall be capable of a minimum of 4 program schedules.
H. Irrigation controllers shall have an output that can energize a pump start circuit or a remote control valve (master).
I. When 2 or more irrigation controllers operate the same electric remote control valve (master), an isolation relay shall be provided and installed per the controller manufacturer's instructions.
J. Irrigation controllers shall be manufactured by the same company.
K. Where direct burial conductors are to be connected to the terminals strip, the conductors shall be connected with the proper size open-end crimp-on wire terminals. No exposed wire shall extend beyond the crimp of the terminal and the wires shall be parallel on the terminal strip.

Attention is directed to the provisions in "Electric Service (Irrigation)" of these special provisions regarding electrical power for irrigation controllers and irrigation controller enclosure cabinets.

Electric Remote Control Valves

Electric remote control valves shall conform to the provisions in Section 20-2.23, "Control Valves," of the Standard Specifications and the following:

A. Valves shall be glass filled nylon, brass, or bronze.
B. Valves shall be angle pattern (bottom inlet) or straight pattern (side inlet) as shown on the plans.

Pull Boxes

Pull box installations shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduits and Pull Boxes," of the Standard Specifications.

Conductors

Low voltage, as used in this section "Conductors," shall mean 36 V or less.

Low voltage control and neutral conductors in pull boxes and valve boxes, at irrigation controller terminals, and at splices shall be marked as follows:

A. Conductor terminations and splices shall be marked with adhesive backed paper markers or adhesive cloth wrap-around markers, with clear, heat-shrinkable sleeves sealed over the markers.
B. Non-spliced conductors in pull boxes and valve boxes shall be marked with clip-on, "C" shaped, white extruded polyvinyl chloride sleeves. Marker sleeves shall have black, indented legends of uniform depth with transparent overlays over the legends and "chevron" cuts for alignment of 2 or more sleeves.

Markers for the control conductors shall be identified with the appropriate number or letter designations of irrigation controllers and station numbers. Markers for neutral conductors shall be identified with the appropriate number or letter designations of the irrigation controllers.

The color of low voltage neutral and control conductor insulation, except for the striped portions, shall be homogeneous throughout the entire thickness of the insulation.

Insulation for conductors may be UL listed polyethylene conforming to UL44 test standards with a minimum insulation thickness of 41 mils for wire sizes 10AWG and smaller.

Relief from maintenance and responsibility for electric automatic irrigation components will be granted in conformance with "Relief from Maintenance and Responsibility" of these special provisions. Before the Engineer grants relief from maintenance and responsibility, the functional test specified in Section 20-5.027J, "Testing," of

the Standard Specifications shall be satisfactorily completed, and the manufacturer's written instructions shall be provided to the Engineer on the use and adjustment of the installed irrigation controllers.

ARMOR-CLAD CONDUCTORS

Armor-clad conductors shall be used in direct burial applications from pull boxes adjacent to irrigation controller to remote control valves and other irrigation facilities in conformance with the details shown on the plans and these special provisions.

Armor-clad conductors shall conform to the following:

A. Conductors shall be the proper size for the application, and shall be solid, uncoated copper with a conductor size not less than 90 percent of the AWG diameter required.
B. At the Contractor's option, conductor insulation coverings shall be either of the following:

    1. Polyvinyl chloride (PVC) conforming to UL style, Type UF 60°C, 600 V. Average thickness of insulation shall be not less than 60 mils, with a minimum thickness of 54 mils, or
    2. UL listed polyethylene conforming to UL44 test standards with a minimum insulation thickness of 41 mils for wire sizes 10AWG and smaller.

C. Armor shall be a minimum 0.005-inch thick by 0.50-inch wide Type 304 stainless steel tape that is helically wrapped over each conductor with a 33 percent minimum overlap.
D. Outer jacket for conductors shall be sunlight resistant PVC and shall conform to the Insulated Power Cable Engineer's Association (ICEA) S-61-402, NEMA Standard WC5, and UL Listing 1263. Nominal thickness of the outer jacket shall be 30 mils with a minimum thickness of 24 mils.

IRRIGATION CONTROLLER ENCLOSURE CABINET

Irrigation controller enclosure cabinets shall be constructed and equipment installed in the cabinets in conformance with the details shown on the plans, the provisions of Section 86-3.04A, "Cabinet Construction," of the Standard Specifications, and these special provisions.

Electric service shall be installed in accordance with "Electric Service (Irrigation)" of these special provisions.

Irrigation controller enclosure cabinets shall be provided with cross ventilation, roof ventilation or a combination of both. The ventilation shall not compromise the weather resistance properties of the irrigation controller enclosure cabinets and shall be fabricated by the manufacturer.

The anchorage arrangement shall be inside the cabinet as shown on the plans. Dimensions of the cabinet shall be suitable for the equipment to be installed as shown on the plans and specified in these special provisions.

Irrigation controller enclosure cabinet dimensions for a single irrigation controller shall be 48 inches (Height) x 24 inches (Width) x 10 inches (Depth).

Irrigation controller enclosure cabinets shall be fabricated in conformance with the provisions in Section 86-3.04A, "Cabinet Construction," of the Standard Specifications.

Irrigation controller enclosure cabinets shall be fabricated of cold rolled steel, stainless steel or aluminum.

Irrigation controller enclosure cabinet doors shall not be furnished with integral door locks. Irrigation controller enclosure cabinet door handles shall have provisions for padlocking in the latched position. Padlocks will be furnished by the Engineer.

Mounting panels shall be fabricated of metal sheets with a minimum thickness of 10-gage for cold rolled steel or 3/16 inch for aluminum.

Mounting panels shall be fabricated of stainless steel metal sheets with a minimum thickness of 0.157 inch.

Inside of the doors shall have provisions for storage of the irrigation plans.

IRRIGATION SYSTEMS FUNCTIONAL TEST

Functional tests for the irrigation controllers and associated automatic irrigation systems shall conform to the provisions in Section 20-5.027J, "Testing," of the Standard Specifications and these special provisions.

Tests shall demonstrate to the Engineer, through one complete cycle of the irrigation controllers in the automatic mode, that the associated automatic components of the irrigation systems operate properly. If automatic components of the irrigation systems fail a functional test, these components shall be repaired at the Contractor's expense and the testing repeated until satisfactory operation is obtained.

Associated automatic components shall include, but not be limited to, booster pump systems, and remote control valves.

Upon completion of work on an irrigation system, including correction of deficiencies and satisfactory functional tests for the systems involved, the plants to be planted in the area watered by the irrigation system may be planted provided the planting areas have been prepared as specified in these special provisions.

PIPE

Plastic Pipe

Plastic pipe supply lines must be polyvinyl chloride (PVC) 1120 or 1220 pressure rated pipe with the minimum pressure rating (PR) shown on the plans.

Plastic pipe supply lines and fittings that are 3 inches or larger in diameter on the supply side of control valves must be the rubber ring gasket type, except when pressure rating (PR) 315 plastic pipe supply line is required.

Plastic pipe supply lines less than 3 inches in diameter must have solvent cemented type joints. Primers must be used on the solvent cemented type joints.

A nonhardening joint compound must be used in place of the pipe thread sealant tape conforming to the provisions in Section 20-5.03E, "Pipe," of the Standard Specifications. Joint compounds must be applied in conformance with the manufacturer's recommendations.

Fittings for plastic pipe supply lines with a pressure rating (PR) of 315 must be Schedule 80.

Recycled Water Supply Lines

New and exposed recycled water supply lines shall be purple colored polyvinyl chloride (PVC) supply lines.

Purple colored PVC supply lines shall conform to the following:

A. Pipe shall be made of PVC 1120 with the minimum pressure ratings (PR) shown on the plans.
B. Pipe shall conform to the requirements in one of the following Standards: ASTM Designation: D 1785, ASTM Designation: D 3139 and ASTM Designation: D 2241 or ASTM Designation: D 2672.
C. Pipe shall have permanent wording "CAUTION RECYCLED WATER" in 2 rows, approximately 180 degrees apart, in the longitudinal direction of the pipe. The warning message shall be repeated every 24 inches continuously along the pipe.

THRUST BLOCK

Thrust blocks shall be installed in accordance with the plans and these special provisions. Thrust blocks shall be installed on the main supply line at all changes in direction and terminus run.

Concrete used for thrust blocks shall conform to Section 20-2.26, "Concrete," of the Standard Specifications.

SPRINKLERS

Sprinklers shall conform to the type, pattern, material, and operating characteristics listed in the "Sprinkler Schedule" shown on the plans.

WYE STRAINERS

Wye strainers shall be installed on the upstream side of the electric remote control valves as shown on the plans.

When garden valves are opened, discharge shall be up and out of the valve box.

RECYCLED WATER WARNING SIGNS

Recycled water warning signs shall be furnished and installed at the locations shown on the plans, as specified in these special provisions, and as directed by the Engineer. Recycled water warning signs shall be affixed to the above ground irrigation facilities that use or are associated with recycled water.

Warning sign decals shall be commercially available, and shall include the following information: "Recycled Water, Do Not Drink" and the "Do Not Drink" drinking glass graphic symbol. Warning sign decals shall be UV fade resistant, purple in color with black text, manufactured from a flexible, vinyl based or flexible, vinyl based with mylar product. Warning sign decals shall be all-weather, self-adhesive with peel-off backs.

Aluminum sign plates shall be 1/16 inch aluminum.

Warning tags shall be purple, doubled sided, manufactured from polyurethane, incorporating an integral neck attachment and attachment hole. The attachment hole shall be capable of withstanding 178 pounds of pull out resistance. Tag lettering shall be hot-stamped in black and capable of withstanding outdoor usage. Warning tags shall include the following information: "Recycled Water, Do Not Drink" and the "Do Not Drink" drinking glass graphic symbol.

Warning signs on above ground irrigation facilities shall be placed in visible locations.

Warning sign decals shall be applied directly to clean smooth surfaces. The smooth surfaces shall be cleaned with alcohol, or an equivalent cleaner, before applying the decals.

Warning sign decals shall be applied directly to irrigation facilities with smooth surfaces or affixed to aluminum sign plates, which shall be attached to the various above ground irrigation facilities.

Warning sign decals or tags shall be permanently affixed to valve boxes, nozzle lines, sprinkler risers, irrigation controller enclosure cabinets, irrigation controller enclosures not in cabinets, gates, fences, and other irrigation facilities in conformance with the details shown on the plans.

Warning sign decals approximately 2.5 inches x 3 inches shall be permanently affixed to sprinkler risers.

A 4 inch x 4 inch warning sign decal shall be permanently affixed to irrigation controller enclosure cabinet doors, irrigation controller enclosures not in cabinets, backflow preventer assemblies, backflow preventer assembly enclosures, and valve box covers. Decals for valve box covers shall be affixed to aluminum sign plates and the plates affixed to the valve box cover with a silicon base adhesive. Decals for cabinets may be affixed to aluminum sign plates and the plates attached with commercial quality, cadmium plated, non-removable, self-tapping screws or commercial quality, cadmium plated bolts, nuts and washers.

A 12 inch x 12 inch warning sign decal on aluminum sign plate shall be permanently affixed to gates, fences and walls 5 feet above finished grade. Sign plates for gates and fences shall be attached with "S" hooks and "C" clips or 14-gage galvanized steel wire as shown on the plans. Sign plates for concrete walls or other rough surfaces shall be affixed with a silicon base adhesive.

Warning tags approximately 2 inch x 2 inch shall be attached to the remote control valves, remote control valves (master), inside the valve box in accordance with the manufacturers recommendations.

Marking underground pipe for recycled water shall conform to the provisions in "Pipe" of these special provisions.

At the Contractor's options, purple colored valves, wye strainers, sprinklers, risers, plastic pipe (irrigation line) and filter assembly units may be used in place of standard irrigation facilities, sprinklers and irrigation line with affixed purple warning tags and decals.

FINAL IRRIGATION SYSTEM CHECK

A final check of existing and new irrigation facilities shall be performed not more than 40 working days and not less than 30 working days prior to acceptance of the contract.

The length of watering cycles using potable water measured by water meters for the final check of irrigation facilities will be determined by the Engineer.

Remote control valves connected to new irrigation controllers shall be checked for automatic performance when the controllers are in automatic mode.

Unsatisfactory performance of irrigation facilities installed or modified by the Contractor shall be repaired and rechecked at the Contractor's expense until satisfactory performance is obtained, as determined by the Engineer.

Repair or replacement of existing irrigation facilities due to unsatisfactory performance shall conform to the provisions in "Existing Highway Irrigation Facilities" of these special provisions.

Nothing in this section "Final Irrigation System Check" shall relieve the Contractor of full responsibility for making good or repairing defective work or materials found before the formal written acceptance of the entire contract by the Director.

Full compensation for checking the irrigation systems prior to the acceptance of the contract shall be considered as included in the contract lump sum price paid for plant establishment work and no additional compensation will be allowed therefor.

SECTION 10-3. ELECTRICAL SYSTEMS

10-3.01 DESCRIPTION

Electrical duct bank and conduit layout shall conform to the provisions in Section 86, "Electrical Systems," of the Standard Specifications and these special provisions.

1. Electrical duct bank and conduit layout including:

    1.1. Install duct banks, manholes and pull box including conduits, anchors, inserts, fittings and supports as shown on the plans.
    1.2. Install fiber optic and twisted pair cables as shown on the plans.

10-3.02 COST BREAK-DOWN

Cost break-downs shall conform to the provisions in Section 86-1.03, "Cost Break-Down," of the Standard Specifications and these special provisions.

The Engineer shall be furnished a cost break-down for each contract lump sum item of work described in this Section 10-3.

The cost break-down shall be submitted to the Engineer for approval within 15 days after the contract has been approved. The cost break-down shall be approved, in writing, by the Engineer before any partial payment for the items of electrical work will be made.

The cost break-down shall include the following items in addition to those listed in the Standard Specifications:

1. Conduit anchors, fittings and supports - list each size and type.
2. Manholes - list each size and type.
3. Fiber optic cables - list each size and type.

10-3.03 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS

Regardless of construction procedure, methods and equipment selected, the Contractor shall have all materials and equipment on the site for the installation of the electrical system. Disconnection of any existing or temporary power will not be permitted until the new equipment has been tested and properly adjusted.

The Contractor shall provide any and all necessary temporary facilities as required to keep any and all electrical facilities in continuous operation. The Contractor is responsible for coordinating all electrical work with all other Contractors, State forces, and entities. Temporary electrical facilities shall be installed as required prior to other work that may affect the electrical facilities. Where damage to facilities is caused by the Contractor's operations, the Contractor shall, at the Contractor's expense, repair or replace damaged facilities promptly in accordance with the Standard Specifications. If the Contractor fails to complete the repairs, the repairs will be made by State forces at the Contractor's expense.

Full compensation for temporary facilities shall be considered as included in the contract lump sum prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

10-3.04 CONDUIT

Conduit to be installed underground shall be Type 2 unless otherwise specified.

After conductors have been installed, the ends of conduits terminating in pull boxes, service equipment enclosures, and controller cabinets shall be sealed with an approved type of compound.

10-3.05 PULL BOX

GENERAL

Summary

This work includes installing a non-traffic-rated pull box as shown on the plans and as specified in these special provisions. Comply with Section 86-2.06, "Pull Boxes," of the Standard Specifications.

Submittals

Before shipping pull boxes to the jobsite, submit a list of materials, Contract number, pull box manufacturer, manufacturer's instructions for pull box installation, and your contact information to the Transportation Laboratory.

Submit reports for pull box from an NRTL-accredited lab to the Engineer.

Quality Control and Assurance

Pull boxes may be tested by the Department. Deliver pull boxes and covers to the Transportation Laboratory and allow 30 days for testing. When testing is complete, you will be notified. You must pick up the boxes and covers from the test site and deliver it to the job site.

Any failure of the pull box or the cover that renders the unit noncompliant with these specifications will be a cause for rejection. If the unit is rejected, you must allow 30 days for retesting. Retesting period starts when the replacement pull box is delivered to the test site. You must pay for all retesting costs. Delays resulting from submittal of noncompliant materials does not relieve you from executing the contract within the allotted time.

If the pull box submitted for testing does not comply with the specifications, remove the unit from the test site within 5 business days after notification that it is rejected. If the unit is not removed within that period, it may be shipped to you at your expense.

You must pay for all shipping, handling, and transportation costs related to the testing and retesting.

Functional Testing

The pull box and cover must be tested under ANSI/SCTE 77, "Specifications for Underground Enclosure Integrity."

Warranty

Provide a 2-year manufacturer replacement warranty for pull box and cover from the date of installation of the pull box and cover. All warranty documentation must be submitted to the Engineer before installation.

Replacement parts must be provided within 5 business days after receipt of failed pull box, cover, or both at no cost to the Department and must be delivered to the Department's Maintenance Electrical Shop at 30 Rickard Street, San Francisco, CA 94134.

MATERIALS

The pull box and cover must comply with ANSI/SCTE 77, "Specifications for Underground Enclosure Integrity," for Tier 22 load rating and must be gray or brown in color.

Each pull box cover must have an electronic marker cast inside.

Extension for the pull box must be of the same material as the pull box and attached to the pull box to maintain the minimum combined depths as shown.

Include recesses for a hanger if a transformer or other device must be placed in a pull box.

The bolts, nuts, and washers must be a captive bolt design.

The captive bolt design must be capable of withstanding a torque range of 55 to 60 ft-lb and a minimum pull out strength of 750 lb. Perform the test with the cover in place and the bolts torqued. The pull box and cover must not be damaged while performing the test to the minimum pull out strength.

Stainless steel hardware must have an 18 percent chromium content and an 8 percent nickel content.

Galvanize ferrous metal parts under Section 75-1.05, "Galvanizing."

Manufacturer's instructions must provide guidance on:

1. Quantity and size of entries that can be made without degrading the strength of the pull box below Tier 22 load rating
2. Where side entries cannot be made
3. Acceptable method to be used to create the entry

Tier 22 load rating must be labeled or stenciled by the manufacturer on the inside and outside of the pull box and on the underside of the cover.

CONSTRUCTION

Do not install pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place a pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

10-3.06 CONDUCTORS, CABLES, AND WIRING

Submittals

When requested by the Engineer the following product information shall be submitted:

1. Descriptive bulletins
2. Product data sheets
3. Certificate of Compliance

Shielded-Twisted Pair Cables

All 50 pairs No. 18, shielded twisted pair communication cables shall be stranded annealed copper (per ASTM Designation: B3 and ASTM B8). The insulation shall be 13 mil nominal.

The cable components are cabled with non-hygroscopic fillers, as necessary, and an overall binder tape. The individual pair shall be shielded with a 7 mil aluminum/polymer tape with tinned copper drain wire applied helically over the pairs. The overall shield shall be a 7 mil Aluminum/polymer tape with tinned copper drain wire applied helically over the cable core.

The overall jacket shall be 110 mil Flame-retardant and sunlight resistant polyvinyl chloride (PVC). A nylon ripcord shall be applied longitudinally under the overall jacket to facilitate jacket removal.

The cable shall be suitable for cable tray use and have the following ratings and listings:

1. UL Type TC-600 volt
2. UL Class XL
3. UL Subject 13 and 1277
4. IEEE 1202
5. NEMA WC-63.1 - 600 volt
6. UL 44

Communication Cable Splices

The Contractor shall submit the cable manufacturer's recommended splicing method to the Engineer for approval prior to using the method. The Engineer will approve splice locations. The splicing kits shall be manufactured by Raychem, 3M or approved equal.

10-3.07 OUTDOOR FIBER OPTIC CABLES

SUMMARY

Outdoor fiber optic cables must meet the requirements of one or more of:

1. TIA-492AAAA-A for multimode 62.5/125 Class 1a fibers
2. TIA-492CAAA for singlemode Class IVa fibers

and the requirements of ICEA S-87-640 with deviations stated herein.
Cables shall be installed and tested in accordance with the requirements NECA/FOA-301 and TIA-568.

Fiber Characteristics

Detail specifications for 62.5 µm core/125 µm cladding diameter Class Ia graded index multimode optical fibers as described by TIA-492AAAAXBBCD.

Property	FOTP(s)	Test conditions	Requirement	Units
Core diameter	58 with 29 or 43 or 44		62.5±3.0	µm
Core non-circularity	176		< 6	%
Cladding diameter µm	45 or 48 or 176		125±2.0	µm
Cladding non-circularity	45 or 48 or 176		< 2	%
core/cladding concentricity error	45 or 176		<3	µm
Coating diameter	55 or 163 or 173		250±15	µm
Coating/cladding concentricity error	55 or 163 or 173		< 20	µm
Tensile strength proof test	31		0.69	GPa
Coating strip force	178	30 mm length	1.0 min, 9.0 max	N
Attenuation coefficient	46 or 53 or 61	@ 850 nm	3.0	dB/km
	46 or 53 or 61	@ 1300 nm	0.9	
Bandwidth length product minimum	30 or 51	@ 850 nm	200	MHz·km
	30 or 51	@ 1300 nm	400	
Point discontinuity	59		<0.2	dB/pt

Detail specifications for Class IVa dispersion unshifted singlemode optical fibers as described by TIA-492CAAAXBBQB.

Property	FOTP(s)	Test conditions	Requirement
Cladding diameter µm	45 or 48 or 176		125±1.0
Cladding non-circularity	45 or 48 or 176		< 1.0 %
Core/cladding concentricity error µm	45 or 176		< 1.0
Coating diameter µm	55 or 163 or 173		250±15
Coating/cladding concentricity error µm	55 or 163 or 173		< 20
Tensile strength proof test	31		0.69 GPa
Coating strip force N	178	30 mm length	1.0 min, 9.0 max
Attenuation coefficient dB/km	78 or 61 or 120	@ 1310 nm	0.5
	78 or 61 or 120	@ 1500 nm	0.4
Mode field diameter	164 or 165 or 167	@ 1310 nm	9.1±0.5
Point discontinuity dB/pt	59		<0.10

Cable Layup

Fiber optic cables include these components:

1. Central strength member
2. Color coded buffer tubes containing:

    2.1 Color coded coated fibers and one of the following filling materials:

        2.1.1 Hydrocarbon blocking gel

3 Flooding material one of the following:

    3.1 Hydrocarbon blocking gel
    3.2 Water blocking swellable polymer yarn or tape

4. Outer strength members.
5. Core wrap
6. Jacket

Cable Properties

Cables shall be tested in accordance with Parts 7 and 8 of ICEA S-87-640.

Part 7 "Cable testing, tests and requirements":

Fibers of completed cables are tested at 1550 nm for singlemode fibers and 1300 nm for multimode fibers. Metallic conductor components shall meet the requirements of ICEA S-84-608 except as agreed between the manufacturer and the user. Testing of metallic components shall meet the requirements of ASTM D 4566.

The following tests and requirements are provided by ICEA S-87-640:

Jacket print test
Jacket thickness measurement
Jacket material density measurement
Jacket tensile strength, yield strength and ultimate elongation
Jacket material absorption coefficient
Environmental stress crack resistance
Jacket shrinkage
Length and marking accuracy
Cable and component dimensions (including ribbon measurements)
Ripcord function
Material compatibility and cable aging
Cable high and low temperature bend

Cable external freezing
Compound flow (drip) for filled cables
Cable temperature cycling
Cable sheath adherence
Water penetration
Cable impact
Cable tensile loading and fiber strain
Cable compressive loading
Cable twist
Lightning damage susceptibility (where applicable)

Part 8 "finished cable optical performance requirements":

The following tests and requirements are provided by ICEA S-87-640:

Attenuation coefficient
Point discontinuity
Multimode optical bandwidth
Singlemode cable cutoff wavelength

Identify and mark cables in accordance with Part 6 of ICEA S-87-640.

FIBER OPTIC TESTING

Perform these tests after installation as specified for post splicing tests provided by ICEA S-87-640:

End to end attenuation, using optical power meter and light source.
Optical anomalies by OTDR in both directions.

PAYMENT

Full compensation for fiber optic cables is included in the contract price paid for electrical duct bank and conduit layout and no separate payment will be made therefor.

PACKAGING AND SHIPPING REQUIREMENTS

Documentation of compliance to the required specifications shall be provided to the Engineer prior to ordering the material.

Attention is directed to "Fiber Optic Testing," in these special provisions.

The completed cable shall be packaged for shipment on reels. The cable shall be wrapped in a weather and temperature resistant covering. Both ends of the cable shall be sealed to prevent the ingress of moisture.

Each end of the cable shall be securely fastened to the reel to prevent the cable from coming loose during transit. Two meters of cable length on each end of the cable shall be accessible for testing.

Each cable reel shall have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, the Contractor's name, the contract number, and the reel number. A shipping record shall be provided to the Engineer in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics (size, attenuation, bandwidth, etc.), factory test results, cable identification number and any other pertinent information.

The minimum hub diameter of the reel shall be at least thirty times the diameter of the cable. The F/O cable shall be in one continuous length per reel with no factory splices in the fiber. Each reel shall be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

Installation procedures and technical support information shall be furnished at the time of delivery.

FIBER OPTIC CABLE INSTALLATION

Fiber optic cable shall be installed in conduit system or cable tray system as shown on the plans. Fiber optic conduit system shall consist of conduits, fiber optic pull boxes and fiber optic splice vaults or cabinets.

Installation procedures shall be in conformance with the procedures specified by the cable manufacturer for the specific cable being installed. The Contractor shall submit to the Engineer the manufacturer's recommended procedures for pulling fiber optic cable at least 20 working days prior to installing cable. Mechanical aids may be used, provided that a tension measuring device is placed in tension to the end of the cable. The tension applied shall not exceed 600 lb force or the manufacturers recommended pulling tension, whichever is less.

The FO cable shall be installed using a cable pulling lubricant recommended by the cable manufacture and a non-abrasive pull tape conforming to the provisions described under "Conduit" in these special provisions. Contractor's personnel shall be stationed at each pull box, vault and cabinet through which the cable is pulled to lubricate and prevent kinking or other damage.

During cable installation, the bend radius shall be maintained at not less than twenty times the outside diameter of the cable. The cable grips for installing the fiber optic cable shall have a ball bearing swivel to prevent the cable from twisting during installation.

Air Blown Installation

At the Contractor's option, the fiber cable may be installed using the air blown method. If integral innerduct is used, the duct splice points or any temporary splices of innerduct used for installation must withstand a static air pressure of 110 psi.

The fiber installation equipment must incorporate a mechanical drive unit or pusher, which feeds cable into the pressurized innerduct to provide a sufficient push force on the cable, which is coupled with the drag force created by the high-speed airflow. The unit must be equipped with controls to regulate the flow rate of compressed air entering the duct and any hydraulic or pneumatic pressure applied to the cable. It must accommodate longitudinally ribbed or smooth wall ducts from nominal 0.625-inch to 2-inch inner diameter. Mid assist or cascading of equipment must be for the installation of long cable runs. The equipment must incorporate safety shutoff valves to disable the system in the event of sudden changes in pneumatic or hydraulic pressure.

The equipment must not require the use of a piston or any other air capturing device to impose a pulling force at the front end of the cable, which also significantly restricts the free flow of air through the inner duct. It must incorporate the use of a counting device to determine the speed of the cable during installation and the length of the cable installed.

Splices During Installation

The cable shall be installed without splices except where specifically allowed on the plans or described in these special provisions. Minimum slack of the cable as shown on the plans shall be provided at each cable access location without a cable splice. At fiber optic splice location, a minimum of 30 feet slack of each cable shall be stored in the splice location.

CONDUIT SEALING PLUGS

Except otherwise noted, all fiber optic conduits shall have their ends sealed with commercial preformed plugs which prevent the passage of gas, dust and water into these conduits.

Sealing plugs shall be removable and reusable. Plugs shall be the split type that permits installation or removal without removing cables. Sealing plugs shall seal the conduit simultaneously with one self contained assembly having an adjustable resilient filler of neoprene or silicone rubber clamped between backing ends and compressed with stainless steel hardware.

To provide suitable sealing between future varying size cables and the plugs, split neoprene or silicone adapting sleeves, used singularly or in multiples, shall be inserted within the body of the plugs. Sealing plugs used to seal the fiber optic conduit shall be capable of withstanding a pressure of 5 psi. A sealing plug that seals an empty conduit shall have an eye or other type of capturing device (on the side of the plug that enters the conduit) to attach onto the pull rope, so that the pull rope will be easily accessible when the plug is removed.

WARNING TAPE

Warning tape must be furnished, installed and placed in the trench over new conduits to receive new fiber optic cable as shown on in the plans.

The warning tape must have:

Description	Parameters
Thickness	not be less than 0.1 mm thick
Width	4 inches
Material	Orange color polyolefin film
Tensile strength	Minimum of 160 lb force
Elongation	minimum of 700 percent elongation before breakage
Printed Text height	1 inch black color
Message background color	bright orange color background
Message statement	CAUTION: BURIED FIBER OPTIC CABLE - CALTRANS RADIO ROOM (510) 286-6359
Message spacing intervals	approximately every 3 feet

The printed warning must not be removed by the normal handling and burial of the tape and must be rated to last the service life of the tape.

The construction of the warning tape must be such that it will not delaminate when it is wet. It must be resistant to insects, acid, alkaline and other corrosive elements in the soil.

Full compensation for furnishing and installing the warning tape will be considered as included in the contract lump sum price paid for electrical duct bank and conduit layout and no additional compensation will be allowed therefor.

10-3.08 DUCT BANKS

Underground conduits shall be Type 2 encased in concrete. Concrete for conduit encasement shall be 2000 lbs test with aggregate of 0.8-inch or smaller.

Cement backfill for installation of duct bank must be a medium to dark, red or orange color. Concrete must be pigmented by addition of commercial quality cement pigments to concrete mixes. Red or orange concrete pigment must be LM Scofield Company; Orange Chromix Colorant; Davis Colors; or equal. The concrete must conform with the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications.

Adequate spacers, tie-downs and bracing shall be provided to maintain conduits in place during the pouring of the concrete. Ducts shall be installed so as to drain to manholes. When installed conduit ducts are lower than the conduits in the manhole, provide conduit drain hole.

All conduits entering and leaving the manholes and pull boxes shall be bonded together with copper bare conductor with ground clamp connected to system ground. All conduit connections shall be threaded. All approved connections shall be made with suitable conductivity enhancing thread compound. After installation all conduits shall be checked for continuity and cleaned properly. Cleaning of conduit shall be done by the use of compressed air for sizes 1-1/2 -inches and smaller, and by the use of mandrel and cleaning brushes pulled through each conduit for sizes larger than 1-1/2 -inches. Prior to backfilling of the underground duct system, the Contractor shall provide a yellow (with black lettering) warning tape, 13-inches from the finished grade, stating "CAUTION-BURIED COMMUNICATION LINE."

Manholes

All manholes shall be installed by the Contractor as shown on the plans.

Manhole Frames and Covers

Frame and cover shall be cast iron and shall be designated for H-20 Traffic loading, and shall comply with ASTM F1143.

Manhole cover shall be engraved with the following nameplates: Caltrans Communication, with manhole number as shown on the plans.

DUCT BANK EXCAVATION

Excavated material resulting from the excavation for duct bank and duct bank manholes shall be considered as contaminated material, and shall comply with "Handling, Transportation, and Disposal of Contaminated Material," of these special provisions.

Excavated material resulting from the excavation for duct bank and duct bank manholes is measured and paid for as roadway excavation (Class II).

10-3.09 CORE CONCRETE

Coring concrete shall consist of coring holes through reinforced concrete of the pedestrian tunnel wall for the installation of the electrical conduits and cables as shown on the plans and in conformance with these special provisions.

For cored holes greater than 10 feet in length, the following shall apply:

A. Prior to coring, the Contractor shall submit, in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications, the methods and equipment to be used in the coring operations.
B. The deviation in alignment of cored holes from that shown on the plans shall not be more than 1/2 inch per 10 feet of cored hole length with a maximum deviation of not more than 3 inches.
C. Immediately after coring, the concrete cores shall be identified by the Contractor with a description of the core locations and submitted to the Engineer for inspection. When reinforcement is cut, coring operations shall be terminated, and the Contractor shall submit to the Engineer for approval, the procedure proposed to repair the cut reinforcement and to prevent further cutting of reinforcement.

The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

Water for core drilling operations shall be from the local domestic water supply or shall not contain more than 1,000 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO_4, nor shall the water contain any impurities in a sufficient amount that would cause discoloration of the concrete or produce etching of the surface.

Water and spoils from coring operations falling onto the tunnel floor must be removed before end of shift and the concrete cleaned.

Full compensation for core concrete shall be considered as included in the contract lump sum price paid for electrical duct bank and conduit layout and no separate payment will be made therefor.

10-3.10 PAYMENT

The contract lump sum prices paid for electrical duct bank and conduit layout shall include full compensation for furnishing all labor, materials, tools, equipment, submittals, testing, and incidentals, and for doing all the work involved in electrical duct bank and conduit layout, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

SECTION 11. (BLANK)

SECTION 12. BUILDING WORK

SECTION 12-1. GENERAL REQUIREMENTS

12-1.01 SCOPE

Building work includes the construction of the Maintenance Complex which will include the Maintenance Building, Wash Rack and canopy, Fuel Island, Wash-Fuel Building, and Material Storage Structure.

The Maintenance Building consists in general of offices, locker and gear rooms, restrooms, crew/break rooms, kitchens, equipment storage rooms, workshops, paint mixing room, vehicle repair area, vehicle storage areas, vehicle parts and tire storage, electrical and communication rooms, utilities- including gas, water, and sewer line systems and connections, and any other items or details required by the plans, Standard Specifications, or these special provisions.

The building work does not include furnishing and driving precast prestressed indicator piling (Class 90) (Alternative X), precast prestressed piling (Class 90) (Alternative X), and precast prestressed piling (Class 140) (Alternative X).

Precast prestressed indicator piling (Class 90) (Alternative X), precast prestressed piling (Class 90) (Alternative X), and precast prestressed piling (Class 140) (Alternative X) shall conform to "Precast Prestressed Indicator Piling (Class 90) (Alternative X), Precast Prestressed Piling (Class 90) (Alternative X), and Precast Prestressed Piling (Class 140) (Alternative X)" of these special provisions.

Sections 10 through 95 of the Standard Specifications do not apply to the work in Section 12 except when specific reference is made thereto.

12-1.02 ABBREVIATIONS

Abbreviations:

AAMA	American Architectural Manufacturers Association
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
AITC	American Institute of Timber Construction
ALSC	American Lumber Standard Committee
AMCA	Air Movement and Control Association International
APA	Engineered Wood Association
APWA	American Public Works Association
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerationng and Air-Conditioning Engineers
ASCE	American Society of Civil Engineers
BIA	Brick Industry Association
CBC	California Building Code
CEC	California Electrical Code
CMC	California Mechanical Code
CPC	California Plumbing Code
CSA	Canadian Standards Association
ESO	Electrical Safety Orders
ETL	Edison Testing Laboratories
FM	FM Global
FS	Federal Specification
GA	Gypsum Association
GANA	Glass Association of North America
IGMA	Insulating Glass Manufacturers Alliance
ICC	International Code Council
ISO	International Organization for Standardization
LEED	Leadership in Energy and Environmental Design
NAAMM	National Association of Architectural Metal Manufacturers
NEC	National Electrical Code
NFPA	National Fire Protection Association or National Forests Products Association
PEI	Porcelain Enamel Institute
RIS	Redwood Inspection Service
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSPC	Society for Protective Coatings
TCNA	Tile Council of North America
TPI	Truss Plate Institute
WCLIB	West Coast Lumber Inspection Bureau (stamped WCLB)
WCLB	Grade stamp for WCLIB
WI	Woodwork Institute
WWPA	Western Wood Products Association

12-1.03 COOPERATION

Comply with "Cooperation" in Section 10, "Construction Details," of these special provisions.

State forces will be working within the project limits during this contract. Plan work to minimize interference with State forces.

Comply with all security policies of the State facility.

Submit requests for approval to the Engineer before interrupting any services for the purpose of making or breaking a connection. Include in the request the proposed time period necessary to complete the work. Allow the Engineer 5 days to review each request.

Do not use State telephone facilities.

12-1.04 SUBMITTALS

Items to be submitted to the Engineer must be approved under Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications.

Items to be furnished to the Engineer do not require approval.

The Engineer may request submittals for materials or products where submittals have not been specified in these special provisions, or may request that you include additional information in specified submittals, as necessary to determine the quality or acceptability of such materials or products or to satisfactorily document compliance with required LEED prerequisites and LEED credits.

Submit the following items within 50 days of contract approval:

1. Working drawings
2. Material lists
3. Product and descriptive data
4. Samples
5. Other submittals

Submit LEED submittals within the times given under Section 5-1, "LEED Requirements."

Submit at least 5 sets of each item. Two sets will be returned either approved for use or returned for correction and resubmittal. LEED submittals are in addition to other submittals and will require additional copies under Section 5-1, "LEED Requirements."

Submit the Schedule of Values within 20 days of contract approval. Submit at least 2 sets.

Each item submitted must include a descriptive title, the name of the project, district, county, contract number, and must reference the applicable portion of the contract documents that it pertains to. Plans and detailed drawings must be not larger than 24" x 36".

The material lists must include the name of manufacturer, catalog number, size, capacity, finish, all pertinent ratings, and identification symbols used on the plans and in these special provisions for each unit.

Deliver submittals to Offices of Structure Design, Documents Unit.

Allow 20 days for approval or return for correction of each submittal or resubmittal. Should the Engineer fail to complete the review within the time specified and Engineer determines that your controlling operation is delayed or interfered with by delay in review, an extension of time commensurate with the delay in completion of the your work will be granted under Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

Remove unapproved samples and samples not incorporated in the work from State property.

Furnish 3 copies of the following items to the Engineer at the job site:

1. Parts lists and service instructions packaged with or accompanying the equipment
2. Operating and maintenance instructions
3. Manufacturer's warranties
4. Qualification data

12-1.05 SCHEDULE OF VALUES

Divide the Schedule of Values into sections representing the cost of each separate building or structure. Do not include work that is not part of the building or structure in the building or structure cost. Include this work under a specific section as General Work.

List indirect costs and bond premiums as separate line items of work.

Identify the sections representing each building or structure as to the building or structure they represent and break them down to show the corresponding value of each craft, trade or other significant portion of the work. Provide a sub-total for each section.

The Schedule of Values must be approved by the Engineer before any partial payment estimate is prepared.

The sum of the items listed in the Schedule of Values must equal the contract lump sum price for building work. Distribute overhead and profit proportionally across all line items of cost.

12-1.06 INSPECTION

Any work that will be covered or not visible in the completed work must be inspected and approved by the Engineer before progress of work conceals portions to be inspected. Notify the Engineer not less than 72 hours in advance of when such inspections are needed.

Provide adequate temporary lighting to allow the Engineer to inspect the project as each portion is completed.

12-1.07 UTILITY CONNECTION

Make all arrangements and obtain all permits and licenses required for the extension of and connection to each utility service applicable to this project. For extensions not performed or provided by the utility, provide all labor and materials necessary for such extensions and install any intermediate equipment required by the serving utilities.

12-1.08 SANITARY FACILITIES

Do not clean tools or dispose of cleaning liquids in State sanitary facilities or sewers.

Provide separate temporary toilet units for your personnel.

Temporary toilet units must be 1) single occupant units of the chemical type, 2) properly vented, and 3) fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.

Perform periodic flushing, waste removal, and cleaning of temporary toilet units. Maintain units in a clean and sanitary condition, including a supply of toilet tissue, toilet seat covers, and paper towels. Dispose of waste material off site in a lawful manner.

12-1.09 MEASUREMENT AND PAYMENT

The contract lump sum price paid for building work includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in performing the building work, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for any incidental materials and labor, not shown on the plans or specified that are necessary to complete the building work, are considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefor.

Furnishing and driving precast prestressed indicator piling (Class 90) (Alternative X), precast prestressed piling (Class 90) (Alternative X), and precast prestressed piling (Class 140) (Alternative X) will be measured and paid

for as specified in "Precast Prestressed Indicator Piling (Class 90) (Alternative X), Precast Prestressed Piling (Class 90) (Alternative X), and Precast Prestressed Piling (Class 140) (Alternative X)" of these special provisions.

12-1.10 PROJECT RECORD DRAWINGS

Prepare and maintain one set of project record drawings, using an unaltered set of original project plans, to clearly show all as-constructed information for the project.

As a minimum, project record drawings must include the following information:

1. Any plan clarifications or change orders
2. Locations of any underground utilities
3. Location, size, type, and manufacturer of all major products or components used in the work.

Prepare project record drawings as follows:

1. Place markings on the project record drawings using red ink or red pencil.
2. Do not eradicate or write over original figures.
3. Neatly line out superseded material.
4. Submit additional drawings if the required information cannot be clearly shown on the original set of project plans. The additional drawings must be not less than 11" x 17" in size. Label each sheet with the contract number.
5. Sign and date each sheet verifying that all as-built information shown on the drawings is correct.

Review the project record drawings monthly with the Engineer during the progress of the work to assure that all changes and other required information are being recorded.

Before completion of the work, request a review of the project record drawings to determine the completeness and adequacy of them. If the project record drawings are unacceptable, you must inspect, measure, and survey the project as necessary to record the required additional information.

Deliver the completed project record drawings to the Engineer before acceptance of the contract.

12-1.11 FIELD ENGINEERING

This section specifies administrative and procedural requirements for field engineering services to be performed by the Contractor.

Lines and Grades:

Attention is directed to Section 5-1.07 "Lines and Grades," of the Standard Specifications.

Such stakes or marks will be set by the Engineer as he determines to be necessary to establish the lines and grades required for the completion of the work shown on the plans and as specified in these special provisions. In general, these will consist of the primary vertical and horizontal control points.

Stakes and marks set by the Engineer shall be carefully preserved by the Contractor. In case such stakes and marks are destroyed or damaged they will be replaced at the Engineer's earliest convenience. The Contractor will be charged for the cost of necessary replacement or restoration of such stakes and marks which in the judgment of the Engineer were carelessly or willfully destroyed or damaged by the Contractor's operations. This charge will be deducted from any moneys due or to become due the Contractor.

All other stakes or marks required to establish the lines and grades required for the completion of the work shall be the responsibility of the Contractor.

Existing utilities and equipment:

The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, the Contractor shall investigate and verify the existence and location of underground utilities and other construction.

Prior to construction, the Contractor shall verify the location and invert elevation at points of connection of sanitary and septic sewers, storm sewer, and water or fire service piping.

Surveys for layout and performance:

The Contractor shall perform all surveys for layout and performance, reduce field notes, and make all necessary calculations and drawings necessary to carry out the work.

The Contractor shall locate and layout site improvements, and other work requiring field engineering services, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

Batter boards shall be located and laid out for structures, building foundations, column grids and locations, floor levels and, control lines and levels required for mechanical and electrical work.

Survey accuracy and tolerances:

The tolerances generally applicable in setting survey stakes for foundations, slabs, and underground work shall not exceed the following:

Survey Stakes or Markers	Tolerance
Rough grading or excavation	0.10-foot
Trimming or preparation of subgrade for roadways	0.05-foot
Roadway surfacing, steel or concrete pipe	0.02-foot
Structures or building construction	0.01-foot

Such tolerance shall not supersede stricter tolerances required by the plans or special provisions, and shall not otherwise relieve the Contractor of responsibility for measurements in compliance therein.

SECTION 12-2. SITEWORK

12-2.01 RELOCATING MATERIALS AND EQUIPMENT

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of relocating existing materials and equipment in accordance with the details shown on the plans and these special provisions.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

RELOCATION

Materials or equipment to be relocated shall be removed carefully to avoid damage to the materials or equipment or to the materials or equipment which are to remain. Assemblies to be relocated which require dismantling for removal shall be matchmarked before dismantling.

The Contractor shall notify the Engineer prior to the relocation work in order that the materials or equipment may be inspected for existing damage.

Materials or equipment to be relocated shall have all adhering concrete, mastics, earth or other deleterious materials removed and shall have all exterior surfaces cleaned.

Materials or equipment which are damaged by the Contractor's operations shall be replaced or restored to match the condition of the materials or equipment prior to the beginning of the Contractor's operations. Replacement or restoration of damaged materials or equipment shall be at the Contractor's expense.

Connections, anchorages and fasteners for relocated materials and equipment shall match existing and shall be furnished and installed by the Contractor. Assemblies which have been dismantled shall be reassembled to match the existing installation. Relocated materials and equipment shall be installed as required for new work.

Modifications to wiring and plumbing to accommodate relocated items shall be as shown on the plans. Ends of piping and conduits to be abandoned shall be capped.

Surfaces that are exposed to view upon removal or relocation of materials or equipment shall be patched. Bumps shall be removed and depressions filled, and the surface finished to match the existing surfaces. Depressions in concrete less than one inch deep shall be deepened to one-inch minimum depth before filling with cement mortar.

DISPOSAL

Materials from existing facilities to be reused in the work that, in the opinion of the Engineer, is unsuitable for use shall be handled under Section 5-1, "Construction Waste Management," of these special provisions. Material that is not salvaged or recycled shall become the property of the Contractor and disposed of as provided in Section 7-1.13, "Disposal of Material Outside of the Highway Right of Way," of the Standard Specifications. The unsuitable material shall be replaced as ordered by the Engineer and will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

12-2.02 WASH RACK SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work consists of testing a wash rack system in accordance with the details shown on the plans and these special provisions.

Comply with "Handling, Transportation, and Disposal of Contaminated Material," of these special provisions, for excavation work within the contaminated area as shown on the plans.

SYSTEM DESCRIPTION

Wash rack system includes following components:

1. Water pipes, Fittings, Hose faucet, and Valves
2. Sewage pipes, Drain pipes, Vent pipes, Fittings, Manhole frame and cover, Clean out, and Valves
3. Sign
4. High Pressure Washer
5. Sand-oil Separator and Clarifier tank
6. Distribution Box
7. Water Truck Filler
8. Sanitary Station
9. Cable Railing

Related Work:

Concrete must conform to Section 90-10, "Minor Concrete," of the Standard Specifications excluding measurement and payment.

Water pipes, fittings, hose faucet, and valves must conform to "Water Pipes, Fittings, Valves, and Appurtenances" in Section 12-2, "Sitework," of these special provisions.

Sewage pipes, drain pipes, vent pipes, fittings, manhole frame and cover, clean out, and valves must conform to "Sewage Pipes and Fittings," in Section 12-2, "Sitework," of these special provisions.

Sand-oil separator, clarifier tank, and sampling box must conform to "Sand-oil Separator and Clarifier tank" in Section 12-11, "Equipment," of these special provisions.

Sanitary station must conform to "Sanitary Station" in Section 12-2, "Sitework," of these special provisions.

Sign must conform to "Building Miscellaneous Metal" in Section 12-5, "Metal," of these special provisions.

Water truck filler must conform to "Water pipes, Fittings, Valves, and Appurtenances" in Section 12-2, "Sitework," and "Building Miscellaneous Metal" in Section 12-5, "Metals," of these special provisions.

Pressure washer must conform to "High Pressure Washer (Portable)" in Section 12-11, "Equipment," of these special provisions.

Earthwork must conform to "Earthwork for Building Work" in Section 12-2, "Sitework," of these special provisions.

QUALITY CONTROL AND ASSURANCE

Field Testing: Test the wash rack system for operational use in the Engineer's presence. The system must operate a minimum of 4 hours without fail. Repairs must be made and the system retested at your expense.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

All components testing must be done before complete wash rack system testing.

12-2.03 CLEARING AND GRUBBING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of removing all objectionable material from the building site in accordance with the details shown on the plans and these special provisions.

Clearing and grubbing shall be performed in advance of any other grading or construction operations.

The area to be cleared and grubbed shall be within the building work construction area.

SITE CONDITIONS

Traffic: Clearing and grubbing shall be conducted to ensure minimum interference with roads, street, walks or other occupied areas.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

SITE CLEARING

Remove trees, shrubs, grass and other vegetation, concrete and masonry, improvements, or obstructions interfering with the new construction.

Trees to be removed shall be grubbed to a depth of not less than 2 feet below finished grade.

REMOVAL OF WASTE MATERIAL

Hauling: When hauling is done over highways or city streets, and when directed by the Engineer, the loads shall be trimmed and all material removed from shelf areas of the vehicles.

Disposal: Trees, shrubs, grass, weeds and other vegetation, debris, and any obstructions above or below the ground surface that interfere with the building work, shall be removed and disposed of outside the highway right of way in accordance with Section 7-1.13 of the Standard Specifications.

12-2.04 ROUGH GRADING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of rough grading the site in accordance with the details shown on the plans and these special provisions.

Rough grading shall consist of excavation or removal of above grade material regardless of character and subsurface condition; filling of all holes, swales, embankments, and low points to the elevation shown on the plans or specified; and the preparation of basement material for the placing of other material thereon and the establishment of the grading plane.

Earthwork for building construction shall conform to the requirements specified under "Earthwork for Building Work" in this Section 12-2 of these special provisions.

Surplus Grading Material: The grading shown on the plans will develop a surplus of approximately 27,900 cubic yards.

PART 2 - PRODUCTS

Fill Material:

Material from the excavation that is suitable for the required compaction may be used for filling holes, swales and low points. Fill material shall be free of organic material. Rocks and lumps shall be well distributed with sufficient earth or other fine matrix material to produce a dense, compacted fill that is suitable for the construction and load support intended.

The Contractor shall furnish suitable borrow material to offset any material deficiencies developed from grading work.

PART 3 - EXECUTION

EXCAVATION

Care shall be exercised to avoid disturbing material below and beyond the limits of excavation. When excavation is carried beyond the limits shown on the plans or specified, such excavation shall be replaced in kind and compacted at the Contractor's expense.

Limits of the excavation shall allow for adequate working space for installing materials and as required for safety of personnel. Such working space excavation shall be replaced in kind and compacted at the Contractor's expense.

Excess and waste materials from the excavation shall become the property of the Contractor and be disposed of outside the highway right of way in accordance with the requirements in Section 7-1.13 of the Standard Specifications.

FILL

Subgrade Preparation: Preparation of subgrade material for placing other material thereon shall include fine grading, compaction, reworking as necessary, and preparation of cut, or fill upon which base materials, surfacing, or slabs are to be placed. The upper 8 inches of the subgrade shall have the same compaction as the fill to be placed over it.

Placing: When footings are to be constructed in fill, the fill shall be constructed to the grading plane required for the building construction prior to excavating for the footings. Fill shall be placed and compacted in layers. The loose thickness of each layer before compaction shall not exceed 6 inches.

Water shall be added to the fill material as needed for compaction.

COMPACTION

Relative compaction shall be determined in accordance with California Test 216 or 231. 22

Relative Compaction (95 percent):

In fill relative compaction of not less than 95 percent shall be obtained for a minimum depth of 2.5 feet below finished grade for the width of the paved areas plus 3 feet on each side thereof.

The prisim of fill directly underneath the building foundation and sloping downward at 1:1 shall be compacted to 95 percent.

Relative Compaction (90 percent): Relative compaction of not less than 90 percent shall be obtained in all fill except as specified above.

FIELD QUALITY CONTROL

Testing and Inspection: The State will conduct compaction tests during the earthwork operations.

12-2.05 EARTHWORK FOR BUILDING WORK

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of performing earthwork for building work in accordance with the details shown on the plans and these special provisions.

Comply with "Handling, Transportation, and Disposal of Contaminated Material," of these special provisions, for excavation work within the contaminated area as shown on the plans.

Earthwork for building work shall consist of structure excavation and structure backfill. Structure excavation shall include excavation for footings, foundations, walls, slabs, tanks, manholes, sand-oil separators, clarifiers, and trenches. Structure backfill shall include backfilling under slabs; backfilling under and around footings; backfilling for walls, backfilling for pipes and conduits; backfilling holes resulting from removal of existing facilities. In addition to structure excavation and structure backfill, earthwork for building work shall include any other earthwork, not mentioned, but necessary to complete the building work.

Attention is directed to the Materials Information Handout for information regarding foundation recommendations and reports that were prepared for use during the design of this project.

Attention is directed to the requirements of “Field Engineering” in Section 12-1, "General Requirements," of these special provisions.

QUALITY ASSURANCE

Samples: Samples of sand, pea gravel, or crushed stone, weighing not less than 25 pounds, shall be submitted to the Engineer at the jobsite for approval.

SITE CONDITIONS

Existing Underground Piping and Conduit: The location of existing underground piping and conduit is based on the best records available. Before beginning work, the Contractor shall accurately locate the piping and conduit involved in the work. If the location of the existing piping or conduit deviates from the location shown on the plans by more than 5 feet, or, if no elevations are indicated and the piping or conduit is more than 3 feet below grade, the cost of the additional excavation, backfill, piping or conduit, and removal and replacement of concrete, if any, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

PART 2 - PRODUCTS

BACKFILL MATERIALS

Structure Backfill: Structure and trench backfill shall be free of organic and other deleterious material and shall be suitable for the required compaction. Gravel without sand matrix shall not be used except as free draining granular material beneath slabs and footings.

Crushed Stone:

Crushed stone shall be clean, washed, dry density of not less than 95 pounds per cubic foot, crushed stone or crushed gravel with an angular particle size not less than 3/4 inch or more than 1-1/2 inch.

Crushed stone shall conform to the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

PART 3 - EXECUTION

PREPARATION AND RESTORATION

Sawcutting: Prior to excavation or trenching, existing surfacing shall be removed to saw cut lines, or to existing wood dividers or expansion joints, if any. The saw cut shall be to a neat line and have a depth not less than one inch.

Restoration: Surfacing shall be replaced to match the thickness, grades and finish of the adjacent surrounding surfaces.

STRUCTURE EXCAVATION

Unless otherwise noted, all excavation for building work shall be classified as structure excavation.

Footing Excavation:

The bottom of excavation shall not be disturbed. The Contractor shall excavate by hand to the final grade. The bottom of concrete footings shall be poured against undisturbed material. Unless otherwise noted, compaction of the bottom of footing excavation is not required unless the material is disturbed. The footing depths shown on the plans shall be changed to suit field conditions when directed by the Engineer. Solid rock at or near required depths shall not be disturbed. Unsuitable material shall be excavated down to firm bearing as directed by the Engineer. Work and materials required because of excavation in excess of the depths shown on the plans, when such excavation has been ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Excavate to the elevations and dimensions within a tolerance of ±1/2 inch. Limits of the excavation shall allow for adequate working space for installing materials and as required for safety of personnel. Such working space excavation shall be replaced in kind and compacted at the Contractor's expense.

Overdepth excavation for footings shall be backfilled with concrete or such other material recommended by the Contractor and approved by the Engineer. Relative compaction shall be not less than 95 percent.

At locations and to the limits shown on the plans, material below the bottom of the foundation or footing shall be removed and replaced with select backfill in accordance with the placing and compacting requirements for backfill.

Excavation for Pipes and Conduits:

Pipes or conduits in the same trench shall have a minimum clear distance between pipes or conduits of 6 inches. Pipes or conduits shall have not less than 2½ feet of cover from top of pipes or conduits to finished grade unless otherwise shown on the plans or specified.

Trenching shall be of sufficient depth to permit placing a minimum depth of 6 inches of crushed stone under all pipes and conduits.

Dewatering: Excavations shall be kept clear of standing water. Water shall be removed by pumping if necessary. Water removed from excavation shall be carried away from the building site and disposed of in a manner that will not harm State or adjacent property.

STRUCTURE BACKFILLING

Unless otherwise noted, all backfill for building work shall be classified as structure backfill. Backfill shall be placed and compacted in horizontal layers, not more than 6 inches thick prior to compaction, and to the lines and grades shown on the plans or to original ground.

Structure Backfill: After structures are in place and forms are removed, wood and other debris shall be removed from excavations before placing structure backfill.

Backfilling Pipes and Conduits:

Backfill placed under pipe and conduits shall be crushed stone, 6 inches depth. Backfill material placed to a level 6 inches above tops of pipes and conduits shall be crushed stone. Backfill material placed higher than 6 inches above tops of pipes or conduits shall be structure backfill, except:

1. The top 12 inches of backfill under roads, walks or paving shall consist of aggregate base material.
2. The top 6 inches of backfill in planted areas shall consist of topsoil.

Unless otherwise shown on the plans, pipe under roads, with less than 2½ feet of cover over the top of pipe, shall be backfilled with concrete to a level 4 inches above the top of pipe. Concrete for backfill shall be commercial quality concrete containing not less than 564 pounds of cement per cubic yard.

COMPACTION

Relative compaction shall be determined in accordance with California Test 216 or 231.

Unless otherwise noted below, all backfill shall be compacted to a minimum relative compaction of 90 percent.

Unless approved in writing by the Engineer, compaction by jetting or ponding will not be permitted.

Compact Original Ground: Original ground surface under fill with surfacing of concrete and asphalt concrete shall be compacted to a relative compaction of not less than 95 percent for a minimum depth of 6 inches.

Subgrade Preparation:

Preparation of subgrade material for placing aggregate base, surfacing, or slabs thereon shall include fine grading, compaction, reworking as necessary. The upper 6 inches of the subgrade shall have the same compaction as the fill to be placed over it.

The prism of backfill directly underneath the building foundation and sloping downward at 1:1 shall be compacted to 95 percent.

Structure Backfill: Structure backfill shall be compacted to not less than 95 percent relative compaction.

Trench Backfill: Trench backfill placed beneath slabs or paved areas shall be compacted to a relative compaction of not less than 95 percent.

DISPOSAL

Surplus Material: Surplus material from the excavation shall be removed and disposed of outside the right-of-way in accordance with Section 7-1.13 of the Standard Specifications.

FIELD QUALITY CONTROL

Inspection: When the excavation is substantially completed to grade, the Contractor shall notify the Engineer. No concrete shall be placed until the foundation has been approved by the Engineer.

Testing: The State will conduct compaction tests during the backfilling and compacting operations.

12-2.06 AGGREGATE BASE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing, spreading and compacting aggregate base in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. Submit for each item cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY CONTROL AND ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content, to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

Aggregate base:

Aggregate base shall be commercial quality aggregates consisting of broken stone; crushed gravel; natural, clean, rough-surfaced gravel and sand; or a combination thereof.

Aggregate base shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
1"	100
3/4"	90 - 100
No. 4	35 - 60
No. 30	10 - 30
No. 200	2 - 9

Aggregate base shall also conform to the following quality requirements:

Tests	California Test No.	Test Requirements
Durability Index	229	35 Min.
Resistance (R-Value)	301	78 Min.
Sand Equivalent	217	22 Min.

PART 3 - EXECUTION

SPREADING AND COMPACTING

Spreading:

Aggregate base shall be placed and compacted to the lines and grades shown on the plans.

Spreading and compacting shall be performed by methods that will produce a uniform base, free from pockets of coarse or fine material.

Compaction: Relative compaction of each layer of compacted base material shall be not less than 95 percent, as determined by California Test 216 or 231.

12-2.07 FREE DRAINING GRANULAR MATERIAL

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and placing free draining granular material beneath slabs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. Submit for each item cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY CONTROL AND ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content, to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content, to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

Free Draining Granular Material: Free draining granular material shall be clean, hard, durable, free-draining rock. The material gradation shall be such that all passes the one-inch screen, and not more than 10 percent passes the No. 4 sieve as determined by California Test 202. Granular material shall be free from organic material, clay balls or other deleterious substances.

PART 3 - EXECUTION

SPREADING AND CONSOLIDATING

Free draining granular material shall be placed, spread, and consolidated by tamping or vibrating.

12-2.08 CAST-IN-DRILLED-HOLE CONCRETE PILES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of constructing cast-in-drilled-hole concrete piles in accordance with the details shown on the plans and these special provisions.

PART 2 - PRODUCTS

Concrete and Reinforcement: Concrete and reinforcement shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

PART 3 - EXECUTION

CONSTRUCTION

Drilling Holes:

All holes for concrete piles shall be drilled to the tip elevations or depths shown on the plans. All holes shall be examined for straightness and any hole which on visual inspection from the top shows less than 1/2 the diameter of the hole at the bottom of the hole shall be rejected. Suitable casings shall be furnished and placed when required to prevent caving of the hole.

All loose material existing at the bottom of the hole after drilling operations have been completed shall be removed before placing concrete in the hole.

Material resulting from drilling holes shall be wasted on the job site as directed by the Engineer.

Surface water shall not be permitted to enter the hole and all water which may have infiltrated into the hole shall be removed before placing concrete therein.

Placing Reinforcement:

The reinforcing cage shall be placed and secured symmetrically about the center of the pile and shall be securely blocked to clear the sides of the hole.

Longitudinal reinforcing steel shall be continuous for the entire length of pile, including pile extensions.

Placing Concrete:

The concrete filling shall be vibrated to a dense and homogeneous condition. Concrete placed in drilled holes shall be placed against undisturbed material except when portions of the pile will be exposed to view. Surfaces exposed to view and adjacent surfaces within 10 inches of finished grade shall be formed.

Casing, if used in drilling operations, shall be removed from the hole as concrete is placed therein. The bottom of the casing shall be maintained not more than 5 feet nor less than one foot below the top of the concrete during withdrawal and placing operations, unless otherwise permitted by the Engineer. Separation of the concrete during withdrawal operations shall be avoided by hammering or otherwise vibrating the casing.

Formed surfaces shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

12-2.09 WATER PIPES, FITTINGS, VALVES, AND APPURTENANCES

PART 1 – GENERAL

SUMMARY

Scope: This work must consist of furnishing and installing water distribution equipment in conformance with the details shown on the plans and of these special provisions. The water distribution equipment must include equipment and accessories necessary for the complete installation and operation of the system.

Related Work:

Excavation, trenching, and backfill must conform to the provisions in "Earthwork for Building Work," in Section 12-2, "Sitework," of these special provisions.

Angle iron, steel supports, and other miscellaneous metals must conform to the provisions in "Building Miscellaneous Metal," in Section 12-5, "Metals," of these special provisions.

Concrete work must conform to Section 90-10, "Minor Concrete" of Standard Specifications excluding measurement and payment.

SUBMITTALS

Product Data: Manufacturer's product data must be submitted for all manufactured materials and equipment. Manufacturer's product data must include name of manufacturer, catalog cuts, size, capacity, finish, all pertinent performance ratings, installation instructions, and identification symbols.

Working Drawings: Working drawings showing complete layout and installation details of all equipment and materials must be submitted.

Closeout Document Submittals:

Closeout documents must be furnished for the following equipment prior to completion of the project:

1. Flow meter
2. Valves
3. Pipes and Fittings

Each closeout document must contain the following information:

1. Parts list
2. Installation Instructions
3. Operating instructions

4. Maintenance instructions
5. Wiring schematics

Closeout documents must be submitted in the following manner:

1. One CD containing PDF files.
2. Two individual 3-ring binders containing paper copies.

Incomplete or inadequate documentation must be returned to the Contractor for correction and resubmittal.

QUALITY ASSURANCE

Codes, Regulations, and Standards: The water distribution system must conform to the California Waterworks Standards, 22 CA Code of Regs §§ 64551-64604, and the California Plumbing Code, 24 CA Code of Regs Pt 5.

PART 2 – PRODUCTS

PIPE AND FITTINGS

Galvanized steel pipe [GSP]: GSP must be Schedule 40 conforming with the requirements in ASTM A 53/A 53M, with Class 150 galvanized malleable iron screwed fittings and galvanized steel couplings. The weight of the zinc coating must be not less than 90 percent of that specified in ASTM A 53/A 53M.

PVC (up to 4-inch Diameter) Pipe: PVC pipe and fittings must be Schedule 40 conforming to the requirements in ASTM D 1785. Pipe must have bell ends conforming to the requirements in ASTM D 3139, or may be plain end with solvent welded couplings and fittings conforming with the requirements in ASTM D 2466 or D 2467. Pipe for conveyance of reclaimed water must be purple in color.

Unions (for GSP): Unions must be Class 250, conforming with the requirements in ASTM B 16.39, galvanized threaded malleable iron, ground joint, and brass to iron seat.

Unions (for PVC): Unions must be Schedule 80 conforming with the requirements in ASTM D-1784.

Insulating Union: Insulating union must be threaded or flange as applicable and suitable for the service on which used. Connections must ensure the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Insulating couplings will not be allowed.

Flexible Joint: Flexible joint must be ductile iron conforming to the material requirements of AWWA C153 and must be rated for 250 psi minimum. Joint must consist of expansion fitting, double ball and socket, sealing gaskets, and flanged ends. Expansion fitting must not expand or exert an axial thrust under internal water pressure, and must not change the water volume as the joint expands or contracts. Expansion fitting must be able to expand a minimum of 12 inches. Polyethylene sleeves must be included for direct burial applications.

VALVES

Ball Valve: Ball valve must be two-piece, minimum 400 psi WOG, brass or bronze body with chrome plated ball and full port. Ball valve must have reinforced PTFE seats and seals. A stainless steel body and trim is acceptable.

Ball Valve: Ball valve body constructed of CPVC must conform to ASTM D1784 and have true union design. All rings must be EPDM of FKM with PTFE seats. Working pressure of 150 psi and maximum temperature of 120 ºF.

Check Valve (less than 4-inch): Check valve must be Class 150, silent spring loaded type, threaded bronze body, nylon or PTFE disc, and stainless steel helical spring and shaft.

FAUCET AND HOSE REEL

Hose Faucet: Hose faucet must be compression type, angle pattern, tee handle, 3/4-inch female thread with hose end, wall flange at exterior wall locations and rough brass finish. Hose faucet must be supplied with an integral or non-removable threaded outlet vacuum breaker conforming to the requirements in ANSI/ASSE 1011.

Hose Reel: Hose reel must be heavy duty assembly of steel construction with connecting hose, locking automatic ratchet, guide rollers and heavy duty spring activated hose pickup. Hose reel must have bushings, swivels, ball stops, and sized for a 1-1/2-inch diameter by 50-foot delivery hose with a fire hose nozzle, and a 3/4-inch diameter by 50-foot delivery hose with an adjustable spray nozzle. The reel must have a baked enamel finish. Manufacturers reel mounting brackets must be supplied with reel.

MISCELLANEOUS EQUIPMENT

Flow Meter: Flow meter must be insertion-type with NEMA 4X housing and PVC sensor body, suitable for water service, and must have a minimum of 125 psi working pressure. Fittings and electronic module with readout must be included with the flow meter. The flow meter must be of the same manufacturer and must have 4-20mA output.

Meter Box: Meter box must be H-20 traffic rated, precast concrete box with a cast iron cover with no holes. Cover must be factory marked "WATER," or "WATER METER" where appropriate. Provide manufacturer's extensions as required.

Valve Box: Valve box must be H-20 traffic rated, precast concrete box with a cast iron cover with no holes. Cover must be factory marked "WATER." Provide manufacturer's extensions as required.

Underground Tracer Tape: Underground tracer tape must be permanent, detectable, bright colored in conformance with APWA Standards, continuous printed plastic tape with integral metallic strip or wire, intended for direct burial service, and must have a minimum width of 2 inches. Printed lettering must read "CAUTION BURIED RECLAIMED WATER LINE BELOW."

PART 3 – EXECUTION

INSTALLATION

PIPE AND FITTINGS

Pipe and Fittings: Pipe and fitting materials must be installed as shown on the plans.

Installing Piping:

Water piping must be installed level, and free of traps and bends.

PVC pipe sleeves must be installed where each pipe will pass through concrete slabs, footings, or walls. Inside diameter of sleeves must be at least 1-inch larger than outside diameter of pipe. Pipes must be installed to provide at least 3/8-inch space all around the full depth of concrete. Caulk space between pipes and pipe sleeves water tight with silicone caulk. Backer rod may be installed, but the caulk must be at least 1-inch deep on both sides.

Pipe Joints and Connections:

Joints in threaded pipe must be made with a PTFE tape or a pipe joint compound that is non-hardening and non-corrosive, placed on the pipe threads and not in the fittings.

The use of thread cement or caulking on threaded joints will not be allowed. Threaded joints must be made watertight. Leaky joints must be remade with new material.

Cleaning and Closing Pipe: The interior of all pipes must be clean before installation. All openings must be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs must remain in place until their removal is necessary for completion of the installation.

Securing Pipe: Pipes must be securely supported and braced to prevent swaying, sagging or flexing of joints. Pipe must be held in place by construction channel, pipe rests, anchors, sway braces, bore spacers, or guides. Material for supports must be compatible with the piping, or neoprene isolators must be used. Allowances must be made for expansion and contraction. Above ground steel and copper pipe must have supports every 10 feet. Above ground PVC pipe and pipe inside crossover casing must have supports every 5 feet. Vertical pipes must be supported with commercial-grade clamps or straps.

Supports:

Supports must be selected to withstand all conditions of loading to which the piping and associated equipment may be subjected and within the manufacturer's load ratings. Supports must be spaced and distributed so as to avoid load concentrations and to minimize the loading effect.

Supports must be sized to fit the outside diameter of pipe or pipe insulation.

Thrust Blocks:

Thrust blocks must be sized to conform to the requirements in the CPC. Thrust blocks must be formed by pouring concrete between the pipe and trench wall.

Plastic pipe underground must be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains 2 inches and larger, and all capped connections.

Water Pipe near Sewers:

Water pipes must not be installed closer than 10 feet to any parallel sewers.

Water lines must cross above a sewer line, with a vertical separation of not less than 12 inches. The measurement must be maintained taken between the top of the sewer and the bottom of the water pipe.

VALVES

Valves below ground must be installed in a valve or meter box. Valves must be installed with a minimum of 6 inches of crushed stone in valve or meter box.

Valves above ground must have a pipe support installed adjacent to the valve.

FAUCET AND HOSE REEL

Hose Faucet: Faucet must be installed so that outlets are at least 20 inches above finished grade and as shown on the plans.

Hose Reel: Hose reel must be installed on concrete island in compliance with the manufacturer's instructions and as shown on the plans. Connect the water line to the hose reel for proper operation and leak-free.

MISCELLANEOUS EQUIPMENT

Flow Meter:

Flow meters and appurtenances must be installed in accordance with the manufacturer's instructions and at the location as shown on the plans.

Meter Box:

Meter box must be installed to finish grade. Extensions must be installed as required.

A reinforced concrete collar must be formed and cast-in-place around each meter box. Collars must be broom surface finished or must match the surrounding surface texture.

Meter boxes that are to be installed in areas to be paved or surfaced must not be placed to final grade until the paving or surfacing has been completed in the indicated area.

Valve Box:

Valve box must be installed to finish grade. Extensions must be installed as required.

A reinforced concrete collar must be formed and cast-in-place around each valve box. Collars must be broom surface finished or must match the surrounding surface texture.

Valve boxes that are to be installed in areas to be paved or surfaced must not be placed to final grade until the paving or surfacing has been completed in the indicated area.

TESTING

Pipe and Fittings:

All piping must be tested after assembly and prior to backfill. In addition to the requirements in the CPC, the Contractor must test the water piping for a period of not less than 4 hours, at a pressure of 125 psi. Piping must remain watertight.

The Contractor must take precautions to prevent damage to tanks, gauges, and appurtenances. The Contractor must repair damage resulting from or caused by testing pipes.

After testing, the Contractor must repair all leaks and retest to determine that leaks have been stopped. Excess potable water must be disposed of into the storm water system in such a manner as to cause minimal erosion.

OPERATIONAL TEST

Equipment or work found deficient during the test must be calibrated, repaired, or replaced, and then re-tested. The Engineer must be notified at least 3 business days in advance of re-testing.

12-2.10 PAINTED PAVEMENT MARKINGS

PART 1 - GENERAL

Scope: This work shall consist of furnishing and applying paint, temporary striping, and pavement marking tape for pavement markings in conformance with the details shown on the plans and these special provisions.

Pavement markings include, but are not limited to, word and symbol markings, and parking stall markings.

PART 2 - PRODUCTS

Paint:

Paint shall be commercial quality for pavement marking, formulated for the use intended, and manufactured by a nationally recognized manufacturer of coating products.

Traffic paint shall confrom to the rules for control of volatile organic compound (VOC) emissions adopted by the air quality control district in the air basin in which the coatings are applied.

Temporary (Removable) Striping and Pavement Marking Tape (6 months or less): Products used for temporary (removable) striping and pavement marking tape (6 months or less) shall be selected from the pre-qualified products list below:

1. Advanced Traffic Marking, Series 200
2. Brite-Line, Series 100
3. Garlock Rubber Technologies, Series 2000
4. P.B. Laminations, Aztec, Grade 102
5. Swarco Industries, "Director-2"
6. Trelleborg Industries, R140 Series
7. 3M Series 620 "CR", and Series A750
8. 3M Series A145, Removable Black Line Mask
   (Black Tape: for use only on Asphalt Concrete Surfaces)
9. Advanced Traffic Marking Black "Hide-A-Line"
   (Black Tape: for use only on Asphalt Concrete Surfaces)
10. Brite-Line "BTR" Black Removable Tape
    (Black Tape: for use only on Asphalt Concrete Surfaces)
11. Trelleborg Industries, RB-140
    (Black Tape: for use only on Asphalt Concrete Surfaces)

PART 3 - EXECUTION

Alignment and Layout:

All necessary alignment and layout work shall be performed by the Contractor, in a manner that will not damage the pavement.

Unless otherwise shown on the plans, the width of parking stall markings shall be 4 inches.

Equipment and Operation:

Mechanical means shall be used to paint pavement markings.

All equipment used in the application of paint shall produce pavement markings of uniform quality.

All spray equipment shall be the proper type and of adequate capacity for the work involved.

Air atomized spray equipment shall be equipped with oil and water extractors and pressure regulators, and shall have adequate air volume and compressor recovery capacity. Spray gun tip needle assemblies and orifices shall be the proper size.

Stencils and hand spray equipment shall be used to paint word and symbol markings. Stencils shall be furnished by the Contractor. The stencil layout shall conform to the dimensions shown on the plans.

Surface Preparation: Surfaces to receive paint, temporary striping, or pavement marking tape shall be cleaned of all dirt and loose material.

Application:

Paint shall be applied only on dry surfaces, and only during periods of favorable weather, in conformance with the manufacturer's recommendations.

On new surfacing, paint shall be applied in 2 coats. The first coat shall be dry before application of the second coat is applied.

On existing surfacing, paint shall be applied in one coat.

Completed pavement markings shall have clean and well-defined edges, and shall conform to the dimensions shown on the plans or as specified in these special provisions.

Drips, oversprays, improper markings, and paint material tracked by traffic shall be immediately removed from the pavement by methods approved by the Engineer. All such removal shall be at the Contractor's expense.

Temporary striping and pavement marking tape shall be applied in conformance with the manufacturer's specifications.

Application Rates: Each application of paint shall be applied at the rates recommended by the paint manufacturer for the type of surface involved.

Protection: Newly placed pavement markings shall be protected from damage by traffic or other causes until the paint is thoroughly dry.

Disabled Accessible Parking Stall Symbol: Each parking space reserved for persons with physical disabilities shall have a minimum 3' x 3' surface identification with the international symbol of accessibility. The symbol and border shall be white and the background shall be blue conforming to Federal Standard 595B, Color No. 15090.

12-2.11 SANITARY STATION

PART 1 - GENERAL

SUMMARY

Scope: This work must consist of furnishing and installing a sanitary station in accordance with the details shown on the plans and these special provisions.

Concrete must conform to Section 90-10, "Minor Concrete," of the Standard Specifications excluding measurement and payment.

Sewage, drain, and vent pipes and fittings must conform to "Sewage Pipes and Fittings" in Section 12-2, "Sitework," of these special provisions.

Water pipes must conform to "Water Pipes, Fittings, Valves, and Appurtenances" in Section 12-2, "Sitework," of these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and catalog cuts for the water tower and accessories shall be submitted for approval.

PART 2 - PRODUCTS

Water Tower: Water tower must be standard commercially manufactured product designed for normal use at RV dump stations. Tower shall have 15-foot reach at full extension, 9 3/4-inch cast steel base; 1/2-inch diameter anchor bolts; 1/2-inch supply bushing at base of vertical, center pivoting stand pipe, heavy return spring at pivot, pressure vacuum breaker at top of tower and flexible 3/8-inch rubber hose with self-closing, rough brass radiator bib.

Sanitary Hatch: Sanitary hatch must be ductile iron and foot-operated that quickly opens or closes. Hatch must be non-recessed design.

Signs: Signs must be galvanized sheet steel not less than 0.064-inch thick (16-gage) with baked enamel finish and galvanized steel mounting plate and fastening hardware. Sign colors and messages must be as shown on the plans.

PART 3 - EXECUTION

INSTALLATION

Sewer and Vent Piping: The sewer and vent piping must be installed in accordance with the applicable requirements specified under "Sewage Pipes and Fittings" in Section 12-2, "Sitework," of these special provisions.

Sanitary Hatch: Sanitary hatch must be installed in accordance with the manufacturer's recommendations and as shown on the plans.

Signs:

Signs for use at the sanitary station must be installed in accordance with the details shown on the plans.

12-2.12 SEWAGE PIPES AND FITTINGS

PART 1 - GENERAL

SUMMARY

Scope: This work consists of furnishing, installing and testing sewage pipes, vent pipes, fittings, manholes and covers, clean outs, valves, valve box.

Comply with "Handling, Transportation, and Disposal of Contaminated Material," of these special provisions, for excavation work within the contaminated area as shown on the plans.

Related Work:

Excavation, trenching, and backfill must conform to "Earthwork for Building Work," in Section 12-2, "Sitework," of these special provisions.

Metals must conform to "Building Miscellaneous Metal" in Section 12-5, "Metals," of these special provisions.

SUBMITTALS

Product data: Manufacturer's product data must be submitted for all manufactured materials and equipment. Manufacturer's product data must include catalog cuts, complete description, performance data, and installation instructions.

Working Drawings: Working drawings for manholes must be submitted for approval. Drawings must show elevations and the shape, size, and method of installation for each component used in the work.

Test Reports: Test reports for piping must be delivered to the Engineer within 3 business days of completion. If the "Air Test" method is used, air test procedures must be submitted for approval. Information must include air compressor type, pressure regulating equipment and pipe plugs.

Closeout Document Submittals:

Closeout documents must be furnished for the all the equipment prior to completion of the project:

Each closeout document must contain the following information:

1. Parts list.
2. Installation Instructions.

3. Operating instructions.
4. Maintenance instructions.
5. Wiring schematics.

Closeout documents must be submitted in the following manner:

1. One CD containing PDF files.
2. Two individual 3-ring binders containing paper copies.

Incomplete or inadequate documentation must be returned to the Contractor for correction and resubmittal.

QUALITY CONTROL AND ASSURANCE

Codes and Standards: All sanitary sewage work must conform to the applicable portions of the California Plumbing Code (CPC), Title 24, Part 5.

Certificates of Compliance: Certificates of compliance must be furnished for manhole frames and covers in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2 - PRODUCTS

IDENTIFICATION

Underground Detectable Warning Tape: Underground detectable warning tape must be permanent, detectable, bright colored in conformance with APWA Standards, continuous printed plastic tape intended for direct burial service; not less than 2 inches wide; lettering must read "CAUTION SEWER BURIED BELOW."

SEWAGE PIPES AND FITTINGS

Sewage, Vent, and Drain Pipe: Sewage, Vent, and Drain pipe and fittings must be polyvinyl chloride (PVC) gravity sewage plastic pipe and fittings conforming to the requirements in ASTM D 3034, Standard Dimension Ratio (SDR) 35, with integral bells and bell and spigot rubber gasketed joints conforming to the requirements in ASTM D 3212. Rubber gaskets must conform to the requirements in ASTM F 477. Stainless steel clamps with rubber boots will not be allowed.

Galvanized Steel Vent Pipe (GSVP): GSVP must be Schedule 40 conforming with the requirements in ASTM A 53/A 53M, with Class 150 galvanized malleable iron screwed fittings and galvanized steel couplings. The weight of the zinc coating must be not less than 90 percent of that specified in ASTM A 53/A 53M.

Vent pipe risers above ground must be Schedule 40 galvanized steel pipe conforming to ASTM A53, with 150 psi galvanized malleable iron banded screwed fittings and galvanized steel couplings. The weight of the zinc coating must be not less than 90 percent of that specified in ASTM A53.

Flexible Joint: Flexible joint must be ductile iron conforming to the material requirements of AWWA C153 and must be rated for 250 psi minimum. Joint must consist of expansion fitting, double ball and socket, sealing gaskets, and flanged ends. Expansion fitting must not expand or exert an axial thrust under internal water pressure, and must not change the water volume as the joint expands or contracts. Expansion fitting must be able to expand a minimum of 12 inches. Polyethylene sleeves must be included for direct burial applications.

SEWER MANHOLES

Distribution Box: Distribution box, riser sections, grade rings, and cones must be precast, reinforced concrete, conforming to the requirements in ASTM C 478. Sealant for precast concrete sections must offer protection against saltwater upon curing and designed for continuous immersion.

Manhole Frame and Cover: Manhole frame and cover must be cast iron conforming to the requirements in ASTM A48, Class 30 or greater (traffic type). Cover must be T-handle bar lock, no bolt, closed pick hole and

must be marked "SS," "SEWER," or "SANITARY SEWER." Three T-handles must be supplied. The side or bottom of the cover must be machined grooved for an integral O-ring gasket. The frame seat for the bottom O-ring gasket must be a minimum of 7/8 inch in width.

VALVE AND METER BOXES

Valve Box: Valve box must be traffic rated, precast concrete box with cast iron cover. Cover must be factory marked "SEWER," "SS," or "SANITARY SEWER." Provide manufacturer's extensions as required.

Meter Box: Meter box must be traffic rated, precast concrete with cast iron cover. Cover must be factory marked "SEWER," "SS," or "SANITARY SEWER." Provide manufacturer's extensions as required.

CLEANOUTS, VALVES AND METER

Cleanout to Grade: Cleanout piping must terminate with an appropriately sized flexible PVC access cap and stainless steel band coupler with hex tightening screw. Rubber coupling and cap will not be allowed.

Gravity Check Valve: Gravity check valve must be 4-inch, hub ends, PVC body, rated for 125 psi minimum back pressure, no metallic parts, angled Viton compound rubber or fluorocarbon compound seat and removable flapper rated for horizontal or vertical usage, unseated pressure opens on contact, full flow design.

MISCELLANEOUS MATERIALS

Cement Mortar: Cement mortar must conform to the provisions for "Cement Mortar," in Section 65-1.06, "Joints," of the Standard Specifications.

Epoxy Mortar: Epoxy mortar must be a commercial quality, trowelable, 3-component epoxy mortar consisting of two pourable epoxy components and a chemically resistant aggregate filler of silica quartz sand with maximum water absorption of 0.1 percent. Epoxy must have a pull-off strength of not less than 1,000 psi and a 90 percent cure in 24 hours. Epoxy mortar must be the type that requires no primer as a bonding agent.

Joint Sealant: Plastic joint sealant must be commercial quality butyl mastic strip type, conforming to the requirements in ASTM C 990.

PART 3 - EXECUTION

INSTALLATION OF IDENTIFICATION

Continuous underground detectable warning tape must be installed directly above buried pipes and 6 to 12 inches below finished grade during backfilling operations.

INSTALLATION OF PIPES AND FITTINGS

Sewage, vent, and drain pipe must be installed upgrade, starting from utility connection back to the building, true to grades and with alignment indicated, and unbroken continuity of invert. Bell ends of piping must be installed facing upstream.

Sewage pipe must not be installed closer than 10 feet to any parallel water distribution pipe.

Water pipes must cross above sewers with a vertical separation of not less than 12 inches. The measurement must be taken between the top of the sewage pipe and the bottom of the water pipe.

Flexible joint must be installed at location as shown on the plans.

Interior of pipes must be kept clean of dirt and other materials as the work progresses.

Sewage pipes between manholes must be flushed as necessary to remove collected material.

INSTALLATION OF DISTRIBUTION, VALVE AND METER BOXES

Distribution, valves and meter boxes must be installed in accordance with their manufacturer's recommendations.

All joints and penetrations of distribution, valve and meter boxes must be sealed watertight, inside and outside, with epoxy mortar.

A concrete collar must be formed and cast in place around each manhole in accordance with the details shown on the plans.

Where distribution, valve or meter boxes are to be installed to grade in areas to be paved or surfaced, no individual structure must be constructed to final grade until the paving or surfacing has been completed in the immediate area.

INSTALLATION OF CLEANOUTS

Cleanouts must be installed 90 degrees to grade and must terminate in a meter box. A concrete pad must be provided full width of the trench under a wye branch. Cleanouts to grade must be a combination of fittings as shown on the plans.

Valve and meter boxes must be installed with extension as required to bring top box to grade.

Box collars must be broom surface finished. Collars must match existing grade. Compaction prior to formwork must conform to the provisions of these special provisions.

APPLICATION OF SEALANT

Sealant must be applied to the exterior surfaces of concrete structures, including the bottom. Sealant must be applied as recommended by the manufacturer and protected from damage during transport and installation. Concrete surfaces to be coated with sealant must be at least 28 days after fabrication.

The edge and bottom of manhole cover seat areas must be coated with a uniform application of heavy duty, waterproof automotive or industrial grease.

FIELD QUALITY CONTROL

Testing Sewage: All 6-inch and larger sewage pipes must be tested for obstructions before covering the pipes by balling and flushing the pipes with an approved commercial sewer-cleaning ball. The ball must be moved slowly through the sewer with a tag line. Obstructions or irregularities must be removed or repaired. Four-inch sewage pipes must be tested by pulling an appropriate sized inflatable plug through the pipe. Obstructions or irregularities must be removed or repaired.

Damaged Pipe: Damaged pipe shall be replaced prior to use. Misaligned pipe shall be corrected or replaced prior to use.

Sewage pipes must be tested for leakage for a minimum period of 4 hours by filling with water to an elevation of 4 feet above the average invert of sewer pipe, or to the top of the manholes where less than 4 feet deep. The system must show no visible leaks, and the leakage rate must not exceed the rate allowed by the local agency. In the absence of such requirements, leakage must not exceed one pint per 24 hours, per millimeter diameter, per 100 feet of pipe. Sewage pipes may be tested in sections with the test water progressively passed down the sewers if feasible. Water must be released at a rate which will not create water hammer or surge in the plugged section of sewer.

In lieu of hydrostatic test with water, the air test method, "Air Test," as outlined in the CPC, may be used.

12-2.13 FILTER FABRIC

PART 1 - GENERAL

Summary

Scope: This work must consist of installing filter fabric in conformance with the details shown on the plans and these special provisions.

Related Work:

Earthwork must conform to the requirements specified under "Earthwork for Building Work" in Section 12-2, "Sitework," of these special provisions.

Submittals

Manufacturer's warranties and guarantees for equipment and materials installed in the work must be delivered to the Engineer at the jobsite.

Closeout Document Submittals: Deliver closeout documents to the Engineer prior to completion of project.

Furnish closeout documents for the following:

Filter Fabric

Each closeout document contains the following information:

Parts list
Installation Instructions
Repair Instructions

Submit closeout documents in the following manner:

One CD containing PDF files.
Two individual 3-ring binders containing paper copies.

Incomplete or inadequate documentation must be returned to the Contractor for correction and resubmittal.

Quality Assurance

Provide Certificate of Warranty issued by the filter fabric manufacturer. Manufacturer warranties will include but not be limited to repair or replace fails fabric that fail(s) in materials, workmanship or that deteriorate(s) under conditions of normal weather within specified warranty period. Deliver Certificate of Warranty to Engineer.

PART 2 - PRODUCTS

General: Filter fabric is commercial quality, chemically stable, non-biodegradable, and resistant to ultraviolet degradation.

Filter fabric is nonwoven, needle punched permeable geotextile, fabricated from 100 percent polyester, 100 percent polypropylene or 100 percent combined polyester and polypropylene having properties as follows:

Property	Value	Test Designation
Average fabric weight, oz/yd²	8.0	--
Tensile strength, lbs	300 ±15	ASTM D4632
Elongation, %	60	ASTM D4632
Trapezoidal tear, lbs	95	ASTM D 4533
Water flow rate, gpm/ft²	8	ASTM D4491
Thickness, mils	100	ASTM D1777 or D5199
Permittivity, sec^{-1}	0.1	ASTM D 4491
AOS U.S. sieve	#170	ASTM D 4751

Protect filter fabric in packaging during shipping, storage, and handling from abrasion and ultraviolet radiation.

PART 3 - EXECUTION

Installation

Install a single layer of filter fabric extending the full perimeter of the utility trench. Place immediately adjacent to the bottom and sides of the trench prior to placing backfill, and as shown on the plans. Overlap all splices of the filter fabric a minimum of 12 inches.

12-2.14 ORNAMENTAL STEEL FENCE AND GATES

PART 1 - GENERAL

SUMMARY

Scope: This work shall include ornamental welded steel fencing panels fabricated with galvanized steel tubing welded into, modular, open grille fencing panels including steel fence, gate posts, and gates.

Related work:

Concrete work relating to footings for support of fence and gate posts shall conform to the requirements specified under "Cast-In-Place Concrete" in Section 12-3 "Concrete and Reinforcement" of the Special Provisions.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM A36 - Structural Steel.
ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
ASTM D1794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
ASTM D3363 - Test Method for Film Hardness by Pencil Test.

SUBMITTALS

Product data: Manufacturer's specifications, anchor details and installation instructions for products, and accessories used in ornamental steel fencing and gates shall be submitted for approval.

Working drawings: Fabrication and installation instructions shall be submitted showing layout, dimensions, spacing and layout of components inclusive of anchorage and installation details. Working drawings shall detail latch and locking components, and other required appurtenances.

Samples: A 8 by 10 inches minimum size sample of fence panel shall be submitted illustrating design, fabrication workmanship, and selected color coating.

LEED Submittals:

MR Credit 4.1 and 4.2, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5.1 and 5.2, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

LEED:

MR Credit 4.1 and 4.2, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.1 and 4.2.

MR Credit 5.1 and 5.2, Regional Materials: Use materials with regional content, to contribute toward achieving MR Credit 5.1 and 5.2.

WARRANTY

The Contractor shall provide manufacturer's standard 10 year warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 - PRODUCTS

MATERIALS

Steel Bar Stock: ASTM A36.

Steel Tubing: ASTM A500, Grade B.

Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

FENCE SYSTEM

General: Fencing shall be ornamental steel fencing system factory fabricated consisting of modular open grille fencing panels fabricated by welding steel shapes, supported by steel posts. The system shall include gates and gate hardware.

Fence Panels: Vertical main bars shall be 1 inch steel tubing spaced at 6 inches. Horizontal cross rods and top and bottom perimeter rods shall be 1 inch steel tubing in configuration indicated on the plans.

Panel Height: 6 ft.
Panel Width: 8 ft. or as indicated on the drawings.

Posts: Fence posts shall be galvanized square steel tubes, 4 inches by 4 inches to suit design requirements. Flat steel bar top caps shall be welded to tubular posts.

GATES

Gates of type and size shall be provided at locations indicated on drawings. Gates shall be equipped with manufacturer's standard hardware as required for complete functional operation.

Hinged Swinging Gates: Construction shall be welded frame fabricated from steel tubing with open grille steel panels to match fencing material. Nominal size shall be as indicated on the drawings.

Hardware:

Attention is directed to the requirements specified in the Door Hardware Schedule in section 12-8.10 "Door Hardware" of the Special Provisions.

FACTORY FINISH

General: Steel fence panels and posts shall be hot-dip galvanized to 1.25 ounces per square foot minimum zinc coating in accordance with ASTM A123. Standard size components shall receive polyester powder coating. Large gate panels shall be coated with 2-part polyurethane coating.

Polyester Powder Coating: Powder coating shall be electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.

Property	Test Method	Performance Requirement
Minimum hardness	ASTM D3363	2H
Direct impact resistance	ASTM D2794:	Withstand 160 inch-pounds
Salt spray resistance	ASTM B117	No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 3/16 inch undercutting.
Weatherability	ASTM D822	No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.

Polyurethane Coating: Coating shall be 1.0 mil dry film thickness of coating of steel test panel cured 30 minutes at 180 degree F and aged 14 days shall resist the following test conditions without failure:

Test	Condition
5 percent salt spray	for 500 hours.
100 percent relative humidity	for 1000 hours.
Water immersion	for 100 hours
Exposure to chemicals	20 double rubs with cloth saturated with either lacquer thinner, acetone, MEK, gasoline, xylene.
Hardness	H to 2H
Flexibility	3 mm conical mandrel.
Temperature Differential	16 cycles of 24 hours at 100 percent humidity, 24 hours at 10 degrees F, and 24 hours at 77 degrees F.

Color: Color shall be as shown on plans.

PART 3 - EXECUTION

PREPARATION

Prior to fabrication, required dimensions shall be field verified.

Concrete footings shall be prepared in accordance with details on approved working drawings and the following minimum requirements:

	Hole Diameter	Minimum Embedment
Terminal and gate posts	12 inches	8 inches
Intermediate line posts	10 inches	8 inches

INSTALLATION

General: Fencing shall be installed in accordance with manufacturer's written installation instructions and approved working drawings. Fence posts shall be installed plumb and level by embedding post directly into concrete footing. Temporarily brace fence posts with 2 x 4 wood supports until concrete is set. Bent, bowed, or otherwise damaged panels shall not be used. Damaged components shall be removed from site and replaced. Fence panels shall be secured with stainless steel anti-intruder bolts to fence posts after posts have been set in footings.

Gates:

Gates shall be installed and hardware adjusted for smooth operation. Concrete center foundation depth and drop rod retainers shall be provided at center of double swinging gate openings. After installation, gates shall be tested to ensure proper function. Gates shall be opened and closed a minimum of five times and deficiencies corrected and adjusted.

Touch-up: Damaged finish shall be touched-up with paint supplied by manufacturer and matching original coating.

12-2.15 GUARD POSTS

PART 1 - GENERAL

Scope: This work shall consist of constructing guard posts in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

PART 2 - PRODUCTS

Steel Posts: Steel posts for guard posts shall be standard weight, galvanized steel pipe conforming to the details shown on the plans.

Concrete: Concrete for guard posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 470 pounds of cement per cubic yard.

PART 3 - EXECUTION

Installation:

The length and diameter of the guard posts shall conform to the details shown on the plans.

Guard posts shall be placed in holes excavated to the depth and cross section shown on the plans, and shall be installed plumb.

Guard posts shall be backfilled with concrete as shown on the plans.

Painting: Guard posts shall be prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-2.16 ACCESSIBLE PARKING SIGNS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing accessible parking signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data for sign materials, colors, graphics, and sign fastening details shall be submitted for approval.

QUALITY CONTROL AND ASSURANCE

Regulatory Requirements: Accessible parking signs shall conform to the requirements in Identification of parking spaces for off-street parking facilities, 24 CA Code of Regs Pt 2 § 1129B.4, and Stopping, Standing, and Parking, CA Veh Code §§ 22500 through 22526.

Certificate of Compliance: The Contractor shall furnish a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the sheet aluminum.

PART 2 - PRODUCTS

Sign Colors: The color white shall conform to the requirements in FED-STD-595, Color No. 17886. The color blue shall conform to the requirements in FED-STD-595, Color No. 15090.

Signs:

Single sheet aluminum signs shall be fabricated from sheet aluminum alloy 6061-T6 or 5052-H38, not less than 0.063-inch thick (14-gage) with rounded corners. Alloy and temper designations for sheet aluminum shall conform to the requirements in ASTM B 209.

Sheet aluminum shall be cleaned and pretreated in conformance with the requirements in ASTM B 449, Class 2.

The Contractor shall furnish Type III retroreflective sheeting in conformance with the requirements in ASTM D 4956. The adhesive backing shall be pressure sensitive and fungus resistant. Retroreflective sheeting shall be applied to sign panels as recommended by the retroreflective sheeting manufacturer without stretching, tearing, or damage.

A protective overlay film of the type, kind, and product that is approved by the manufacturer of the retroreflective sheeting shall be applied. Protective overlay film shall be premium quality.

The face of each finished sign shall be uniform, flat, smooth, and free of defects, scratches, wrinkles, gel, hard spots, streaks, extrusion marks, and air bubbles. The front, back, and edges of the sign panels shall be free of router chatter marks, burns, sharp edges, delaminated skins, excessive adhesive over spray and aluminum marks.

Signs shall be protected by thorough wrapping, or other methods to ensure that signs are not damaged by weather conditions and during transit. Padding and protective materials shall be placed between signs as appropriate. Finished sign panels shall be transported and stored by method that protects the face of signs from damage. The Contractor shall replace wet, damaged, or defective signs.

Sign Post: Sign post shall be commercial quality, standard weight, galvanized steel pipe conforming to the requirements in ASTM F 1083. Post shall be supplied with galvanized steel post top.

Fastening Hardware: Fastening hardware shall be galvanized or cadmium plated.

Concrete: Concrete for sign posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 470 pounds of cement per cubic yard.

PART 3 - EXECUTION

INSTALLATION

Sign posts shall be set vertically in concrete, in holes excavated to the depth and cross-section shown on the plans.

Signs shall be fastened rigidly and securely to the sign post.

12-2.17 BICYCLE RACKS

PART 1 - GENERAL

SUMMARY

This work shall consist of furnishing and installing a stainless steel bicycle rack, parked 5 bikes, in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.

Product Data: Include physical characteristics such as shape, dimensions, bicycle parking capacity and finish for each bicycle rack.

Working Drawings: Show installation details for each bicycle rack.

Samples for Verification: Submit finish samples for review and verification.

Maintenance Data: For each bicycle rack, including recommended methods for repairing damage to the finish.

QUALITY CONTROL AND ASSURANCE

Source Limitations: Obtain each color, finish, shape and type of bicycle rack from a single source with resources to provide components of consistent quality in appearance and physical properties.

DELIVERY, STORAGE AND HANDLING

Upon delivery, before signing for shipment, inspect for any damage and notate on the Bill Of Landing.

Store bicycle racks in original undamaged packages and containers until ready for installation.

Handle bicycle racks with sufficient care to prevent any scratches or damage to the finish.

WARRANTY

Bicycle racks carry a 1 year manufacturer's limited warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

Material:

1. 2" x 2" x 3/16" square tube
2. Surface mount bike rack has two 5.5" x 5.25" x 0.25" foot plates with four masonry anchors per foot.

Finish: 304 grade stainless steel material finished in a satin finish.

Setbacks: A minimum of 36" must be left between the wall and the rack, and 96" minimum between rack and street.

PART 3 - EXECUTION

Examination:

Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

Installation:

Install in accordance with manufacturer's installation instructions. Install units plumb, level, square, accurately aligned, correctly located per drawings and free from warp or twist while maintaining alignment with surrounding adjacent surfaces.

12-2.18 BICYCLE STORAGE LOCKERS

PART 1 - GENERAL

SUMMARY

This work shall consist of furnishing and installing stainless steel bicycle storage lockers in accordance with the details shown on the plans and these special provisions.

SUBMITTALS.

Product Data: Include physical characteristics such as shape, dimensions, bicycle storing capacity and finish for each bicycle storage locker.

Working Drawings: Show assembly and installation details for each bicycle storage locker.

Samples for Verification: Submit finish samples for review and verification.

Maintenance Data: For each bicycle storage locker, including recommended methods for repairing damage to the finish.

QUALITY CONTROL AND ASSURANCE

Source Limitations: Obtain each color, finish and type of bicycle locker from a single source with resources to provide components of consistent quality in appearance and physical properties.

DELIVERY, STORAGE AND HANDLING

Upon delivery, before signing for shipment, inspect for any damage and notate on the Bill Of Landing.

Deliver materials to the site in an undamaged condition. Carefully store materials to provide proper protection against damage from moisture, heat, cold, direct sunlight or other causes.

Store products in manufacturer's original undamaged packages and containers until ready for installation.

PROJECT CONDITION

Anticipate environmental conditions (temperature, humidity and ventilation) to schedule work within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

WARRANTY

Bicycle lockers carry a 1 year manufacturer's limited warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

Material:

Stainless Steel Fabrication:

Exterior Walls, Tops and Doors (ASTM A314): 16-gage stainless steel. Doors must have 16 gage stainless steel horizontal stiffener for additional rigidity.

Corners and Floors (ASTM A314): 14-gage stainless steel. All Corner components must have 6 punched-in louvered vents.

Floor (ASTM A591): 14-gage stainless steel with built-in longitudinal roll formed stiffeners at 13 inches on center.

Divider Panels (ASTM A591): 18-gage stainless steel.

Provide two interior hanging hooks for each locker.

Full Length Door Hinge (ASTM A314): 16-gage stainless steel.

Three-Point Locking Bar Mechanism (ASTM B221): 1 inch wide by 1/4 inch thick stainless steel flat bar running beyond the full length of the door frame and into the top and floor and jamb (3-Points).

Dimensions including floor: 39 inches wide by 48 inches high by 75 inches long.

Accessories: Stainless steel padlock style handle.

PART 3 - EXECUTION

EXAMINATION

Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

Do not begin installation until location has been properly prepared.

Clean location thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer.

INSTALLATION

Install in accordance with manufacturer's installation instructions. Install units plumb, level, square, accurately aligned, correctly located per drawings and free from warp or twist while maintaining alignment with surrounding adjacent surfaces.

PROTECTION

Protect installed products until completion of project.

Touch-up, repair or replace damaged products before contract acceptance.

12-2.19 CABLE RAILING

PART 1 - GENERAL

SUMMARY

Scope: This work consists of furnishing and installing cable railings in accordance with the details shown on the plans and the provisions in Sections 83-1, "Railings," of the Standard Specifications and these special provisions.

Full compensation for cable railings shall be considered as included in the lump sum price paid for building work and no additional compensation will be allowed therefor.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

SECTION 12-3. CONCRETE AND REINFORCEMENT

12-3.01 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of constructing cast-in-place concrete facilities in accordance with the details shown on the plans and these special provisions.

Concrete:

Except for concrete designated by compressive strength, concrete shall conform to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications, and these special provisions.

Concrete designated by compressive strength shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications, and these special provisions.

Reinforcement: Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications, and these special provisions.

DEFINITIONS

Concrete Designated by Compressive Strength: Concrete with a compressive strength shown on the plans greater than 3,600 psi.

SUBMITTALS

Product Data:

Manufacturer's descriptive data, installation and use recommendations for admixtures, expansion joint material, vapor barrier, curing compound, hardener, and sealer shall be submitted for approval.

Descriptive data shall be delivered to the Engineer at the jobsite.

Concrete Mix Designs: Copies of concrete mix designs shall be submitted to the Engineer at the jobsite.

Certificates of Compliance: Certificates of compliance shall be submitted when required as informational submittals.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-

consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY CONTROL AND ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

The following materials must have recycled content:

Fly ash (50% recycled content)
Steel (25% recycled content)

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

CONCRETE MIXES

The amount of cementitious material used per cubic yard of concrete for each building element shall conform to the following:

Type	Cementitious Material Content (Pounds/CY)
Concrete (Structural Work): Footings, foundation walls, floor slabs, building frame members, building walls	658 min.[a,]
Concrete (Sewer Structures): For sewer structures, and vehicle washracks	658 min.[b]
Concrete (Minor Work): For concrete curbs, sidewalks, driveways, gutter depressions, new door openings, and collars	505 min.

Notes:

[a]For concrete designated by compressive strength, the maximum amount of cementitious material shall be 800 pounds per cubic yard.

[b]Concrete shall be air entrained in conformance with the requirements in Section 90-4, "Admixtures," of the Standard Specifications. The air content at time of mixing and prior to placing shall be 6 ± 1½ percent.

In addition to the above requirements, concrete shall conform to "Corrosion Control For Portland Cement Concrete" of these special provisions.

FORM MATERIALS

Forms for Exposed Finish Concrete:

Forms for exposed surfaces shall be plywood, metal or other panel type materials. Plywood shall be not less than 5/8 inch thick and without scars, dents, and delaminations. Forms shall be furnished in largest practical pieces to minimize number of joints.

Plywood shall conform to the requirements of U. S. Product Standard PS-1 for Exterior B-B (Concrete Form) Class I.

Forms for edges of slabs shall be nominal 2-inch solid stock lumber, plywood, or metal forms.

Forms for Unexposed Finish Concrete: Forms for unexposed finish concrete surfaces shall be plywood, lumber, metal or other acceptable material.

Forms for Cylindrical Columns or Supports: Forms for cylindrical columns shall be metal, fiberglass reinforced plastic, paper or fiber tubes. Paper or fiber tubes shall be constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for protection against weather or moisture.

Form Ties: Form ties shall be factory fabricated, removable or snapoff metal ties for use as necessary to prevent spreading of forms during concrete placement.

Form Oil: Form oil shall be commercial quality form oil which will permit the ready release of the forms and will not discolor the concrete.

REINFORCEMENT

Bar Reinforcement: Bar reinforcement shall conform to ASTM A 615/A 615M, Grade 60, or ASTM A 706/A 706M.

Bar Supports: Bar supports for reinforcement shall be precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads.

RELATED MATERIALS

Anchor Bolts and Anchor Rods, Nuts and Washers:

Headed and Unheaded Anchor Bolts and Anchor Rods: Comply with ASTM F 1554. Use Grade 36 unless a higher grade is shown on the plans.

Nuts: Comply with ASTM A 563.

Washers:

1. Washers bearing on wood surfaces must be commercial quality.
2. Washers bearing on steel surfaces must comply with ASTM F 436, Type 1.
3. Plate washers must comply with ASTM A 36/A 36M.

Exposed anchor bolts and anchor rods, nuts and washers must be hot-dipped galvanized.

Expansion Joint Material: Expansion joint material shall be commercial quality asphalt impregnated pressed fiber sheets, ½-inch minimum thickness.

Vapor Barrier: Vapor barrier shall be not less than 15 mils thick and shall conform to the requirements of ASTM E 1745, Grade A. Tape for overlapped seams shall be as recommended by the manufacturer of the vapor barrier.

Bond Breaker: Bond breaker shall be Type I asphalt saturated organic felt or such other material approved by the Engineer.

Nonskid Abrasive Aggregate: Nonskid abrasive aggregate shall be commercial quality aluminum oxide, silicon carbide, or almandite garnet grit particles; screen size 12-30 or 14-36.

Type A Control Joints: Type A control joints shall be commercial quality, preformed, T-shaped plastic strips with detachable top flange.

Keyed Construction Joint Forms: Keyed construction joint forms shall be commercial quality, galvanized metal or plastic, factory fabricated construction joint forms. Forms shall produce a rabbeted key type joint.

Divider and Edger Strips: Divider and edger strips shall be foundation grade redwood.

Mortar: Mortar shall consist of one part cement to 2 parts clean sand and only enough water to permit placing and packing.

Curing Compound: Curing compound shall be a non-pigmented curing compound with fugitive dye conforming to the requirements of ASTM C 309, Type 1-D, Class A.

Concrete Hardener: Concrete hardener shall be commercial quality water borne penetrating type magnesium fluosilicate, zinc fluosilicate or combination thereof.

Concrete Sealer: Concrete sealer shall be commercial quality VOC-compliant, silane type sealer with hydrophobic and oleophobic properties.

Splash Block: Splash blocks shall be precast concrete splash blocks with depressed runoff trough. Splash blocks shall be 12" x 24" x 3½" in size unless otherwise shown on the plans.

Nonshrink Grout:

Nonshrink grout shall be metallic for concealed areas, nonmetallic for exposed areas.

Grout shall be factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107; free of oxidizing catalysts and inorganic accelerators, used as dry or damp pack, or mixed to a 20-second flow (CRD C621), without segregation or bleeding at any temperature between 45 °F and 90 °F.

Working time of grout shall be 30 minutes or more.

PART 3 - EXECUTION

PREPARATION

Existing Concrete Construction:

Where fresh concrete joins existing or previously placed concrete, the contact surfaces of the existing or previously placed material shall be roughened, cleaned, flushed with water and allowed to dry to a surface dry condition immediately prior to placing the fresh concrete. The roughened surface shall be no smoother than a wood trowelled surface. Cleaning of the contact surfaces shall remove laitance, curing compounds, debris, dirt and such other substances or materials which would prevent bonding of the fresh concrete.

Abrasive blast methods shall be used to clean horizontal construction joints to the extent that clean aggregate is exposed.

Exposed reinforcing steel located at the contact surfaces which is to be encased in the fresh concrete shall be cleaned to remove any substance or material that would prevent bonding of the fresh concrete.

Forms:

Forms shall be mortar tight, true to the dimensions, lines, and grades shown on the plans, securely fastened and supported, and of adequate rigidity to prevent distortion during placing of concrete.

Forms for exposed surfaces shall be constructed with triangular fillets not less than 3/4" x 3/4" attached so as to prevent mortar runs and to produce smooth straight chamfers at all sharp edges of the concrete.

Form fasteners shall be removable without chipping, spalling, heating or otherwise damaging the concrete surface. Form ties shall be removed to a depth of at least one inch below the surface of the concrete.

The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign material. Forms shall be thoroughly coated with form oil prior to use.

Forms shall not be stripped until at least 40 hours after placing concrete, except soffit forms and supports shall not be released or removed until at least 10 days after placing concrete.

Anchorages and embedded items shall be placed and rigidly secured at their planned locations prior to placing concrete.

Reglets or embedded flashing shall be installed on concrete forms before the concrete is placed.

Redwood dividers shall have 16d galvanized nails partially driven into both vertical faces at 18 inches on center.

Vapor Barrier:

Vapor barrier shall be installed in conformance with the manufacturers recommendations.

Unless otherwise shown on the plans, vapor barrier shall be placed under portions of the floor slab scheduled to receive finish flooring.

Placing Reinforcement:

Set wire ties with ends directed into concrete, away from exposed concrete surfaces.

Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

Ground Bar: A continuous reinforcing steel bar shall be installed in the building foundation at the location indicated on the plans for the electrical ground bar. The use of epoxy coated reinforcing bar is not permitted. The end of the ground bar shall extend beyond the concrete surface and shall be protected from damage by construction operations.

PLACING CONCRETE

Concrete shall be placed in conformance with the provisions in Section 51-1.09, "Placing Concrete," of the Standard Specifications, and these special provisions.

Concrete shall be deposited and consolidated in a continuous operation within limits of construction joints, until the placing of the panel or section is completed.

When concrete is to be placed in large areas requiring more than two pours, concrete shall be placed in alternate long strips between construction joints and the final slab infilled.

FINISHING CONCRETE SURFACES

Finishing Unformed Surfaces:

Slabs shall be placed full thickness to finish elevation and leveled to screeds by use of long straightedges. The screeds shall be set to grade at approximately 6-foot centers. After leveling, screeds shall be removed and the surface shall be floated with wooden floats.

Type A control joint strips shall be inserted into the floated concrete so that the bottom of the top flange is flush with the finish elevation. Strips shall be standard manufactured lengths and shall be placed on an approximate straight line. The top flange of the strips shall be removed after the concrete has set and cured.

The floated surface shall be trowelled with steel trowels. Troweling shall form a dense, smooth and true finish. Walkways, pedestrian ramps, stairs and outdoor slabs for pedestrian traffic shall be given a non-slip broom finish unless a different finish is called for on the plans or in these special provisions.

The application of cement dust coat will not be permitted.

Steel trowel finish and broom finish will not be required for slabs to receive exposed aggregate finish nor for slabs to be covered with ceramic tile.

Concrete floor surfaces to receive ceramic tile shall be floated to grade and then, before final set of the concrete, the floated surfaces shall be roughened with stiff bristled brushes or rakes.

Finished surfaces of floor slabs shall not deviate more than 1/8 inch from the lower edge of a 10-foot long straight edge.

Finishing Formed Surfaces:

Formed concrete surfaces shall be finished by filling holes or depressions in the surface, repairing all rock pockets, and removing fins. All surfaces of formed concrete exposed to view shall have stains and discolorations removed, unsightly bulges removed, and all areas which do not exhibit the required smooth, even surface of uniform texture and appearance shall be sanded with power sanders or other approved abrasive means until smooth, even surfaces of uniform texture and appearance are obtained.

Cement mortar, patching and finishing materials used to finish exposed surfaces of concrete shall closely match the color of surrounding surfaces.

Nonskid Abrasive Aggregate Finish: Where shown on the plans, walkways shall receive a nonskid abrasive aggregate (grit) finish. The grit shall be applied uniformly at the rate of not less than 0.3 pound per square foot and tamped into the floated concrete surface while the concrete is plastic. The grit shall be buried about 0.7diameter of each particle into the concrete.

CURING CONCRETE

Freshly placed concrete shall be protected from premature drying and excessive cold or hot temperatures.

Initial curing of floor slabs shall start as soon as free water has disappeared from the concrete surface. The concrete shall be kept continuously wet by application of water for not less than 7 days after the concrete has been placed.

Cotton mats, rugs, carpets, or sand blankets may be used as a curing medium to retain the moisture during the curing period. Curing materials that will stain or discolor concrete shall not be used on surfaces exposed to view.

Prior to placing the curing medium, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is

covered with the curing medium. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

Concrete surfaces, other than floor slabs, shall be kept moist for a period of at least 5 days by leaving the forms in place or by covering the exposed surfaces using moist rugs, cotton mats or other curing materials approved by the Engineer.

Concrete curbs, sidewalks, collars, and gutter depressions may be cured with a curing compound.

PROTECTING CONCRETE

Vehicles, equipment, or concentrated loads weighing more than 300 pounds individually and material stockpiles weighing more than 50 pounds per square foot will not be permitted on the concrete within 10 calendar days after placing.

SPECIAL TREATMENTS

Concrete Hardener:

Chemical concrete hardener shall be applied to the floor surfaces shown on the plans, prior to the application of concrete sealer. Surfaces shall be clean and dry before the application of hardener.

The solution shall be applied in accordance with the manufacturer's instructions.

After the hardener has dried, the surface shall be mopped with water to remove encrusted salts.

Concrete Sealer: Concrete sealer shall be applied to the concrete surfaces designated on the plans in accordance with the manufacturer's instructions for heavy duty use. The sealer shall be applied to dry concrete surfaces.

SECTION 12-4. (BLANK)

SECTION 12-5. METALS

12-5.01 STRUCTURAL STEEL FOR BUILDINGS

PART 1 - GENERAL

SUMMARY

This work includes fabricating, assembling, furnishing, and erecting structural steel.

DEFINITIONS

Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on the plans.

RCSC: The Research Council on Structural Connections.

Seismic-Load-Resisting System (SLRS): Elements of structural-steel frame designated as SLRS or along grid lines designated as SLRS on plans, including columns, beams, and braces and their connections.

Structural Steel: Elements of the structural steel frame essential to support the design loads, including the following:

1. Base Plates
2. Beams

3. Anchor Rods
4. Columns
5. Crane Stops
6. Angles
7. Bolts
8. Girts
9. Girders
10. Rods

SUBMITTALS

Product Data: Submit product data for items to be incorporated into the work, including structural steel, high strength fastener assemblies, and alternative connectors.

LEED:

Submit product data for Credit MR 4.1 and Credit MR 4.2:

1. For products having recycled content, submit documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
2. Include statement indicating costs for each product having recycled content.

Working Drawings:

Submit working drawings that include the following:

1. A comprehensive list of all structural steel elements to be used as described under AISC 303, Section 2.1, "Definition of Structural Steel."
2. Sequence of shop and field assembly and erection, welding sequence and procedures, and welding nondestructive testing (NDT) sequence and procedures.
3. Identification of welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Location of butt welded splices on a layout drawing of the entire structure.
5. Location and details of any temporary supports that are to be used.
6. Type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted connections.
7. Identification of members and connections of the seismic-load-resisting system.
8. Identification of locations and dimensions of protected zones.
9. Identification of demand critical welds.
10. Any changes proposed in the work, details of connections and joints exposed to the weather, and details for connections not dimensioned on the plans. If changes are proposed or connections are designed, submit design calculations stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The expiration date of the registration must be shown.

Working Drawings for Falsework: Submit working drawings and calculations for falsework for use during the erection of structural steel. Design and construct the falsework to provide the necessary rigidity, and to support the applied loads. Working drawings and design calculations must be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The expiration date of the registration must be shown.

Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Submit WPSs and PQRs under AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

Qualification Data: Submit fabricator and welder qualifications.

QUALITY CONTROL AND ASSURANCE

Fabricate, assemble, and erect structural steel under AISC 303, 325, 341, and 360.

Welding: Weld under AWS D1.1/D1.1M and AWS D1.8/D1.8M, and comply with Section 8-3, "Welding" of these special provisions.

Welding Qualifications:

Qualify procedures and personnel under AWS D1.1/D1.1M.

Welders and welding operators performing work on bottom-flange, demand-critical welds must pass the supplemental welder qualification testing, under AWS D1.8/D1.8M. FCAW-S and FCAW-G must be considered separate processes for welding personnel qualification.

Certificates of Compliance: Furnish a Certificate of Compliance for structural steel products under Section 6-1.07, "Certificates of Compliance" of the Standard Specifications. Include mill test certificates for each heat number of steel used in the work.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content, to contribute toward achieving MR Credit 5.

Final Drawings:

At the completion of each structural steel building, furnish one set of reduced prints on 60-pound (minimum) bond paper, 11 inches x 17 inches, of the corrected original tracings of all approved working drawings for each building. Include an index prepared specifically for the drawings for each building containing sheet numbers and titles on the first reduced print in the set for each building. Arrange reduced prints for each building in the order of drawing numbers shown in the index.

The edge of the corrected original tracing image must be clearly visible and visually parallel with the edges of the page. Provide a clear, legible symbol on the upper left side of each page to show the amount of reduction, and provide a horizontal and vertical scale on each reduced print to facilitate enlargement to original scale.

DELIVERY, STORAGE, AND HANDLING

Load, transport, unload, and store structural materials so they are kept clean and undamaged. Store materials to permit access for inspection and identification.

Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Provide covers for protection of materials.

PART 2 - PRODUCTS

MATERIALS

Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 50 percent.

Steel Bars, Plates, Channels, Angles, and Shapes (other than W-shapes): For each yield stress shown on the plans, comply with the following:

1. ASTM A 36/A 36M, when minimum yield stress is 36 ksi.
2. ASTM A 572/A 572M, Grade 50, when minimum yield stress is 50 ksi.

W-shapes: Comply with ASTM A 992/A 992M.

Pipe: Comply with ASTM A 53/A 53M, Grade B, standard weight, unless otherwise shown on the plans.

Hollow Structural Sections: For each yield stress shown on the plans, comply with the following:

ASTM A 500/A 500M, Grade B, when minimum yield stress is 42 ksi for round shapes, and when minimum yield stress is 46 ksi for square and rectangular shapes.

BOLTS, CONNECTORS, AND ANCHORS

Stud Connectors: Comply with ASTM A 108, AISI Grades 1018 through 1020, cold drawn, either semi- or fully kilned.

Anchor Bolts and Anchor Rods, Nuts and Washers:

Headed and Unheaded Anchor Bolts and Anchor Rods: Comply with ASTM F 1554. Use Grade 36 unless a higher grade is shown on the plans.

Nuts: Comply with ASTM A 563.

Washers:

1. Washers bearing on wood surfaces must be commercial quality.
2. Washers bearing on steel surfaces must comply with ASTM F 436, Type 1.
3. Plate washers must comply with ASTM A 36/A 36M.

Exposed anchor bolts and anchor rods, nuts and washers must be hot-dipped galvanized.

Machine Bolts, Nuts, and Washers:

Machine Bolts: Comply with ASTM A 307.

Nuts: Comply with ASTM A 563.

Washers: Commercial quality.

MORTAR

Mortar: Use one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

SHOP FABRICATION

Shop Fabrication and Assembly:

1. Cuts must not deviate more than 1/16 inch from the intended line. Remove roughness, notches, and gouges.
2. At points of loading, bearing stiffeners must be square with the web. At least 75 percent of the stiffener must be in contact with the flanges.
3. Finished members must be true to line and be free from twists, kinks, warps, dents, and open joints. Finished members must have square corners and smooth bends
4. Exposed edges and ends of metal must be dressed smooth, with no sharp edges, and with corners slightly rounded.
5. Mark and match-mark materials for field assembly.

6. Complete structural steel assemblies, including welding of units, before shop-priming operations.

Stud Connectors: Prepare steel surfaces as recommended by manufacturer of stud connectors. Use automatic end welding of stud connectors under AWS D1.1/D1.1M and manufacturer's instructions.

Connections:

1. Clean abutting surfaces at connections.
2. Do not cut or weld at the jobsite, except as shown on the approved working drawings or approved by the Engineer.
3. Cut, drill, or punch holes perpendicular to steel surfaces. Finished holes for bolts must be cylindrical. Sub-punch and sub-drill holes ¼ inch smaller in diameter than the diameter specified for the finished hole.

Bolted Connections:

Fabricate steel to steel bolted connections with machine bolts or HS fastener assemblies when shown on the plans.

Machine Bolts: Snug tighten.

The bolt head type and head location must be consistent within a joint.

Install nuts on side of member least exposed to view.

Holes for Other Work: Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarged holes by burning. Drill holes in bearing plates.

SHOP FINISHES

Shop prime structural steel members, except those to receive sprayed-fireproofing.

Clean and coat steel surfaces of shop primed members under "Painting" in Section 12-9, "Finishes," of these special provisions.

SOURCE QUALITY CONTROL

Welded Connections: Test and inspect welded connections under AWS D1.1/D1.1M and the following:

Inspection:

1. Comply with AISC 341, Section Q5.2, except for CJP groove welds not receiving ultrasonic testing, perform magnetic particle testing on 100% of each root weld pass and each final weld pass of these welds.
2. Perform magnetic particle testing on 25% of each PJP groove weld. The Engineer will select the locations for testing. The cover pass must be ground smooth before testing.

Acceptance Criteria:

1. Ultrasonic Testing: Comply with AWS D1.1/D1.1M, Table 6.2 for statically loaded nontubular connections.
2. Magnetic Particle Testing: Comply with AWS D1.1/D1.1M, Clause 6, Part C.

Repairs:

1. If repairs are required, perform NDT on the repaired portion and re-inspect the weld by performing additional NDT on the entire length of the unrepaired portion of the weld under "Source Quality Control."
2. NDT of repaired work must be performed at your expense.

PART 3 - EXECUTION

ERECTION

Set structural steel accurately in locations and to elevations indicated.

Setting Bases and Bearing Plates:

Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

Set base plates and bearing plates for structural members on wedges or other adjusting devices.

Solidly pack mortar between bearing surfaces and base or bearing plates so there are no voids. Neatly finish exposed surfaces and allow to cure.

Field Splices:

Field splices must be made only at the locations shown on approved working drawings or approved by the Engineer.

Accurately assemble parts in their final position as shown on the plans and in true alignment with related and adjoining work before final fastening.

Support parts to provide a vibration free, rigid, and secure installation.

FIELD CONNECTIONS

Assembly and installation of bolted connections must comply with "Bolted Connections" under "Shop Fabrication."

FIELD QUALITY CONTROL

Testing and inspection of field-welded connections must comply with "Welded Connections" under "Source Quality Control."

FIELD FINISHES

Touch-up Painting: After erection, clean field welds, bolted connections, and abraded areas of shop paint under SSPC-SP 2 or SSPC-SP 3. Apply one coat of the same coating as applied for shop painting to the cleaned areas.

After touch-up painting, coat all surfaces with a second prime coat, and finish coats when specified, to comply with "Painting" in Section 12-9, "Finishes," of these special provisions.

12-5.02 OPEN WEB STEEL JOISTS

PART 1 - GENERAL

SUMMARY

This work includes:

K-series steel joists.
K-series steel joist substitutes.
Long-span steel joists.

Joist accessories.

DEFINITIONS

SJI: Steel Joist Institute.

SJI Specifications: SJI's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in the SJI specifications.

SUBMITTALS

Product Data: Submit manufacturer's descriptive data and installation instructions. Submit quality control manual and welder qualifications for field welding.

LEED Submittals:

Submit product data for Credit MR 4.1 and Credit MR 4.2:

1. For products having recycled content, submit documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
2. Include statement indicating costs for each product having recycled content.

Working Drawings:

Submit working drawings and design calculations for the steel joists, permanent bracing, continuity angles, and connection details.

1. Show layout, location and identification of each steel joist, number, type, and spacings of steel joists. Include joining and anchorage details, bridging, joist accessories, splice and connection locations and details, and attachments to other construction.
2. Show size and shape of truss members and both temporary and permanent bracing members.
3. Calculations for design of steel joists, bracing, and connections must include a list of applied loads and load combinations with the resulting member forces and member stresses. Design steel joists and connections for the chord forces shown on the plans.
4. Design calculations must be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The expiration date of the registration must be shown.
5. If the design calculations contain or consist of computerized or tabulated calculations, the values pertaining to the design must be identified, described, or indexed in such a manner that a design review can be performed.

QUALITY ASSURANCE

Manufacturer Qualification: The manufacturer must be certified by the SJI to manufacture steel joists under the SJI specifications. Furnish documentation of certification.

Codes and Standards: Design steel joists and permanent bracing for the loads shown on the plans and other applied loads, including fire sprinkler systems. The design must comply with the CBC and the SJI specifications.

Field Welding: Qualify procedures and personnel for field welding under AWS D1.1/D1.1M, "Structural Welding Code - Steel."

Certificates of Compliance: Furnish a Certificate of Compliance for steel joists under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Identification: Stamp or mark each joist with a location identification mark or symbol.

DELIVERY, STORAGE, AND HANDLING

Protect steel joists from corrosion, deformation, and other damage during delivery, storage, and handling. Provide covers for protection of materials.

PART 2 - PRODUCTS

MATERIALS

Open Web Steel Joists:

Comply with the SJI specifications for K & LH Series. Steel joists must be tapered and designed to support the loads shown on the plans.

Recycled Content: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

Bearing Plates, Fasteners, and Accessories: Comply with the approved working drawings.

Anchors: Comply with the specifications for anchors in Section 12-5, "Building Miscellaneous Metal," of these special provisions.

FABRICATION

Fabricate steel joists under the SJI specifications.

Build camber into the steel joists if required by the design.

SHOP FINISHES

Clean and prepare surfaces under one of the following:

1. SSPC-SP 1 and SSPC-SP 2
2. SSPC-SP 1 and SSPC-SP 3
3. The coating manufacturer's printed instructions.

Shop Paint: Comply with SSPC-Paint 15. Apply one coat.

Apply and cure the coating under the coating manufacturer's printed instructions.

PART 3 - EXECUTION

ERECTION

Installation of steel joists must comply with the approved working drawings. Accurately cut steel joists and bracing members to provide tightly fitted joints and connections.

Remove and replace damaged steel joists at your expense, except when field repair is approved by the Engineer. Repairs must comply with the manufacturer's recommendations.

INSTALLATION

Install steel joists and accessories plumb, square, and true to line. Securely fasten steel joists to supporting construction under SJI specifications, steel joist manufacturer's printed instructions, and the approved working drawings. Do not field cut or otherwise alter steel joists without the written approval of the Engineer.

Install temporary bracing and erection bridging, connections, and anchors to ensure that steel joists are stabilized during construction.

Bearing plates must have full bearing after the supporting members have been plumbed and properly positioned, before placing superimposed loads.

Comply with specifications for welding, appearance and quality of welds, and methods used in correcting welding work under AWS D1.1/D1.1M, "Structural Welding Code - Steel." Exposed welds must be ground smooth and flush.

Install and connect bridging concurrently with steel joist erection before construction loads are applied. Distribute temporary loads so that the design carrying capacity of any steel joist is not exceeded. Do not apply loads to bridging during construction or in the completed work.

Secure permanent bracing before any sustained permanent loads are applied to the steel joist system.

FIELD FINISHES

After installation, clean and prepare field connections, rust spots, and abraded surfaces of shop-primed steel joists and accessories under SSPC-SP 2 or SSPC-SP 3. Prime or reprime the cleaned and prepared surfaces with the same or compatible type of coating used in the shop priming.

Coatings: Comply with the specifications in Section 12-9, "Painting," of these special provisions. Clean and prepare steel surfaces under the manufacturer's printed instructions. The final finish color must be approved by the Engineer.

12-5.03 METAL DECK

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing metal deck in accordance with the details shown on the plans and these special provisions.

Metal deck includes ribbed sheet steel decking units, bent plates, accessories, fasteners and such other components, not mentioned, but required for a rigid, secure and complete installation.

REFERENCES

The design, fabrication and erection of metal deck shall conform to the applicable requirements of the American Iron and Steel Institute (AISI) publication, "Specifications for the Design of Light Gauge Cold Formed Steel Structural Members," and the applicable Steel Deck Institute Design Manual and these special provisions.

Welding shall be in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

ICC ES Report as applicable for deck manufacturer selected.

SUBMITTALS

Product Data: Manufacturer's descriptive data for each type of deck and accessories shall be submitted for approval.

Working Drawings: Working drawings showing complete erection layouts, details, dimensions, deck section properties shall be submitted for approval. Drawings shall show types and gages, fastening methods, including

the location, type and sequence of connections, sump pans, cut openings, surface finishes and temporary supports or bracing.

The metal deck supplier shall submit a fastening schedule and calculations stamped by an engineer who is registered as a Civil Engineer in the State of California showing that the metal roof panels, clips, and fasteners conform to the span and design loads shown on the plans and the wind uplift requirements of the CBC.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Qualification of Field Welding:

Welding processes and welding operators shall be qualified in accordance with "Welder Qualification," procedures in American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

Welding decking in place is subject to inspection and testing. Defective work shall be removed and replaced with acceptable work.

Certificates of Compliance: Certificates of Compliance shall be furnished for the metal decking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE

Metal deck units and accessories shall be transported, stored and erected in a manner that will prevent corrosion, distortion or other damage.

Deck units shall be stored off the ground with one end elevated to provide drainage.

PART 2 - PRODUCTS

Manufacturers: Acceptable manufacturers shall be; Verco Manufacturing Co., ASC Profiles Co.; or equal.

MATERIALS

Deck Units:

Deck units, closures and plates shall be fabricated from galvanized sheet steel conforming to ASTM Designation: A 653/A 653M, Grade 33 [230] as a minimum.

Galvanizing shall conform to the requirements of ASTM Designation: A 924/A 924M, G60 [Z180].

Miscellaneous Steel Shapes: Miscellaneous steel shapes shall conform to ASTM Designation: A 36/A 36M.

Anchor Clips, Vent Clips, Flashing, Saddle Plates, Flexible Closure Strips and Other Accessories: Anchor clips, vent clips, flashing, saddle plates, flexible closure strips and other accessories shall be as recommended by the decking manufacturer.

FABRICATION

Deck units shall be formed to span 3 or more supports, with flush, telescoped or nested 2-inch laps at ends and interlocking or nested side laps unless otherwise shown on the plans.

Deck units shall conform to the configurations, metal thickness, depth and width and section properties shown on the plans.

End bearing shall be not less than 1½ inches.

Metal Closure Strips: Metal closure strips for opening between deck units and other construction shall be fabricated from the same gage and material as the adjacent deck units. Strips shall be formed to provide tight-fitting closures at end of cells or flutes and sides of decking.

Roof Sump Pans: Sump pans shall be fabricated from single piece of galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Sump pans shall be of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide. Pans shall be recessed not less than 1½ inches below roof deck surface unless otherwise shown or required by deck configuration. Holes for drains shall be cut in the field.

Cleaning: When spray-on fireproofing is specified, the decking manufacturer shall supply decking free of amounts of oil or lubricants which would significantly impair the adhesion of the spray-on fireproofing.

PART 3 - EXECUTION

INSTALLATION

Deck units and accessories shall be installed in accordance with the manufacturer's recommendations and approved drawings and these special provisions.

Units shall be placed on supporting steel framework, adjusted in place and properly aligned before being permanently fastened. Ends of units shall have positive bearing over structural supports.

Cutting and fitting shall present a neat and true appearance with exposed burrs removed. Openings through the decking shall be cut square and shall be reinforced as recommended by the decking manufacturer.

The metal deck shall not be used as a working platform before deck units are fastened in place. Supplies, equipment or other loads shall not be stored on the deck. Mechanical equipment or other loads shall not be hung from metal roof decking.

Welding:

Welding shall conform to AWS requirements (D1.1 and D1.3) and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Welding washers shall be used where recommended by the manufacturer.

Fastening Roof Deck Units: Roof deck units shall be fastened to supporting steel members as shown on the structural plans.

Fastening Side Laps: Side laps of adjacent deck units shall be fastened as shown on the plans.

Roof Sump Pans: Roof sump pans shall be placed over openings provided in roof and welded to top decking surface. Welds are to be spaced at not more than 12 inches with at least one weld in each corner. Cut opening in sump bottom to accommodate drain size indicated.

Field Painting:

Immediately following erection, field welds, bolted connections and abraded areas shall be cleaned with a wire brush.

Galvanized surfaces shall be touched-up with galvanizing repair paint recommended by the manufacturer.

12-5.04 COLD FORMED METAL FRAMING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing cold formed metal framing, including load-bearing and non-bearing steel studs, and "C"-shaped steel joists and rafters, in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION

Loadings:

Components shall be sized to withstand the design loads shown on the plans.

Wall system shall be designed to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclical day/night temperature range.

Wall system design shall accommodate construction tolerance, deflection of building structural members, and clearances of intended openings.

REFERENCES

Component Design: Structural properties of studs and joists shall be computed in accordance with American Iron and Steel Institute (AISI), "Specification for Designing of Cold-Formed Steel Structural Members."

Welding:

Welding shall be in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

Welders shall be qualified in accordance with "Welder Qualification," procedures of AWS D1.1, "Structural Welding Code-Steel."

SUBMITTALS

Product Data:

Manufacturer's descriptive data and installation instructions for each item of cold-formed metal framing and accessories shall be submitted for approval.

Installation instructions shall include instructions for securing studs to tracks and other framing connections.

Working Drawings:

Working drawings and calculations for cold formed metal framing components not fully dimensioned in manufacturer's descriptive data shall be submitted for approval.

Working drawings shall include framing members showing size and gage designations, number, type, location and spacing. Working drawings shall include supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

The cold formed metal framing supplier shall submit drawings and calculations stamped by an Engineer who is registered as a Civil Engineer in the State of California showing that the metal framing and fasteners comply with seismic and wind uplift requirements of the CBC.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Fire-rated Assemblies: Where cold formed metal framing units are components of assemblies indicated to be fire-rated, provide units which have been approved for the rating indicated on the plans.

DELIVERY, STORAGE AND HANDLING

Cold formed metal framing components shall be protected from rusting and damage. Components shall be delivered to the jobsite in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Components shall be stored off ground in a dry ventilated space.

PART 2 - PRODUCTS

COLD FORMED METAL FRAMING

Steel Studs, Joists and Rafters:

Load-bearing studs shall be formed to channel shape, punched web, and knurled faces, conforming to ASTM Designation: A 653/A 653M, Grade 50 [340]. Studs shall be 16-gage minimum thickness and size as shown on the drawings.

Joists, rafters, and other framing components, 18-gage or lighter, shall be fabricated of commercial quality galvanized steel sheets; conforming to ASTM Designation: A 653/A 653M, Grade 33 [230].

Steel Track: Track shall be formed steel, channel shape, and same width as studs; solid web; not less than 18-gage thickness.

ACCESSORIES

Fasteners: Fasteners shall be hot-dipped galvanized, self-drilling, self-tapping screws, or bolts, nuts and washers as indicated on the plans.

Anchorages: Anchorages shall be ICC-ES approved for the purpose intended, integral stud type, powder driven or drilled expansion bolts.

FINISHES

Studs, Track and Headers: Studs, tracks and headers shall be hot-dipped galvanized to conform to ASTM Designation: A 653M, G60.

Miscellaneous Metal Parts: Miscellaneous parts, including, bracing, furring, plates, gussets, and bridging, shall be hot dipped galvanized to not less than 1¼ ounces per square foot.

FABRICATION

Cold formed metal framing components shall be fabricated in place or prefabricated into panels to the maximum extent possible prior to erection. Panels shall be fabricated plumb, square, true to line and braced against racking with joints welded. Lifting of prefabricated panels shall be performed in a manner to prevent damage or distortion.

Panels shall be fabricated in jig or templates to hold members in proper alignment and position to assure accurate placement.

Fastenings: Components shall be fastened by shop welding, bolting or screw fasteners as shown on the approved drawings.

PART 3 - EXECUTION

INSTALLATION

Studs:

Studs shall be erected plumb, except as needed for diagonal bracing or similar requirements. Channel tracks shall be aligned accurately to the wall layout at both floor and ceiling. Tracks shall be secured to floor and ceiling with fasteners spaced at not more than 16-inch intervals. Fasteners shall be provided at corners and ends of track.

Studs shall extend from floor to underside of ceiling except at wall openings. Each stud shall be secured to tracks at both top and bottom by bolting or screw fastening at both inside and outside flanges. Field welding shall not be permitted. A ½-inch clearance shall be provided at the top shoes. Door openings shall have double studs continuous across head and from floor to ceiling on each jamb.

Studs at openings shall be fastened solidly and securely to floor clips. Floor clips shall be fastened to the floor with 2 anchors unless otherwise shown on the plans.

Supplemental framing, blocking and bracing shall be installed in steel stud system wherever walls or partitions are to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition.

One continuous, horizontal ¾-inch channel reinforcement shall be placed approximately 6 inches above all wall openings. The reinforcement shall pass through the web openings in the studs and shall extend through the first stud located beyond the double studs at either side of the opening and shall be saddle tied to each stud it passes through.

Joists and Rafters:

Joists and rafters shall be installed directly over bearing studs or a load distribution member shall be installed at the top track.

Web stiffeners shall be provided at reaction points where shown on the plans.

Ends of joists shall be reinforced with end clips, steel hangers, steel angle clips, steel stud section, or as otherwise recommended by the manufacturer.

Joists shall be secured to interior support systems to prevent lateral movement of bottom flanges.

12-5.05 BUILDING MISCELLANEOUS METAL

PART 1 - GENERAL

Scope: This work shall consist of fabricating, furnishing, and installing building miscellaneous metal in accordance with the details shown on the plans and these special provisions.

Building miscellaneous metal shall consist of the following:

Metal Sign
Anchors
Straps
Clamps
Filter Screen
Angle, Plate, and Channel
Metal Wall Ladder
Ladder Safety Cage
Drainage Piping
Downspout Cover
Railings and Handrails
Emergency Eyewash Grab Bars

Including all anchors, fastenings, hardware, accessories, and other supplementary parts necessary to complete the work.

REFERENCES

Codes and Standards: Welding of steel shall be in accordance with American Welding Society (AWS) D 1.1, "Structural Welding Code - Steel" and D 1.3, "Structural Welding Code - Sheet Steel." Welding of aluminum shall be in accordance with AWS D 1.2, "Structural Welding Code - Aluminum."

SUBMITTALS

Product Data: Submit manufacturer's specifications, anchor details, and installation instructions for products used in miscellaneous metal fabrications.

Working Drawings: Working drawings of fabricated items shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Shop Assembly: Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark all units for reassembly and installation.

Inspection and Tests: Materials and fabrication procedures shall be subject to inspection and tests by the Engineer, in mill, shop, and field. Such tests will not relieve the Contractor of responsibility of providing materials and fabrication procedures in compliance with specified requirements.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

MATERIALS

Steel Bars, Plates, and Hot-rolled Shapes: Steel bars, plates, and hot-rolled shapes shall conform to ASTM A 36/A 36M.

Galvanized Sheet Steel: Galvanized sheet steel shall conform to ASTM A 653/A 653M. Galvanizing shall be G60.

Aluminum Bars, Wire, and Tubes: Aluminum bars, wire, and tubes shall conform to ASTM B 221-12.

Pipe: Pipe shall be commercial quality standard steel pipe.

Hollow Structural Sections: Hollow structural sections shall conform to ASTM A 500/A 500M, Grade B, or A 501.

Bolts, Studs, Threaded Rods, Nuts, and Washers:

Bolts, studs, and threaded rods for general application shall conform to ASTM A 307 or F 1554, Grade 36.

Nuts shall conform to ASTM A 563.

Washers bearing on wood surfaces shall be commercial quality. Washers bearing on steel surfaces shall conform to ASTM F 844 or F 436.

Fittings: Brackets, bolt, threaded studs, nuts, washers, and other fittings for railings and handrailings shall be commercial quality pipe and fittings.

Expansion Anchors: Expansion anchors shall be ICC approved for the purpose intended, integral stud type anchor or internally threaded type with independent stud, hex nut, and washer.

Powder Driven Anchors: Powder driven anchors shall be plated, spring steel alloy drive pin or threaded stud type anchors for use in concrete or steel. Spring steel shall conform to ASTM A 227, Class 1. The diameter, length, and type of shank and the number and type of washer shall be as recommended by the manufacturer for the types and thickness of material being anchored or fastened.

Resin Capsule Anchors: Stud anchors for resin capsule anchors shall conform to ASTM A 307 or F 1554, Grade 36, threaded steel rod with hex nut and washer and sealed glass capsule or cartridge containing an adhesive composed of unsaturated polyester resin and benzol peroxide coated quartz sand. Resin capsule shall be Hilti; Molly; or equal.

Drainage Grates: Drainage grates shall be fabricated from steel bars as specified herein; ductile iron castings conforming to ASTM A 536, Grade 65-45-12; or carbon steel castings conforming to ASTM A 27, Grade 65-35.

Mortar: Mortar shall consist of one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

Metal Ladders:

Design and construction of aluminum ladders shall comply with ANSI A14.3, OSHA 1910.27, and CA Code of Regs Title 8, Section 3277- fixed ladders, unless otherwise indicated.

Rungs shall be deeply serrated on top surface, 1-1/4 inch minimum in section, formed from tubular aluminum extrusions, non-slip, and high strength 6061-T6 aluminum alloy. Rungs shall be able to withstand a 1,500 pound load without failure.

Side rails shall be continuous extruded-aluminum channel with cover plate or tube, 1/8-inch minimum wall thickness, 3-inch minimum in section, and high strength 6061-T6 aluminum alloy. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds, and clean, smooth and burr-free surfaces. Mounting bracket shall be a minimum 3/8-inch thick and securely mounted to wall framing. Side rails shall be spaced at minimum 16 inches apart, unless otherwise indicated.

Crossover platform shall be 1-1.2 inches minimum tubular aluminum guardrails and decks of serrated aluminum treads.

Fasteners shall be of adequate size to provide a 4:1 safety factor, based on ultimate loading, and shall be an integral part of the fixed ladder.

Grab bars shall be of a serrated non-slip tubular construction.

Ladders shall be supported at top and bottom and not more than 60 inches on center with welded or bolted brackets made from same metal as ladder.

Security door shall be formed 1/8-inch thick aluminum sheet, 72-inch minimum in high, unless otherwise indicated. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.

Ladder Safety Cages:

Fabricated ladder safety cage to comply with authority having jurisdiction. Assemble by welding. Spacing of primary hoops, secondary hoops and vertical bars shall no exceed that required by code.

Ladder safety Cage shall have primary hoops at tops and bottoms of cages and spaced not more than 20 feet on center, secondary intermediate hoops spaced no more than 48 inches on center between primary hoops.

Primary hoops shall be 1/4-inch by 4-inch flat bar hoops. Secondary intermediate hoops shall be 1/4-inch by 2-inch flat bar hoops. Vertical bars shall be 1/4-inch by 2-inch flat bars secured to each hoop.

Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners unless otherwise indicated.

Emergency Eyewash Grab Bars

Design and construction of galvanized steel grab bar shall comply with applicable ASTM, ANSI, and OSHA industry standard.

Grab bar shall be floor to wall, 2-3/8-inch outside diameter, schedule 40, galvanized steel pipe, configuration as indicated on the plans.

Mounting accessories including threaded pipe flange at floor and wall, and expansion anchors shall be galvanized steel. All galvanized steel pipes and accessories shall be zinc coated to reduce corrosion.

FABRICATION

Workmanship and Finish:

Workmanship and finish shall be equal to the best general practice in modern shops.

Miscellaneous metal shall be clean and free from loose mill scale, flake rust and rust pitting, and shall be well formed and finished to shape and size with sharp lines and angles. Bends from shearing or punching shall be straightened.

The thickness of metal and details of assembly and support shall give ample strength and stiffness.

Built-up parts shall be true to line and without sharp bends, twists, and kinks. Exposed ends and edges of metal shall be milled or ground smooth, with corners slightly rounded.

Joints exposed to the weather shall be made up to exclude water.

Galvanizing: Items indicated on the plans to be galvanized shall be hot-dip galvanized after fabrication. The weight of galvanized coating shall be at least 1½ ounces per square foot of surface area, except drainage grates shall have at least 2 ounces per square foot of surface area.

Painting: Building miscellaneous metal items that are not galvanized shall be cleaned and coated with one prime coat prior to erection in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions. After erection, surfaces shall be coated with a second prime coat, and finish coats when specified, in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

Loose Bearing and Leveling Plates: Loose bearing and leveling plates shall be furnished for steel items bearing on concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Plates shall be drilled to receive anchor bolts. Galvanize after fabrication.

Drainage Pipes, Frames and Grates:

Drain piping shall have connections sealed watertight.

Drainage grates shall have end bars of the same cross section as support bars. Connections between end bars and support bars of structural steel shall be welded all around.

Drainage frames shall be angles and plates as shown on the plans.

Drainage grates and frames shall be match marked.

Steel Pipe Railings and Handrailings:

Pipe handrailing shall consist of handrailing elements supported by metal brackets (wall type) or handrailing elements supported by tubular steel posts (post type).

Ends of railing pipe shall be closed, except for a 1/8-inch diameter weep hole at the low point.

All corners on railings shall be rounded. Simple and compound curves shall be formed by bending pipe in jigs to produce uniform curvature; maintain cylindrical cross-section of pipe throughout the bend without buckling, twisting or otherwise deforming exposed surfaces of the pipe.

Wall brackets, end closures, flanges, miscellaneous fitting and anchors shall be provided for interconnections of pipe and attachment of railings and handrails to other work. Inserts and other anchorage devices shall be furnished for connecting railings and handrails to concrete or masonry.

Steel railing shall be galvanized after fabrication. After galvanizing, all elements of the railing shall be free of fins, abrasions, rough or sharp edges, and other surface defects and shall not be kinked, twisted, or bent.

PART 3 - EXECUTION

GENERAL

Anchorages:

Anchorage devices and fasteners shall be provided for securing miscellaneous metal in-place construction; including threaded fasteners for concrete, toggle bolts, through bolts, lag bolts, and other connectors.

Cutting, drilling, and fitting shall be performed as required for installation of miscellaneous metal fabrications. Work is to set accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

Loose Leveling and Bearing Plates: Plates shall be set on wedges or other adjustable devices. Anchor bolts shall be wrench tightened after the plates have been positioned and plumbed. Mortar shall be packed solidly between bearing surfaces and plates to ensure that no voids remain.

Steel Pipe Railings and Handrailings:

Railings shall be adjusted prior to anchoring to ensure matching alignment at abutting joints. Secure posts and railing ends to building construction as shown on the plans.

Resin capsule anchors shall not to be used for anchoring railings and handrailings.

Powder Driven Anchors: Powder driven anchors shall be installed with low velocity powder actuated equipment in accordance with the manufacturer's instructions and State and Federal OSHA regulations.

Resin Capsule Anchors: Resin capsule anchors shall be installed in accordance with the manufacturer's instructions.

Bolted connections not otherwise specified or shown on plans must be snug-tightened.

DAMAGED SURFACES

Galvanized surfaces that are abraded or damaged shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating. The clean areas shall then be painted with 2 spot applications of a coating conforming to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) and listed on MPI List Number 18, Primer, Zinc Rich, Organic, and meeting the requirements under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-5.06 METAL STAIRS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of fabricating, and installing steel stairs with abrasive-filled epoxy treads and steel tube railings in conformance with the details shown on the plans and these special provisions.

PERFORMANCE REQUIREMENTS

Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

Structural Performance of Stairs: Metal stairs must withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 square inches.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.

Structural Performance of Railings: Railing must withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

Handrails and Top Rails of Guards:

Uniform loads of 50 lbf/ft. applied in any direction

Concentrated load of 200 lbf applied in any direction

Uniform and concentrated loads need not be assumed to act concurrently.

Infill of Guards:

Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.

Infill load and other loads need not be assumed to act concurrently.

Seismic Performance: Metal stairs must withstand the effects of earthquake motion determined according to ASCE 7, "Minimum Design Loads for buildings and Other Structures": Section 9, "Earthquake Loads."

Component Importance Factor is 1.5.

SUBMITTALS

Product Data: For metal stairs and the following:

Manufacturer's product data.
Manufacturer's installation instructions.

LEED Submittals:

Product Data for Credit MR 4: For products having recycled content, documentation indicating percentage by weight of postconsumer and preconsumer recycled content. Include statement indicating cost of each product having recycled contents.

Working Drawings:

Working drawings of metal stairs including plans, elevations, sections, details, method of installation, anchoring and attachments to other work.

Show members, sizes and thickness, anchorage location and accessory items.

Furnish setting diagrams for anchorage installation as required.

Include calculations stamped by a Civil Engineer registered in the jurisdiction in which the project is located.

Samples: Minimum two samples of 6 inch square, representing actual product, finish and patterns for each finished tread product specified shall be submitted for approval.

Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Manufacturer's Instructions: Submit manufacturer's storage and installation instructions.

Source Quality Control: Submit documentation verifying that components and materials specified in this Section are from single manufacturer.

Qualification Statements:

Submit certificate of compliance that manufacturer is American Institute of Steel Construction (AISC) Certified for Standard Steel Building Structures.

Submit letter of verification for Installer's Qualifications.

Welding Certificates:

Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with top coats.

Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for stairs and railings.

Testing railing according ASTM E894 and ASTM E935.

QUALITY ASSURANCE

Qualifications:

Manufacturer:

American Institute of Steel Construction (AISC) Certified firm having 10 years experience manufacturing components similar to or exceeding requirements specified in scope of project.

Having sufficient capacity to produce and deliver required materials without causing delay in work.

Installer: Acceptable to manufacturer.

NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standard for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual", for class of stair designated, unless more stringent requirements are indicated.

Welding Qualifications: Qualify procedures and personnel according to the following:

AWS D1.1/D1.1M, "Structural Welding code - Steel".

AWS D1.3, "Structural Welding Code - Sheet Steel".

DELIVERY, STORAGE AND HANDLING

Delivery and Acceptance Requirements:

Deliver material in accordance with manufacturer's written instructions.

Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.

Storage and Handling Requirements:

Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

Packaging Waste Management:

Separate waste materials for recycling in accordance with this specifications.

Remove packaging materials from site and dispose of at appropriate recycling facilities.

Remove pallets from site and return to supplier or manufacturer.

COORDINATION

Coordinate selection of shop primer with topcoats to be applied over them. Comply with paint and coating manufacturer's written recommendations to ensure that shop primer and topcoats are compatible with one another.

Coordinate installation of anchorages for metal stairs. Furnish setting drawing, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

STAIR AND RAIL SYSTEM

Manufacturer's standard prefabricated, pre-engineered straight run stair and landing system, consisting of hot rolled steel sheet stringers, riser, treads, landings, fasteners/supports and railings.

Stringers:

Steel plate or channel with side mounted prefabricated railings.

Minimum thickness or gage as determined by structural design calculations, structural grade steel plate or channel.

Risers: Closed riser, minimum 14-gage hot rolled mild steel sheet, sloped maximum 1-1/2 inches and conforming to Americans with Disabilities Act (ADA) nosing requirements.

Treads: Factory installed tread fill combination of epoxy, aggregate, and fiber compounds, 3/8 inch thick, 8,000 psi compressive strength, designed to meet Class 1 Building Code flame spread requirements.

Mid Landings: Minimum of 12-gage hot-rolled mild steel sheets, formed for a minimum 2-1/2 inches concrete fill, with 11-gage channel supports and bracing welded to perimeter framed at 12 inches on center.

Fasteners and Supports: Sized by the manufacturer to meet structural design criteria. If hanger rod connections are applicable to any of the landing connections, they shall be a minimum of 5/8 inch diameter steel rod, with actual size based on stair load.

Manufacturer's standard welded steel tube railing system complying with the following requirements:

Guard Rails: 1-1/2 inches diameter x 13-gage minimum round steel tube, continuous multi-strand type, equally spaced with not more than 3-15/16 inches clearance between strands and with a minimum extension per code at top and bottom risers. Wrap rail continuously past space between flights to form guardrail as required by building code. Terminate rail ends with radius returns, newel posts or safety terminations approved by local code. Provide not less than 1-1/2 inches clearing between rail and wall.

Guard Rail Posts: 1-1/2 inches square x 11-gage tubing. Rail posts to fasten to side of plate stringers per manufacturer's working drawings. Manufacturer to pre-weld erection aid to rail post for proper height to aid stair erector. Erection aid (setting block) to be removed and weld-ground smooth after installation.

Fabrication:

1. Use preformed or prefabricated bends.
2. Butt weld tee and cross intersections in tubing. Cope and weld intersections in pipe. Miter elbows.
3. Mechanically fasten internal sleeves and fittings.
4. Provide minimum 12-gage welded steel plate closures or hemispherical closure fittings on all exposed rail ends.

MATERIALS

Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

Steel Shapes and Plates: ASTM A36/A36M.

Steel Pipe: ASTM A53 Type E or S, Grade B.

Steel Tubing:

Structural Use: ASTM A500, Grade B or C.

Non-Structural Use: ASTM A513, hot rolled or coiled rolled (mill option).

Steel Sheet:

Structural Use: ASTM A 1011/A 1011M (hot rolled).

Non-Structural Use: ASTM A786, ASTM A 1008/A 1008M.

Fasteners: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

Welding Rods: In accordance with AWS code and AWS filler metal specifications for material being weld.

Primer: HAPS-free, solvent-based, rust inhibitive primer containing less than 3.5 lb/gal Volatile Organic Compounds (VOC) and compatible with conventional alkyds topcoats.

FABRICATION

Use same material and finish as parts being jointed. Use stainless steel between dissimilar metals and non-corrosive fasteners at exterior connections or joints.

Provide fasteners of sufficient strength to support connected members and loads, and to develop full strength of parts fastened or connected.

Construct stairs and rails with all components necessary for support and anchorage, and for a complete installation.

FINISHES

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendation for applying and designating finishes.

Finish metal stairs after assembly.

Rails and Stairs Components: Completely removed oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter from steel surface in accordance with SSPC SP3.

Shop primer immediately after fabrication and cleaning, spray apply primer to dry film thickness recommended by primer manufacturer, but not less than 2.0 mil thickness. Apply one coat High Solids Red Oxide Anticorrosive primer meeting SSPC-15 Paint.

ACCESSORIES

Stair Nosing: Stair nosing must meet OSHA requirements for anti-slip safety on stairs, as recommended by the manufacturer in conformance with the details shown on the plans.

Anchor bolts, clip angles, hanger rods, hardware and incidental materials required for complete installation, as recommended by the manufacturer.

PART 3 - EXECUTION

EXAMINATION

Verification of Conditions: Verify that conditions of substrates previously installed under other sections or contract are acceptable for product installation in accordance with manufacturer's instructions prior to metal stair and railing installation.

INSTALLATION

Coordinate metal stairs and railings work with work of other trades for proper time and sequence to avoid construction delay.

Install stairs, landings, and handrails in accordance with manufacturer's instructions. Install square, plumb, straight and true to line and level, with neatly fitted joints and intersections.

Do not cut or alter structural components without written authorization.

Field welding and joining shall conform to AWS D1.1 and AWS D1.3.

Grind all exposed welds smooth and touch-up shop-primed areas with same primer as used by Manufacturer.

ADJUSTING

Adjust components and systems for correct function and operation in accordance with manufacturer's written instructions.

CLEANING

Paint, dirt, stains and grout shall be removed without marring or scratching the aluminum surfaces. Solvents and cleaning compounds shall be chemically compatible with the anodic coating and aluminum.

PROTECTION

Finishes of railing systems and handrails shall be protected from damage during constructions by use of temporary protective coverings. Coverings are to be removed upon completion of the work.

Finishes damaged during installation and construction shall be restored so that no evidence remains of construction work.

12-5.07 EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing vertical and horizontal expansion joint assemblies, fillers and sealers for expansion and seismic joints in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions for vertical and horizontal expansion joint assemblies, seals and sealants shall be submitted for approval.

Working Drawings: For each expansion joint cover assemblies specified, include plans, elevations, sections, details, splices, blockout requirement, attachments to other work.

Samples: For each exposed expansion joint assemblies, full width by 6 inches long in size.

Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint assemblies.
2. Expansion joint assemblies location cross-referenced to the plans.
3. Nominal joint width.
4. Movement capability.
5. Classification as thermal or seismic.
6. Materials, colors, and finishes.
7. Product options.

WARRANTY

Provide manufacturer's standard 1 year material and workmanship warranty.

Finish Warranty: Warrant fluoropolymer coating to remain free, under normal atmospheric conditions, from peeling, checking, cracking, chalking in excess of numerical rating of 8 when measured in accord with ASTM D 4214, of fading in excess of 5 NBS (ASTM D 2244) units during warranty period. Warranty period shall be 20 years.

PART 2 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturers: Subject to these special conditions, acceptable manufacturers shall be D. S. Brown Co.; General Tire Engineered Construction Products; Watson Bowman and Acme Corp. (Wabco); or equal.

MATERIALS

Expansion joint closures and seals shall be aluminum extrusions and neoprene or silicone rubber seals of the type and size to suit the construction as shown on the plans.

Aluminum Retainers and Cover Plates: Aluminum retainers and cover plates shall conform to ASTM Designation: B 221-95a. Finish shall be anodized, 0.04-0.07 mil thick anodic coating conforming to AA-M10C22A31. Configuration and size is indicated on the plans, or recommended by the expansion control system manufacture.

1. Extrusions: 6063-T5 and 6005-T5 alloys
2. Plates: 6061-T6 alloys
3. Sheets: 5052-H32 alloy
4. Apply manufacturer's standard protective coating on aluminum surface to be placed in contact with cemetitious materials.

Visual Seals: Visual seal shall be dense neoprene or dense silicone synthetic rubber conforming to ASTM Designation: C 864, 70 durometer hardness, plus or minus 5.

Functional Seal: Functional seal shall be closed cell neoprene synthetic rubber conforming to ASTM Designation: C 509, medium density.

Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.

Compression Joint Seals: ASTM E 1612; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression, conforming to ASTM E 1612.

Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

Moisture Barrier: Flexible elastomeric material, EPDM minimum 45 mils thick.

Fasteners: Fasteners shall be the expansion joint assembly manufacturer’s standard corrosion resistant fasteners.

Sealant: Sealant shall be as recommended by the expansion joint assembly manufacturer.

PART 3 - EXECUTION

PREPARATION

Surface Preparation: Supporting joint surfaces shall be prepared as recommended by the manufacturer. Edges of the substrate shall be level and sound.

INSTALLATION

Expansion joint cover assemblies shall be installed and set to the proper width for the ambient temperature at the time of setting.

Nominal width shall be based on an ambient width shown on the plans.

Expansion joint cover assemblies shall be set according to the manufacturer's recommendations.

Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint assemblies.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
5. Install frames in continuous contact with adjacent surfaces. Shimming is not permitted.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches on center.

Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions according to manufacturer's written instruction. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frame with adhesive or pressure-sensitive tape as recommended by manufacturer.

Compression Joint Seals assemblies shall be installed with adhesive or lubricant adhesive as recommended by the manufacturer to both frame interfaces before installing compression seals.

Foam Seals: Install with adhesive recommended by manufacturer.

Epoxy-Bounded Seals: Pressurize seal for time period and to pressure recommended by manufacturer.

Terminate exposed ends of expansion joint assemblies with field- or factory-fabricated termination devices.

Moisture Barrier: Provide at all exterior joints and where indicated on the plans.

PROTECTION

Protective covering shall not be removed until finish work in adjacent area is complete. Exposed metal surfaces shall be cleaned when protective covering is removed to comply with manufacturer's written instructions.

Protect the installation from damaged by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint assemblies. Reinstall cover plates or seals prior contract acceptance.

CLEANING

Unused materials, containers, and equipment shall be removed from the work area.

Surfaces that are stained, marred or otherwise damaged shall be cleaned and repaired.

SECTION 12-6. WOOD AND PLASTICS

12-6.01 ROUGH CARPENTRY

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing materials and performing rough carpentry work including wood sheathing in accordance with the details shown on the plans and these special provisions.

Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed.

SUBMITTALS

Product Data: Manufacturer's material data and installation instructions shall be submitted for gypsum sheathing, framing hardware and underlayments.

Wood Treatment Data:

Chemical treatment manufacturer's instructions shall be submitted for the handling, sorting, installation, and finishing of treated materials.

For each type of fire-retardant treatment, include certification by treating plant that the treated material complies with the applicable standards and other requirements.

LEED Submittals:

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MR Credit 7, Certified Wood: For materials with certified wood content, submit product data and vendor invoices showing products on a line item basis, with cost, and identifying FSC-certified products as FSC Pure, FSC Mixed Credit, or FSC Mixed (NN) %; chain of custody certification; and spreadsheet(s) calculating cost of wood-based construction materials qualifying as certified wood.

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.4, Low-Emitting Materials—Composite Wood and Agrifiber Products: Submit product data for composite wood and agrifiber products (particleboard, medium density fiberboard, plywood, wheatboard, strawboard, panel substrates, and door cores) to be used inside building weatherproofing system, indicating no added urea formaldehyde in resins or laminating adhesives.

QUALITY CONTROL AND ASSURANCE

LEED:

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

MR Credit 7, Certified Wood: Use materials with certified wood content to contribute toward achieving MR Credit 7.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.4, Low-Emitting Materials—Composite Wood and Agrifiber: Provide composite wood and agrifiber products which contain no added urea formaldehyde resins in materials or laminating adhesives. Composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores. Furniture and fixtures are not included in this credit.

DELIVERY, HANDLING AND STORAGE

Delivery and Storage: Materials shall be kept under cover and dry. All materials shall be protected from exposure to weather and contact with damp or wet surfaces with blocking and stickers. All lumber, plywood and other panels shall be stacked in such a manner to provide air circulation within and around the stacks.

PART 2 - PRODUCTS

PLYWOOD PANELS

Plywood panels shall comply with Voluntary Product Standard PS 1, "Structural Plywood," or its predecessor, "Construction and Industrial Plywood," and shall be certified by FSC (Forest Stewardship Council).

Plywood panels shall be Group 1 unless otherwise noted.

Each plywood panel shall be factory marked with APA or other trademark evidencing compliance with grade requirements.

Structural Plywood Wall Sheathing: Structural plywood wall sheathing for walls shall be APA RATED SHEATHING, Structural 1, Exposure 1. Thickness and grade shall be as shown on the plans.

Structural Plywood Roof Sheathing:

Structure plywood roof sheathing shall be APA RATED SHEATHING, Exposure 1. Span rating, thickness and grade shall be as shown on the plans.

Structure plywood roof sheathing in exposed overhangs shall be APA RATED SHEATHING, A-C, Exterior, Group 1. Thickness shall be the same as the remainder of the sheathing.

Fire-Retardant-Treated Plywood: Fire-retardant-treated plywood shall be pressure-treated in accordance with American Wood Preservers Association (AWPA) Standard C27 with an approved (low hygroscopic Interior Type A) or (Interior Type B) or (Exterior Type) fire retardant. Each panel shall be labeled or marked by an approved independent testing agency. After treatment, plywood shall be dried to an average moisture content of 15 percent or less. Fire-retardant-treated plywood shall be all-veneer APA Rated Sheathing EXP 1 or EXT, American Plywood Association certified Performance Standard PS 1-09 or PS 2-10, Fire Classification Class A in accordance with ASTM E 84, and be certified by the Forest Stewardship Council (FSC).

MISCELLANEOUS MATERIALS

Rough Carpentry Hardware:

Steel plates and rolled sections shall be mild, weldable steel, conforming to AISI grades 1016 through 1030 except 1017.

Nails, screws, bolts, nuts, washers shall be commercial quality. Exposed fasteners shall be hot dipped galvanized or stainless steel. Fasteners for use with preservative treated wood shall be hot dip galvanized. Fastener for use with fire-retardant-treated plywood shall be hop-dip zinc-coated steel, stainless steel,

silicon bronze or copper fasteners in accordance with ASTM A 153 or ASTM B 695, Class 55 minimum, except for bolts 1/2-inch diameter or larger.

Joist hangers, clips and other standard framing hardware shall be ICC approved, commercial quality, galvanized sheet steel or hot dipped galvanized, of the size shown on the plans.

Expansion anchors and powder driven anchors shall be as specified under "Building Miscellaneous Metal," in Section 12-5, "Metals," of these special provisions.

Nails: Nails shall conform to ASTM F 1667. "Common" nails shall conform to the following table:

Nail Size	Length (inches)	Diameter (inches)
8d	2½	0.131
10d	3	0.148
16d	3½	0.162

Building Paper: Building paper shall be kraft type waterproofing building paper, Type I (No. 15) asphalt saturated roofing felt or high density, bonded polyethylene fiber building paper.

Adhesive: Adhesive for plywood glue-nailed systems shall conform to APA Specification: AFG-01.

WOOD TREATMENT BY PRESSURE PROCESS

Fire Retardant Treatment: Fire retardant treatment shall be paintable, odorless fire retardant preservative applied by pressure treating methods.

Fire-Retardant-Treated Plywood by Pressure Process:

Products shall have a flame spread index of 25 or less when tested according to ASTM E 84, and shall show no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

A treatment that does not promote corrosion of metal fasteners shall be used.

Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898.

Plywood shall be kiln-dry after treatment to a maximum moisture content of 15 percent.

Fire-retardant-treated plywood shall be identified with appropriate classification marking of qualified testing agency.

For exposed area of plywood to receive a stained, painted, or natural finish, chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes shall be used.

PART 3 - EXECUTION

INSTALLATION

Plywood Panels:

Plywood panels shall be attached to the framing as shown on the plans and these special provisions. All structural plywood sheathing (both roof and wall) shall be fastened with self-drilling, self-tapping screws specified in plans.

Plywood sheathing shall be fastened to the framing system and shall be continuous over 2 or more supports. Roof and floor panels shall be installed with the long dimension across the supports, with end

joints staggered 4 feet. Wall sheathing shall have all edges blocked. Spacing between panels shall be 1/8 inch.

Fire-retardant-treated plywood shall not be installed in areas where it is exposed to precipitation, direct wetting, or regular condensation.

12-6.02 FINISH CARPENTRY

PART 1 - GENERAL

SUMMARY

Scope: This work consists of furnishing and installing materials and performing finish carpentry, including exterior and interior trim, plywood soffits and panels and plywood and softwood paneling, as shown on the plans and these special provisions.

Finish carpentry includes carpentry work not specified as part of other sections and which is generally exposed to view.

SUBMITTALS

Product Data: Manufacturer's specifications and installation instructions for each item of factory-fabricated siding and paneling.

Samples: One sample shall be submitted to the Engineer at the jobsite for each species and cut or pattern of finish carpentry as shown below:

Interior standing and running trim: 2 feet long by full board or molding width, finished on one side and one edge.

Plywood paneling: 2 feet long x full panel width, finished on one side.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MR Credit 7, Certified Wood: For materials with certified wood content, submit product data and vendor invoices showing products on a line item basis, with cost, and identifying FSC-certified products as FSC Pure, FSC Mixed Credit, or FSC Mixed (NN) %; chain of custody certification; and spreadsheet(s) calculating cost of wood-based construction materials qualifying as certified wood.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.4, Low-Emitting Materials – Composite Wood and Agrifiber Products: Submit product data for composite wood and agrifiber products (particleboard, medium density fiberboard, plywood, wheatboard, strawboard, panel substrates, and door cores) to be used inside building weatherproofing system, indicating no added urea formaldehyde in resins or laminating adhesives.

QUALITY ASSURANCE

Factory Marks: Each piece of lumber and plywood shall be marked with type, grade, mill and grading agency identification. Marks shall be omitted from surfaces to receive transparent finish. A mill certificate stating that material has been inspected and graded in accordance with requirements shall be furnished if marks cannot be placed on concealed surfaces.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

MR Credit 7, Certified Wood: Use materials with certified wood content to contribute toward achieving MR Credit 7.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.4, Low-Emitting Materials—Composite Wood and Agrifiber: Provide composite wood and agrifiber products which contain no added urea formaldehyde resins in materials or laminating adhesives. Composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores. Furniture and fixtures are not included in this credit.

PRODUCT DELIVERY, STORAGE AND HANDLING

Delivery: Carpentry materials shall be delivered after painting, wet work and similar operations have been completed.

Protection: Finish carpentry materials shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2 - PRODUCTS

WOOD PRODUCT QUALITY STANDARDS

Softwood Lumber: Softwood lumber shall conform to the requirements of PS 20, "American Softwood Lumber Standard," with applicable grading rules of inspection.

Plywood: Plywood shall conform to the requirements of Voluntary Product Standard PS 1, "Structural Plywood," or its predecessor, "Construction and Industrial Plywood" and shall be certified by FSC (Forest Stewardship Council).

Hardwood Lumber: Hardwood lumber shall conform to the requirements of the National Hardwood Lumber Association (NHLA) rules.

Woodworking: Woodworking shall conform to the requirements of WI "Architectural Woodwork Standards," custom grade

MATERIALS

Plywood Paneling and Wainscotting: Plywood paneling and wainscotting shall be APA Interior Grade A-C, Group 1, Exposure 1 plywood. Thickness shall be as shown on the plans.

Interior Standing and Running Trim:

Standing and running trim to be painted shall be paint-grade pine, solid stock or finger jointed.

Standing and running trim to have transparent finish shall be solid hardwood, species to be shown on the plans.

Open Shelving: Open shelving shall be ¾-inch Grade A-C fir plywood with veneer core and ½-inch thick solid stock pine edge banding glued and nailed.

Miscellaneous Materials:

Nails, screws and other anchoring devices of the type, size, material and finish required shall be provided for secure attachment, concealed where possible.

Fasteners and anchorages for exterior use and for use with preservative treated wood shall be hot dip galvanized.

Screens for soffit vents shall be 4 x 4 or 8 x 8 mesh, galvanized screen. Open area shall be not less than 50 percent.

Fire Retardant Treatment: Fire retardant treatment shall be paintable, odorless fire retardant preservative applied by pressure treating methods.

PART 3 - EXECUTION

INSTALLATION

All work shall be installed plumb, level and true with no distortions.

Standing and Running Trim:

Standing and running trim shall be installed with minimum number of joints possible, using full length pieces to the greatest extent possible.

Exterior joints shall be made water-resistant by careful fitting.

Anchor Finish Carpentry:

Finish carpentry shall be anchored to framing or blocking built in or attached directly to the substrate.

Interior carpentry shall be attached to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing where required for complete installation. Fine finish nails shall be used for exposed nailing, countersunk and filled flush with finished surface and matching final finish where transparent finish is indicated.

ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

Damaged and defective finish carpentry work shall be repaired or replaced.

All exposed or semi-exposed surfaces shall be cleaned.

Finish carpentry shall be finished in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-6.03 CABINETS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing wood cabinets and plastic laminate tops, splashes and returns as shown on the plans and in these special provisions.

SUBMITTALS

Product Data: Manufacturer's product data for plastic laminates and cabinet hardware shall be submitted for approval.

Samples: Three samples shall be submitted for each of the items shown below:

Plastic laminate, 8" x 10" for each type, color, pattern and surface finish.

Working Drawings: Working drawings for cabinets showing location of cabinets, dimensioned plans and elevations, attachment devices and other components, such as food waste disposal and sinks, shall be submitted for approval. Working drawings shall bear the "WI Certified Compliance Label" on the first sheet of the drawings.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MR Credit 7, Certified Wood: For materials with certified wood content, submit product data and vendor invoices showing products on a line item basis, with cost, and identifying FSC-certified products as FSC Pure, FSC Mixed Credit, or FSC Mixed (NN) %; chain of custody certification; and spreadsheet(s) calculating cost of wood-based construction materials qualifying as certified wood.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.4, Low-Emitting Materials – Composite Wood and Agrifiber Products: Submit product data for composite wood and agrifiber products (particleboard, medium density fiberboard, plywood, wheatboard, strawboard, panel substrates, and door cores) to be used inside building weatherproofing system, indicating no added urea formaldehyde in resins or laminating adhesives.

QUALITY ASSURANCE

Codes and Standards: Cabinets and swinging gate shall be manufactured and installed in accordance with the "Architectural Woodwork Standards" of the Woodwork Institute (WI) requirements for the grade or grades specified or shown on the plans.

Certificates of Compliance:

Prior to delivery to the jobsite, the cabinet manufacturer shall issue a WI Certified Compliance Certificate indicating that the products he will furnish for this job and certifying that they will fully meet all the requirements of the grade or grades specified.

WI Certified Compliance Label shall be stamped on all cabinet work and swinging gate.

Each plastic laminate top shall bear the WI Certified Compliance Label.

Prior to completion of the contract, a WI Certified Compliance Certificate for Installation shall be delivered to the Engineer.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content, to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

MR Credit 7, Certified Wood: Use materials with certified wood content to contribute toward achieving MR Credit 7.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.4, Low-Emitting Materials—Composite Wood and Agrifiber: Provide composite wood and agrifiber products which contain no added urea formaldehyde resins in materials or laminating adhesives. Composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores. Furniture and fixtures are not included in this credit.

DELIVERY, STORAGE AND HANDLING

Protection: Cabinets shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Manufacturers: Subject to compliance with these special provisions, high pressure decorative laminates shall be Wilsonart; Formica Corp.; Nevamar Corp.; or equal.

MANUFACTURED UNITS

Cabinets shall be fabricated to the dimensions, profiles, and details shown on the plans with openings and mortises precut, where possible to receive hardware and other items and work.

Fabrication, assembly, finishing, hardware application, and other work shall be completed to the maximum extent possible prior to shipment to the jobsite.

Laminate Clad Cabinets:

Laminate clad cabinets shall be custom grade, flush overlay construction.

Laminate cladding shall be high pressure decorative laminate complying with NEMA LD 3. Color, pattern and finish shall be as shown on the plans. Laminate surface and grade shall be as follows:

Horizontal and vertical surfaces other than tops shall conform to NEMA LD 3, general purpose grade GP-50 (50-mil nominal thickness).

Postformed surfaces shall conform to NEMA LD 3, postformed grade PF-42 (42-mil nominal thickness).

Laminated Counter Tops and Splashes:

Laminated counter tops and splashes shall be WI custom grade.

Surface material shall be high pressure laminated plastic conforming to NEMA LD-3, 50-mil thickness.

Unless otherwise shown on the plans, splashes shall be 4 inches high from the surface of the deck. Back splashes shall be continuous formed and coved. Side splashes shall be top set.

Laminated counter tops shall be self edged. Counter tops to receive sinks or plumbing fixtures shall have a bullnose.

The underside of tops and backsides of splashes shall be covered with an approved backing sheet.

Adjustable Shelf Loading:

Load is the total applied weight, uniformly dispersed on an individual shelf, not to exceed 200 lbs. on any one shelf.

a. 50 lbs/sq. ft. where shelving occurs at office, training, or conference areas.
b. 40 lbs/sq. ft. for all other shelving.

CABINET HARDWARE AND ACCESSORY MATERIALS

Cabinet hardware and accessory materials shall be provided for cabinets.

Hardware shall be provided with standard US 32D metal plated finish.

Drawer Slides: Drawer slides shall be side mounting full extension with fully enclosed rolling balls and rollers, concealed slides and bearings, and positive stop. Capacity shall be not less than 75 pounds, except capacity shall be not less than 100 pounds for heavy duty drawers.

Door Guides: Sliding door guides shall be continuous, dual channel, metal guides, top and bottom. Bottom guide shall have crowned track.

Shelf Supports: Shelf supports shall be adjustable, semi-recessed, chrome finished pressed metal, heavy duty standards and support clip, with one inch adjustment increments.

Cabinet Hinges:

Cabinet hinges shall be concealed European style hinges, 120-degree door opening angle, press-fit, with vertical and horizontal adjustment. One hinge per door shall be self closing.

Cabinet hinge manufacturers shall be Stanley, Hager, McKinney, or equal.

Cabinet Catches:

Cabinet catches shall be self aligning magnetic type in aluminum case with zinc plated steel strike.

Cabinet catch manufacturers shall be Stanley, Hager, McKinney, or equal.

Cabinet Pulls:

Cabinet pulls shall be U-Shaped 3/8-inch diameter approximately 5 inches long with 1 3/8-inch offset and stainless steel satin finish.

Cabinet pull manufacturers shall be Stanley, Hager, McKinney, or equal.

FABRICATION

Shop Assembly:

Nails shall be countersunk and the holes filled, molds shall be neatly mitered and all joints shall be tight and true.

As far as practicable, work shall be assembled at the mill and delivered to the building ready to be set in place. Parts shall be smoothly dressed and interior work shall be belt sanded at the mill and hand sanded at the building. After assembly, work shall be cleaned and made ready for the specified finish.

All work shall be prepared to receive finish hardware. Finish hardware shall be accurately fitted and securely fastened as recommended by the manufacturer. Finish hardware shall not be fastened with adhesives.

Drawers shall be fitted with dust covers of ¼-inch plywood or hardboard above compartments and drawers except where located directly under tops.

Precut Openings: Openings for hardware, appliances, plumbing fixtures, and similar items shall be precut where possible. Openings shall be accurately located and templates used for proper size and shape. Edges of cutouts shall be smoothed and edges sealed with a water-resistant coating.

PART 3 - EXECUTION

INSTALLATION

Cabinets: Cabinets shall be installed without distortion so that doors and drawers fit openings properly and are accurately aligned. Hardware shall be adjusted to center doors and drawers in openings and to provide unencumbered operation. Installation of hardware and accessory items shall be completed as indicated on the approved drawings.

Laminate Tops: Laminate tops shall be securely fastened to base units and other support systems as indicated on the approved drawings.

Cabinet Hardware:

Doors for cabinets shall be equipped with one pair of hinges and one catch per leaf, unless otherwise shown on the plans. Each door leaf shall be equipped with one pull.

Drawers up to 24 inches wide shall have one pull and drawers over 24 inches wide shall have two pulls.

SECTION 12-7. THERMAL AND MOISTURE PROTECTION

12-7.01 BITUMINOUS WATERPROOFING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and applying a bituminous waterproofing membrane in accordance with the details shown on the plans and these special provisions.

Bituminous waterproofing membrane shall consist of a coating of primer, a bonded, continuous membrane composed of 2 layers of asphalt saturated glass fabric and 3 moppings of waterproofing asphalt.

SUBMITTALS

Product Data: Manufacturer's descriptive data, installation instructions and recommendations for each waterproofing material shall be submitted for approval.

QUALITY ASSURANCE

The Contractor shall obtain primary materials from a single manufacturer. Secondary materials shall be only as recommended by the primary manufacturer.

Labels: Materials shall be furnished which have factory applied labels affixed to each container or roll of material certifying compliance with ASTM standards specified.

PART 2 - PRODUCTS

Asphalt Primer: Asphalt primer shall be cut-back type conforming to ASTM Designation: D 41.

Waterproofing Asphalt: Waterproofing asphalt shall conform to ASTM Designation: D 449, Type I, suitable for vertical surfaces below grade.

Glass Fiber Fabric: Glass fiber fabric shall conform to ASTM Designation: D 1668, Type I, for woven glass fabric treated with asphalt and weighs about 1.5 pounds per 100 square feet.

Plastic Cement: Plastic cement shall be suitable for use with bituminous materials.

Protection Board: Protection board shall be organic fiberboard treated for resistance to fungus and insects, asphalt impregnated and asphalt coated on both faces; ½ inch thick unless otherwise noted.

PART 3 - EXECUTION

PREPARATION

Protection: Liquid or mastic compounds shall not be permitted to enter or clog drains and conductors. Spillage or migration onto other surfaces of work shall be prevented by masking or otherwise protect adjoining work.

Surface Preparation: All concrete surfaces which are to be waterproofed shall be reasonably smooth and free from holes and projections which might puncture the membrane. The surface shall be dry and thoroughly cleaned of dust and loose materials.

The primer shall be applied to the surface and allowed to dry before applying asphalt.

INSTALLATION

Installation shall comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where proper conditions require extra precautions or provisions to ensure satisfactory performance of work.

Application:

No primer or asphalt shall be applied in wet weather, nor when the temperature is below 65°F. Heating shall be in accordance with the manufacturer's instructions.

Multiply-courses of bitumen and felts or fabrics shall be installed in individual courses, unless manufacturer recommends shingle-fashion courses. Courses shall be laid in direction or directions recommended.

Membrane shall be extended as flashing at edges, openings and projections, so as to complete waterproof enclosure as required for leakproof installation.

Protection Board: Protection board shall be set into last course of asphalt before it cools.

12-7.02 SHEET WATERPROOFING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a premolded bituminous sheet waterproofing system in accordance with the details shown on the plans and these special provisions.

The premolded membrane waterproofing system shall consist of an adhesive or primer coating, a premolded bituminous sheet, mastic for sealing the edges of the sheet, and a protective covering attached to the exposed bituminous sheet.

SUBMITTALS

Product Data: Manufacturer's descriptive data, installation instructions and recommendations for each waterproofing material shall be submitted for approval.

QUALITY ASSURANCE

Single Source Responsibility: Primary waterproofing materials shall be obtained from a single manufacturer and secondary materials shall be only as recommended by the manufacturer of the primary materials.

Labels: Materials shall be furnished which have factory-applied labels affixed to each container or roll of material certifying compliance with ASTM standards specified.

PART 2 - PRODUCTS

Premolded Membrane: Preformed membrane shall be premolded sheets of bitumen and other compounds, laminated between bituminous saturated felts, reinforced with glass fiber of similar fabrics or mats, coated with bitumen and covered with plastic anti-stick film. Vapor transmission rating shall be not more than 0.005 grains per square foot per hour when tested in accordance with ASTM Designation E 96 and weight approximately 60 pounds per 100 square feet.

Adhesives: Adhesives shall be types of adhesive compounds and tapes recommended by the waterproofing manufacturer, for bonding to substrate, for waterproof sealing of seams in membrane and for waterproof joints between membrane and flashings, adjoining surfaces and projections through membrane.

Primer: Primer shall be type of concrete primer recommended by the manufacturer of the sheet waterproofing.

Protective Covering: Protective covering shall be hardboard, 1/8 inch thick or such other material that will furnish equivalent protection to the preformed membrane. Protective covering shall prevent cutting, scratching, depression or any other damage to the membrane caused by concrete, backfill material or equipment.

PART 3 - EXECUTION

Preformed membrane waterproofing shall not be applied to any surface until the Contractor is prepared to follow its application with the placing of the protective covering and concrete or backfill within a sufficiently short time that the membrane will not be damaged by workers, equipment, exposure to weathering or from any other cause. Damaged membrane or protective covering shall be repaired or replaced by the Contractor at his expense.

PREPARATION

Surface Preparation: All surfaces which are to receive waterproofing shall be reasonably smooth and free from holes and projections which might puncture the membrane. The surface shall be dry and thoroughly cleaned of dust and loose materials.

Prime Coat:

The primer shall be applied in one coat to the entire area to be sealed by spray or roller methods. The rate shall be as recommended by the primer manufacturer.

All primers shall be thoroughly mixed and continuously agitated during application. Primers and adhesive shall be allowed to dry to a tack free condition prior to placing membrane sheets.

INSTALLATION

Application:

Preformed membrane material shall be placed vertically with each successive sheet lapped to the preceding by a minimum of 3 inches. Horizontal splices shall be lapped by a minimum of 6 inches.

Exposed edges of membrane sheets shall have a trowelled bead of manufacturer's recommended mastic applied after the membrane is placed.

Holes or tears in the preformed membrane sheeting shall be patched with an additional layer of membrane sheet of sufficient size to provide a 5-inch minimum lap outside the edge of the defect.

Protective Covering:

The surface of the waterproofing membrane shall be cleaned free of all dirt and other deleterious material before the protective covering is placed.

The protective covering shall be placed on a coating of adhesive of a type recommended by the manufacturer. The adhesive shall be applied at a rate sufficient to hold the protective covering in position until the concrete or backfill is placed.

12-7.03 WATER REPELLENT COATING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and applying water repellent coating to concrete or masonry surfaces in accordance with the details shown on the plans and these special provisions.

The water repellent coating shall be applied to all exterior concrete or masonry surfaces and exposed aggregate surfaces as shown on the plans.

SUBMITTALS

Product Data: Manufacturer's descriptive data, application instructions and general recommendations for water repellents shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.2, Low-Emitting Materials – Paints and Coatings: Submit product data for paints and coatings to be used on-site and inside the building weatherproofing system, indicating product name, manufacturer's generic description, chemical composition, and VOC content; schedule of paints and coatings used, giving manufacturer, product name, regulatory category under VOC rules for this credit, actual VOC, allowed VOC under this credit, allowed VOC under current rules of local air district, and quantity used.

QUALITY ASSURANCE

Codes and Standards: Water repellent coatings shall comply with all rules and regulations concerning air pollution in the State of California.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward LEED MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward LEED MR Credit 5.

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: For interior application (inside the weatherproofing system and applied on-site), provide paints and coatings that comply with LEED limits for VOC content. The limit under this credit is 100 g/L for waterproofing concrete/masonry sealers. Comply with local requirements if more stringent.

Certificates of Compliance: Certificates of Compliance shall be furnished with each shipment of water repellent coating materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2 - PRODUCTS

Water Repellent Coating: Water repellent coating shall be clear, colorless, water-based sealer not containing silane, recommended for use on concrete in vertical applications.

Compatibility: Verify compatibility between water repellent coating and anti-graffiti coating when an anti-graffiti coating is specified in Section 12-9, "Finishes," of these special provisions.

PART 3 - EXECUTION

Preparation: All surfaces to receive water repellent coating shall be dry and cleaned by removing contaminants that block pores of the surface. Cleaning methods shall be as recommended by the water repellent manufacturer.

Application:

The water repellent solution shall be applied in accordance with the manufacturer's printed instructions

The time period between applications of water repellent coating shall be not less than 24 hours.

Protection: Surfaces of other materials surrounding or near the surfaces to receive the water repellent coating shall be protected from overspray or spillage from the waterproofing operation. Water repellent coating applied to surfaces not intended to be waterproofed shall be removed and the surfaces restored to their original condition.

12-7.04 INSULATION (GENERAL)

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing insulation in accordance with the details shown on the plans and these special provisions. Insulation includes related materials such as substrate boards, underlayment, vapor retarders, and cover boards.

Insulation materials shall be as specified in these special provisions, and shall be compatible with existing or new materials incorporated in the building.

SUBMITTALS

Product Data:

A list of materials, manufacturer's descriptive data, location schedule, and time schedule shall be submitted for approval.

The list of materials to be used shall include the trade name, manufacturer's name, smoke developed and flame spread classification, resistance rating and thickness for the insulation materials and accessories.

Schedules:

A location schedule and time schedule shall be submitted for approval.

The location schedule shall show where each material is to be installed.

The Contractor shall provide the Engineer at the jobsite with an accurate time schedule of the areas of the building to be insulated each day. The time schedule shall be submitted 3 working days in advance of the work.

Samples: Samples of insulation material shall be submitted to the Engineer at the jobsite.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

Codes and Standards: All insulating materials shall be certified to comply with the California Quality Standards for Insulating Materials and shall be listed in the Department of Consumer Affairs publication "Consumer Guide and Directory of Certified Insulation Material."

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

DELIVERY, STORAGE AND HANDLING

Insulating materials shall be delivered to the jobsite and stored in a safe dry location with labels intact and legible.

Insulating materials shall be protected from physical damage and from becoming wet or soiled.

In the event of damage, materials shall be repaired or replaced as necessary to comply with these specifications.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION (Not applicable)

12-7.05 BATT AND BLANKET INSULATION

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing batt or blanket insulation in accordance with the details shown on the plans and these special provisions.

Batt insulation shall include faced and unfaced batts in walls and ceilings, acoustical batts for sound control and exposed batt or blanket insulation for ceilings and walls.

QUALITY ASSURANCE

Laminator's Qualifications:

Laminator for bonding polyethylene vapor-retarder to insulating batts shall be approved by the insulation manufacturer.

The name of the laminator shall be submitted with the Product Data.

Codes and Standards:

All batt or blanket insulation, including facings such as vapor barriers, shall have a flame-spread rating not to exceed 25 and a smoke density not to exceed 450 when tested in accordance with ASTM E 84 or UL 723.

The flame-spread and smoke density limitations do not apply to facings on batt insulation installed between ceiling joists, or in roof-ceiling or wall cavities, provided the facing is installed in substantial contact with the surface of the ceiling or wall finish.

PART 2 - PRODUCTS

INSULATING MATERIALS

Fiberglass batts shall be thermal insulation produced by combining glass fibers with thermosetting resins to comply with ASTM Designation: C 665.

Wall Insulation: Wall insulation shall be R-19 fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type II, Class C.

Acoustical Insulation: Acoustical insulation shall be 3½ inches, unfaced fiberglass insulation batts. Insulation shall conform to ASTM Designation: C 665, Type I.

VAPOR-RETARDERS

Paper-laminate Vapor-retarder: Paper-laminate vapor-retarder shall be kraft paper sheets laminated together with asphalt or other vapor retarding compounds, scrim reinforced at edges of sheets.

Foil-paper Vapor-retarder: Foil-paper vapor-retarder shall be 0.3 mil reflective aluminum foil laminated with scrim reinforcing to plastic-coated kraft paper.

Polyethylene Vapor-retarder: Polyethylene vapor-retarder shall be factory-applied, 3 mils, white polyethylene film, a blend of fiberglass and polyester yarn reinforcement, and metallized polyester film laminated with a flame resistant adhesive, and a Class I flame-spread classification.

AUXILIARY INSULATION MATERIALS

Insulation Tape: Insulation tape shall be as recommended by the insulation manufacturer.

Insulation Adhesive: Insulation adhesive shall be the type recommended by the insulation manufacturer and complying with the requirements for fire resistance and VOC content.

Impaling Pins: Impaling pins shall be self-adhering wire pins with sheet metal retaining clips and protective rubber tips. Adhesive for pins shall be as recommended by the pin manufacturer.

Line Wire: Line wire shall be commercial quality 20-gage galvanized steel wire.

FABRICATION

Polyethylene shall be factory laminated to fiberglass batts or blankets by an applicator approved by the manufacturer of the batts or blankets.

PART 3 - EXECUTION

INSTALLATION

The vapor retarder on faced batts shall be toward the interior and shall be fastened to provide a sealed retarder. Punctures and holes in the retarder shall be repaired.

Unless otherwise shown on the plans or specified elsewhere in these special provisions, insulation shall be kept at minimum 3 inches clear of lighting fixtures and heat producing electrical appliances and equipment.

Installing Batt Type Insulation: Insulation batts shall be installed to completely fill the space between framing members. Apply a single layer of insulation of required thickness, unless otherwise shown on the plans or required to make up total thickness. Installation shall conform to the manufacturer's recommendations and these special provisions.

Installing Exposed Insulation:

Exposed insulation shall be installed on impaling pins adhered to the substrate at 16-inch centers each direction with a minimum distance of 4 inches to the edge of the batt. Retainer clips shall be placed onto the pins so that the batt is slightly compressed. Pins shall be cut within ½ inch of the retaining clips and protective rubber caps placed on the ends of the pins.

When line wire is shown on the plans, blankets shall be supported with line wire spaced at 16 inches on center.

Joints in exposed insulation shall be sealed by lapping not less than 4 inches. Exposed insulation shall be fastened to framing at top, end and bottom, at perimeter of wall openings and at lap joints.

Overlapping joints shall be sealed with insulation adhesives as recommended by vapor retarder manufacturer's printed directions. Butt joints and fastener penetrations shall be sealed with insulation tape of the type recommended by the vapor retarder manufacturer. Joints at pipes, conduits, electrical boxes and similar items penetrating the vapor retarder shall be sealed.

12-7.06 RIGID ROOF INSULATION

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing rigid roof insulation in accordance with the details shown on the plans and these special provisions.

Rigid insulation shall include rigid insulation, underlayment, vapor retarders, cover boards, wood nailers, fasteners and such other materials, not mentioned, which are required for the complete installation of the rigid insulation system. Materials and installation shall be coordinated with the roof covering system to meet the requirements for a Class 1 Factory Mutual approved assembly.

PART 2 - PRODUCTS

Vapor Retarder:

Vapor retarder shall have permeance of 0.1 perm or less under ASTM E 96 and shall be recommended by roofing system manufacturer for intended application.

Self-Adhering Sheet, Rubberized Asphalt: ASTM D 1970, polyethylene film laminated to rubberized asphalt adhesive, cold-applied, with slip-resisting surface and release paper backing, not less than 40 mils thick, maximum permeance of 0.1 perm.

Underlayment: Underlayment shall be building paper, Type I (No. 15) asphalt roofing felt, or rosin-sized paper.

Insulation board material	R value (for 1") (approx)	Compressive strength (psi) (approx)	Flame Spread Index / Smoke Developed Index	Other
Polyisocyanurate	6.5	16/20/25	25 or less / 450 or less	Type II is faced w/ fiberglass mat; for other facings (composite boards) see std
Mineral fiber (fiberglass, rock wool, or slag wool)	4.0	Less than 1**	--	Fire and moisture resistant
Extruded polystyrene (XPS) (orig. Dow's Styrofoam)	5.0	15/25/up	25 or less / 450 or less	Type IV is 25 psi, Type X is 15. Heat-sensitive

*Wood fiber insul board standard does not test compressive strength.
**Mineral fiber board is 0/12/25/50 psf, which is very low psi.

Rigid Roof Insulation: Rigid roof insulation shall be multilayer, preformed board roof insulation of one of the following types:

1. Expanded perlite board conforming to ASTM Designation: C 728, Type 2
2. Wood fiber board conforming to ASTM Designation: C 208, Type II, Grade 2
3. Polyisocyanurate board conforming to ASTM Designation: C 1289, Type II, Class 1
4. Mineral fiber board conforming to ASTM Designation: C 612, Category 2
5. Cellular glass board conforming to ASTM Designation: C 552, Type IV
6. Extruded polystyrene (XPS) board conforming to ASTM Designation: C 578, Type IV
7. Expanded polystyrene (EPS) board conforming to ASTM Designation: C 578, Type IX

Rigid roof insulation shall have R value of at least 6 per inch (30 total R value as installed) and compressive strength of at least 25 psi.

Cover Board:

Cellulosic fiber reinforced, water-resistant gypsum substrate, ASTM C 1278, 5/8 inch thick.

Perlite board, ASTM C 728, 3/4 inch thick.

Insulation Tape: Insulation tape shall be as recommended by the insulation manufacturer.

Bitumen: Bitumen shall conform to ASTM Designation: D 312, for Type III roofing asphalt.

Adhesives, Sealants, and Primers: Adhesives, sealants, and primers shall be recommended by manufacturer for intended use.

Adhesives (including bitumens), sealants, and related primers shall comply with LEED VOC limitations.

Fastener (Metal Decking): Fastener (metal decking) shall be galvanized spring steel barbed clip driven through galvanized one-inch minimum nominal diameter caps; galvanized hardened steel nail with one-inch minimum nominal diameter head and serrated shank to provide backout resistance; or threaded self tapping screw driven through 3-inch minimum nominal diameter galvanized cap.

PART 3 - EXECUTION

Preparation:

The preparation of the deck surfaces shall conform to the manufacturer's recommendations and these special provisions.

The deck surface shall be made smooth and level.

Installation:

Underlayment shall be fastened to nailable decks with randomly located roofing nails.

Install vapor retarder in accordance with manufacturer's recommendations.

Insulation panels shall be placed in at least 2 layers with end joints staggered and with joints of the second layer offset at least 6 inches from joints in the first layer.

Insulation panels shall be oriented with the long side perpendicular to the direction roofing felts are to be laid. End joints between panels shall be staggered.

Insulation clips and fasteners shall resist the wind uplift classification specified for the roof covering.

The first layer of insulation shall be mechanically fastened as recommended by the manufacturer to meet the requirements of Factory Mutual Loss Prevention Data Sheets 1-28 and 1-29. At least one fastener per 2 square feet of insulation panel shall be used. Panels that are cracked or broken by the installation of the mechanical fasteners shall be replaced.

Additional layers of insulation shall be secured with adhesive in accordance with manufacturer's instructions.

The completed layer of insulation shall be smooth and level, and suitable for the proper bedding of succeeding layers of roofing material.

Insulation shall be laid just before application of roofing felts. Units shall be laid in parallel courses with transverse joints staggered, in moderate contact with adjoining surfaces.

No more insulation shall be laid than can be covered with roofing the same day. Cutoffs of 2 layers of hot mopped Type I (No. 15) asphalt saturated felt shall be installed, not less than 4 inches onto completed work and extended out not less than 6 inches onto the deck, at exposed edges of insulation at the end of each day's work. Cutoffs shall be removed when work is resumed.

Joints in the top layer of glass fiber roof insulation shall be taped with 6-inch wide felt stripping set in hot asphalt mopping.

Continuous joints between insulation units and parallel to decking flutes shall not occur over the flute openings. Both units shall have full edge bearing on rib tops.

Insulation panels with broken or crushed corners or edges shall be trimmed free of such defects or shall be discarded. Replacement boards less than 12 inches wide shall not be used.

Damaged insulation in the completed work shall be removed and replaced. Insulation that has been wet or is wet shall be considered damaged.

Install cover board with joints staggered from joints in insulation units. Attach in accordance with manufacturer's instructions.

12-7.07 THROUGH-PENETRATION FIRESTOPPING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing firestopping materials at penetrations in fire-rated walls, floors, and ceilings in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data:

A list of materials, manufacturer's descriptive data, and location schedule shall be submitted for approval.

Descriptive data shall include trade names, manufacturers' names, complete information on the materials to be applied, California State Fire Marshal Approved Lab Listing, the material thickness for the required fire resistance ratings, and the manufacturer's printed instructions for installation. Manufacturer's assembly shall be California State Fire Marshal approved.

QUALITY ASSURANCE

Certificates of Compliance: Certificates of Compliance shall be furnished with each shipment of firestopping materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING

Delivery: Materials to be applied shall be delivered in original unopened packages. Packages shall be identified by the manufacturer's label and shall bear proper labels for fire resistance classification.

Storage: Materials shall be stored above ground, under cover, and in a dry location until ready for use. Packages which have been exposed to moisture before use shall be discarded.

PART 2 - PRODUCTS

Fire-rated Caulk: Fire-rated caulk shall conform to ASTM Designation: E 814 and shall be rated for use in 2 and 3-hour fire-rated assemblies. Fire-rated caulk shall be 3M Brand, Fire Barrier Caulk; Dow Corning, Fire Stop Sealant; Standard Oil, Fyre Putty; or equal.

Wrap Strip: Wrap strip shall be nominal ¼-inch thick intumescent elastomeric material in 2-inch wide strips, faced one side with aluminum foil, and rated for use in 1-hour and 2-hour fire-rated systems.

Packing Material: Packing material shall be polyethylene backer rod or nominal one-inch thickness of tightly packed ceramic (alumina silica) fiber blanket, mineral-wool batt or glass fiber insulation material.

Fire-rated Mortar: Fire-rated mortar shall be non-asbestos, 47 to 57 pounds per cubic foot air dried density portland cement fly ash through-penetration firestopping mortar. Fire-rated mortar shall conform to ASTM Designation: E 814 and shall be rated for use in 3-hour fire-rated systems at 3-inch minimum thickness.

Fire Safing Insulation: Fire safing insulation shall be inorganic 3.5 pounds per cubic foot minimum density, non-combustible fiber insulation conforming to Federal Specifications HH-1-521F, when tested in accordance with ASTM Designation: E 119 and ASTM Designation: E 136 for 3 hour fire resistance.

PART 3 -EXECUTION

Installation: Firestopping materials shall be installed to conform to the requirements of the California State Fire Marshal Listing and the manufacturer's recommendations.

12-7.08 WEATHER BARRIER

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a weather resistant membrane in accordance with the details shown on the plans and these special provisions.

Definition: A weather barrier is a weather-resistant membrane for vertical building envelope protection that will maintain air/moisture resistance while maintaining moisture-vapor permeability. The weather barrier system shall consist of a weather barrier membrane, seam tape, flashing, and fasteners.

REFERENCES

ASTM International:

ASTM C920; Standard Specification for Elastomeric Joint Sealants
ASTM C1193; Standard Guide for Use of Joint Sealants
ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
ASTM E96; Test Method for Water Vapor Transmission of Materials
ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
ASTM E2178; Test Method for Air Permeance of Building Materials
ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

AATCC – American Association of Textile Chemists and Colorists:

Test Method 127 Water Resistance: Hydrostatic Pressure Test

SUBMITTALS

Product Data: Submit manufacturer current technical literature for each component, manufacturer test reports indicating product compliance with indicated requirements, and manufacturer’s written installation instructions.

Sample: Weather Barrier membrane, minimum 8-1/2 inches by 11 inch.

QUALITY ASSURANCE

Qualifications: Installer shall have a minimum 3 years experience with installation of weather barrier assemblies on projects of similar scope and size.

Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

PART 2 - PRODUCTS

Product Description: Weather Barrier Membrane, a spunbonded polyolefin, non-perforated, nonwoven, non-absorbing, breathable membrane providing air flow, bulk water and wind driven rain protection with a ribbed surface texture that channels water and moisture to the outside and allows moisture vapor to escape from inside walls.

Weather Barrier Membrane: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 10 and 10, respectively, when tested according to ASTM E 84 and UV stabilized.

Weather Barrier Membrane Performance Characteristics:

Water-Vapor Permeance: 28 perms when tested according to ASTM E 96, Method B.

Air Permeance: Not more than 0.001 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.

Allowable UV Exposure Time: Not less than nine months.

Tensile Strength: Minimum 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.

Tear Resistance: 12/10 lbs, when tested in accordance with ASTM D1117.

Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.

Air Resistance: Air infiltration at greater than 1500 seconds, when tested in accordance with TAPPI Test Method T-460.

Basis Weight: 2.7 oz/sq yd, when tested in accordance with TAPPI Test Method T-460.

Building-Wrap Tape: Provide pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

Fasteners: Provide rust resistant screws and plastic caps or washers as required by weather barrier manufacturer. Use manufacturer product when provided.

Sealants: Provide sealants as recommended by the weather barrier manufacturer that comply with ASTM C 920, elastomeric polymer sealant to maintain watertight conditions.

Adhesive: Provide adhesive recommended by weather barrier manufacturer.

Primer: Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

Flashing: Provide flexible membrane flashing materials for openings and penetrations recommended by manufacturer.

PART 3 - EXECUTION

EXAMINATION

Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

INSTALLATION

Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer installation guidelines and recommendations.

Seal seams, edges, fasteners, and penetrations with tape. Extend into jambs of openings and seal corners with tape.

Seal any tears or cuts as recommended by weather barrier manufacturer.

12-7.09 METAL ROOF AND SIDING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing manufactured metal roof and siding panels, in accordance with the details shown on the plans and these special provisions.

Metal roof and siding system shall consist of underlayment, prefinished metal roof and siding panels, gutters, downspouts, fasteners, sealants, snow guards, and accessories and components, not mentioned, which are required for a complete, securely fastened and weathertight installation.

SYSTEM DESCRIPTION

Design Requirements: The roof and siding system shall conform to the wind design requirements for uplift or outward pressures in accordance with Chapter 16 of the CBC for the wind speed and exposure shown on the plans.

SUBMITTALS

Product Data:

Manufacturer's technical product data, installation instructions, and recommendations for each type of sheathing material shall be submitted for approval.

Product data shall include the manufacturer's name and a complete material description of all components of the metal sheathing system.

Samples:

Material samples shall include a 12" x 12" sample of the roofing and siding panels for each color to be installed and a sample of each anchor clip and fastening device.

A sample of each type of snow guard shall be submitted for approval.

Working Drawings:

Working drawings showing the layout and details of the roofing and siding system shall be submitted for approval.

Working drawings shall include the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; details of connections and closures; and details for expansion joints and weathertight joints.

Design calculations for the fastening system of the roof and wall panels with the substrate shown on the plans shall be submitted to verify compliance with the design requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer’s signature shall be original.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Certificates of Compliance: Certificates of compliance shall be furnished for the metal sheathing system in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE

Delivery and Handling: Metal panels shall be protected against damage and discoloration.

Storage: Metal panels shall be stored above ground, with one end elevated for drainage and protected against standing water and condensation between adjacent surfaces.

PART 2 - PRODUCTS

MATERIALS

SHEET MATERIALS

Base Metal: Base metal shall be cold formed, 24-gage, galvanized sheet steel conforming to ASTM Designation: A 653/A 653M, Grade 33 [230] with G90 [Z275] coating, except where a higher strength is required for performance, extra smooth; or cold formed aluminum-zinc alloy-coated, commercial quality, sheet steel conforming to ASTM Designation: A 792/A 792M, Grade 40 [275] with G90 [Z275] coating, extra smooth.

Configuration: Metal roofing and siding system shall be a standing seam system with standing seams a minimum of 1¾ inches high and spaced not less than 12 inches nor more than 18 inches on center.

METAL FINISHES

Coatings shall be applied before or after forming and fabricating panels, as required for maximum coating performance capability.

Colors or color matches shall be as shown on the plans or, if not otherwise shown, shall be as selected by the Engineer from the manufacturer's standard color palette.

Fluoropolymer Coating:

Finish shall be the manufacturer's standard Kynar coating with a baked on primer (0.2 mil) and a finish coat of 0.8-mil nominal for a total dry film thickness of approximately 1.0-mil nominal.

Interior finish shall consist of a 0.15-mil epoxy primer and a backer coat.

MISCELLANEOUS METAL SHAPES

Flashings, Gutters, and Downspouts: Flashings, gutters, and downspouts shall be formed from the same material, gage and in the same finish as the metal roofing and siding panels.

Perforated Soffit: Perforated soffit shall be formed from the same material, gage and in the same finish as the metal sheathing panels.

MISCELLANEOUS MATERIALS

Fastener Clips: Fastener clips shall be noncorrosive, ferrous metal fasteners as recommended by the metal panel system manufacturer to resist the design loads.

Fasteners: Fasteners shall be as recommended by the metal panel system manufacturer. Sheet metal screws shall not be used except to fasten trim and flashings.

Underlayment: Underlayment shall be as recommended by the metal panel system manufacturer, but not less than 15-pound minimum asphalt impregnated fiber glass mat roofing felt.

Sealant and Sealant Tape: Sealant and sealant tape shall be as recommended by the panel system manufacturer.

Closures: Closures shall be rubber, neoprene, closed cell plastic or prefinished metal.

FABRICATION

Unless otherwise shown on the plans, or specified herein, roof panels shall be fabricated in continuous lengths for the length of the roof, from ridge or peak to eaves, except such length shall not exceed the manufacturer's maximum production length.

Unless otherwise shown on the plans, or specified herein, siding panels shall be fabricated in continuous lengths for the height of the structure, from eaves to sill, except such length shall not exceed the manufacturer's maximum production length.

Flashings shall be fabricated in the longest practical lengths.

Roofing and siding panels shall be factory formed. Field formed panels are not acceptable.

PART 3 - EXECUTION

INSTALLATION

Underlayment: The roof and siding panels shall be installed over underlayment. Underlayment shall be laid parallel to the eaves, shingle fashion with 6-inch edge laps and 12-inch end laps and shall be fastened as recommended by the metal roofing system manufacturer.

Roof and Siding Panels:

The roof and siding shall be installed and fastened in accordance with the details shown on the plans and the approved working drawings. Cutting and fitting shall present a neat and true appearance with exposed burrs removed. Openings through roof panels shall be cut square and shall be reinforced as recommended by the metal roofing system manufacturer.

Metal panels shall be adjusted in place and properly aligned for the detailed conditions before fastening. Panels shall not be warped, bowed or twisted. The surface finish on the panels shall not be cracked, blemished or otherwise damaged.

Fasteners shall not be driven through roof panels or batten covers.

Miscellaneous Metal Shapes:

Trim, fascia, flashings, gutters, downspouts, scuppers, caps, and other prefinished metal work shall be positioned to the correct alignment for each detailed condition. Metal work shall be securely attached to backing construction using fasteners at the spacing shown on approved working drawings. Prefinished metal to be installed over concrete, masonry or plaster shall be back-coated with asphaltic paint as recommended by the metal roofing system manufacturer.

Metal panels, trim, gutters, and other prefinished metal that are marred, punctured, incorrectly bent, or incorrectly installed will be considered damaged and shall be replaced with undamaged units.

Gutters shall be fabricated by the metal panel system manufacturer to the shape and lengths shown on the plans. Expansion joints shall conform to the manufacturer's recommendations and to SMACNA "Architectural Sheet Metal Manual."

The metal panel system shall be installed weathertight. Closures shall be tight fitting and shall be provided at the ends of panels, at the boundary of the roof, and as indicated on the approved working drawings.

CLEAN UP AND CLOSE OUT

Clean up:

Adjacent surfaces shall be protected during the roofing system installation and sealant work. Excess sealant shall be removed as the installation progresses.

Roof panels, molding, trim, and other prefinished metal surfaces shall be cleaned after installation as recommended by the manufacturer. Exposed cuts shall be touched-up with a matching durable primer and paint as recommended by the metal roofing system manufacturer.

Touch up: Damaged paint surfaces shall be touched up by using an air dry touch up paint supplied by the metal roofing system manufacturer. Only a small brush shall be used for touching up. No spraying of touch up paint is to be performed.

Damaged Units: Panels and other components of the work which have been damaged or have deteriorated beyond successful repair shall be removed and replaced.

12-7.10 INSULATED METAL WALL PANELS

PART 1. GENERAL

SUMMARY

Scope: This work consists of furnishing and installing manufactured foamed insulated core horizontal metal wall panel assembly, in accordance with the details shown on the plans and these special provisions.

Sheet metal flashing shall conform to the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Metal wall system shall consist of pre-finished insulated core metal wall panels, flashing, clips, fasteners, sealant, and accessories and components, not mentioned, which are required for a complete, and weathertight installation.

SUBMITTALS

Product Data:

For each type of product indicated. Include catalog cuts, construction details, installation instructions, material descriptions, dimensions of individual components and profiles, and finishes for each type of insulated wall panel and accessory.

Product data shall include the manufacturer's name and a complete material description of all components of the insulated metal panel system.

Working Drawings:

Working drawings, prepared by manufacturer or manufacturer's authorized dealer, and engineering calculations shall be submitted for approval.

Working drawings shall show layout and details of the insulated wall panel system, including elevations and sections of each condition for approval. Include the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; details of connections and closures; and details for expansion joints and weathertight joints.

Design calculations for the fastening system with the substrate shown on the plans shall be submitted to verify compliance with the design requirements. Indicate points of supporting structure that must coordinate with composite wall panel system installation.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The name, number, and expiration date of the registration shall be shown. The Engineer's signature shall be original.

The engineering calculations for the design of the insulated metal wall panel system shall include applied loads, load combinations, panel stresses and deflections, fastener loads and stresses and provisions for accommodating the canopy deflections.

Closeout Submittals: Maintenance data.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Manufacture Source: Provide metal wall panel system and panel accessories from single manufacturer.

Manufacturer Qualifications: The manufacturer of the insulated metal wall panel system specified in this section shall have a minimum of 10 years experience in the production of factory assembled insulated metal panels.

Installer Qualifications: The installer shall be approved by the insulated metal wall panel manufacturer and have a minimum of 5 years experience in the specified system, type of construction, and documentation indicating successful completion of contract similar to this project.

Testing Agency Qualifications: Qualify in accordance with ASTM E 329.

Adhesion Test:

Prior to deliver of composite wall panel system, perform test on adhesive and sealants in accordance with ASTM D 3359. Test each adhesive and sealant utilizing specified panel finish.

Before installing sealants, field test the adhesion to project joint substrates as specified under "Joint Sealant" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Fire Performance Characteristics:

Provide metal composite wall systems with the following fire-test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.

Surface-Burning Characteristics: Provide metal composite wall system panels with the following characteristics when tested in accordance with ASTM E 84.

a. Flame spread index: 25 or less.
b. Smoke developed index: 450 or less.

Fire Performance of Insulated Wall: Class 1 wall panel in accordance with ANSI/FM 4880.

Room Corner Test: NFPA 286 or UL 1715.

Intermediate Scale Multistory Fire Test: Representative mockup tested in accordance with NFPA 285.

Fire Resistance Rating: Where indicated by design designations, provide metal wall panel tested in accordance with ASTM E 119 or UL Standard 263 by a testing and inspecting agency acceptable to authorities having jurisdiction.

Field measurements:

Field measurements shall be taken prior to the completion of shop fabrication whenever possible. However, coordinate fabrication schedule with construction progress as directed by the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.

Mockups:

Build mockup of the size and in the location indicated. Include details of insulated metal wall panel system. Demonstrate methods and details of installation. Show details of gasketed return vertical joints, penetrations, doors, windows, louvers, pipe openings, inside and outside corners, top and bottom of wall, horizontal and vertical joints.

Approved mockup may become part of installation if approved by the Engineer.

PRE-INSTALLATION MEETINGS

Meet with Engineer, metal panel installer, metal panel manufacturer's representative, structural-support installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, louvers, and metal ladders. The Contractor must notify the Engineer 1 week prior to scheduling the pre-installation meeting.

Review methods and procedures related to metal panel installation, including manufacturer's written instructions.

Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.

Review temporary protection requirements for metal panel assembly during and after installation.

Review procedures for repair of metal panels damaged after installation.

WARRANTY

Contractors shall submit the following manufacturer's written warranties:

Special Manufacturer's Warranty: On manufacturers' standard form, in which manufacturer agrees to repair or replace metal wall panel assemblies that fail in materials and workmanship within 2 years from date of contract acceptance as specified in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications.

Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace wall panels that evidence deterioration of finish within 20 years from date of contract acceptance as specified in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE

Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

Retain strippable protective covering on metal panels during installation.

FIELD CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

COORDINATION

Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2.- PRODUCTS

PERFORMANCE REQUIREMENTS

General: Provide metal wall panel system meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.

Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, in accordance with ASTM E 72:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
2. Limits of Deflection: Composite wall panel system shall withstand scheduled wind pressure of maximum allowable deflection limited to L/175 deflection of panel perimeter normal to plane of wall with no evidence of failure.
3. Secondary Metal Framing: Design secondary metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions." Provide minimum 4-inch wide bearing surface for metal wall panels at vertical joints.
4. Seismic Performance: Comply with ASCE 7 Section 9, "Earthquake Loads."

Air Infiltration: Maximum 0.06 cfm/sq ft in accordance with ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq ft, using a minimum 10'-0" x 10'-0" test panel that includes horizontal and vertical joints.

Water Penetration under Static Pressure: No uncontrolled water penetration in accordance with ASTM E 331 at a minimum static differential pressure of 15 lbf/sq ft, using minimum 10-by-10 foot test panel that includes horizontal and vertical joints.

Water Penetration under Dynamic Pressure: No uncontrolled water penetration per AAMA 501.1 at a minimum static differential pressure of 15 lbf/sqft, using a minimum 10'-0" x 10'-0" test panel that includes horizontal and vertical joints.

System Performance:

A 3rd party test report utilizing the standard ASTM E 283, E 331 and AAMA 501 procedures following the test protocol described in AAMA 508-07. Test panel must include a horizontal joint, with an imperfect air barrier.

Panel systems that have not successfully passed AAMA 508-07 shall provide a backup system that meets the air and water infiltration values as listed in both Water Penetrations under Dynamic and Static Pressures.

Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance in accordance with ASTM E 119.
2. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, in accordance with ASTM E 84.

SYSTEM DESCRIPTION

Foamed-Insulation Core Metal Wall Panels:

Factory-foamed-in-place horizontal wall panel system consisting of an exterior metal face sheet with interior metal liner panel, bonded to factory foamed-in-place core in thermally-separated profile, with no glues or adhesives, and with factory-sealed tongue-and-groove and rainscreen-designed pressure-equalized horizontal joint, configured with weep-hole-vented chamber to maintain equalized atmospheric pressure reducing potential for moisture drive into wall assembly, attached to supports using concealed fasteners.

Exclusions: The following do not meet the requirements of this Section:

1. Laminated panels.
2. Barrier wall-designed systems.
3. Systems relying upon field-installed gaskets or wet seals to meet performance requirements.

Horizontal Joints: Horizontal joints with positive drip edge, sloped drain shelf and integral venting to the exterior along the panel length to permit moisture drainage and to allow air to enter the pressure equalization chamber. Joint shall have a 2 3/8-inch baffle interlock to provide effective rain screen and pressure equalized performance as demonstrated by testing specified in this Section.

Vertical Joint: Vertical joints for insulated metal panels shall be gasketed, exposed wet seals are not permitted. Outer wings of gasket shall compress against the metal return flange of the panel face, include

an integrated, insulated metal vertical joint spline. The insulated vertical reveal shall be recessed 1 3/16-inch deep and shall be 5/8-inch wide. The insulated metal vertical joint should not add exterior sightlines, expose metal edges, or exposed wet seals. The joint spline shall include polyisocyanurate foam insulation adhered to a metal face of the same material and gage as the face of the panel. The vertical joint shall be designed to allow moisture to be drained from the panel's horizontal joint. No end dam sealant is to be applied to the ends of the horizontal joint at the vertical joint location. A continuous back-up flash behind the vertical joint is required with two beads of field applied non-curing butyl sealant between the panel and back up flashing for each panel.

Panel Ends: Factory formed trimless ends, tabbed under panel horizontal shelf.

Panel Width: 24 inch.

Panel Profile: Flat and Profile-Faced in locations and sizes indicated.

Panel Thickness: 3.00 inch - T, flat.

Thermal-Resistance (R) Value: 22.

PANEL MATERIALS

Metal Facing Sheets

Metallic-coated steel face sheet: Coil-coated, ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90, structural quality.
2. Face Sheet Thickness: Minimum 0.030 inch/22 gage Face Sheet Thickness: As required to meet performance requirements.
3. Surface: Embossed

Metallic-coated steel liner sheet: Coil-coated ASTM A 755/A 755M, 0.019 inch/26-gage.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90, structural quality.
2. Surface: Embossed planked.

Metal Panel Foamed-Insulation-Core: Foamed-in-place urethane-modified isocyanurate, density minimum 2.7 lb/cu ft, minimum compressive strength 20 lb/sq in, and containing no chlorofluorocarbon (CFC) or hydrofluorocarbon (HCFC) compounds.

FINISHES

Exposed Trim and Fasteners: Match panel finish.

Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Exterior Metal Facing Sheets:

Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Exterior Metallic Metal Facing Sheets:

Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Concealed Metal Facing Sheets:

Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of 0.2 mil prime coat and wash coat with 0.6 mil acrylic color coat.

Aluminum Accessories:

Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

MISCELLANEOUS MATERIALS

Metal Wall Panel Accessories:

General: Provide complete metal wall panel assembly incorporating trim, copings, fasciae, parapet caps, soffits, sills, inside and outside corners, and miscellaneous flashings. Provide manufacturer's factory-formed clips, shims, flashings, gaskets, lap tapes, closure strips, and caps for a complete installation. Fabricate accessories in accordance with SMACNA Manual.

Formed Flashing and Trim: Match material, thickness, and color of metal wall panel face sheets.

Extrusion Trim: Provide manufacturer-provided extruded trim for the following locations and as indicated on plans:

1. Base trim.
2. Coping.
3. Panel installation perimeter.
4. Opening perimeters.

Coping: Stainless Steel Sheet ASTM A 240/A Type 316, dead soft, fully annealed; with smooth, flat surface.

Sealants: Type recommended by metal wall panel system manufacturer for application, conforming to the requirements specified under "Joint Sealants" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Flashing Tape: 4-inch wide self-adhering butyl flashing tape.

Panel Attachment Clips: Concealed G-90 galvanized steel clip configured to prevent overdriving of fastener and crushing of foam core, with panel fasteners engaging both face and liner elements and mechanically attaching to panel supports.

Fasteners: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal wall panels by means factory-applied coating.

Secondary Metal Framing:

Miscellaneous Framing Components, General: Cold-formed metallic-coated steel sheet, ASTM C 645, Grade 50, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating.

Subgirts: C- or Z- shaped sections, 0.064-inch minimum.

Sill Channels: 0.064-inch minimum.

Hat Channels: 0.040 inch minimum.

FABRICATION

General:

Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

Sheet Metal Flashing and Trim:

Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

PART 3. — EXECUTION

EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

Inspect framing that will support metal wall panels to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal wall panels.

Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation. Verify that window, door, louver and other penetrations match layout on shop drawings.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION

Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C 754 and the metal panel manufacturer's written recommendations.

METAL PANEL INSTALLATION

General: Install metal wall panel system in accordance with approved shop drawings and manufacturer's recommendations. Install metal wall panels in orientation, sizes, and locations indicated. Anchor metal wall panels and other components securely in place. Provide for thermal and structural movement

Attachment and Joinery:

Attach panels to metal framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved working drawings.

Fasteners for Steel Wall Panels:

Stainless-steel for exterior locations and locations exposed to moisture; carbon steel for interior use only.

Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as approved by manufacturer.

Fasten metal wall panels to supports with concealed clips at each joint at location, spacing, and with fasteners recommended by manufacturer. Install clips to supports with self-tapping fasteners.

Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

Horizontal Joinery: Working from base of installation to top connect upper panel to lower panel at dry seal joinery.

Vertical Joinery: Provide reveal between vertical ends of panels as shown on shop drawings using hardware and gaskets furnished by manufacturer to form a weather tight seal between panels.

Dissimilar Materials: Where elements of metal wall panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

Joint Sealers:

Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies.

Seal panel end utilizing 2 beads of non-curing butyl aligning with factory-applied seal in adjacent panel pocket; apply continuously without gaps to complete panel system air barrier.

Seal metal wall panel end laps to supports or back-up flashing sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer. Do not install sealant in locations that will interfere with drainage of pressure-equalized panel chambers.

Prepare joints and apply sealants in conformance with the requirements specified under Section 12-7 "Joint Sealants," of these special provisions.

ACCESSORY INSTALLATION

General:

Install metal wall panel accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

Install related flashings and sheet metal trim in conformance with the requirements specified under "Sheet Metal Flashing and Trim" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Install components required for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

Comply with performance requirements and manufacturer's written installation instructions.

Provide concealed fasteners except where noted on approved working drawings.

Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

FIELD QUALITY CONTROL

Testing Agency: Engage an independent testing and inspecting agency acceptable to the Engineer to perform field tests and inspections and to prepare test reports.

Water-Spray Test: After completing portion of metal wall panel assembly including accessories and trim, test 2-bay area selected by the Engineer for water penetration, according to AAMA 501.2.

Manufacturer's Field Service: Engage a service representative authorized by metal wall panel manufacturer to inspect completed installation. Submit written report. Correct deficiencies noted in report.

Metal wall panels will be considered defective if they do not pass test and inspections.

CLEAN UP, PROTECTION, AND CLOSE OUT

Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

12-7.11 COMPOSITE WALL PANELS

PART 1.- GENERAL

SUMMARY

This work shall consist of designing, fabricating, furnishing and installing a water tight Rout and Return Dry panel aluminum composite panel system as shown on the plans and these special provisions. The Rout and Return Dry panel system must consist of a dry gasket interlocking system. The panel system shall consist of dry gasketed perimeter extrusions, extruded stiffeners, gaskets, fasteners, shims, related flashings and adaptors, sealants between jamb panels and previously installed adjacent construction, furring, and other miscellaneous

accessories required for a complete watertight installation. Work also includes parapet coping, column covers, soffits, sills, border, extruded aluminum metal shaped accessories, and filler items indicated as integral components of the panel system or as designed. Assembly shall be water and airtight without reliance on a secondary backup membrane.

QUALITY ASSURANCE

Fabrication History: Fabricator shall assume undivided responsibility for all components of the panel work and shall demonstrate no less than 5 years successful experience of metal panel work similar in scope and size to this project.

Performance Requirements: Work shall conform with all applicable codes and regulations.

Design Criteria: Make allowances for free and noiseless vertical and horizontal thermal movement due to the contraction and expansion of component parts, for ambient temperature range of 20 to 180 ºF. Buckling, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement of component parts will not be permitted. Fabrication, assembly and erection procedure shall take into account the ambient temperature range at the time of the operation.

Wind Loads.--Assemblies shall be designed for flexural, shear and torsional stresses for the following positive and negative wind pressures acting normal to the place of the assemblies. Loading design shall be as specified on the drawings.

Pressure and Load.--Normal to the plane of the wall between structural supports, deflection of the connected perimeter framing members shall not exceed 1/175 of span length or 3/4 inch, whichever is less.

At connection points of framing members to anchors, anchor deflection is any direction shall not exceed 1/16 inch. Where connection points are not clearly defined, maximum anchor deflection shall not exceed 1/16 inch.

Stresses must take into account interaction and in no case shall allowable values exceed the yield stress.

At 1.5 times design pressure, permanent deflections of framing members must not exceed 1/1000 of the span length, and components must not experience failure or gross permanent distortion. Art connection points of framing members to anchors, permanent set shall not exceed 1/16 inch.

Flatness Criteria: Maximum 1/2 inch in 15 on panel in any direction for assembled units. (Not accumulative)

General Approval: Composite panel manufacturer shall have an ICBO research report.

Field measurements: Shall be taken prior to the completion of shop fabrication whenever possible. However, coordinate fabrication schedule with construction progress as directed by the Contractor to avoid delay of work. Field fabrication may be allowed to ensure proper fit. However, field fabrication shall be kept to an absolute minimum with the majority of the fabrication being done under controlled shop conditions.

Source Limitations: Obtain each type of metal-faced composite wall panel from single source from single manufacturer

TESTS

Wall system: Walls furnished shall have been tested. If such tests are not available, mockups shall be constructed and tests performed. Test results shall meet or exceed the following:

Air infiltration: When tested in accordance with ASTM E283, air infiltration at 6.245 psf must not exceed 0.06 cfm per square foot of wall area.

Static Water Infiltration: Water infiltration is defined as the appearance of uncontrolled water on the wall. Design shall provide drainage to the exterior face of the wall, any leakage of water occurring at joints

and/or any condensation taking place within the construction. No water infiltration under static pressure with ASTM E331 at a differential static pressure of 15 psf, after 15 minutes.

Structural Performance: Shall be tested in accordance with ASTM E330 at design pressure. After initial test, test at 150 % of design pressure. No permanent deformation exceeding 1/1000 or failure to structural members allowed.

Seismic Racking: There shall be no failure or deterioration of the system when the unit is laterally racked to 3/4 inch in both directions and repeated for three cycles.

Bond Integrity Test: When in accordance with ASTM D1781 for bond integrity, simulating resistance to delamination.

Peel Strength:

Fire Performance: ASTM E84 maximum value flame spread 0, smoke developed 0.

NFPA 286: No flame spread along interior face or penetration through the wall assembly.

ASTM 162: No surface flaming.

SUBMITTALS

Product Data: For each type of product indicated. Include catalog cuts, construction details, installation instructions, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.

Samples: Five metal panel samples (8 inch x 8 inch in size), five panel anchorage system samples. Also provide sample of extruded accessory shaped metal.

Working Drawings: Working drawings and engineering calculations shall be submitted for approval.

Working drawings shall show the shape, size, thickness, and method of attachment for each component used in the work; the layout and spacing of fasteners; details of connections and closures; and details for expansion joints and weathertight joints.

Design calculations for the fastening system with the substrate shown on the plans shall be submitted to verify compliance with the design requirements.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer’s signature shall be original.

The engineering calculations for the design of the metal panel system shall include applied loads, load combinations, panel stresses and deflections, fastener loads and stresses and provisions for accommodating the canopy deflections.

Mock up: Construct full size mock-up per that outlined on the drawings. Mock-up must be approved prior to ordering materials and release of panels for fabrication.

Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless the Engineer specifically approves such deviations in writing.

Acceptable fabricator's: The following are acceptable manufacturer’s providing they meet all of the criteria for this specification; Elward Systems Corporation, CSP Wall Systems, Center Glass Company, Universe Corporation, or equal.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

PREINSTALLATION CONFERENCE

Meet with Engineer, metal-faced composite wall panel Installer, metal-faced composite wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal-faced composite wall panels including installers of doors, windows, louvers, and metal ladders.

Review methods and procedures related to metal-faced composite wall panel installation, including manufacturer's written instructions.

Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal-faced composite wall panels.

Review temporary protection requirements for metal-faced composite wall panel assembly during and after installation.

Review wall panel observation and repair procedures after metal-faced composite wall panel installation

DELIVERY, HANDLING AND STORAGE

Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.

Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.

Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120°F.

Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.

COORDINATION

Coordinate metal-faced composite wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leak proof, secure, and non corrosive installation.

PART 2.- PRODUCTS

MATERIALS

Sheet Material:

Panel coating:

Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. The coating system shall not be field applied. The color of the panel coating shall be as shown on the plans.

Aluminum composite material:

Panels shall match the color shown on the plans and the following:

1. Composite metal panel shall consist of two exterior sheets of 0.020 inch thick AA3000 series aluminum alloy and a core of extruded thermoplastic. The exterior sheets and core shall be bonded together with no glues or adhesives. The panels shall be integrated into a 1 5/8 inch maximum depth extruded aluminum edge grip system. The edge grip system shall be of 6063-T5 aluminum alloy.
2. The maximum allowable fabrication tolerances for the panels shall be as follows:

Panel Bow	Maximum of 0.8 percent of length or width panel dimension
Width or thickness	0.157 inch
Length	1/8 inch
Camber	1/32 inch
End Squareness	0.25 percent of panel width

3. All panels surfaces shall be free of seams, warp, and buckling. The panel lines, breaks and angles shall be sharp and true.
4. The metal panel system shall have an internal drainage system to catch condensation and any other accumulations of moisture and direct it to discharge weeps.
5. Attachment clips, fasteners, furring, shims, brackets and miscellaneous hardware shall be stainless steel and shall be as recommended by the metal panel manufacturer. All fasteners shall be concealed.
6. Acceptable products are Alucobond, Reynobond, Alpolic, or equal.

Sealants and Gaskets:

Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer. Sealant and gaskets shall be black in color.

Edge Trim:

Edge trim shall be extruded aluminum with integral weather-stripping as detailed on the plans so as to provide the following features:

Rout and return of the composite aluminum sheet on all perimeters. "Continuous Edge Grip" is not acceptable.

Exposed edge of composite aluminum sheet shall be protected inside an extruded aluminum pocket.

Maximum overall panel thickness shall not exceed 3 inches nor be less than 2 inches.

The composite aluminum sheet shall be mechanically attached to all perimeter extrusions.

Color shall be black painted silicone modified polyester.

Stiffeners:

Extruded aluminum sections secured to edge trim and bonded to rear face of composite aluminum sheet with silicone, and of sufficient size and strength to maintain flatness of the panel within the specified tolerances. Stiffeners shall have a mill finish.

Flashings:

Fabricate flashing from 1/16 inch thickness aluminum sheet; where exposed to biew finish to match adjacent panels. Provide lap strip under flashing at abutted conditions, with lapped surfaces sealed with full bed of non-hardening sealant.

Accessories:

Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.

Flashing and Trim: Stainless-steel sheet, ASTM A 666 type 316 marine grade, fully annealed; with smooth, flat surface and 2D dull, cold rolled finish. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fascia, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.

Extruded Aluminum Shape: An aluminum shape which may be selected from standard configurations, modified configurations, or customized that is anchored directly to the curtain wall mullions and integrated with composite wall panel system. Color and finish to match that of composite panels.

Miscellaneous Metal Framing:

Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

Hat-Shaped, Rigid Furring Channels:

Nominal Thickness: As required to meet performance requirements
Depth: As indicated.

Cold-Rolled Furring Channels:

Minimum 1/2-inch wide flange.
Nominal Thickness: As required to meet performance requirements
Depth: 3/4 inch.
Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.

PART 3. -EXECUTION

EXAMINATION

Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.

Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.

Proceed with installation only after unsatisfactory conditions have been corrected

PREPARATION

The metal panel system shall be installed rigidly and securely in accordance with the manufacturer's recommendations.

Extreme care shall be exercised in handling, storing, moving and installation the metal panels to avoid twisting, racking, scratching, denting, chipping, staining or any other type of damage or distortion. Panels damaged in handling or installing shall be replaced by the Contractor at his expense.

Fabricate panels so that the panel thickness at the joinery is 1 3/4-inch.

Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions

INSTALLATION

Panels shall be erected in accordance with an approved set of working drawings.

Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.

Conform to panel fabricator's instructions for installation of concealed fasteners.

Do not install component parts that are observed to be defective, including warped, bowed, dented, abraised, and broken members.

Panels shall be accurately positioned to maintain the straight joint lines between panels as shown on the plans. Joints shall be kept uniform throughout the installation and shall be of sufficient width to accommodate the deflections of the frame and the expansion and contraction of the panels but shall not exceed 1/2 inch in width.

Adjoining panels shall be aligned and matched to one another at the joints. The surfaces at the edges of each panel shall be flush with the surfaces at the edges of the adjacent panels.

Neoprene isolation material shall be provided to separate adjoining incompatible metals. Nylon washers shall be used to separate canopy members, fasteners, clips, and brackets of ferrous metal (except stainless steel) from aluminum.

Openings through the panels for penetrations shall be cut square to present a neat and true appearance with exposed burrs, removed. Openings shall be reinforced and sealed as recommended by the panel manufacturer.

A dry gasket shall be the primary method to seal joints. The dry gasket shall be compatible with silicone sealants.

Other surfaces necessary to use sealants shall be clean and shall be free of dust, dirt oil, moisture and other deleterious matter that might adversely affect the adhesion of the sealant. Primer shall be applied in accordance with the sealant manufacturer's instructions. Application of backing materials and sealant shall be in accordance with the panel manufacture's working drawings and the sealant manufacturer's instructions, all as specified under Submittals," in these special provisions.

Joints to be sealed shall be inspected for construction defects that would adversely affect the execution of the work. Unsatisfactory conditions shall be corrected before the joint sealant is applied.

The installation metal panel system shall be weathertight.

ADJUSTING AND CLEANING

Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

Repair panels with minor damage.

Make sure weep holes and drainage channels are unobstructed and free of dirt and sealants.

The metal panel system shall be thoroughly cleaned after installation to remove excess sealant, tapes, dirt, grease or other unsightly materials. Cleaning shall be in accordance with the panel and sealant manufacturer's instructions.

12-7.12 SINGLE PLY - THERMOPLASTIC POLYOLEFIN MEMBRANE ROOFING SYSTEM (TPO)

PART 1 GENERAL

Scope: This work includes furnishing and installing a mechanically fastened single ply - thermoplastic polyolefin (TPO) membrane roofing system and roof insulation and all accessories.

Provide insulation under "Rigid Roof Insulation" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

DEFINITIONS

Roofing Terminology: Refer to ASTM D 1079 and the "NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.

SYSTEM DESCRIPTION

The mechanically fastened thermoplastic roofing system includes white 80-mil thick scrim-reinforced, thermoplastic polyolefin membrane field sheets, thermoplastic polyolefin membrane perimeter sheets, rigid roof insulation, tapered rigid roof insulation, protection board, bonding adhesive, flashing, fasteners, and other materials required, which provide a complete and waterproof assembly meeting the performance requirements specified herein.

Installed roofing membrane and base flashings must remain watertight; prevent the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

Roofing materials must be compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

Performance Requirements:

Fire Hazard Classification: Class A under UL.

Energy Performance: Roofing system must achieve initial solar reflectance not less than 0.78 and emissivity not less than 0.75 when tested according to CRRC-1.

Wind Resistance: FM Class 1 rating with 1-90 windstorm resistance classification.

Fire-Test-Response Characteristics:

Membrane roofing materials must have the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials must be identified with appropriate markings of applicable testing and inspecting agency.

Exterior Fire-Test Exposure: Class A, ASTM E 108, for application and roof slopes indicated.

Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

SUBMITTALS

Product Data: Product data for each type of product indicated.

Samples: 12" x 12" square samples of sheet roofing, of color specified, including T-shaped side and end lap seam.

Working Drawings: Drawings showing sheet layout including seam layout and details, adhesive layout, perimeter details, required spacing of mechanical fastening devices, interface with contiguous materials; penetrations, curbs, drains, scupper, and projections; flashing details, including inside and outside corner reinforcements and terminations; details of expansion joints; and edge termination including parapet flashing termination. Provide working drawings for the protection board, rigid roof insulation and tapered rigid roof insulation, showing slopes and components and required fastening procedure including requirement for drain.

Installer Certificates: Certificates signed by roofing system manufacturer certifying that installer is approved, authorized, or licensed by manufacturer to install roofing system.

Manufacturer Certificates:

Certificates of compliance signed by roofing manufacturer certifying that roofing system complies with requirements specified in these special provisions.

Manufacturer's evidence that performance requirements are met.

Qualification Statements: Qualification statements for installer and manufacturer.

Test Reports: Product test reports based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

Compliance Reports: FM Approvals and UL information for roofing system with products proposed for use.

Maintenance Manual: Maintenance manual for roofing system to include in maintenance manuals.

Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

LEED Submittals:

SS Credit 7.2, Heat Island Effect – Roof: Submit product data for roof covering materials indicating minimum 3 aged solar reflectance index (SRI), or 3 year aged thermal emittance and solar reflectance.

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-

consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty. Installer must have not less than 5 years' experience in installing work similar in material, design, and extent to that required for this project, whose work has resulted in construction with a successful record of in-service performance.

Manufacturer Qualifications: A qualified manufacturer that has UL listing for membrane roofing system identical to that used for this Project. Manufacturer must have not less than 5 years' experience in manufacturing products or systems similar to those required for this project and have a record of successful in-service performance, as well as sufficient production capacity to produce required units.

Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ISO 17025.

Source Limitations: Obtain components for membrane roofing system from roofing membrane manufacturer or approved by roofing membrane manufacturer, as required by warranty.

Pre-Installation Conference: After approval of submittals and before commencing any work on the roofing system, the Engineers shall hold a pre-installation conference to review:

1. Plans and Specifications;
2. Procedure for onsite inspection and acceptance of Roofing substrate and pertinent details;
3. Contractor's plan for coordination of work of the various trades involved in providing the roofing system and other components;
4. Inspection procedures;
5. Safety requirement.

LEED:

SS Credit 7.2, Heat Island Effect – Roof

Provide roofing materials for building roofs with a solar reflectance index of at least 78 for low-sloped roofs (slope 2:12 or less) and at least 29 for steep-sloped roofs (slope greater than 2:12).

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

DELIVERY, STORAGE, AND HANDLING

Deliver roofing materials to project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store materials in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

COORDINATION

Coordinate installation of roofing system with related Work specified in other Sections to ensure that roofing assemblies, including substrate, sheathings, flashing, trim, joint sealants, and other components, are protected against damage from the weather, corrosion, moisture, and other causes.

WARRANTY

Special Warranty:

Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

Special warranty period is manufacturer's longest available term for roofing system of type specified, minimum 20 years from date of acceptance of contract.

PART 2 PRODUCTS

GENERAL

Performance: Roofing materials must be provided which are recognized to be of generic type indicated and tested to show compliance with indicated performance.

Compatibility: Products which are recommended by the manufacturer must be fully compatible with the substrates used.

Roofing system: Provide thermoplastic polyolefin sheet roofing system, including but not limited to thermoplastic polyolefin sheet, flashing, edge lap sealant, substrate membrane adhesive, mastics, thinners, sealers, release agents, sheet activators, sheet primers and solvents; rigid insulation boards, membrane termination bars, clamping rings, fasteners, and other accessories recommended by roof membrane manufacturer for a complete system.

Single Ply - Thermoplastic Polyolefin Roofing Membrane:

Membrane must conform to the requirements of ASTM D 6878-11a, and must have a solar reflectance index (SRI) of 110 in accordance with ASTM E 1980, an emittance of 0.95 in accordance with ASTM E 408.

Manufacturers: Subject to compliance with requirements, acceptable manufacturers include the following, or equal:

Carlisle SynTec Incorporated.
Firestone Building Products Company.
GAF Materials Corporation.
GenFlex Roofing Systems.

Thickness: 80 mils, nominal.

Exposed Face Color: White.

Auxillary Materials: Recommended by roofing system manufacturer for intended use and compatible with membrane roofing conforming to the following:

Adhesives, sealants, and primers that are used inside the weatherproofing system must comply with LEED and Bay Area Air Quality Management District limits for VOC content.

Protection Board: Protection board must be glass mat gypsum roof board conforming to the requirement of ASTM C 1177.

Rigid Insulation Board and Tapered Rigid Insulation Board: Insulation Boards must be polyisocyanurate board covered on both sides with a coasted glass fiber mat facer conforming to ASTM C 1289-06, Type II, Class 1, Grade 2 or Grade 3. Provide preformed, tapered insulation boards, preformed saddles, crickets, tapered edge strips, and other insulation shapes as required by the manufacturer and as shown on the plans.

Underlayment and Slip Sheets: As recommended by manufacturer and required for Class A and Class 1-90 ratings.

Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 80 mils thick, minimum, of same color as sheet membrane.

Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars with splayed top to receive sealant bead, approximately 1 inch x 0.1 inch thick; with anchors.

Fasteners: Stainless Steel, factory-coated galvanized steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer and approved by the insulation manufacturers.

Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

Roof Walkways: Flexible walkways that consist of white, factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads, as shown on the plans, approximately 180 mil thick, and acceptable to membrane roofing system manufacturer.

Sacrificial Membrane: Sacrificial membrane shall be white, factory-formed nonporous, heavy-duty, solid-rubber, slip-resisting, surface-texture rolls adhered to the membrane surface of TPO membrane. Membrane shall be nominal 180-mils thick.

PART 3 EXECUTION

PREPARATION

Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

All penetrations or projections through the roof deck must be installed prior to beginning roof system installation. Holes, cavities and joints greater than 1/4 inch shall be filled and finished flush in utilizing recommended materials.

Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

INSTALLATION

Mechanically Fastened Roofing Membrane Installation:

Provide cover board over insulation of type and thickness recommended by manufacturer as required for Class A and Class 1 rating.

Mechanically fasten membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.

Sacrificial Membrane: Install sacrificial membrane over area to receive Photovoltaic Panels between TPO roofing and Photovoltaic Panel ballast pans. Membrane to extend a minimum of six-inches beyond the Photovoltaic Panel ballast pans.

Treatment at Joints: Provide treatment at joints in substrate, cracks and penetrations as required and with such materials and designs. Fill non-moving cracks and joints with sealant or other compounds compatible with the TPO roofing system.

Priming: Prime metal substrates using recommended products and methods.

Insulation Installation:

Extend insulation over entire surface as indicated, cutting and fitting tightly around obstructions.

Secure the insulation to the substrate utilizing specified mechanical fasteners in the patterns as required to comply FM-1-28 and with the specified wind uplift criteria, but no less than one fastener per each square foot at corners, 1.33 fastener per square foot at the perimeter and one fastener per two square feet of field area. Predrill holes for fastener installation utilize recommended fastener lengths and depth of embedment for various types of substrates. Provide stress plates fabricated form same material as fasteners which will not cause the stress distribution surface to become concave or deform. Fasteners must be installed with a depth-sensing screw gun to prevent overdriving or under driving. Remove and replace fasteners which are overdriven, under-driven, snapped, bent, not engaged or in any manner not properly installed.

Continuous joints between insulation boards and parallel to decking flutes shall not occur over the flute openings. Boards must have full edge bearing on rib tops.

Insulation board with broken or crushed corners or edges must be trimmed free of such defects or must be discarded. Replacement boards less than 12 inches wide must not be used.

End joints between insulation boards must be staggered as recommended by the manufacturer.

Base Flashing Installation:

Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

Flash penetrations and field-formed inside and outside corners with sheet flashing.

Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

FIELD QUALITY CONTROL

Inspection:

Engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Engineer.

Notify Engineer and the Department 48 hours in advance of date and time of inspection.

Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

PROTECTING AND CLEANING

Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Engineer and the Department.

12-7.13 SHEET METAL FLASHING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of fabricating, furnishing and installing sheet metal flashing in accordance with the details shown on the plans and these special provisions.

Sheet metal shall include metal flashings, counterflashings, straps, gutters, downspouts, roof jacks, reglets, copings, scuppers, conductor heads, and screen type vents.

Alternatives: Premolded roof flashings may be used in lieu of sheet metal flashings where shown on the plans or required elsewhere in these special provisions.

SUBMITTALS

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

Codes and Standards: Sheet metal work shall in accordance with the requirements in the latest edition of the SMACNA "Architectural Sheet Metal Manual."

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with recycled content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

MATERIALS

Galvanized Sheet Steel: Galvanized sheet steel shall conform to ASTM Designation: A 653/A 653M with G 90 [Z275] coating, not less than 24-gage, unless otherwise shown on the plans. Surfaces to be painted shall not have factory coatings on galvanizing that cannot be removed by paint thinner.

Sheet Aluminum: Sheet aluminum shall be not less than 0.032 inch thick, mill finish, 3003-H14 alloy, conforming to ASTM Designation: B 209M.

Sheet Metal for Green Roof Counterflashings: Counterflashings and reglets at green roof shall be prefinished stainless steel sheet or prefinished galvanized steel sheet. Finish shall be polyvinyl chloride (PVC) or fluoropolymer containing at least 70% resin by weight.

Stainless Steel Sheet: Stainless steel sheet shall conform to ASTM Designation: A 666, Type 316, dead soft, fully annealed.

Sheet Lead: Sheet lead shall be not less than 0.062 inch thick, conforming to ASTM Designation: B 749.

Premolded Roof Flashing: Premolded flashing shall be polyvinyl chloride (PVC) flashing, designed for heat welding to PVC roof membrane.

Hardware and Fastenings: Hardware and fastening for premolded roof flashings shall be stainless steel.

Solder: Solder shall conform to ASTM Designation: B 32, Alloy Grade Sn50 for zinc-coated steel; ASTM Designation: B 32, Alloy Grade Sn60 for stainless steel.

Soldering Flux: Soldering flux shall be acid type, conforming to Federal Specification: A-A-51145D, Type I, Form A.

Insect Screen: Insect screen shall be industrial wire cloth and screen, medium grade, 18 mesh, 0.017-inch diameter, 0.039-inch openings, plain weave, galvanized steel.

Lap Joint Sealant: Lap joint sealant for concealed locations shall be a non-drying butyl conforming to ASTM Designation: C 1311.

Flashing Cement: Flashing cement shall be a bituminous plastic cement, asbestos free, conforming to ASTM Designation: D 4586, Type II.

Sealant: Sealant for exposed locations shall be a silicone sealant conforming to ASTM Designation: C 920.

Primer: Primer shall be as recommended by the sealant manufacturer.

Bituminous Coating: Bituminous coating shall be a cold-applied asphalt emulsion conforming to ASTM D 1187.

FABRICATION

Sheet metal shall be assembled to SMACNA standards.

Sheet metal shall be formed to the sizes, shapes and dimensions shown on the plans or as specified herein with angles and lines straight, sharp and in true alignment. The number of joints shall be kept to a minimum.

Angle bends and folds for interlocking the metal shall be made with full regard for expansion and contraction to avoid buckling or fullness in the metal after it is installed.

Joints in sheet metal work shall be closed watertight unless slip joints are specifically required. Watertight joints shall be mechanically interlocked and then thoroughly soldered for metals other than aluminum. Watertight joints in aluminum or between aluminum and other metals shall be sealed with acrylic sealant.

Sheet metal joints to be soldered shall be cleaned with steel wool or other means, pre-tinned and soldered watertight.

All joints shall be wiped clean of flux after soldering. Acid flux shall be neutralized by washing the joints with sodium bicarbonate.

Flashings shall have a 45 degree drip return at bottom edges. Unless otherwise shown on the plans, counterflashing shall extend not less than 4 inches over roofing or other materials protected by the counterflashing and shall be arranged so that roofing or materials can be repaired without damage to the counterflashing. Where reglets are indicated, counterflashing shall be fastened by lead wedges or snap-in flashing.

Roof counterflashings shall consist of separate reglet and counterflashing pieces for ease of removal during maintenance or testing.

PART 3 - EXECUTION

Preparation: Surfaces to receive sheet metal shall be clean, smooth and free from defects.

Protection: Aluminum surfaces to be in contact with concrete, mortar, or dissimilar metals shall be given a heavy coat of coal tar paint.

INSTALLATION

Roof Penetration Flashings:

All pipes, ducts, vents and flues passing through roofs shall be made waterproof with flashings of storm collars or counterflashings.

Roof penetration flashings shall be fabricated from galvanized sheet steel, not less than 24-gage. Size and shape shall be as shown on the plans.

On built-up roofing, 2 flashings shall be furnished for each pipe, vent or flue through roof. Flashings shall be constructed so that the lower flashing shall sit directly on the roof deck, with the top flashing set over it on top of the roof felts.

The lower flashing shall be galvanized sheet metal, 24-gage, and extend 6 inches minimum from outside of the pipe in all directions and 1½ inches above the top of the roofing.

The top flashing shall be galvanized sheet steel or sheet lead as shown on the plans.

Hung Gutters:

Hung gutters shall be fabricated from galvanized sheet steel, not less than 24-gage. Gutters shall be size and shape as shown on the plans.

Gutters shall be fabricated in sections not less than 10 feet in length. Use sections as long as practicable for lengths over 10 feet.

Joints shall be lapped at least 1½ inches, rivet and solder watertight. Butt type expansion joints, ¾ inch wide, shall be provided at midpoint between down spouts and where expansion joints occur in the structure.

Downspouts:

Downspouts shall be fabricated from galvanized sheet steel, not less than 24-gage. Size and shape shall be as shown on the plans.

Downspouts shall be installed as shown on the plans, secured to the wall with straps near top, bottom and at intermediate points not more than 8 feet apart. Straps shall extend 2 inches out on wall and be secured with suitable anchors.

Unless otherwise shown on the plans, the lower end of downspout shall terminate with mitered 45 degree elbow.

Premolded Roof Flashings: Premolded roof flashings shall be installed in accordance with the manufacturer's instructions.

12-7.14 ROOF SPECIALTIES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing roof specialties in accordance with details shown on the plans and these special provisions.

Roof specialties shall include roof hatches and prefabricated curb and equipment support units.

SUBMITTALS

Product Data: Manufacturer's descriptive data, rough-in diagrams, installation instructions and general product recommendations shall be submitted for approval.

Samples: Two samples, minimum 8 inches square, of each exposed metal and plastic sheet materials, and 2 samples, minimum 24 inches long, of formed or extruded metal member each color and finish specified shall be submitted for approval.

Coordination Drawings: Coordination drawings for items interfacing with or supporting mechanical or electrical equipment, ductwork, piping or conduit, shall be submitted for approval. Drawings shall indicate dimensions and locations of items provided in this special provision, together with relationship and methods of attachment to adjacent construction and to mechanical and electrical items.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Labels: Units shall be provided which have been tested, listed, and bear the label of UL, FM or other recognized testing agency.

Codes and Standards: Prefabricated units shall conform to the requirements of SMACNA, "Architectural Sheet Metal Manual," details for fabrication of units, including flanges and cap flashing to coordinate with types of roofing involved.

PART 2 - PRODUCTS

Manufacturer's standard units, modified as necessary, shall be provided to comply with the contract requirements. Each unit shall be shop fabricated to the greatest extent possible.

MATERIALS

Sheet Steel: Sheet steel shall be structural quality conforming to the requirements of ASTM Designation: A 570.

Galvanized Sheet Metal: Galvanized sheet metal shall be commercial quality, conforming to the requirements of ASTM Designation: A 446, G90 hot dipped galvanized, and mill phosphatized.

Stainless Steel: Stainless steel shall conform to ASTM Designation: A 167, Type 302/304, with annealed finish. Stainless steel shall be tempered as required for forming and performance.

Aluminum Sheet: Aluminum sheet shall conform to the requirements of ASTM Designation: B 209, tempered as required, anodized finish, except furnish mill finish where field painting is required.

Extruded Aluminum: Extruded aluminum shall be the manufacturer's standard extrusions of sizes and profiles required, clear anodized finish unless otherwise shown.

Insulation: Insulation shall be the manufacturer's standard rigid or semi-rigid board of glass fiber and shall be the thickness required.

Wood Nailers: Wood nailers shall be softwood, pressure treated with copper napthenate, pentachlorophenol, or water-borne arsenicals (ACA, CCA or ACZA); not less than 2-inch nominal thickness.

Fasteners: Fasteners shall be the same metal as the metal to be fastened, or other non-corrosive metal as recommended by the unit manufacturer. Finish of the fastener shall be the same finish as the metal being fastened.

Bituminous Coating: Bituminous coating shall be as recommended by the unit manufacturer for the use specified.

Gaskets: Gaskets shall be tubular or fingered design of neoprene or polyvinyl chloride as recommended by the unit manufacturer.

PREFABRICATED ROOF HATCHES

Cover for roof hatch or scuttle shall be stainless steel, welded to support a live load of 40 pounds per square foot and beaded flange. Insulation shall be glass fiber, not less than one inch in thickness, fully covered by metal liner. Unit shall have a roof flange for attaching to roof deck. Curb insulation shall be fiberboard or glass not less than one inch thick. Unit shall be equipped with hinges, positive latch with turn handles, inside and outside, and padlock hasp on inside, with gaskets. Cover shall be equipped with automatic hold open arm with handle to permit easy release.

Curb height shall be not less than 7-inches above thermoplastic polyolefin (TPO) roof membrane, except where slope of roof exceeds 2%, curb shall be tapered to result in level top installation.

PREFABRICATED CURB AND EQUIPMENT SUPPORTS

Curb and equipment support shall conform to the loading and strength requirements of the equipment to be supported. Dimensions shall conform to the dimensions shown on the coordination drawings of equipment to be supported. Unit shall be fabricated from sheet steel conforming to ASTM Designation: A 570 and galvanized after fabrication.

Units shall be fabricated with welded or sealed mechanical corner joints, complete with cant strips and base profile coordinated with roof insulation thickness. Wood nailers shall be provided at top of curb tapered as necessary to compensate for roof slopes of 2%.

Where roof slope is more than 2%, curb or equipment supports shall be fabricated with height tapered to provide a level installation.

PART 3 - EXECUTION

INSTALLATION

Prefabricated units shall be installed in accordance with the manufacturer's instructions and approved coordination drawings.

Installation of the units shall be coordinated with installation of the roof decking and other substrates to receive accessory units, vapor barriers, insulation, roof and flashing materials.

Units shall be securely fastened to supporting members, adequate to withstand all lateral, inward or outward loading pressures.

Where metal surfaces are to be installed in contact with non-compatible metals or other corrosive substrates, including wood decking, bituminous coatings shall be applied to metal surfaces.

Except as noted above, roof flanges shall be set in a thick bed of roofing cement to form a watertight seal.

Operational Testing: Units with operational components shall be fully tested. Joints and hardware shall be cleaned and lubricated. All units shall be adjusted for proper operation.

CLEANING AND PROTECTION

All exposed metal and plastic surfaces shall be cleaned in accordance with the manufacturer's instructions. Damaged metal coatings shall be repaired.

12-7.15 SKYLIGHTS

PART 1- GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing aluminum framed curb mounted rectangular unit skylights and tubular daylight devices, in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION

Commercially available curb mounted rectangular vaulted, prismatic metal framed skylights, which have been verified by load testing and independent design analyses to meet specified design requirements.

Tubular daylight devices are plastic-glazed tubular skylights consisting of a light-transmitting dome with internal curved reflector, upper tube supporting element, reflective light-conducting tubing, and ceiling mounted diffusers. Devices shall comply with Chapters 24 and 26 of the 2010 CBC.

SUBMITTALS

Product Data:

Skylights: Manufacturer's descriptive data and catalog cuts.

Warranty: Manufacturer's 5 year complete warranty.

Test Reports: Certified test reports from independent testing laboratory for each type and class of panel system. Reports shall verify that the material meets specified performance requirements. Previously completed test reports will be acceptable if they are current and indicative of products used on this project. Where a Class A, B or C roof is part of the project, a listing certificate for roof covering systems category shall be provided certifying that the product complies with the safety standards of ASTM E 108 and the California Building Code.

Certificates: Manufacturer's certificate stating that products meet or exceed specified requirements. Skylight system shall be evaluated and listed (the whole skylight as a unit, not just a glazing material in the unit) by the recognized building code authority: ICC Evaluation Service (ICC-ES). Product ratings determined using NFRC 100-2004 and NFRC 200-2004 shall be authorized for certification and properly labeled by the manufacturer.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

DELIVERY STORAGE AND HANDLING

System modules shall be factory assembled to the greatest extent possible. Panels shall be shipped to the jobsite in rugged shipping units and shall be ready for erection. All skylights shall have conspicuous decals affixed warning individuals against sitting or stepping on the units. Skylight panels shall be stored on the long edge, several inches above the ground, blocked and under cover to prevent warping. Unit skylights shall be delivered in manufacturer's original containers, dry, undamaged, with seals and labels intact. All products shall be delivered, stored and protected in accordance with manufacturer's recommendations.

WARRANTY

The Contractor shall provide the manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-framed skylights that fail in materials or workmanship within a 5 year warranty period from date of project completion.

Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Noise or vibration caused by thermal movements.
3. Deterioration of metals finishes, and other materials beyond normal weathering.
4. Adhesive or cohesive sealant failures.
5. Water leakage

QUALITY ASSURANCE

Qualifications: Documentation of manufacturer's and installer experience indicating compliance with specified requirements.

The manufacturer shall be a company specializing in the manufacture of the specified products with a minimum of 5 years documented experience. The installer shall have documented experience of 5 years minimum performing the work specified.

PART 2.- PRODUCTS

CURB MOUNTED RECTANGULAR UNIT SKYLIGHT

Skylight shall be aluminum framed curb mounted rectangular unit skylight with acrylic plastic dome mounted in extruded aluminum framing. Glazing assembly shall be double glazed and distortion free.

Performance requirements:

Skylights must conform with all federal, state4 and local code bodies having jurisdiction and be designed to withstand all forces of nature deemed necessary by those code bodies for the specified product location.

Skylights shall conform to recommendations of the AAMA specifications for aluminum structures.

Skylights must be designed to carry a minimum of 30 psf tributary roof load or greater.

Air infiltration shall not exceed 0.06 cfm of the total glazed surface area when tested in accordance with ASTM E 283 at a static pressure of 6.24 psf.

Water penetration at a static test pressure of 6.24 psf shall be zero in accordance with ASTM E 331.

Drop test:

A 200 lb. drop test from a height of 24 inches above to center of dome shape at mid points of length and width.

The 200 lb. load must be contained within a flexible bladder or sack having approximate dimensions no larger than 30 inches long 20 inches wide and 8 inches high.

The dome must withstand the sack drop without inverting or breaking.

Finished skylight domes sealed in frame must also handle 500 lb. on 1 square foot point loading without inverting.

The drop test must be witnessed and certified by the test laboratory which provides the NAFS certification.

Energy requirements: Glazing material must have a maximum light distribution characteristic that maximizes the shading factor. Per Addendum D of ASHRAE 90.-2007, the diffusing qualities of the glazing must have a minimum haze factor of 90 percent or greater. The combined inner/outer lens target values shall be as follows:

1. Visible light transmittance (VT): 67.8 percent minimum Class 1 acrylic.
2. Diffusion/haze factor: 100 percent minimum.
3. Solar heat gain coefficient (SHGC): 0.42 maximum. NFRC 200
4. "U" factor: 0.74 or lower (glazing and framing) in accordance with NFRC 100
5. Hail resistance level: Class 1 (1" hail) as tested by certified engineering firm.
6. "U" factor and SHGC must be certified and published by National Fenestration Rating Council (NFRC) and listed on website at: http://www.nfrc.org

Retaining and curb framing shall be ASTM B 221 alloy 6063-T5 extruded aluminum with mitered, full welded corners.

Skylight shall be thermally broken, with no exposed metal to the interior, and integral condensate gutter. Separate glazing from framing with EDPM rubber seal. Provide safety-security guard.

Skylights must be factory assembled and glazed ready for installation.

Protect exterior drip/counter flashing and drainage ports from weather and airborne debris.

Retaining frames that secure the glazing panels along each side under spring tension need not be welded and must be sealed with silicone sealant along the full perimeter of the retaining frame. Skylight frames must be pre-drilled for anchorage to roof curbs.

Skylights shall be rated by the manufacturer to withstand a 40 pounds per square foot live loading.

Outer lens: SR40 100 percent impact modified clear prismatic acrylic of sufficient thickness recommended to meet the specified performance requirements . Tested for Class 1 hail resistance (1" hail)

Inner lens: SR 25 white prismatic acrylic lens

High-Performance Organic Finish: Three coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Color to be white.

Accessories

Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer.

Washers: Neoprene/stainless steel bonded washers

TUBULAR PLASTIC GLAZED UNIT SKYLIGHT

Dome Skylights Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICBO/ICC AC-16

Size and Type: Penetrating Ceiling, 21-inch Day lighting System with 0.030 inch thick extruded aluminum frame.

Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

Outer Dome Glazing:

1. 0.125-inch minimum thickness injection molded acrylic classified as CC2 material; UV inhibited, impact modified acrylic blend.
2. Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.

Inner Dome Glazing: 0.115-inch minimum thickness acrylic classified as CC2 material.

Roof Curb Flashing Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.

Base Material: Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M, 0.028 inch thick.

High-Performance Organic Finish: Three coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Color to be white.

Accessories

Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

Diffuser Assembly: Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube; 23.8 inches by 23.8 inches square frame to fit standard suspended ceiling grids or hard ceilings.

1. Round to square transition box made of opaque polymeric material, classified as CC2, Class C, and 0.110 inch thick.
2. Natural Effect Lens made of acrylic, classified as CC2, Class C, 0.060 inch thick, with open cell foam seal to minimize condensation and bug, dirt, and air-infiltration per ASTM E283.

PART 3.- EXECUTION

PREPARATION

The Contractor shall verify when structural support is ready to receive all specified work and to convene a pre-installation conference, if approved by the Engineer, including the Contractor, skylight installer and all parties directly affecting and affected by the specified work. All submitted opening sizes, dimensions and tolerances shall be field verified; preparation of openings shall include isolating dissimilar materials from aluminum

system to avoid damage by electrolysis. The installer shall examine area of installation to verify readiness of site conditions and to notify the Contractor about any defects requiring correction. Work shall not commence until conditions are satisfactory.

ERECTION

Tubular Plastic Glazed Unit Skylight: Install in accordance with manufacturer's printed instructions. System shall be installed clean of dirt, debris or staining and thoroughly examined for removal of all protective material prior to final inspection of the designated work area.

Curb Mounted Rectangular Unit Skylight: Coordinate unit skylight installation with installation of substrates, vapor retarders, roof insulation, roofing, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weather tight.

Where metal surfaces of units will contact incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by unit skylight manufacturer.

Anchor unit skylights securely to supporting substrates.

Set unit skylight flanges in thick bed of roofing cement to form a seal, unless otherwise indicated.

Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing. Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

12-7.16 JOINT SEALANT

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of preparing and placing a joint sealant in accordance with the details shown on the plans and these special provisions.

The sealed joint shall consist of tempered hardboard, expanded polystyrene and a pourable joint seal.

SUBMITTALS

Product Data: Manufacturer’s descriptive data, specifications and installation instructions shall be submitted to the Engineer at the jobsite for approval.

LEED Submittals:

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

LEED:

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

Tempered Hardboard: Tempered hardboard shall be 1/8-inch minimum thickness, commercial quality suitable for the use intended. Other facing materials may be used provided they furnish equivalent protection.

Expanded Polystyrene: Expanded polystyrene shall be commercially available polystyrene board.

Polyethylene Foam: Polyethylene foam shall be commercial quality, with a continuous, impervious, glazed top surface, suitable for retaining the liquid sealant in the joint while hardening.

Primer: Primer shall be as recommended by the sealant manufacturer.

Joint Sealant: Joint sealant shall be a commercial quality, 2 component polyurethane sealant, which shall be self-levelling and withstand up to 25 percent movement.

PART 3 - EXECUTION

PREPARATION

Forming:

Groove for joint seal shall be formed to a uniform width and depth and to the alignment shown on the plans or as ordered by the Engineer. The completed groove shall have a top width within 1/8 inch of the width shown on the plans and the bottom width shall not vary from the top width by more than 1/16 inch.

At least 24 hours prior to installing the joint seal, the Contractor shall repair all spalls, fractures, breaks, or voids in the concrete surfaces of the joint groove.

The lip of the joint shall be beveled by grinding as shown on the plans.

Cleaning:

Prior to sealing joints, expanded polystyrene, hardboard, concrete spillage and all foreign material shall be removed from the deck to the bottom of the formed joint.

Prior to placing the joint seal, the joint shall be cleaned by a method which shall include abrasive blast cleaning and then be cleaned with a high pressure air jets to remove all residue and foreign material.

INSTALLATION

Materials:

No material shall be used which has skinned over or which has settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

Each container of material shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, and date, if any, beyond which the sealant shall not be used.

Primer: A primer shall be applied to the sides of the groove and all exposed vertical surfaces in the joint prior to placing the sealant. Primer shall be dry at the time of placing the sealant. Contaminated primer shall be removed and replaced.

Joint Sealant: The 2-component sealant shall be mixed and placed in the groove in accordance with manufacturer's instructions. Unmixed liquid components which have been exposed to the atmosphere for more than 24 hours, shall not be used.

12-7.17 SEALANTS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and applying sealants which are required for this project, but not specified elsewhere, in accordance with the details shown on the plans and these special provisions.

Related Work: Pourable polyurethane joint sealant for joints in concrete decks shall conform to the requirements under "Joint Sealant" elsewhere in this Section 12-7.

QUALITY ASSURANCE

Certificates of Compliance: Certificates of compliance shall be furnished for the sealants in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Preconstruction Field Adhesion Testing: Before installing sealants, field test adhesion to joint substrates:

Locate test joints where indicated by Engineer.

Conduct field tests for each type of sealant and joint substrate. Test method: Hand pull method in accordance with sealant manufacturer's recommendations.

LEED:

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

SUBMITTALS

Product Data: Manufacturer’s descriptive data and installation instructions for all sealants shall be submitted for approval.

Samples: Color samples of all sealants shall be submitted for approval. Unless otherwise shown on the plans, colors will be selected by the Engineer from the manufacturer’s standard colors.

Compatibility and Adhesion Test Reports:

Submit evidence that materials forming joint substrates and joint sealant backings have been tested for compatibility with and adhesion to joint sealants.

Submit interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

LEED Submittals:

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

PART 2 - PRODUCTS

MATERIALS

All sealants, primers and accessories shall be non-staining to adjacent exposed surfaces. Products having similar applications and usage shall be of the same type and same manufacturer. Gun consistency compound shall be used unless otherwise required by the job conditions.

Nonstaining: Products that have undergone testing according to ASTM C 1248 or ASTM C 510 and have not stained porous substrates.

Compatibility: Provide joint sealants, backings, and related materials compatible with one another and with joint substrates under conditions of service and application as demonstrated by sealant manufacturer based on testing and field experience.

Acrylic Sealant: Acrylic sealant shall be one compound, solvent release acrylic sealant.

Polyurethane Sealant: Multicomponent, nonsag, capable of 50 percent extension and contraction without failure, complying with ASTM C 920. Provide BASF, Sika, Tremco, or equal.

Butyl Sealant: Butyl sealant shall be single-component, solvent-release, polyisobutylene sealant complying with ASTM C 1311.

Silicone Sealant: Silicone sealant shall be one component, low modulus, non-acid curing building sealant complying with ASTM C 920 and formulated for reduced dirt pickup. Sealant shall be tack-free in one hour, shall not sag or flow, shall be ozone resistant and capable of 100 percent extension and 50 percent contraction without failure. Provide BASF Sonneborn Sonolastic 150, Dow Corning 756 SMS Building Sealant, GE Silicones SilPruf NB SCS 9000, or equal.

Mildew Resistant Silicone Sealant: One component, sanitary type, mildew resistant, formulated with fungicide, intended for damp areas and complying with ASTM C 920. Provide Pecora 898, GE Sealants SCS 1700, Dow Corning 786, or equal.

Acoustical Sealant: Single component, latex, ASTM C 834, nondrying, nonhardening, nonsag, nonstaining, acoustically tested in accordance with ASTM E 90, paintable by acrylic or alkyd paints. Provide USG Sheetrock, Pecora AC-20, Owens Corning QuietZone, or equal.

Polysulfide Sealant: Polysulfide sealant shall be a two-part, non sag polysulfide base, synthetic rubber sealant formulated from liquid polysulfide polymer.

Backer Rod: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (consisting of both open- and closed-cell material) as recommended by manufacturer for application, of size and density to control sealant depth; polyurethane or polyethylene as recommended by sealant manufacturer. Backer rod shall be sized such that it must be compressed between 25 percent and 75 percent of its uncompressed diameter during installation in the joint.

Bond Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint.

Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated under anticipated service conditions, as determined from preconstruction joint sealant substrate tests and field tests.

Neoprene: Neoprene shall conform to the requirements of ASTM Designation: C 542.

PART 3 - EXECUTION

APPLICATION

Unless otherwise shown on the plans, sealants shall be applied in accordance with the manufacturer's instructions and ASTM C 1193.

When silicone sealants (or mildew-resistant silicone sealants) are used in locations where painting is required, use sealants formulated to accept paint satisfactorily and demonstrated to do so in preconstruction mockups, or sealants tinted to match adjoining painted surfaces.

Sealants shall be applied in a continuous operation for the full length of the joint. Immediately following the application of the sealant, the sealant shall be tooled smooth using a tool similar to that used to produce concave masonry joints. Following tooling, the sealant shall remain undisturbed for not less than 48 hours.

SECTION 12-8. DOORS AND WINDOWS

12-8.01 HINGED DOORS

PART 1 – GENERAL

Scope: This work shall consist of furnishing and installing hinged doors and frames in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions for fire rated assemblies and a door schedule shall be submitted for approval. The door schedule shall include a description of the type, location and size of each door and frame.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MR Credit 7, Certified Wood: For materials with certified wood content, submit product data and vendor invoices showing products on a line item basis, with cost, and identifying FSC-certified products as FSC Pure, FSC Mixed Credit, or FSC Mixed (NN) %; chain of custody certification; and spreadsheet(s) calculating cost of wood-based construction materials qualifying as certified wood.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.4, Low-Emitting Materials – Composite Wood and Agrifiber Products: Submit product data for composite wood and agrifiber products (particleboard, medium density fiberboard, plywood, wheatboard, strawboard, panel substrates, and door cores) to be used inside building weatherproofing system, indicating no added urea formaldehyde in resins or laminating adhesives.

QUALITY ASSURANCE

Steel Doors: Comply with ANSI/SDI A250.8 and A250.4.

Level 1C - Standard duty:
Level 2B - Heavy duty:
Level 3A - Extra heavy duty:
Level 4A - Maximum duty:

LEED:

MR Credit 4, Recycled Content: Use doors, door cores, or frames with recycled content to contribute toward achieving MR Credit 4. For example, honeycomb paperboard door cores (see para 11) often have recycled content.

MR Credit 5, Regional Materials: Use doors, door cores, or frames with regional content to contribute toward achieving MR Credit 5.

MR Credit 7, Certified Wood: Use doors, door cores, or frames with certified wood content to contribute toward achieving MR Credit 7.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.4, Low-Emitting Materials—Composite Wood and Agrifiber: Provide composite wood and agrifiber products which contain no added urea formaldehyde resins in materials or laminating adhesives. Composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores. Furniture and fixtures are not included in this credit.

PART 2 - PRODUCTS

Metal Door:

Metal door shall be flush, seamless steel door factory prepared and reinforced to receive hardware and having cold rolled stretcher leveled sheet steel face sheets not less than 0.048 inch thick (18-gage). Face sheets shall be bonded with thermosetting adhesive to rigid board honeycomb or precured foam core; or face sheets shall be welded to all parts of an assembled grid of cold formed pressed metal stiffeners and framing members located around edges, ends, openings and at all locations necessary to prevent buckling of face sheets. Seams shall be tack welded, filled and ground smooth. Bottom edge and internal stiffeners of grid type core shall have moisture vents. Welds on exposed surfaces shall be ground smooth. Louvered or glazed openings shall be provided where shown on the plans.

Where fire rated doors are required, doors shall be listed and labeled for the fire rating shown on the plans.

Active leaf of double door shall have a full height astragal of 1/8-inch flat bar or folded sheet strip, not less than 0.060 inch thick (16-gage), welded on the outside of the active leaf.

Door shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Aluminum Door: Aluminum door shall be glazed door with medium stiles of not less than 1/8-inch nominal wall thickness, clear anodized, thermally treated and artificially aged 6061 or 6063 extruded aluminum alloy tubing reinforced to receive hardware.

Glazing for Doors: Glazing for doors shall be safety glass as specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions. Glazing shall be not less than 3/16 inch thick.

Door Louvers: Door louvers shall be inverted V-type factory primed, galvanized sheet steel louvers. Exterior door louvers shall not be removable from outside of the building. Louvers at exterior doors shall have inside mounted bronze insect screens.

Fire Rated Louvers:

Fire rated louvers shall be factory fabricated, multi-blade adjustable fire damper type units of galvanized steel sheet not less than 3/16 inch thick (16-gage) with a 160°F fusible link and removable bronze 16 x 16 mesh insect screen mounted on the inside of the units. Fire rated louvers shall be listed for the fire rating shown on the plans.

Louvers shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Pressed Metal Frame:

Pressed metal frame shall be not less than 0.060-inch thick (16-gage) sheet steel with integral stop, mitered corners, face welded and ground smooth corners. Frames shall be reinforced for all hardware and shall be cleaned and treated by the bonderized process or an approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Provide frames designed to accept grout without leakage. Provide grout guards, formed from same material as frame not less than 0.016 inch thick, welded to frame at back of hardware mortises in frames to be grouted.

Frames for fire rated doors shall be listed for the same rating shown on the plans for fire rated doors.

Aluminum Frame: Aluminum frame shall be manufactured by aluminum door manufacturer of clear anodized thermally treated and artificially aged 6061 or 6063 aluminum alloy extrusions with minimum nominal wall thickness of 1/8 inch. Frame shall be reinforced to receive hardware.

Sealants: Sealants shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, multicomponent, complying with ASTM C 920.

PART 3 - EXECUTION

INSTALLATION

Doors and frames shall be installed rigidly, securely, plumb and true and in such a manner that the doors operate freely without rubbing or binding. Clearance between frame and door shall be not more than 1/8 inch. The exterior frame shall be sealed weathertight.

Pressed metal frames shall be secured with clips and anchors as shown on the plans.

Fire rated assemblies shall be installed according to the manufacturer's recommendations.

Fire rated assemblies shall include doors, door frames, automatic smoke-actuated closers, self-closing mechanisms, panic hardware, wire glass, and fire rated louvers. Assemblies shall be approved by the California State Fire Marshal.

Painting: Except for the primer application specified herein, doors and frames shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-8.02 PRE-ASSEMBLED METAL DOOR AND FRAME ASSEMBLY

PART 1 – GENERAL

Scope: This work shall consist of furnishing and installing pre-assembled metal door and frame assemblies in accordance with the details shown on the plans and these special provisions. Assembly to include pre-asembled metal door and frame assembly, and associated finish hardware, unless specified elsewhere.

Related sections:

1. Section 12-6.01: Rough Carpentry
2. Section 12-8.09: Door Hardware
3. Section 12-8.10: Glazing
4. Section 12-9.09: Painting
5. Section 12-16: Electrical
6. Section 12-16.11: Intrusion Alarm System and Access Contol System

SUBMITTALS

Product data: Manufacturer's descriptive data sheets including material descriptions, installation instructions, construction and installation details, details of anchorages and connections, details of conduit and preparations for power, signal and control systems, anchorage, hardware reinforcements, fire resistance rating, operational descriptions and finishes.

Door Hardware Schedule: Reference Section 12-8.09 "Door Hardware" in the Special Provisions for door hardware requirements.

Keying Schedule: Reference Section 12-8.09 "Door Hardware" in the Special Provisions for keying requirements.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MR Credit 7, Certified Wood: For materials with certified wood content, submit product data and vendor invoices showing products on a line item basis, with cost, and identifying FSC-certified products as FSC Pure, FSC Mixed Credit, or FSC Mixed (NN) %; chain of custody certification; and spreadsheet(s) calculating cost of wood-based construction materials qualifying as certified wood.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.4, Low-Emitting Materials – Composite Wood and Agrifiber Products: Submit product data for composite wood and agrifiber products (particleboard, medium density fiberboard, plywood, wheatboard, strawboard, panel substrates, and door cores) to be used inside building weatherproofing system, indicating no added urea formaldehyde in resins or laminating adhesives.

QUALITY ASSURANCE

Codes and References:

1. ANSI A156.32- Integrated Door Opening Assemblies

2. ANSI/SDI A250.4- Test Procedures for and Acceptance Criteria for Physical Evidence for Steel Doors and Reinforcement
3. ANSI/SDI A250.6- Recommended Practice for hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.8- Recommended Specifications for Standard Steel Doors and Frames

Source Limitations: Obtain complete integrated opening assemblies, including metal frame and integrated door system with operating hardware, through one source and from a single manufacturer wherever possible.

Installer Qualifications: Installers acceptable by the primary assembly manufacturer, with a minimum 3 years documented experience installing both standard and electrified integrated door opening assemblies similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance

LEED Provisions:

MR Credit 4, Recycled Content: Use doors, door cores, or frames with recycled content to contribute toward achieving MR Credit 4. For example, honeycomb paperboard door cores often have recycled content.

MR Credit 5, Regional Materials: Use doors, door cores, or frames with regional content to contribute toward achieving MR Credit 5.

MR Credit 7, Certified Wood: Use doors, door cores, or frames with certified wood content to contribute toward achieving MR Credit 7.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.4, Low-Emitting Materials—Composite Wood and Agrifiber: Provide composite wood and agrifiber products which contain no added urea formaldehyde resins in materials or laminating adhesives. Composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores. Furniture and fixtures are not included in this credit.

PART 2 - PRODUCTS

Where fire rated doors are required, Pre-assembled Metal Door and Frame Assembly shall be listed and labeled for the fire rating shown on the plans.

Pre-assembled metal door and frame assembly:

Metal door for pre-assembled metal door and frame shall be 1-3/4" thick, with no seams or spot welds on door face and be of manufacturer's standard construction: Door face skins to be minimum 18-gage cold rolled steel. Face sheets shall be bonded with thermosetting adhesive to rigid board honeycomb or precured foam core; or face sheets shall be welded to all parts of an assembled grid of cold formed pressed metal stiffeners and framing members located around edges, ends, openings and at all locations necessary to prevent buckling of face sheets. Bottom edge and internal stiffeners of grid type core shall have moisture vents. Glazed openings shall be provided where shown on the plans.

Integral vision lite preparation, or field installed lite kit, as required.

Door shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Glazing for Doors: Glazing for doors shall be safety glass as specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions. Glazing shall be not less than 3/16 inch thick.

Door Frame:

Door frame for pre-assembled metal door and frame shall be not less than 0.060-inch thick (16-gage) cold rolled steel with integral stop, mitered corners, face welded and ground smooth corners. Frames shall be reinforced for all hardware. Provide suitable adjustable type anchors, minimum 4 per jamb.

Hardware:

Provide a complete pre-assembled metal door and frame assembly including the installation and adjustment of the latching mechanism within the door construction. The exit device shall be clean and unobtrusive in design. Push bar shall be made of heavy duty aluminum extrusion, available in anodized and true architectural finishes using a metal cladding. End caps shall be metal. The push and pull devices and lever handles shall be clean and unobtrusive in design and shall match design of the other hardware furnished on the project.

Hardware for pre-assembled metal door and frame assembly shall be as specified under "Door Hardware" in Section 12-8.09 "Door Hardware" of these special provisions.

Sealants: Sealants shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, multicomponent, complying with ASTM C 920.

PART 3 - EXECUTION

INSTALLATION

Pre-assembled metal door and frame assembly shall be installed rigidly, securely, plumb and true and in such a manner that the doors operate freely without rubbing or binding. Clearance between frame and door shall be not more than 1/8 inch. The exterior frame shall be sealed weathertight.

Pressed metal frames shall be secured with clips and anchors as shown on the plans.

Fire rated assemblies shall be installed according to the manufacturer's recommendations.

Fire rated assemblies shall be approved by the California State Fire Marshal.

Painting: Except for the primer application specified herein, doors and frames shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-8.03 OVERHEAD COILING DOORS

PART 1 - GENERAL

SUMMARY

This work includes:

1. Overhead coiling doors

DEFINITIONS

Operation Cycle: Beginning with the door in the closed position, the door is moved to the open position and back to the closed position.

PERFORMANCE REQUIREMENTS

Structural Performance: Doors must withstand effects of the following without permanent deformation or disengagement of door components:

1. Live loads, dead loads, and lateral loads
2. Seismic loads
3. Wind loads as shown on the plans, but not less than 20 pounds per square foot, acting inward and outward, with a midspan deflection not to exceed 1/120 span
4. Operational stresses

Door Operational Durability: Door components and operator must be designed to operate for at least 20,000 operation cycles. Provide tamperproof cycle counter.

Motorized Operator Durability: Standard duty, 16 to 60 cycles per hour.

Accessibility: Door, operator, and controls must comply with ADAAG and CBC requirements.

Thermal Performance: R-value of 7 or higher for door curtain.

Acoustical Performance: Sound Transmission Class (STC) rating of 20 or higher under ASTM E 413.

Windborne Debris Impact Resistance: Passing missile impact and cyclic pressure tests under ASTM E 1886.

SUBMITTALS

Product Data: Submit manufacturer's descriptive data for each type and size of door and accessory. Include:

1. Construction details showing materials, component dimensions, profiles, and finishes
2. Roughing-in diagrams
3. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices
4. Furnished components and accessories
5. Installation instructions
6. Motors:

    6.1. Nameplate data and ratings
    6.2. Operating and electrical characteristics
    6.3. Mounting arrangements
    6.4. Size and location of winding termination lugs, conduit entry, and grounding lugs
    6.5. Coatings

Manufacturer Certificate: Submit manufacturer's signed certificate that door system complies with specified requirements.

Test Reports: Submit product test reports, listings, and certifications by qualified testing agencies showing compliance with requirements.

Engineering Design and Calculations: Submit design and calculations:

1. Complying with the CBC
2. Performed by a qualified Civil Engineer registered in the State of California
3. Signed and sealed
4. Including detailed fabrication and assembly of seismic restraints
5. Including summary of forces and loads on wall and jambs

Working Drawings: Submit working drawings for special components and installations not dimensioned or detailed in manufacturer's data sheets.

Wiring Diagrams: Submit wiring diagrams that:

1. Show detailed wiring for power, signal, and control systems
2. Differentiate between manufacturer-installed and field-installed wiring
3. Differentiate between components provided by door manufacturer and those provided by others

Finish Charts: Submit manufacturer's charts showing full range of colors and textures available.

Samples: Submit samples:

1. Of each type of exposed finish
2. Of same thickness and material required for the work
3. Curtain Slats: 12 inch
4. Bottom Bar: 6 inch
5. Guides: 6 inch
6. Brackets: 6 inch square
7. Hood: 6 inch square

Installer Certificates: Submit certificates signed by manufacturer, certifying manufacturer's approval of installers.

Operation and Maintenance Data: Submit manufacturer's data for inclusion in operation and maintenance manuals.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY CONTROL AND ASSURANCE

Electrical Components:

1. Electrically Operated Fixtures: Listed and labeled under the CEC
2. Products Requiring Electrical Connection: Listed and classified by UL
3. Listed and classified as suitable for intended purpose

Installer Qualifications:

1. Have 5 years of documented experience in overhead coiling door installation
2. Be an authorized representative of door manufacturer for both installation and maintenance

Manufacturer Qualifications:

1. Have 5 years of documented experience in manufacture of overhead coiling doors

Single Source Responsibility: Door assembly must be a complete unit provided by one manufacturer, including operators and controls, hardware, accessories, mounting, and installation components. Obtain all overhead coiling doors used in the work from a single manufacturer.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

WARRANTY

Provide manufacturer's written warranty that all overhead coiling doors' components will be free of defective materials or workmanship for a minimum of 3 years from date of installation.

Provide 5 years manufacturer's limited warranty against defects in overhead coiling doors' finishes from date of installation.

PART 2 - PRODUCTS

GENERAL

Overhead coiling doors must be:

1. Standard product of qualified manufacturer
2. Of commercial quality
3. Electrically operated
4. Equipped for manual operation as backup
5. Weathertight when closed
6. Thermally insulated

Door system must be recommended by manufacturer:

1. For performance, size, and type of door required
2. For intended application, including climate, exposure, indoor and outdoor conditions, and anticipated use
3. For durability and extended service life in intended application without loss of functionality or appearance
4. For suitability in opening and surrounding construction as shown on the plans

Materials and components must be of thickness, dimension, strength, and design sufficient to meet performance standards and other requirements. Installation must be reinforced and supported as required for door size and weight to provide strength and rigidity, and to ensure against sag, sway, and vibration during operation.

Inserts and Anchorages: Furnish inserts and anchoring devices to be set in concrete or built into masonry to install units. Provide setting drawings, templates, and installation instructions.

MANUFACTURERS

Provide doors manufactured by one of the following, or equal:

1. Alpine Overhead Doors
2. C.H.I. Overhead Doors
3. The Cookson Company
4. Cornell Iron Works
5. McKeon Door Company
6. Overhead Door Corporation

MATERIALS

Materials:

1. Steel: Cold-rolled structural steel sheet, ASTM A 653, hot-dip galvanized with G90 zinc coating
2. Stainless Steel: Cold-worked austenitic stainless steel, ASTM A 666, Type 304
3. Aluminum: Aluminum and aluminum alloy, ASTM B 209 sheet and ASTM B 221 extrusions, alloy and temper manufacturer's standard for required application and finish
4. Malleable Iron: Malleable iron castings, galvanized after fabrication
5. Insulation: Manufacturer's standard material, maximum flame spread 75 and maximum smoke developed 450 under ASTM E 84, completely enclosed within slats

Finishes:

1. General:

    1.1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products"
    1.2. Noticeable variations in finish are not acceptable
    1.3. Unless otherwise noted, other components must match finish of door curtain

2. Galvanized Steel:

    a. Zinc rich powder coated finish, manufacturer's standard
    b. Color: As shown on plans

3. Aluminum:

    3.1. Powder coated finish, manufacturer's standard, AAMA 2605
    3.2. Color: As shown on plans

4. Stainless Steel:

    4.1. No. 4 (polished directional satin)

DOOR CURTAIN

Components:

1. Slats: Flat profile, interlocking metal slats extending full width of door without splices; made of galvanized steel
2. Interior Slats: Same as exterior
3. Endlocks: Provided on not less than alternate curtain slats; malleable iron, secured to slats with galvanized rivets or high-strength nylon
4. Windlocks: Provided instead of endlocks on some or all curtain slats as required; malleable iron
5. Bottom Bar: Consisting of angles, each at least 1-1/2" x 1-1/2" by 1/8 inch thick, or channels and angles; galvanized steel, stainless steel, or aluminum extrusions
6. Jamb Guides: Angles or channels of same material as slats; of sufficient depth and strength to retain curtain, to allow curtain to operate smoothly and to withstand loading; designed for the clearances shown on the plans; with:

    6.1. Slotted bolt holes for guide adjustment
    6.2. Removable stops to prevent overtravel of curtain
    6.3. Continuous bar for holding windlocks

HOOD

Hood must:

1. Entirely enclose coiled curtain and operating mechanism
2. Have rolled and reinforced top and bottom edges
3. Enclose ends and mounting
4. Have intermediate support brackets to prevent sagging
5. Provide weather protection
6. Be profiled at perimeter to accept joint sealant
7. Match curtain material and finish
8. Be mounted between jambs.

LOCKING DEVICES

Cylinder Lock: Provide cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinder: As specified under Section 12-8, "Door Hardware," and keyed to building keying system
2. Keys: Provide 3 for each cylinder
3. Locking Bars: Single jamb side
4. Operation: Operable from inside only, with cylinder

Slide Bolt: Provide side-locking bolts for locking by padlock, located on both left and right jamb sides, operable from coil side.
Chain Lock Keeper: Suitable for padlock.

Safety Interlock Switch: To disengage power supply when door is locked.

ACCESSORIES

Weatherseals: Provide weatherstrip gaskets fitted to entire perimeter of door for weathertight installation.

1. At Door Head: Replaceable, continuous 1/8 inch sheet secured to inside of hood.
2. At Door Jambs and Bottom: Replaceable, adjustable, continuous, flexible 1/8 inch thick seals of flexible vinyl, rubber, or neoprene

Smoke Seals: Provide weatherstrip gaskets for smoke and draft control as required for door listing and labeling.

Push-Pull Handles: Provide lifting handles on each side of door, finished to match door.

1. Provide pull-down strap
2. Provide pole hooks for doors more than 84 inches high

COUNTERBALANCING MECHANISM

Counterbalancing mechanism must:

1. Be manufacturer's standard for door type, size, and performance
2. Support rolled-up curtain without distortion of slats
3. Limit barrel deflection under full load to no more than 0.033 inch per foot of door span
4. Be adjustable from outside of barrel

Spring Balance: ASTM A 229 oil-tempered, heat-treated steel wire

Counterbalance Barrel: Hot-formed, structural quality, welded or seamless carbon steel pipe.

Bearings: Grease-sealed or self-lubricating graphite.

Provide all components and accessories including cast-steel barrel plugs, cold-rolled steel torsion rod, and cast iron or cold-rolled steel mounting brackets.

ELECTRIC DOOR OPERATOR

Electric door operator must:

1. Comply with CEC
2. Be of size and capacity recommended by manufacturer to meet requirements
3. Include:

    3.1. Electric motor
    3.2. Factory-prewired motor controls
    3.3. Starter
    3.4. Gear reduction unit
    3.5. Solenoid-operated brake
    3.6. Clutch
    3.7. Remote control stations
    3.8. Control devices
    3.9. Integral gearing for locking door
    3.10. Other components specified or required
    3.11. Accessories for installation and operation

Mount door operator at location shown on plans.

Control equipment must comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with CEC Class 2 control circuit, maximum 24 V, AC or DC.

Electric motor must be:

1. High starting torque
2. Reversible
3. Continuous duty
4. Class A insulated
5. Compliant with NEMA MG 1
6. Equipped with overload protection
7. Polyphase, medium induction type
8. Of service factor according to NEMA MG 1
9. Totally enclosed
10. Nonventilated or fan cooled
11. Fitted with plug drain
12. Equipped with controller in NEMA ICS 6, Type 4 enclosure

Motor must be sized to start, accelerate, and operate door in either direction, from any position, at not less than 8 inches or more than 12 inches per second, without exceeding nameplate ratings or considering service factor.

Motor must be designed and enclosed for exposure to interior conditions.

Operator must be designed to permit removal of motor without disturbing limit-switch adjustment and without affecting emergency auxiliary operation.

Coordinate wiring requirements and electrical characteristics of motor with building electrical system.

Provide adjustable limit switches interlocked with motor controls to automatically stop door at fully opened and fully closed positions.

Remote control station must be:

1. A momentary contact, 3-button control station
2. Equipped with push button controls labeled Open, Close, and Stop
3. Interior unit
4. Full guarded
5. Surface mounted
6. Heavy duty
7. In general purpose NEMA ICS 6, Type 1 enclosure
8. Mounted where shown on plans

Obstruction Detection Device: Equip door with external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.

1. Photoelectric sensor to detect obstruction without contact
2. Automatic safety sensor edge, contact-activated
3. Self-monitoring type, to detect failure of sensor; when activated, door closes only with sustained pressure on Close button
4. Electrically-actuated bottom bar

Provide audible alarm and visual indicator lights meeting accessibility standards.

EMERGENCY MANUAL DOOR OPERATOR

Door must be equipped for emergency manual operation.

1. Type: Chain-hoist.
2. Maximum Force Required: 25 pounds.
3. Provide emergency motor disconnect device which:

    3.1. Engages manual operator and releases brake
    3.2. Disconnects motor and prevents its operation
    3.3. Does not affect timing of limit switch
    3.4. Is hand operated
    3.5. Is accessible from floor level

HARDWARE

Hardware shall be heavy-duty, rust-resistant, with galvanized or cadmium-plated or stainless steel fasteners, to suit door, installation, and application.

PART 3 - EXECUTION

INSTALLATION

Door, track, and operating equipment, complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports, must be installed in accordance with the final drawings, manufacturer's installation instructions, and these special provisions.

Coordinate door installation with installation of intrusion detection sensors and similar components required under "Intrusion Alarm Systemand Access Control System" in Section 16, "Electrical," of these special provisions.

Fasten vertical track assembly to framing at not less than 24 inches on center. Hang horizontal track from structural overhead framing with angle or channel hangers, welded or bolted into place. Provide sway bracing, diagonal bracing, seismic bracing, and reinforcing as required for rigid installation of track and door operating equipment.

12-8.04 SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing heavy duty commercial sectional overhead doors in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data:

Manufacturer's descriptive data, roughing-in diagram and installation instructions for each size and type of door shall be submitted for approval.

Manufacturer's descriptive data shall include door panel construction and material thickness, door track size and material thickness, counterbalance spring service life and motor operator specifications.

Materials list shall contain all items proposed to be furnished and installed under this section of these special provisions.

Working drawings shall show details of special components and installations which are not fully dimensioned in manufacturer’s descriptive data. Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Single Source: Each sectional door shall be provided as a complete unit produced by one manufacturer, including frames, sections, bracket guides, tracks, counterbalance mechanisms, hardware, operators and installation accessories, to suit opening and head room available.

Wind Loading: Design and reinforce sectional overhead doors to withstand wind loads shown on the plans, but not less than 20 pounds per square foot, acting inward and outward, with a midspan deflection not to exceed 1/120 span.

Installer: Installer shall be an authorized representative of the manufacturer.

Standards: Provide doors complying with ANSI/DASMA 102 and CBC.

Accessibility: Door and controls shall comply with ADA and CBC requirements.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content, to contribute toward achieving MR Credit 5.

WARRANTY

Provide manufacturer's written warranty that all sectional overhead doors' components will be free of defective materials or workmanship for a minimum of 3 years from date of installation.

Provide 20 years manufacturer's limited warranty against defects in sectional overhead doors' finishes from date of installation.

PART 2 - PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with these special provisions, manufacturers offering products which may be incorporated into the work include, but are not limited to the following: Clopay Corp., div. Griffon Corporation; Overhead Door Corp.; Raynor Garage Doors.

STEEL SECTIONS

Door Sections:

Door sections shall be galvanized commercial quality steel sheets and a minimum of G60 zinc coating complying with ASTM Designation: A 653.

Face sheets shall be not less than 20-gage (0.0339 inch). Back sheet shall be not less than 26-gage (0.0169 inch).

Sections shall be fabricated from a single sheet to provide sections not more than 24 inches high, and nominal 2 inches deep. Meeting horizontal edges shall be rolled to a continuous shiplap, rabbeted. or keyed weather seal, with a reinforcing flange return.

Intermediate and end stiles shall be 16-gage galvanized steel welded in place. Intermediate stiles shall be spaced at not more than 48 inches on center.

Bottom section shall be reinforced with a continuous channel or angle conforming to the bottom section profile.

Insulation: Insulation shall be the manufacturer’s glass fiber, polystyrene or polyurethane foam type insulation and have an R-Value not less than 8.0.

Finish: Finish shall be the manufacturer’s standard baked enamel polyester or epoxy prime and finish coats, applied to interior and exterior faces.

TRACKS, SUPPORTS, AND ACCESSORIES

Door Tracks: Door tracks shall be the manufacturers standard galvanized steel track system, complying with ASTM A 653 with G60 zinc coating, sized for door size and weight, and designed for the clearances shown on the plans. Complete track assembly shall be provided, including brackets, bracing and reinforcing for rigid support of ball bearing roller guides, for required door type and size.

Track Reinforcement and Supports: Track reinforcement and supports shall be galvanized steel complying with ASTM A 136 and galvanized in accordance with ASTM A 123. Tracks shall be reinforced and supported as required for the size and weight of door to provide strength and rigidity, and to ensure against sag, sway and vibration during operation.

Door Seals: Doors shall have perimeter gasket seals at head and jambs and seal shall have a replaceable vinyl or neoprene bottom seal.

Vision Panels: Vision panels shall be door manufacturer's standard glazed opening with safety glass, metal frame and vinyl or neoprene glazing gasket for water tight construction. The approximate size shall be as shown on the plans.

Adjustable Louvers:

Adjustable louvers shall be factory fabricated units of extruded aluminum alloy not less than 0.081 inch thick or galvanized steel not less than 0.040 inch thick (20-gage) with standard "Z" type blades set in a continuous channel frame, with a 1/4-inch mesh galvanized bird-screen in a removable frame on the inside.

Blades shall have center pivot on 3/8-inch aluminum rods in stainless steel ball bearings in cadmium plated races.

Adjustable louvers shall be equipped with hand-hold fixed to the operating bar for easy adjustment with wingnut spring tension to lock louvers in desired position.

Adjustable louvers shall have three coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pre-treat, and apply coating to exposed metal surface to comply with coating and resin manufacturer's written instruction. Color to match sectional overhead door finish.

HARDWARE

Hardware shall be heavy-duty, rust-resistant, galvanized, with galvanized or cadmium-plated or stainless steel fasteners, to suit type of door.

Hinges: Heavy steel hinges shall be provided at each end stile and at intermediate stiles, per manufacturer’s recommendations for size of door; galvanized steel.

Rollers: Rollers shall be heavy-duty with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Rollers shall have case-hardened tires.

COUNTERBALANCE MECHANISMS

Counterbalance Spring: The door shall have a torsion spring counterbalance on a continuous cross header shaft made of steel spring wire complying with ASTM A 229; the entire assembly shall be all-bearing mounted. The spring shall have a rated service life of not less than 25,000 cycles.

ELECTRIC DOOR OPERATORS

Door operator shall be heavy duty, commercial type. Motor shall be a 240-volt, 3-phase, high starting torque motor with single reduction worm gear, completely housed and running in an oil bath. Motor shall be of sufficient capacity to raise and lower the door at speed of approximately 0.67 feet per second.

Door operator and assembly shall be equipped with solenoid brake, limit switches for upper and lower limits of door travel, emergency hand chain with electrical interlock to break motor circuit when hand chain is engaged, 3-button operating station in a NEMA Type 4 enclosure, and a factory wired NEMA Type 1 control panel.

Control panel shall contain an instrument transformer, reversing magnetic contactor with overload relay, and all necessary control relays and other devices required for complete automatic operation of the door. Motor shall

be removable for repair without affecting emergency operation. Motor shall be centermounted or sidemounted as shown on the plans.

Reversing Door Edge: Reversing door edge shall be an electrically or pneumatically operated safety device extending across the full width of the bottom of the door which shall cause the door to stop automatically and return to open position upon contact with any obstruction.

PART 3 - EXECUTION

INSTALLATION

Door, track, and operating equipment, complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports, shall be installed in accordance with the final drawings, manufacturer's installation instructions and these special provisions.

Coordinate door installation with installation of intrusion detection sensors and similar components required under "Intrusion Alarm System and Access Control System" in Section 16, "Electrical," of these special provisions.

Vertical track assembly shall be fastened to framing at not less than 24 inches on center. Horizontal track shall be hung from structural overhead framing with angle or channel hangers, welded or bolted into place. Provide sway bracing, diagonal bracing, seismic bracing, and reinforcing as required for rigid installation of track and door operating equipment.

Sealants used in installation shall comply with "Sealants" in Section 12-7, "Thermal and Moisture Control," of these special provisions.

12-8.05 ALUMINUM STOREFRONT SYSTEM

PART 1.- GENERAL

Scope: This work shall consist of furnishing and installing an aluminum storefront system in accordance with the details shown on the plans and these special provisions.

Related Sections: Glazing shall conform to the requirements specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions to the extent not specified in this section.

System Description: Aluminum storefront system shall include frames, doors, glass, glazing accessories, fasteners, frame anchors, and such other components, not mentioned, but required for a rigid, secure, weatherproof, and complete assembly and installation.

DESIGN REQUIREMENTS

Wind load: The storefront system shall be designed to withstand wind loads in either direction without exceeding specified deflection limits and allowable stresses when tested in accordance with ASTM Designation: E 330, and verified by design calculations.

Basic Wind Speed:	85 mph.
Importance Factor:	1.0
Exposure Category:	D.

Deflection of Framing Members: Limited to 1/240 or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

Deflection Normal to Wall Plane: Limit to 1/175 of clear span for spans up to 13.5 feet and to 1/240 of clear span spans greater than 13.5 feet.

Deflection Parallel to Glazing Plane: Limit to 1/360 of clear span or 1/8-inch, whichever is smaller.

Thermal Movements: System shall allow for thermal movements resulting from the following maximum change (range) of 120 to180 °F, in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and night-time-sky heat loss.

Miscellaneous performance requirements: The system shall conform to the following performance requirements:

Test	Description	Specification	Remarks
ASTM E 283	Air infiltration	0.06 cfm/sq.ft. of fixed area using a static air pressure difference of 1.57 lbf/sq.ft.	--
ASTM E 331	Water infiltration	No water penetration at a static air pressure difference of 20% of positive wind-load design pressure, but not less than 6.24 lbf/sq.ft.	--
AAMA 1503	Condensation-Resistance Factor (CRF)	Not Less Than 53	System
AAMA 1503	Thermal Conductance	0.69 Btu/sq. ft. x h x °F	System
ASTM E 413	Sound Transmission Class	Minimum STC=35 when tested for laboratory sound transmission loss according to ASTM E 90	System

SUBMITTALS

Product data: Manufacturer's descriptive data, a detailed list of glazing materials, aluminum finish system materials and color samples, and installation instructions shall be submitted for approval.

Samples: Three samples for each of the following materials shall be submitted for approval. Material samples shall include a glass sample not less than 6-inches square, frame samples of perimeter and intermediate mullion not less than 12-inches in length, and fastener samples of each type of fastener to be used in the installation.

Working drawings: Submit working drawings and design calculations for fabrication and installation of storefront system. Working drawings shall include framing requirements, accessory components, elevations, detailed sections, anchorages, and glazing details.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The expiration date of the registration shall be shown.

Storefront Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Single source responsibility: Storefront, entrance doors, and accessories shall be obtained fabricated and installed from a single manufacturer.

Pre-installation Conference: After approval of submittal and before commencing any work on the storefront system, the Engineer will hold a pre-installation conference to review methods and procedures related to the storefront system including, but not limited to, the following:

Review, discuss, and coordinate the interrelationship of storefront system with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.

Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.

Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

DELIVERY, STORAGE AND HANDLING

General: Framing members shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling. Covers shall be provided to protect the materials from corrosion.

Framing members shall be handled in such a manner as to prevent damage due to bending and warping.

PROJECT CONDITIONS

Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on working drawings.

WARRANTY

Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period. Failures include the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Noise or vibration caused by thermal movements.
3. Deterioration of metals and other materials beyond normal weathering.
4. Water leakage through fixed glazing and framing areas.
5. Failure of operating components to function properly.

Warranty Period: 10 years from date of contract acceptance.

PART 2.- PRODUCTS

METALS

Available Manufacturers: Subject to compliance with performance and aesthetic requirements, manufacturers offering products that may be incorporated into the Work include the following:

CMI Architectural Products, Inc.
Kawneer
Vistawall Architectural Products
or equal.

Aluminum: Alloy and temper shall be recommended by manufacturer for type of use and finish to meet performance requirements.

Sheet and Plate: ASTM B 209.

Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

Extruded Structural Pipe and Tubes: ASTM B 429.

Structural Profiles: ASTM B 308.

Finish.--High-Performance Organic Finish (3-Coat Fluoropolymer): Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

Steel Reinforcement: Manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 shall be applied immediately after surface preparation and pretreatment. Surface preparation methods shall conform to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

Structural Shapes, Plates, and Bars: ASTM A 36.

Cold-Rolled Sheet and Strip: ASTM A 1008.

Hot-Rolled Sheet and Strip: ASTM A 1011.

FRAMING SYSTEMS

Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

Construction: Framing members are one-piece members that are internally slotted at regular intervals.

Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with no staining, nonferrous shims for aligning system components.

Fasteners and Accessories: Manufacturer's standard corrosion-resistant, no staining, no bleeding fasteners and accessories compatible with adjacent materials. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices. Reinforce members as required to receive fastener threads.

Flashing: Manufacturer's standard corrosion-resistant, no staining, no bleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

Framing System Gaskets and Sealants: Manufacturer's standard for joint type.

Glazing: Glazing shall be insulated units as specified under "Glazing" In Section 12-8, "Windows and Doors," of these special provisions.

Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

Anchors, Accessories, and Fasteners:

Anchors, accessories and fasteners shall be non-corrosive metals compatible with aluminum and steel. Exposed finish shall match adjacent surfaces.

DOORS

Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation

Door Construction: 2-inch overall thickness, with minimum 0.188-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

Door Design: Wide stile; 5-inch nominal width, smooth surfaced for width of door in area within 10 inches above floor or ground plane. Exterior doors shall be closed flush at the top edge.

Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets. Provide non-removable glazing stops on outside of door

DOOR HARDWARE

Door Hardware: Door Hardware shall conform to the requirements specified under "Finish Hardware" in Division 8 "Doors and Windows" to the extent not specified in this section.

Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA reference standards.

Egress Doors: Not more than 5 lbf to release the latch and not more than 5 lbf to fully open the door to its minimum required width.

Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

Hardware reinforcements: Doors shall be mortised, reinforced, drilled and tapped at the factory for templated mortised hardware only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated mortised hardware apply, doors shall be reinforced, with drilling and tapping done by others in the field. Hardware reinforcements shall be Type 304 stainless steel.

Pivot Hinges: 3/4" Offset pivots. Weather resistant, full race ball bearing and designed for weight of door.

Quantities: Provide 3 hinges per leaf.

Mortise Locksets: As specified under "Door Hardware" in Section 12-8, "Windows and Doors," of these special provisions.

Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

Cylinders and keying: As specified under "Door Hardware" in Section 12-8, "Windows and Doors," of these special provisions.

Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to meet field conditions and requirements for opening force.

Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

Push Bar (interior side)

Weather Stripping: Manufacturer's standard replaceable components.

Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch. Configuration per plans.

ACCESSORY MATERIALS

Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified under "Sealants," in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

PART 3.- EXECUTION

Installation:

Aluminum storefront system shall be installed in accordance with the manufacturer's instructions, the approved working drawings, the details shown on the plans and these special provisions.

All broken, scratched, or cracked glass must be replaced before Contract acceptance.

Frames shall be installed rigidly, securely, plumb and true. Frames shall be isolated from dissimilar metals and cementitious materials which could corrode or otherwise damage the frames. Installations shall be sealed watertight and weather tight. Backer rod shall be installed behind all sealant.

Clean-up: All panes shall be cleaned just before the final inspection. Paint, dirt, stains, labels (except etched labels), and surplus glazing compound shall be removed without scratching or marring the surface of the panes or metal work.

12-8.06 PRESSED METAL FRAMED WINDOWS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing pressed metal framed windows in accordance with the details shown on the plans and these special provisions.

PERFORMANCE REQUIREMENTS

Windows as complete assemblies shall meet or exceed the following requirements:

1. Design Wind Loads: As shown on the plans; tested to resist 150% of design pressure.
2. Deflection: Less than 1/175 of glass edge length, not to exceed 3/4 inch.
3. Condensation Resistance: CRF under AAMA 1503 or CR under NFRC 500 of 36 or more.

4. Thermal Transmittance: U-factor not greater than 0.49 Btu/sq. ft. x h x °F.
5. Air Leakage: Not more than 0.3 cfm/sq. ft. at 1.6 psf.
6. Water Penetration: Resistant at not less than 4.5 psf.

SUBMITTALS

Submittals: Manufacturer's descriptive data, working drawings and installation instructions shall be submitted for approval.

Submit product test reports.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives and sealants to be applied on-site and inside the building weatherproofing system, showing type, brand, and product name, indicating VOC content.

QUALITY ASSURANCE

Windows shall comply with one of the following:

1. AAMA/WDMA/CSA 101/I.S.2/A440-08, "North American Fenestration Standard/Specification for Windows, Doors, and Skylights," meeting the requirements of performance class CW (commercial) with a minimum performance grade (PG or Grade) of 30.

2. WDMA "Architect's Guide to Steel Windows and Doors."

Windows shall bear National Fenestration Rating Council (NFRC) label indicating U-value, solar heat gain coefficient (SHGC), visible transmittance, air leakage, and condensation resistance factor (CRF).

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with recycled content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

Framing: Framing shall be pressed metal complying with ASTM Designation: A 568; hot-dip galvanized under ASTM Designation: A 924 and A 653; not less than 0.060 inch thick (16-gage) with all members square and true, full mitered frame corners and continuous welds at all joints and cover plates. Welds at frame faces shall be ground smooth and flush with surrounding surfaces. All metal surfaces shall be cleaned and factory primed with one coat of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Thermal Break: Provide frames with manufacturer's optional thermal break design.

Finish: Epoxy primer (1.0 mil dft) and baked acrylic polyurethane (2.0 mil dft); manufacturer's standard primer (1.0 mil dft) and powder coat (2.0 mil dft); or equal.

Anchors: Anchors shall be manufacturer's standard.

Glazing: Glazing shall conform to the requirements specified under "Glazing," in Section 12-8, "Doors and Windows," of these special provisions.

Backer Rod: Backer rod shall be close cell, non-absorbent, non-staining foam rod compatible with sealant.

Sealant: Sealant shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, single component. Sealant shall conform to ASTM Designation: C 920.

PART 3 - EXECUTION

Installation: Frames shall be installed rigidly, securely, plumb and true. Installations shall be sealed watertight and weathertight.

Painting: Except for the primer application specified herein, exposed frame surfaces shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-8.07 OVERHEAD COILING GRILLE

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing an electrically operated overhead coiling grille in accordance with the details shown on the plans and these special provisions.

The grille shall be manufactured by a nationally recognized door manufacturer for interior use in commercial and institutional buildings. The manufacturer shall have an established parts store, and an authorized service organization in California.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, and drawings of supporting members, grille, control systems and motor operator shall be submitted for approval. The submittals shall be approved prior to installation.

The name and address of the manufacturer's authorized service organization, and parts supply store, shall be included with the data submitted for approval. The length of time such businesses have serviced the manufacturer's products, and sold its parts shall be listed.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

Curtain: Curtain shall be interlocking network of horizontal rods and vertical links which form a pattern of straight horizontal and vertical lines. Horizontal rods shall be full length, 5/16-inch diameter galvanized steel spaced at 2 inches on center. Vertical links of galvanized steel shall flex, and shall be approximately 1/8 inch thick by ¾ inch wide, and shall be spaced at 9 inches on center. Links shall be separated with 3/8-inch diameter stainless steel tubing placed over the horizontal rods. End links shall be designed to prevent the curtain from leaving the guides. The tubing shall have a No. 4 finish.

Curtain Guides: Curtain guides shall be channel shaped 6063-T6 extruded aluminum, with silicon-treated wool pile or nonmetallic inserts which will prevent metal to metal contact, deaden noise, and prevent electrolytic action. Guides shall be designed to prevent the end links of the grille from pulling out of the guides.

Curtain Guide Supports: Curtain guide supports shall be galvanized steel. Size and shape shall be as shown on the plans.

Counterbalancing Assembly:

Counterbalancing assembly shall be steel pipe or welded tube barrel shaft of the diameter and wall thickness required to limit the deflection under load to 0.03 inch per foot of grille width maximum, and with an internal counterbalancing spring mounted on a cold rolled steel inner shaft. Sealed ball bearings shall be provided to minimize wear of pipe shaft rotation around the inner shaft.

Counterbalancing spring shall be an oil tempered, helical spring sized to provide sufficient torque for easy operation of the curtain from any position. Spring tension shall be adjustable from outside of the end bracket plate without removing the hood.

Bracket Plates: Bracket plates shall be steel plates of 1/4-inch minimum thickness to carry pipe and counterbalancing shaft, the hood and to house ends of grille coil.

Hood: Hood shall be galvanized sheet steel not less than 0.028 inch thick (24-gage), reinforced to prevent bending or sagging and to provide a rigid, quiet and vibrationless installation. The hood reinforcement shall be concealed.

Motor Operator: Motor operator shall be high starting torque motor, reduction gearing, solenoid brake, limit switches for upper and lower limits of grille travel, lower limit switch shall have auxiliary contact, removable emergency hand crank with electric interlock to break motor circuit when hand crank is engaged, cylinder lock operating station in a NEMA waterproof enclosure, magnetic relay contactor, overload protection and prewiring to terminal block. Motor shall be removable for repair without affecting emergency operation or limit switch settings.

Safety Bar: Safety bar shall be waterproof, aluminum angled protective safety bar assembly which shall either stop or reverse the grille travel upon contact with an obstruction, shall be installed at the bottom of the grille.

PART 3 - EXECUTION

INSTALLATION

Grilles and accessories shall be installed in accordance with the manufacturer's instructions and shall operate freely without binding.

The motor operator shall not interfere with the manual operation of the grille when the emergency hand crank has been engaged.

The operator controls and mechanism shall be easily accessible for adjustment and service.

The motor for the operator shall be the size and type recommended by the grille manufacturer, and shall adequately power the unit for proper operation of the grille.

All supporting members and guides shall be installed rigidly and securely to prevent swaying and vibration of the grille.

Conduit and wiring, of adequate size, shall be installed as required for proper operation of the grilles and controls. Conduit and conductors shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

12-8.08 FOLDING AND ACCORDION PARTITIONS

PART 1 – GENERAL

Scope: This work shall consist of furnishing and installing folding and accordion partitions in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

Sample for exposed material, finish, covering, or facing will be selected from the manufacturer's standard color and pattern line by the Engineer.

Working drawings shall show partition plan layout, elevations, sections, installation sequence, details, anchoring and fastening details and attachment to other work. Indicate location and installation requirements for hardware and track, blocking, and direction of travel. Indicate stacking clearances.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame Spread Index of 25 or less.
Smoke Developed Index: of 450 or less.

Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

STC: Not less than 40.

FOLDING PARTITION

Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories

Panel Operation: Manually operated, individual.

Panel Weight: 8 lb/sq. ft.

Panel Assembly: Nominal 3-inch thick panels in manufacturer's standard 48-inch widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin. Assembly shall be factory fabricated partition of equal width, close stacking pairs of joining panels and a single fixed jamb.

Panel Skin: 1/2-inch tackable gypsum board, Class "A" ASTM C 1396/C 1396M rated single material or composite layers continuously bonded to panel frame. Panel finish shall be reinforced heavy duty vinyl with woven backing weighing not less than 30 ounces per lineal yard.

Panel trim: Exposed panel trim of one consistent color from manufacturer's standard offering. Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints

Seals:

General: Provide seals that produce operable panel partitions complying with performance requirements and the following:

Manufacturer's standard seals unless otherwise indicated.
Seals made from materials and in profiles that minimize sound leakage.
Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

Bottom Seal: Manually activated bottom seals with self-contained handle providing nominal 2-inch operating clearance with an operating range of plus 1/2-inch to minus 1-1/2 inch. Seal shall be operable from panel edge or face.

Vertical Seals: Deep-nesting, interlocking steel astragals mounted on each edge of panel, with continuous PVC acoustical seal.

Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track.

Suspension System:

Suspension Tracks: Minimum 11-gage, 0.12-inch roll-formed steel track, supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 3/8-inch diameter threaded rods. Aluminum track is not acceptable.

Exposed track soffit: Steel, integral to track, and pre-painted off-white.

Carrier: Two all-steel trolleys with steel tired ball bearing wheels. Non-steel tires are not acceptable. Suspension system shall provide automatic indexing of panels into stack area using preprogrammed switches and trolleys without electrical, pneumatic, or mechanical activation.

ACCORDION PARTITION

Accordion Folding Partition: Accordion folding frame with pantograph sections designed for horizontal extension and retraction, covered with decorative facing material, reinforced for hardware attachment, supported by overhead suspension system, and equipped with manufacturer's standard air-release method to prevent billowing.

Dimensions:

Stack Width (Stored): Maximum 12-1/2 inches.
Width When Extended: Maximum 7 inches.
Total Stack Depth (Stored): Maximum 36 inches.

Facing Material: Woven fabric from same dye lot, treated to resist stains.

Components:

Posts and Seals: Provide types of posts and seals that produce accordion folding partitions complying with performance requirements.

Posts: Steel or aluminum; formed with deep-nesting and interlocking interfaces and fabricated to ensure rigidity of accordion folding partition.

Perimeter Seals: Manufacturer's standard vinyl, neoprene, or woven silica vertical seals, horizontal top and bottom seals, and closures for lead posts and jambs.

Hardware: Manufacturer's standard manually operated pulls, latches, locks, and bolts as required to operate accordion folding partitions; with decorative, protective finish.

Trim: Manufacturer's standard with decorative, protective finish.

Tiebacks: As required to maintain accordion folding partitions in stacked position; with manufacturer's standard finish.

Suspension System:

Suspension Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of accordion folding partition indicated. Size track to support partition operation and storage without damage to suspension system, accordion folding partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

Track: Recessed with head closure trim integral with track for protecting overhead surfaces.

Carriers: Trolley system as required for size and weight of partition and for easy, quiet operation.

Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

Steel Finish: Factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

INSTALLATION

Folding partitions shall be installed rigidly, securely, plumb and true in accordance with the manufacturer's instructions. The folding partition shall operate smoothly and shall stack neatly and compactly.

Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

Install panels from marked packages in numbered sequence indicated on Working Drawings.

Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

Provide manufacturer's representative to conduct demonstration for designated Department's personnel with respect to adjustment, operation, and maintaining operable panel partitions. Notify the Engineer at least 72 hours in advance to permit Department's authorized representative to schedule such an instruction period.

12-8.09 DOOR HARDWARE

PART 1 - GENERAL

SUMMARY

Scope: This work consists of furnishing and installing mechanical door hardware and electrified door hardware for swinging doors.

Design Requirements

Hardware must be free of defects, blemishes, and excessive play. Obtain each kind of hardware from 1 manufacturer for (1) latch and locksets, (2) exit devices, or (3) hinges and closers.

Furnish hardware items required to complete the work complying with performance level and design intent. Comply with the manufacturers' instructions for installation.

Furnish the manufacturer's updated item where specified item is now obsolete.

Furnish hardware with suitable fasteners to complete work.

Furnish ANSI/BHMA A156 Operational Grade 1 and Security Grade 1 door hardware unless otherwise specified.

Fire-Rated Door Assemblies: Furnish door hardware (1) rated for use, (2) approved by the SFM, and (3) complying with NFPA 80.

Smoke-Control Assemblies: Furnish door hardware (1) rated for use, (2) approved by the SFM, (3) complying with UL 1784, and (4) installed under NFPA 105.

Maintenance Tools: Furnish a complete set of specialized tools for continued adjustment, maintenance, removal, and replacement of door hardware.

DEFINITIONS

BHMA: Builders Hardware Manufacturers Association.

NRP: Non-removable pin.

NRTL: Nationally Recognized Testing Laboratory as defined by OSHA in 29 CFR 1910.7.

SFIC: Small format interchangeable core.

SFM: California State Fire Marshal.

SUBMITTALS

Product Data: Submit for all products. Include the following:

1. Manufacturer's technical information and catalog cuts for each door hardware item. Include style, function or type, grades, size, and finish.
2. Fasteners and other pertinent information.

3. Explanation of abbreviations, symbols, and codes contained in schedules.
4. ANSI/BHMA certification.
5. SFM listing and UL approval where specified in these special provisions.
6. Installation details for door hardware.
7. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

Working Drawings:

Submit locations of door hardware sets, cross-referenced to drawings, both on floor plans and in door schedule. Include identification number, location, hand, fire rating, and material of each door and frame.

Submit details of electrified door hardware, including:

1. Power, signal, and control wiring diagrams. Include conductor numbers.
2. Schematic diagrams of interface of electrified door hardware and building intrusion and security systems.

Door Hardware Schedule: Submit door hardware sets with all items required for each door. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, style, thickness, hand, function, and finish of door hardware.

Closeout Documents:

Include closeout documents in the Maintenance and Operations Manual before completion of the work. Submit 1 copy of PDF files on CD or DVD.

Closeout documents must include the following:

1. Index.
2. Parts list.
3. Operating instructions.
4. Maintenance instructions.

Incomplete or inadequate documentation will be returned for correction and resubmittal.

QUALITY CONTROL AND ASSURANCE

Floor Stops must comply with California Access Compliance Reference Manual Policy No. 99-08, Door Stops and Other Floor-Mounted Obstructions.

Regulatory Requirements

Door hardware and installation must comply with the CBC and the following table:

Door hardware item	ANSI/BHMA Standard
Full mortise hinges	ANSI/BHMA A156.1
Cylindrical locksets	ANSI/BHMA A156.2
Automatic flush bolts, panic devices, exit only devices, and coordinators	ANSI/BHMA A156.3
Door closers	ANSI/BHMA A156.4
Lock cylinders, single cylinder deadbolts and electric strikes	ANSI/BHMA A156.5
Push plates, pull plates, kick plates, and mop plates	ANSI/BHMA A156.6
Mortise locksets	ANSI/BHMA A156.13
Manual flush bolts, floor stops, wall stops, door stops, and wall bumpers	ANSI/BHMA A156.16
Materials and finishes	ANSI/BHMA A156.18
Thresholds	ANSI/BHMA A156.21
Door gasketing, automatic door bottoms, door shoes with rain drip, door sweeps, door top weatherstrips, and overhead door drips	ANSI/BHMA A156.22
Electromechanical locks	ANSI/BHMA A156.23
Keying systems	ANSI/BHMA A156.28
Electric strikes and frame mounted actuators	ANSI/BHMA A156.31
Hardware preparation in steel doors and steel frames	ANSI/BHMA A156.115
Hardware preparation in wood doors with wood or steel frames	ANSI/BHMA A156.115W

Certificates

Product Certificates: From manufacturer; that electrified door hardware is approved for use on types and sizes of labeled fire-rated doors and complies with listed fire-rated door assemblies.

PART 2 - PRODUCTS

Furnish door hardware sets for each door as shown on the plans or as specified in these special provisions.

Electrified door hardware must be listed and labeled by a NRTL. Manufacturers may perform electrical modifications that are listed by a NRTL.

Exit doors must be operable from the inside at all times with single motion and without the use of a key, special knowledge, or effort.

Plans show direction of swing or hand of each door leaf. Furnish each item of hardware for proper door movement.

HINGES

Hinges must be full mortise, five knuckle, ball bearing construction and comply with the following:

1. Heavy Weight Hinges:

    1.1. Interior: Type 8111
    1.2. Exterior: Type 5111, use NRP with set screw on out swinging exterior doors

Where electrified door hinges are shown on the plans at Aluminum doors, use a fully concealed Electric Power Transfer, ten 24-gage wires, up to 1 amp @ 24 VDC with a 16 amps maximum surge, UL listed as "Miscellaneous Door Accessory."

Where electrified door hinges are shown on the plans at all locations other than at Aluminum doors, use the specified full mortise hinge with manufacturer's electric thru wire type; 8 wire- 28-gage wires, 3.5 amperes continuous; 16 amperes pulse. Omit NRP if a different pin is required for electrical wiring.

MECHANICAL LOCKS AND LATCHES

Lock Throw: Comply with length of bolts required for labeled fire-rated doors and the following:

1. Cylindrical Lockset: At least 1/2-inch latchbolt throw
2. Mortise Lockset: At least 3/4-inch latchbolt throw
3. Deadbolt: At least 1-inch bolt throw

Lock Backset: 2-3/4 inches, unless otherwise shown on the plans or specified in these special provisions.

Strike: Manufacturer's standard strike for each lock bolt or latchbolt, with strike box and curved lip extended to protect frame. Furnish (1) flat-lip strike for three-piece antifriction latchbolts where instructed by the lock manufacturer, (2) extra-long-lip strike for frames with applied wood casing trim, or (3) manufacturer's specific aluminum strike box for aluminum frames.

CYLINDRICAL LOCKSETS

Cylindrical locksets must be series 4000, non handed steel lock chassis, SFIC, self aligning trim with concealed through bolts. Include the following:

1. Lever: Contour with angled return. On exterior doors, freewheeling exterior lever when locked.
2. Rose: Chromium, flat with rounded edge.
3. Latchbolt: Chrome, square corner. Same manufacturer as lockset.
4. Screws: Supplied with lockset.

Entrance lockset must be Function F109 with dual levers and roses. Passage lockset must be Function F75 with dual levers and roses. Privacy lockset must be Function F76A, dual levers and roses, with coin turn outside and thumbscrew turn inside.

MORTISE LOCKSETS

Mortise locksets must be series 1000, non handed steel lock case, SFIC, self aligning trim with concealed screws. Include the following:

1. Lever Contour with angled return. On exterior doors, freewheeling exterior lever when locked.
2. Escutcheon: Stainless steel with standard cylinder.
3. Rose: Stainless steel, flat with rounded edge.
4. Latchbolt: Anti friction latchbolt, supplied with lockset.
5. Screws: Supplied with lockset.

Exit lockset must be Function F12, dual levers with exterior escutcheon and interior rose, and 1-inch throw stainless steel deadbolt. Passage lockset must be Function F01 with dual levers and roses. Privacy lockset must be Function F22, dual levers and roses, with coin turn outside and thumbscrew turn inside.

AUXILIARY LOCKS

Single cylinder deadbolt must be Function E2151, free spinning solid brass cylinder collar and security shield, non handed, steel alloy deadbolt with anti-saw center, SFIC, with concealed through bolts.

LOCK CYLINDERS

Lock cylinders must be a master key system.

Lock cylinders must be tumbler type, constructed from nickel silver, and same manufacturer as locking devices. Cylinders must be SFIC type, interchangeable cores with six pin barrels, and face finished to match lockset.

Temporary cores must be SFIC type with interchangeable cores with six pin barrels. Temporary cores must be a change key system. Temporary cores and keys must not be the Department's permanent keying system or

furnished on the same keyway or key section as the Department's permanent keying system. Temporary cores will remain Department property.

Keys must be nickel silver and same manufacturer as locking devices. Furnish 2 change keys per temporary core. Furnish 2 blank keys per permanent core. Stamp change key bows and blank key bows "State of California" and "Do Not Duplicate."

ELECTROMECHANICAL LOCKS

Electromechanical locks must use the specified cylindrical lockset, and be locked outdoor type, fail-secure, motor or solenoid driven, 24 volts DC, mechanical override, with strike that suits frame.

FLUSH BOLTS

Manual Flush Bolts: Function L04251 set or Function L02461 set as required, non handed, 1/2-inch bolt head, 3/4-inch min bolt throw, and dust proof strikes.

SURFACE CLOSER

Door Closers: Surface mounted, aluminum cover, non handed, field adjustable sizes 1 through 6, parallel arm set with hold open and stop. Include separate adjusting valves for closing, latching speed, and backcheck. Use drop brackets at narrow head rails.

EXIT DEVICES

Panic Devices (at locations other than at Aluminum Doors): Type 3 with push pad, mortise lockset with SFIC cylinder, Function 08 outside trim with freewheeling lever when locked and exterior escutcheon. UL and SFM listed for panic Exit. Use Type 2 with push pad for inactive leaf.

Panic Devices at Aluminum Doors: Narrow stile concealed vertical rod exit device, Type 6 with 36" push pad, electric latch retraction for Night latch (NL) function, and electric dogging. Trim Package to include pull with cylinder lockset with SFIC cylinder, UL and SFM listed for panic exit.

OPERATING TRIM

Push Plates and Pull Plates: Beveled edges, stainless steel, and size 16 by 4 inches. Push plate must be Type J301. Pull plate must be Type J405, with one-inch diameter round pull and 1 1/2-inch standoffs on 8-inch centers.

PROTECTIVE TRIM UNIT

Kickplates and Mop Plates: Beveled edges, stainless steel, countersunk screw holes, width 2 inches less than door width for single doors, and 1-inch less than door width each for door pairs. Kickplate must be Type J102, 12 inches tall. Mop plate must be Type J103, 6 inches tall.

MECHANICAL STOPS AND HOLDERS

Floor Stops: Dome type, Type L12141 or L12161 as required, countersunk screw holes, non marring rubber bumper, and height for threshold or non threshold door frame as required.

Wall Stops and Door Mounted Stops: Wall type, 3 1/2-inch projection, Type L12011 or L12021 as required, countersunk screw holes, and non marring rubber tip.

Wall Bumpers: Wall type bumper, Type L22101 or L22201 as required, no visible screw holes, and convex rubber pad.

DOOR GASKETING

Automatic Door Bottoms: Heavy duty, full mortise, mill finished aluminum with silicone insert, end covers, and strike plates.

Door Shoe with Rain Drip: Mill-finished aluminum with neoprene insert, end covers, and formed rain drip.

Door Sweep: Mill-finished aluminum and neoprene.

Overhead Door Drip: Mill-finished aluminum 2-1/2 inches wide.

Door Gasketing: Bumper-type resilient inserts with retainer strips and surface applied. Perimeter seals must meet performance tests for heat, cold, air leakage, and smoke. At astragals, furnish a compression bulb resilient pressure sensitive door gasketing. Materials must be NRTL listed where used with labeled assemblies.

THRESHOLDS

Thresholds must be factory non-slip mill-finished aluminum, nominal 6 inches wide unless otherwise shown on the plans, and full width of opening.

Threshold bedding sealant must be weatherproof silicone sealant and adhesive.

SHOP FABRICATION

Manufacturer's Nameplate: Do not use products that have manufacturer's name or trade name displayed in a visible location except with required fire-rated labeling. Manufacturer's identification will be permitted on lock cylinder rims.

Base Metals: Furnish door hardware items of base metal specified, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware items. Do not use a manufacturer's standard materials or forming methods if different from the specified standard.

Fasteners: Screws must comply with commercially recognized industry standards for application intended. Furnish Phillips oval-head screws finished to match surface of door hardware. Furnish fire-rated fasteners for labeled assemblies for the following:

1. Hinges mortised to wood doors or frames.
2. Strike plates to wood frames.
3. Closers to wood doors and frames.
4. Surface hinges to steel doors.
5. Closers to steel doors and frames.
6. Surface-mounted exit devices to steel doors and frames.
7. Spacers or sex bolts for through bolting of hollow-metal doors.

Do not use aluminum fasteners. Furnish noncorrosive fasteners for exterior door gasketing applications.

FINISHES

Interior Hardware: Standard Finish 626 (US 26D), satin chromium.

Exterior Hardware: Standard Stainless Steel Finish 630 (US 32D), satin stainless steel. Where shown on the plans, use Standard Finish 626 (US 26D), satin chromium.

Factory Covering: Apply a strippable, temporary protective covering to exposed finishes before shipping.

PART 3 - EXECUTION

Doors and Frames: Doors and frames must be set square, plumb, and properly prepared before hardware installation.

EXAMINATION

Doors and Frames: Examine doors and frames for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting door hardware installation.

Electrified Door Hardware: Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

INSTALLATION

Furnish heavy weight hinges for (1) interior doors with closers or panic devices, (2) interior doors wider than 3'-5", and (3) exterior doors. You must use 4-1/2 inch hinges unless otherwise shown on the plans or specified in these special provisions.

Furnish standard weight hinges for interior doors unless otherwise specified. For doors 2'-0" wide you must use 3 inch hinges. For doors wider than 2'-0" you must use 3-1/2 inch hinges.

Hardware items must be accurately fit, securely applied, adjusted, and lubricated to comply with the manufacturer's instructions. Hardware items must operate without binding or excessive play.

Hinges must be installed at equal spacing with the end hinges not more than 9-5/8 inches from the top and bottom of the door. Kickplates and mop plates must be mounted on the push side of the doors, 1 inch up from bottom edge.

Thresholds must be set in a continuous bed of bedding sealant.

Mechanical stops on concrete surfaces must be attached with expansion anchoring devices. Mechanical stops mounted elsewhere must be attached with wood screws. Do not locate stops in the path of travel.

Closers shall be adjusted that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3-inches from the latch, measured to the leading edge of the door.

Hardware, except hinges, must be removed from surfaces to be painted before painting. Do not install surface-mounted items until finishes have been completed on substrates involved.

Furnish all dogging keys, closer valve keys, lock spanner wrenches, other factory furnished installation aids, instructions, and maintenance guides to the Engineer.

Install continuous weatherstripping at each edge of exterior door leaf. Seal finish must match adjacent frame color.

LOCK CYLINDERS

Install temporary cores in all lockable doors during construction.

Furnish permanent cores and keys to the Engineer before Contract acceptance. The Department will install the permanent cores.

CLEANING AND PROTECTION

Clean adjacent surfaces soiled by door hardware installation.

Clean hardware items as necessary to restore proper function and finish.

Furnish final protection and maintain conditions that ensure that door hardware is without damage or deterioration before Contract acceptance.

ADJUSTING

Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of HVAC equipment.

Electric Strike: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

DOOR HARDWARE SCHEDULE

Furnish hardware sets as specified in the following tables:

DOOR HARDWARE SET 1: (Pair exterior aluminum storefront system doors with security access. Doors 1, 10, 107 and 115. Comform with the requirements under "Aluminum Storefront" in Section 12-8, "Windows and Doors," and Section 12-16, "Electrical," of these special provisions.)

No.	Item	Description	Quantity
1	Hinges	Continuous hinge provided with storefront system	Min 1 per leaf
2	Electrical power transfer (electrified door hinge)	Provided with storefront system	2
3	Exit device (panic device)	Concealed vertical rod and latch with panic bar and electric latch retraction for night latch (NL) function. Provided with storefront system	2
4	Operating trim	Pull provided with storefront system	2
5	Surface closer	Provided with storefront system	2
6	Mechanical stops and holders	Floor mounted door stop	2
7	Gasketing	Provided with storefront system	2 sets
8	Threshold	Provided with storefront system	1
9	Protective trim unit	Door shoe with raindrip provided with storefront system	2

DOOR HARDWARE SET 2: (Single exterior aluminum storefront system door. Door 117)

No.	Item	Description	Quantity
1	Hinges	Continuous hinge provided with storefront system	1
2	Cylindrical lockset and latch	Storeroom lockset provided with storefront system	1
3	Operating trim	Provided with storefront system	1
4	Mechanical stops and holders	Floor mounted door stop	1
5	Gasketing	Provided with storefront system	1 set
6	Threshold	Provided with storefront system	1
7	Protective trim unit	Door shoe with raindrip provided with storefront system	1

DOOR HARDWARE SET 3: (Single interior aluminum Storefront system door. Door 116)

No.	Item	Description	Quantity
1	Hinges	Continuous hinge provided with storefront system	1
2	Cylindrical lockset and latch	Classroom lockset provided with storefront system	1
3	Operating trim	Provided with storefront system	1
4	Mechanical stops and holders	Floor mounted door stop	1

DOOR HARDWARE SET 4: (Gate hardware, exterior pair. Doors 19 and 20)

No.	Item	Description	Quantity
1	Hinges	Heavy weight, provided by gate manufacturer	1 sets
2	Exit device (panic device)	On interior side (push side) of operable side, operating trim with keyed lock cylinder on exterior side (pull side) of operable leaf - provided by gate manufacturer.	1
3	Flush bolts	On inoperable side	1

DOOR HARDWARE SET 5: (Pair exterior door. Doors 56, 58, and 136. Also Wash/Fuel Building Door 2)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 5111 with non removable pen.	3 pair
2	Cylindrical lockset and latch	Lever operated classroom lockset	1
3	Flush bolts	Manual, flush mounted on inoperable side	1
4	Lock guard	---	1
5	Accessories for pairs of doors	Astragal	1
6	Surface closer	Door closer	2
7	Mechanical stops and holders	Wall bumper	2
8	Gasketing	Weatherstrip	2 sets
9	Threshold	---	1 each
10	Protective trim unit	Door shoe with raindrip	2

DOOR HARDWARE SET 6: (Single exterior door with security access. Door 21, 60, 78, 87, 113, 127, 134, 148, 153, and 154)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 5111 with non removable pen.	Minimum 2
2	Energy transfer hinge (electrified door hinge)	---	1
3	Electromechanical lock	Electrically unlocked, exit function (fail secure)	1
4	Lock guard	---	1
5	Surface closer	Door closer	1
6	Mechanical stops and holders	Wall bumper	1
7	Gasketing	Weatherstrip	1 set
8	Threshold	---	1
9	Protective trim unit	Door shoe with raindrip	1

DOOR HARDWARE SET 7: (Single exterior door. Doors 9, 22, 30, 57, 59, 62, 67, 74, 90, 92, 100, 157, 162 and 166. Also Wash/Fuel Building Door 1)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 5111 with non removable pen.	1 1/2 pair
2	Cylindrical lockset and latch	Lever operated storeroom lockset	1
3	Lock guard	---	1
4	Surface closer	Door closer	1
5	Mechanical stops and holders	Wall bumper	1
6	Gasketing	Weatherstrip	1 set
7	Threshold	---	1
8	Protective trim unit	Door shoe with raindrip	1

DOOR HARDWARE SET 8: (Single exterior fire rated, smoke seal door. Door 31)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 5111 with non removable pen.	Minimum 1-1/2 pair
2	Cylindrical lockset and latch	Lever operated storeroom lockset	1
3	Lock guard	---	1
4	Surface closer	Door closer	1
5	Mechanical stops and holders	Wall bumper	1
6	Gasketing	Weatherstrip and smoke gasketing	1
7	Threshold	---	1
8	Protective trim unit	Door shoe with raindrip	1

DOOR HARDWARE SET 9: (Single interior door with security access. Door 68, 91, 108, 111, 118, and 132)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111	Minimum 2
2	Energy transfer hinge (electrified door hinge)	---	1
3	Electromechanical lock	Electrically unlocked, exit function (fail secure)	1
4	Lock guard	---	1
5	Surface closer	Door closer	1
6	Mechanical stops and holders	Wall bumper	1

DOOR HARDWARE SET 10: (Single interior door, locking. Doors 2, 3, 4, 16, 61, 64, 69, 71, 88, 94, 96, 105, 106, 109, 110, 119, 120, 121, 122, 123, 124, 125, 126, 130, 137, 140, 141, 142, 146, 156, 160, and 164)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111.	1 1/2 pair
2	Cylindrical lockset and latch	Lever operated classroom lockset	1
3	Surface closer	Door closer	1
4	Mechanical stops and holders	Wall bumper	1

DOOR HARDWARE SET 11: (Pair interior door with passage hardware. Door 32)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111.	3 pairs
2	Latchset	Lever operated, passage latch set	2
3	Surface closer	---	2
4	Mechanical stops and holders	Wall bumper	2
5	Threshold	---	2

DOOR HARDWARE SET 12: (Single interior door with passage hardware. Doors 5, 29, 42, 51, and 66)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111.	1-1/2 pairs
2	atchset	Lever operated, passage latch set	1
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1

DOOR HARDWARE SET 13: (Single interior door with push/pull hardware. Doors 24, 25, 27, and 28)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111.	1-1/2 pair min
2	Operating trim	Push/pull door hardware	1 set
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1

DOOR HARDWARE SET 14: (Single interior door w/ privacy lock. Doors 46, 98, 143, and 159)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111.	1-1/2 pairs
2	Cylindrical lockset and latch	Lever operated, privacy lock set	1
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1
5	Threshold	---	1

DOOR HARDWARE SET 15: (Single interior fire rated assembly door with security access. Doors 33 and 83)

No.	Item	Description	Quantity
1	Hinges	Heavy weight butt hinge provided by the pre-assembled metal door and frame assembly manufacturer	Minimum 2
2	Energy transfer hinge (electrified door hinge	Provided by the pre-assembled metal door & frame manufacturer	1
3	Electromechanical lock	Electrified dual lever exit lockset provided by the pre-assembled metal door and frame assembly manufacturer. Concealed wire transfer.	1
4	Surface closer	Provided by the pre-assembled metal door and frame assembly manufacturer.	1
5	Mechanical stops and holders	Wall bumper	1
6	Gasketing	Fire/smoke seal	1 set

DOOR HARDWARE SET 16: (Single interior fire rated assembly door. Doors 8, 50, 139, and 144)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111.	1-1/2 pair min
2	Cylindrical latch	Lever operated passage latchset	1
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1
5	Gasketing	Fire/smoke seal	1 set
6	Threshold	---	1

DOOR HARDWARE SET 17: (Single interior door, storeroom lock. Doors 14, 15, 34, 35, 36, 38, 102, 129, and 133)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111 with non removable pen.	1-1/2 pair
2	Cylindrical lockset and latch	Lever operated storeroom lockset	1
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1
5	Threshold	---	1

DOOR HARDWARE SET 18: (Single interior smoke sealed door, storeroom lock. Doors 49, and 147)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111 with non removable pen.	1-1/2 pair
2	Cylindrical lockset and latch	Lever operated storeroom lockset	1
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1
5	Gasketing	Smoke seal	1 set
6	Threshold	---	1
7	Trim unit	Smoke rated door bottom seal	1

DOOR HARDWARE SET 19: (Single interior door, locking. Doors 41, 43, 52, 53, and 54)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111.	1-1/2 pair
2	Cylindrical lockset and latch	Lever operated classroom lockset	1
3	Surface closer	Door closer	1
4	Mechanical stops and holders	Wall bumper	1
5	Gasketing	Acoustic gasketing	1
6	Threshold	---	1
7	Trim unit	Acoustic door bottom seal	1

DOOR HARDWARE SET 20: (Gate hardware, single interior. Door 163)

No.	Item	Description	Quantity
1	Hinges	Provided by gate manufacturer	1-1/2 pair
2	Cylindrical lockset and latch	Classroom lockset with lever handle provided by gate manufacturer	1

DOOR HARDWARE SET 21: (Pair exterior door w/ panic. Door 97)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 5111 with non removable pen.	3 pairs
2	Exit device	Panic device	2
3	Lock guard	---	2
4	Accessories for pairs of doors	Astragal	1
5	Surface closer	Door closer	2
6	Mechanical stops and holders	Wall bumper	2
7	Gasketing	Weatherstrip	2 sets
8	Threshold	---	1
9	Protective trim unit	Door shoe with raindrip	2

DOOR HARDWARE SET 23: (Double interior smoke sealed door, storeroom lock. Doors 72, 73, 76, and 77)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111	3 pairs
2	Cylindrical lockset and latch	Lever operated storeroom lockset	2
3	Flush bolts	Manual flushbolt mounted on inoperable side	1
4	Surface closer	---	2
5	Mechanical stops and holders	Wall bumper	2
6	Gasketing	Smoke seal	2 sets
7	Threshold	---	1
8	Trim unit	Smoke rated door bottom seal	2

DOOR HARDWARE SET 24: (Single interior door with passage hardware. Door 11, 12, 23, 26, 37, 47, 48, 99, 103, 104, and 145)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 5111.	1-1/2 pairs
2	Cylindrical latch	Lever operated, passage latch set	1
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1
5	Threshold	---	1

DOOR HARDWARE SET 25: (Single interior door with security access. Doors 17 and 128)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111	Minimum 2
2	Energy transfer hinge (electrified door hinge)	---	1
3	Electromechanical lock	Electrically unlocked, exit function (fail secure)	1
4	Lock guard	---	
5	Surface closer	Door closer	1
6	Mechanical stops and holders	Wall bumper	1
7	Threshold	---	1

DOOR HARDWARE SET 26: (Single interior door, storeroom lock. Doors 13, 39, 40, and 138)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111 with non removable pen.	1-1/2 pair
2	Cylindrical lockset and latch	Lever operated storeroom lockset	1
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1

DOOR HARDWARE SET 27: (Double interior door, storeroom lock. Doors 44, 45, and 165)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111 with non removable pen.	1-1/2 pair
2	Cylindrical lockset and latch	Lever operated storeroom lockset	1
3	Surface closer		1
4	Mechanical stops and holders	Wall bumper	1

DOOR HARDWARE SET 28: (Single interior fire rated door, storeroom lock. Door 18, 82)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111	1-1/2 pair
2	Cylindrical lockset and latch	Lever operated storeroom lockset	1
3	Surface closer	---	1
4	Mechanical stops and holders	Wall bumper	1
5	Threshold	---	1

DOOR HARDWARE SET 29: (Single interior door, locking. Door 112

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111.	1 1/2 pair
2	Cylindrical lockset and latch	Lever operated classroom lockset	1
3	Surface closer	Door closer	1
4	Mechanical stops and holders	Wall bumper	1
5	Threshold	---	1

DOOR HARDWARE SET 30: (Single interior door, locking with panic device. Door 6 and 7)

No.	Item	Description	Quantity
1	Hinges	Heavy weight type 8111	1-1/2 pair
2	Exit device (panic device)	On the push side, operating trim with keyed lever operated classroom lockset - provided by gate manufacturer	1
3	Surface closer	Door closer	1
4	Mechanical stops and holders	Wall bumper	1

12-8.10 GLAZING

PART 1 - GENERAL

SUMMARY

This work consists of furnishing and installing glazing.

Glazing for windows, doors, and other glazed openings includes:

1. Glass
2. Acrylic sheets
3. Polycarbonate cores and laminated sheets

DEFINITIONS

SHGC: Solar Heat Gain Coefficient.

Surface: Surfaces of lites numbered inward with the exterior surface being the 1st surface.

SUBMITTALS

General

Submit manufacturer's product data including catalog cuts, performance data, installation instructions, and additional documentation.

A detailed list of glazing materials including glass, sheet, sealants, tapes, setting blocks, shims, compression seals, and glazing channels must be submitted for approval. The list must include a schedule of materials to be used at each location and be presented in the form of a glazing schedule using the same designations for windows as shown on the plans.

Submit the installation schedule. The installation schedule must include the location, size, and type for each glazing.

Adhesion and Compatibility Testing Reports:

Submit adhesion and compatibility testing reports. Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants. Testing will not be required if data is submitted based on previous testing of current sealant products and glazing materials matching those submitted.

For materials that fail tests, submit manufacturer's instructions for corrective measures, including use of specially formulated primers.

LEED Submittals

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 8.1, Daylight and Views - Daylight: Submit product data including visual light transmittance factor for window glazing.

QUALITY CONTROL AND ASSURANCE

Each individual pane of heat strengthened or tempered glass must bear an identification label complying with ASTM C 1048.

Each individual pane of bullet-resistant glass or acrylic sheet must bear an identification label of performance complying with UL 752 or ASTM F 1233.

Safety glass must be permanently labeled under 24 CA Code of Regs Pt 2 § 2406.

PERFORMANCE REQUIREMENTS

Installed glazing systems must withstand normal thermal movement and wind and impact loads (where applicable) without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

PART 2 - PRODUCTS

General

Glass must be clear glass, unless otherwise shown on the plans, and comply with ASTM C 1036 and the following:

1. Tempered glass must comply with ASTM C 1048.
2. Heat strengthened glass must comply with ASTM C 1048.
3. Laminated glass must comply with ASTM C 1172.

Furnish glass thicknesses specified unless otherwise shown on the plans.

Acrylic sheets must comply with ASTM D 4802, Category A-1, Finish 3 (abrasion-resistant).

Polycarbonate sheets must comply with ASTM C 1349, Appendix X1, Type II (mar-resistant).

Glazing

Tempered Glass: Tempered glass must be Kind-FT, Condition-A, Type 1, Class 1, and Quality-Q3 glass.

Spandrel glass: Spandrel glass shall be heat-treated, (tint) float glass with a ceramic backing. Glass shall be dark navy blue spandrel, heat-treated in accordance with ASTM Designation: C 1048.

Insulating Glass Assemblies:

Float Glass (Exterior Storefront): Factory-assembled insulating glass unit assemblies consisting of sealed lites of glass separated by a dehydrated interspace, and consisting of 1-inch units with 1/2-inch airspace and two 1/4-inch tempered glazed lites; interior lite clear unless otherwise noted on plans (spandrel).

1. Tint Color: PPG Solarban 60 Solar Control Low E- clear
2. Thickness: 1/4-inch
3. Interlayer Color: Clear
4. Visible Light Transmittance: 70 percent minimum.
5. Winter Nighttime U-Factor: 0.29 maximum.
6. Summer Daytime U-Factor: 0.27 maximum.
7. Solar Heat Gain Coefficient: 0.33 maximum.
8. Shading Coefficient: 0.42 maximum

Float Glass (Exterior Window): Factory-assembled insulating glass unit assemblies consisting of sealed lites of glass separated by a dehydrated interspace, and consisting of 1-inch units with 1/2-inch airspace and two 1/4-inch lites; interior lite clear unless otherwise noted on plans.

1. Tint Color: PPG Solarban 60 Solar Control Low E- clear
2. Thickness: 1/4-inch
3. Interlayer Color: Clear
4. Visible Light Transmittance: 70 percent minimum.
5. Winter Nighttime U-Factor: 0.29 maximum.
6. Summer Daytime U-Factor: 0.27 maximum.
7. Solar Heat Gain Coefficient: 0.33 maximum.
8. Shading Coefficient: 0.42 maximum

Acrylic Plastic Sheet: Acrylic sheet must be Category A-2, Finish 3, with abrasion resistant surface coating, and at least 92 percent luminous transmission and less than 1 percent haze under ASTM D 1003.

Miscellaneous Materials: Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels must be top grade, commercial quality, complying with the glass or sheet manufacturer instructions and complying with GANA *Glazing Manual* and the IGMA *North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use*.

PART 3 - EXECUTION

GENERAL

Safety glass must be installed under 24 CA Code of Regs Pt 2 § 2406.

INSTALLATION

Glazing must be installed under the GANA *Glazing Manual* and the IGMA *North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use*.

Cut edges of tinted glass must comply with the glass manufacturer's instructions. The glazier must inspect each edge of tinted glass. Panes with edges that do not comply with the manufacturer's standards for tinted glass edges for sunny elevations will not be allowed.

Panes must be bedded fully and evenly, set straight and square within panels so that the pane is entirely free of any contact with metal edges and surfaces.

For panes on the exterior of buildings, the glazing on both sides of the panes must provide a watertight seal and watershed. Seals must extend no more than 1/16-inch beyond the holding members. A void must be left between the vertical edges of the panes and the glazing channel. Weep systems must be provided to drain condensation to the outside.

Panes in assemblies using extruded gasket glazing must be set under the assembly manufacturer's instructions using gaskets and stops supplied by the manufacturer.

Laminated glass must be set on setting blocks.

Whenever welding or burning of metal is in progress within 15 feet of glazing materials, a protective cover must be provided over exposed surfaces.

REPLACEMENT AND CLEANUP

Panes must be kept clean of cement and plaster products, cleansers, sealants, tapes and all other foreign material that may cause discoloration, etching, staining, or surface blemishes to the materials.

Excess sealant left on the surface of the glass or surrounding materials must be removed during the work life of the sealant.

Solvents and cleaning compounds must be chemically compatible with materials, coatings and glazing compounds. Cleaners must not have abrasives that scratch or mar the surfaces.

The protective covering on plastic sheet surfaces must not be removed until construction is completed or 2 weeks after glazing, whichever is shorter. The covering must be removed before adhesives dry sufficiently to adhere to the sheet during removal rather than the protective membrane.

Acrylic plastic sheets must be protected against scuffs, scratches and marring of the surface during construction and any such damaged sheet must be replaced or restored to like new condition. Restoration work must comply with the manufacturer's instructions.

All broken, scratched, or cracked glass must be replaced before Contract acceptance.

Paint, dirt, stains, labels , and surplus glazing compound must be removed without scratching or marring the surface of the panes or metal work, except do not remove etched labels.

12-8.11 MIRRORS (MONOLITHIC)

PART 1.- GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing monolithic glass mirrors in accordance with the manufacturer's installation guidelines and these special provisions.

SUBMITTALS

Product data: Manufacturer’s descriptive data including description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

Working Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

Samples: Mirror clips and trim.

DELIVERY, STORAGE AND HANDLING

Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

PROJECT CONDITIONS

Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

WARRANTY

Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

Warranty Period shall be for 10 years from project date of completion.

PART 2.- PRODUCTS

MATERIALS

Silver Flat Glass Mirrors:

Number 1 quality, 1/4 inch thick, electrolytically copper plated float or plate glass mirror with non-moisture absorbing filler.

Miscellaneous Materials:

Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

Mirror Hardware:

Bottom Aluminum J-Channel: Clear, bright anodized Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 inch and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.

Mirror Top Clips: Metal polished chrome as recommended per manufacturer with capability of receiving one fastener per clip.

Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

Anchors and Inserts: Provide devices as required for mirror hardware installation.

Fabrication:

Mirror Sizes: Cut mirrors to final sizes and shapes as shown on plans. Field verify size prior to fabrication.

Mirror Edge Treatment: Rounded polished. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

PART 3.- EXECUTION

INSTALLATION

General:

Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.

Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced. Clip spacing as per manufacturers installation requirements.

Install mastic as follows: Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

FIELD QUALITY CONTROL

Cleaning and Protection: Protect mirrors from breakage and contaminating substances resulting from construction operations. Do not permit edges of mirrors to be exposed to standing water. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

12-8.12 ALUMINUM CURTAIN WALL SYSTEM

PART 1.- GENERAL

SCOPE

This work shall consist of furnishing and installing an aluminum curtain wall system in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION

Aluminum curtain wall system shall include frames, glazing accessories, fasteners, frame anchors, and such other components, not mentioned, but required for a rigid, secure, weatherproof, and complete assembly and installation.

Glazing shall conform to the requirements specified under "Glazing" in Section 12-8, "Doors and Windows," of these Special Provisions.

General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

Glazed Aluminum Curtain Walls:

Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

Failure also includes the following:

Thermal stresses transferring to building structure.
Glass breakage.
Noise or vibration created by wind and thermal and structural movements.
Loosening or weakening of fasteners, attachments, and other components.
Failure of operating units.

Wind Load:

The curtain wall system shall be designed to withstand a 40 pound per square foot wind load in either direction without exceeding specified deflection limits and an allowable stress with a safety factor of 1.65 when tested in accordance with ASTM Designation: E 330, or verified by design calculations.

Deflection of Framing Members.-- Limited to 1/240 or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

Deflection Normal to Wall Plane.--Limit to 1/175 of clear span for spans up to 13 feet and to 1/240 of clear span spans greater than 13 feet.

Deflection Parallel to Glazing Plane.--Limit to 1/360 of clear span or 1/8-inch, whichever is smaller.

Thermal Movements: System shall allow for thermal movements resulting from the following maximum change (range) of 20 °Fto180 °F, in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Miscellaneous Performance Requirements: The system shall conform to the following performance requirements:

Test	Description	Specification	Remarks
ASTM E 283	Air infiltration	0.06 cubic feet per minute per square foot of fixed area.	
ASTM E 331	Water Penetration under Static Pressure	No water penetration at a test pressure of 10.0 pounds per square foot.	
AAMA 1503	Condensation-Resistance Factor (CRF)	Not Less Than 53	System
AAMA 1503	Thermal Conductance	0.69 Btu/sq. ft. x h x °F	System
ASTM E 90	Noise Reduction	Minimum STC=32	System

SUBMITTALS

Product Data: Manufacturer's descriptive data, a detailed list of glazing materials, and installation instructions shall be submitted for approval.

Samples: Three samples for each of the following materials shall be submitted for approval. Material samples shall include a glass sample not less than 6 inch square, frame samples of perimeter and intermediate mullion not less than 12 inch in length, and fastener samples of each type of fastener to be used in the installation.

Working drawings:

Working drawings and design calculations for fabrication and installation of window framing shall be submitted for approval. Working drawings shall include elevations, detailed sections, anchorages, and glazing details.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The expiration date of the registration shall be shown.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit pProduct data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

Certificates of Compliance: Certificates of Compliance shall be furnished for aluminum curtain wall system in accordance with the requirements specified under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Single Source Responsibility: Curtain wall, entrance doors, and accessories shall be obtained fabricated and installed from a single manufacturer.

DELIVERY, STORAGE AND HANDLING

General:

Framing members shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling. Covers shall be provided to protect the materials from corrosion.

Framing members shall be handled in such a manner as to prevent damage due to bending and warping.

PROJECT CONDITIONS

Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

WARRANTY

Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Noise or vibration caused by thermal movements.
3. Deterioration of metals and other materials beyond normal weathering.
4. Water leakage through fixed glazing and framing areas.
5. Failure of operating components to function properly.

Warranty Period: 10 years from date of contract acceptance.

PART 2.- PRODUCTS

METALS

Available Manufacturers: Subject to compliance with performance and aesthetic requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

CMI Architectural Products, Inc;
Kawneer North America;
Oldcastle Inc.;
or equal.

Aluminum: Alloy and temper recommended by manufacturer for type of use and finish to meet performance requirements.

Sheet and Plate.--ASTM B 209M.
Extruded Bars, Rods, Profiles, and Tubes.--ASTM B 221M.
Extruded Structural Pipe and Tubes.--ASTM B 429.
Structural Profiles.--ASTM B 308/B 308M.
Welding Rods and Bare Electrodes.--AWS A5.10/A5.10M.
Finish: High-Performance Organic Finish (3-Coat Fluoropolymer): Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

Steel Reinforcement: Manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

Structural Shapes, Plates, and Bars.--ASTM A 36/A 36M.
Cold-Rolled Sheet and Strip.--ASTM A 1008/A 1008M.
Hot-Rolled Sheet and Strip.--ASTM A 1011/A 1011M.

FRAMING SYSTEMS

Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

Construction: Framing members are one-piece members that are internally slotted at regular intervals.

Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices. Reinforce members as required to receive fastener threads.

Concrete Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

GLAZING

Glazing seals, compounds, setting blocks, shims, tapes, and spacers:

Glazing seals, compounds, setting blocks, shims, tapes, and spacers shall conform to the requirements specified under "Glazing" in Section 12-8, "Doors and Windows," of these special provisions.

Anchors, accessories, and fasteners:

Anchors, accessories and fasteners shall be noncorrosive metals compatible with aluminum and steel. Exposed finish shall match adjacent surfaces.

ACCESSORY MATERIALS

Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified under "Caulking and Sealants," in Section 12-8, "Thermal and Moisture Protection," of these special provisions.

Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

PART 3.- EXECUTION

Installation:

Aluminum curtain wall system shall be installed in accordance with the manufacturer's instructions, the approved working drawings, the details shown on the plans and these special provisions.

All broken, scratched, or cracked glass must be replaced before Contract acceptance.

Frames shall be installed rigidly, securely, plumb and true. Frames shall be isolated from dissimilar metals and cementitious materials which could corrode or otherwise damage the frames. Installations shall be sealed watertight and weathertight. Backer rod shall be installed behind all sealant.

Clean-up: All panes shall be cleaned just before the final inspection. Paint, dirt, stains, labels (except etched labels), and surplus glazing compound shall be removed without scratching or marring the surface of the panes or metal work.

SECTION 12-9. FINISHES

12-9.01 GYPSUM WALLBOARD

PART 1 – GENERAL

Scope: This work shall consist of furnishing, installing and finishing gypsum wallboard in accordance with the details shown on the plans and these special provisions.

Where assembly fire ratings are indicated on the plans, construction shall provide the fire resistance in accordance with the applicable standards in the Fire Resistance Design Manual published by the Gypsum Association.

Wallboard backing for use in restroom and shower areas shall be specifically manufactured to be resistant to mold, mildew, and moisture or shall be cementitious backer panels. Conventional water-resistant gypsum backing board (greenboard) shall not be used. Use mold and moisture resistant joint tape and compound with this gypsum board.

Provide gypsum wallboard that is specifically manufactured to be resistant to mold, mildew, and moisture. Use mold and moisture resistant joint tape and compound.

SUBMITTALS

Submit product data for mold, mildew, and moisture resistant gypsum wallboard, joint tape, and joint and finish compound.

Submit test reports of performance under ASTM D 3273 and ASTM D 3274.

Submit product data for other gypsum wallboard, joint tape, and joint and finish compound.

LEED Submittals:

MR Credit 4, Recycled Content: Submit product data and certification letter documenting post-consumer and pre-consumer recycled content; worksheets documenting each item's cost, percentage recycled content, recycled content value, and total recycled content value as a percentage of total materials cost.

MR Credit 5: MR Credit 5, Regional Materials: Submit product data for regional materials indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.2, Low-Emitting Materials – Paints and Coatings: Submit product data for paints and coatings to be used on-site and inside the building weatherproofing system, indicating product name, manufacturer's generic description, chemical composition, and VOC content.

LEED Provisions:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use regional mateials to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: For interior application (inside the weatherproofing system and applied on-site), use wallboard sealers and coatings that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

Gypsum Wallboard: Gypsum wallboard, except mold-, moisture-, and water-resistant gypsum board, shall conform to ASTM Designation: C 1396.

Mold, Mildew, and Moisture Resistant Gypsum Board: Mold, mildew, and moisture resistant gypsum board must achieve a minimum mold resistance rating of 10 when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Provide one of the following types:

1. Glass mat water-resistant gypsum panel, with glass mat facings and water-resistant fiber-reinforced gypsum core, complying with ASTM C 1658/C 1658M; Georgia-Pacific DensArmor Plus Fireguard Paperless Interior Drywall, or equal.

2. Fiber-reinforced, water-resistant gypsum panel, unfaced with water-resistant core, complying with ASTM C 1278/C 1278M; US Gypsum Fiberock Aqua-Tough Interior Gypsum Panel, or equal.

3. Gypsum panel with paper faces treated with an antimicrobial agent and containing core additives to add resistance to mold, mildew, and moisture, complying with ASTM C 1396/C 1396M; National Gypsum Gold Bond XP Fire Shield Gypsum Wallboard, or equal.

Gypsum board, including mold, mildew, and moisture resistant gypsum board, must be Type X, of thickness as shown on the plans, with tapered edges.

Joint Tape and Joint and Finishing Compound: Joint tape and joint and finishing compound shall conform to ASTM Designation: C 475.

Mold and Moisture Resistant Joint Tape and Joint and Finishing Compound: Conform to ASTM C 475.

1. Joint Tape: Glass mesh or as recommended by gypsum board manufacturer.

2. Joint Compound: Setting-type joint compound or as recommended by gypsum board manufacturer. Compound must be rated 10 when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274.

Corner Beads, Metal Trim and Control Joints: Corner beads, metal trim and control joints shall be galvanized steel of standard manufacture.

Resilient Metal Channel: Resilient metal channel shall be galvanized sheet steel channels of standard manufacture for reducing sound transmission in wood frame partitions.

Fasteners: Fasteners shall be gypsum wallboard nails conforming to ASTM Designation: C 514 or steel drill screws conforming to ASTM Designation: C 1002.

PART 3 - EXECUTION

DELIVERY AND STORAGE

Materials shall be delivered in original packages, containers or bundles bearing brand name, applicable standard of manufacture, and name of manufacturer or supplier and shall be kept dry and fully protected from weather and direct sunlight exposure. Gypsum wallboard shall be stacked flat with adequate support to prevent sagging or damage to edges, ends and surfaces.

INSTALLATION

Wallboard panels to be installed on ceilings and soffits shall be installed with the long dimension of the panels perpendicular to the framing members. Wallboard panels to be installed on walls may be installed with the long dimension of the panels either parallel or perpendicular to the framing members. The direction of placing the panels shall be the same on any one wall or partition assembly.

Edges of wallboard panels shall be butted loosely together. All cut edges and ends shall be smoothed as needed for neat fitting joints.

All edges and ends of gypsum wallboard panels shall coincide with the framing members, except those edges and ends which are perpendicular to the framing members. End joints on ceiling and on the opposite sides of a partition assembly shall be staggered.

Except where closer spacings are shown on the plans, the spacing of fasteners shall not exceed the following:

Nails	7 inches
Screws	12 inches
Screws at perimeter of panels for fire resistive assemblies having metal framing	8 inches

Type S steel drill screws shall be used to fasten wallboard to metal framing. Nails or Type W steel drill screws shall be used to fasten wallboard to wood framing. Except as shown on the plans, screws shall not be used in fire resistive assemblies.

Adhesives shall not be used for securing wallboard to framing.

Gypsum wallboard panels shown on the plans for shear wall sheathing or for fire resistive assemblies shall be fastened to all framing members. Gypsum wallboard panels at other locations and gypsum wallboard finish over plywood sheathed shear walls shall be fastened to all framing members except at the following locations:

At internal angles formed by ceiling and walls; ceiling panels shall be installed first with the fasteners terminating at a row 7 inches from the walls, except for walls parallel to ceiling framing. Wall panels shall butt the ceiling panels. The top row of wall panel fasteners shall terminate 8 inches from the ceiling.

At internal vertical angles formed by the walls; fasteners shall not be installed along the edge or end of the panel that is installed first. Fasteners shall be installed only along the edge or end of the panel that butts and overlaps the panel installed first.

Fasteners shall be located at least 3/8 inch from wallboard panel edges and ends. Nails shall penetrate into wood framing at least 1 1/8 inches. Screws shall penetrate into wood framing at least 5/8 inch. All metal fasteners shall be driven slightly below surface level without breaking the paper or fracturing the core.

Metal trim shall be installed at all free edges of panels, at locations where wallboard panels abut dissimilar materials and at locations shown on the plans. Corner beads shall be installed at external corners. Control joints shall be installed at the locations shown on the plans.

Joints between face panels, the internal angles formed by ceiling and walls and the internal vertical angles formed by walls shall be filled and finished with joint tape and at least 3 coats of joint compound. Tape in the corners shall be folded to conform to the angle of the corner. Tape at joints and corners shall be embedded in joint compound.

Dimples at nail and screw heads, dents, and voids or surface irregularities shall be patched with joint compound. Each patch shall consist of at least 3 coats and each coat shall be applied in a different direction.

Flanges of corner beads, control joints and trim shall be finished with a least 3 coats of joint compound.

Each coat of joint compound shall be feathered out onto the panel surface and shall be dry and lightly sanded before applying the next coat. The finished surfaces of joint compound at the panel joints, internal angles, patches and at the flanges of trim, corner beads and control joints shall be flat and true to the plane of the surrounding surfaces and shall be lightly sanded.

Good lighting of the work area shall be provided during the final application and sanding of the joint compound.

Gypsum wallboard used as backing boards for tile or rigid sheet wall covering or wainscotting shall be mold, mildew, and moisture resistant. Joints in backing board shall not be taped or filled and dimples at the fastener heads shall not be patched. Edges of cuts and holes in backing board shall be sealed with a primer or sealer that is compatible with the wall covering or wainscotting adhesive to be used.

Surfaces of wallboard to be textured shall receive an orange peel texture, unless otherwise shown on the plans.

12-9.02 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

PART 1 – GENERAL

Scope: This work shall consist of furnishing, installing and finishing gypsum board shaft-wall assemblies in accordance with the details shown on the plans and these special provisions.

Where assembly fire resistance ratings are indicated on the plans, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

SUBMITTALS

Submit product data for mold, mildew, and moisture resistant gypsum wallboard, joint tape, and joint and finish compound.

Submit evaluation reports for shaft-wall assemblies from ICC-Evaluation Service.

LEED Submittals:

MR Credit 4, Recycled Content: Submit product data and certification letter documenting post-consumer and pre-consumer recycled content; worksheets documenting each item's cost, percentage recycled content, recycled content value, and total recycled content value as a percentage of total materials cost.

MR Credit 5: MR Credit 5, Regional Materials: Submit product data for regional materials indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.2, Low-Emitting Materials – Paints and Coatings: Submit product data for paints and coatings to be used on-site and inside the building weatherproofing system, indicating product name, manufacturer's generic description, chemical composition, and VOC content.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use regional materials to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: For interior application (inside the weatherproofing system and applied on-site), use wallboard sealers and coatings that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

Gypsum Board Shaft-Wall Assemblies**:**

1. Fire-Resistance Rating: 1 hour
2. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
3. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches.
4. Elevator Hoistway Entrance: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.
5. Room-Side Finish: Gypsum board.
6. Shaft-Side Finish: Gypsum shaftliner board

Panel Products:

1. Panel Size: Panel shall have maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
2. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M, manufacturer's proprietary fire resistive liner panels with paper faces, 1 inch thick, and double bevel long edges.
3. Gypsum Board: As specified in Section 12-9 "Gypsum Board."

Non-Load-Bearing Steel Framing:

1. Steel Framing Members: Comply with ASTM C 645 requirement for metal unless otherwise indicated.

Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 unless otherwise indicated.

Auxiliary Materials:

1. General: Auxiliary materials shall be provided in compliance with manufacturer's written recommendation.
2. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 12-9 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
3. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
4. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

PART 3 - EXECUTION

DELIVERY AND STORAGE

Materials shall be delivered in original packages, containers or bundles bearing brand name, applicable standard of manufacture, and name of manufacturer or supplier and shall be kept dry and fully protected from weather, condensation, direct sunlight exposure, construction traffic, and other potential causes of damage. Boards shall be stacked flat with adequate supported on risers on a plaform to prevent sagging or damage to edges, ends and surfaces.

EXAMINATION

Substrates shall be examined to which gypsum board shaft wall assemblies are attached with installer present, including hollow-metal frame, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

Panels shall be examined before installation. Panels shall be rejected that are wet, moisture damaged, or mold damaged.

Installation shall be process only after unsatisfactory conditions have been corrected.

INSTALLATION

Installation of gypsum board shaft wall assemblies shall comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.

Building expansion joints shall not be bridged with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

Supplementary framing shall be installed in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing:

Elevator Hoistway: At elevator hoistway entrance door frames, jamb struts shall be provided on each side of door frame.

Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

Perimeter of gypsum panels shall be isolated from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

Control Joints: Control joints shall be installed according to ASTM C 840 while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

Installation Tolerance: Each framing member shall be installed so fastening surfaces vary no more than 1/8 inch from the plane formed by faces of adjacent framing.
Interior products shall not be installed until installation areas are enclosed and conditioned.

Contractor shall not install gypsum board panels that are wet, moisture damaged, or mold damaged, including but not limited to discoloration, sagging, and irregular shape, and fussy or splotchy surface contamination.

PROTECTION

Installed products shall be protected from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

Wet, moisture damaged, or mold damaged gypsum panels shall be removed and replaced, including but not limited to discoloration, fuzzy or splotchy surface contamination, sagging, and irregular shapes.

12-9.03 CERAMIC TILE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing ceramic tile in accordance with the details shown on the plans and these special provisions.

Ceramic tile shall include glazed wall tile, patterned porcelain tile, matte porcelain tile, textured porcelain tile, polished porcelain tile, trim tile, setting materials, grouts and such other materials as maybe required for a complete installation.

SUBMITTALS

Product Data:

Manufacturer's descriptive data, a list of materials to be used, and installation instructions for all materials required for the work shall be submitted for approval.

Manufacturer’s descriptive data shall be submitted for each type of tile, mortar bed materials, bond coat materials and additives, and grout materials and additives.

Materials list and installation instructions shall include all products and materials to be incorporated into the work.

Friction reports shall be submitted for tile products to be used on floors and other pedestrian surfaces.

Samples: Samples shall include 2 individual samples of each type and color of tile and trim to be installed and shall be of the same size, shape, pattern and finish as the tile and trim to be installed.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.3, Low-Emitting Materials—Flooring Systems: Submit the following:

1. Product data for tile setting adhesives and grout.
2. Certification of compliance with referenced standards:

    Tile Setting Adhesives and Grout: SCAQMD rules under IEQ Credit 4.1.

QUALITY ASSURANCE

Single Source Responsibility: Each type and color of tile, grout and setting materials shall be obtained from a single source.

Master Grade Certificates: Each shipment of tile to the project site shall be accompanied by a Master Grade Certificate issued by the tile manufacturer.

Certificates of Compliance: Certificates of compliance shall be furnished for bond coat materials, setting bed materials and grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.3, Low-Emitting Materials—Flooring Systems: Provide flooring materials which comply with the following standards. Comply with local requirements if more stringent.

1. Tile setting adhesives and grout: VOC complying with IEQ Credit 4.1.

DELIVERY, STORAGE AND HANDLING

Delivery: Tile and packaged materials shall be delivered to the job site in sealed, unbroken, unopened containers with the labels intact. Tile containers shall bear the Standard Grade label.

Storage and Handling: Materials shall be stored and handled in such a manner as to prevent damage or contamination by water, freezing or foreign matter.

PROJECT CONDITIONS

Protection: Tile work shall be protected and environmental conditions maintained during and after installation to comply with the reference standards and manufacturer's printed instructions.

Temperatures:

Unless otherwise specified in the manufacturer's installation instructions, the ambient temperature shall be maintained at not less than 50°F nor more than 100°F in tiled areas during installation and for 7 days after completion. Exterior work areas shall be shaded from direct sunlight during installation.

Tile shall not be installed when the temperature of the substrate is greater than 90°F or is frost covered.

Illumination: Interior work areas shall be illuminated to provide the same level and angle of illumination as will be available during final inspection.

PART 2 - PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with the specifications, tile shall be American Olean Tile Co., Inc.; United States Ceramic Tile Co.; Daltile; Crossville, Inc.; or equal.

GENERAL

Ceramic Tile:

Ceramic tile shall conform to the requirements in ANSI Standard: A137.1, "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.

Ceramic tile shall conform to the "Standard Grade" requirements.

Tile Installation Materials: Tile installation materials shall conform to the requirements in ANSI A108/A118/A136.1 with products and materials indicated for setting and grouting.

Tile Color and Size: Tile color shall be as shown on the plans; tile size shall be as indicated in the Schedule elsewhere in this special provision.

Slip Resistant Tile: Slip resistant tile shall have sufficient abrasives added such that the static coefficient of friction, wet or dry, shall be not less than 0.6 for walking surfaces and 0.8 for ramps when tested in accordance with ASTM Designation: C 1028.

TILE PRODUCTS

Glazed Wall Tile:

Glazed wall tile shall be machine made, dust pressed white body clay, and shall have a glossy glaze finish, plain face, and cushion edges. Tile shall be 5/16-inch nominal thickness.

Ceramic tile trim shall match material, size and finish of field tile. Free edges of tiled areas of walls shall have bullnose type trim. Outside corners shall have bullnose type runner trim (not beads). Reentrant corners shall have cove type trim.

Patterned Porcelain Tile:

Patterned porcelain tile shall be machine made, unpolished, dust pressed natural porcelain clay. Tiles shall have less than 0.5 percent water absorption and be suitable for exterior use. Tiles shall be 3/8-inch nominal thickness. Patterned porcelain shall be slip resistant.

Tile shall have truncated domes, 0.90-inch diameter, 0.20-inch nominal height, and center to center spacing of 2.35 inches. Arrangement of the domes shall be such that there is no break in pattern or spacing when tiles are arranged side by side.

Matte Porcelain Tile:

Matte porcelain tile shall be machine made, unpolished, dust pressed natural porcelain clay and shall have a plain face. Tile shall have a nominal thickness of 5/16 inch. Matte porcelain tile shall be slip resistant.

Matte porcelain trim tile shall include cove type base at walls and single piece intersecting cove base at corners.

Textured Porcelain Tile: Textured porcelain tile shall be machine made, unpolished, dust pressed natural porcelain clay. Tile shall have less than 0.5 percent water retention and be suitable for exterior use. Tiles shall have a nominal thickness of 5/16 inch. Textured porcelain tile shall be slip resistant.

Polished Porcelain Tile: Polished porcelain tile shall be machine made, dust pressed natural porcelain clay. Tile shall have less than 0.5 percent water absorption and be suitable for exterior use. Tile shall have a glossy polished finish and plain face. Tiles shall have a nominal thickness of not less than 5/16 inch.

SETTING MATERIALS

Portland Cement Mortar Installation Materials: Materials for portland cement mortar installation shall conform to the requirements in ANSI Standard: A108.1 as required for installation method designated, unless otherwise indicated.

Membrane: Membrane shall be a waterproof membrane recommended by the manufacturer for ceramic tile installation and complying with ANSI Standard: A118.10.

Reinforcement: Reinforcement shall be galvanized welded wire fabric with 2" x 2"-W0.3 x W0.3 conforming to ASTM Designations: A 82 and A 185 except for minimum wire size. Reinforcement shall be provided in flat sheets.

Metal Lath: Metal lath shall be self furring, galvanized, conforming to ASTM Designation: C 847, flat expanded type weighing not less than 2.5 pounds per square yard. Factory assembled metal lath and paper backing may be used where reinforcement over paper is shown on the plans.

Tile Bond Coat:

Tile bond coat shall be latex-portland cement bond coat.

Latex-portland cement mortar bond coat shall be a prepackaged mortar mix, conforming to ANSI Standard: A118.4, incorporating a dry acrylic resin, and to which only water is added at the job site. Mortar shall be suitable for exterior use and be labeled for the type of tile to be installed.

Epoxy Bond Coat: Epoxy bond coat shall be a 2 part prepackaged epoxy mortar conforming to ANSI Standard: A118.3, suitable for exterior use. Mortar shall be labeled for the type of tile to be installed.

GROUTING MATERIALS

Tile Grout:

Tile grout shall be latex-portland cement grout.

Latex-portland cement grout shall be a prepackaged grout mix, conforming to ANSI Standard: A118.6, incorporating a dry acrylic resin, and to which only water is added at the jobsite. Grout shall be suitable for exterior use and labeled for the type of tile to be installed.

Epoxy Grout: Epoxy grout shall be a 2 part prepackaged epoxy grout conforming to ANSI Standard: A118.3 and suitable for exterior use. Grout shall be labeled for the type of tile to be used.

Grout Pigment: Grout pigment shall be chemically inert, fade resistant mineral oxide or synthetic type. Color shall be as shown on the plans.

SEALANTS

Sealant:

Sealant for vertical expansion joints shall be a medium modulus silicone or polyurethane. Sealant for horizontal joints shall be a 2-part polyurethane type material with a Shore Hardness of 35 to 45.

Color of exposed sealants shall match color of grout in tile adjoining sealed joints.

MORTAR BEDS

Cement Mortar Bed:

Cement mortar bed for walls shall be proportioned of one part cement, ½ part hydrated lime, 6 parts damp sand by volume and only enough water to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than ¾ inch in thickness.

Cement mortar bed for floors shall be proportioned of one part cement, 1/10 parts hydrated lime, 5 parts damp sand by volume and only enough water added to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than 1¼ inches in thickness.

MISCELLANEOUS MATERIALS

Sand: Sand shall be a natural or manufactured sand conforming to ASTM Designation: C 144, except that no more than 10 percent shall pass the No. 100 sieve.

Sealers:

Sealer for unglazed quarry tile shall be water repellent, clear solution of ammonium cementitious compound, silicone base material, or other commercially manufactured sealer.

Sealer for grout shall be a penetrating proprietary compound designed for sealing grout. Silicone sealers shall not be used.

Cement: Cement shall conform to ASTM Designation: C 150, Type I.

Hydrated Lime: Hydrated lime shall conform to ASTM Designation: C 206, Type S, or ASTM Designation: C 207, Type S.

Water: Water shall be clean and potable.

Metal Edge Strips: Metal edge strips shall be stainless steel terrazzo strips, 1/8 inch wide at top edge with integral provision for anchorage to mortar bed or substrate.

Marble Thresholds:

Marble thresholds shall conform to the requirements in ASTM Designation: C 503 for exterior use and abrasion resistance for use in areas subject to heavy foot traffic.

Marble threshold shall be uniform in color and finish and fabricated to sizes and profiles shown on the plans or required to provide a smooth transition between tile surfaces and adjoining finished floor surfaces.

Cementitious Tile Backer Board: Cementitious backer board shall be a backing and underlayment panel composed of a concrete core with glass mesh reinforcing on both faces and conforming to the requirements of ANSI Standard: A118.9.

Shower Pan:

Shower pan shall be flexible polyvinyl chloride (PVC) sheeting conforming to ASTM Designation: D 4551, Grade 40, and manufactured for use as a shower membrane.

Solvent cement shall be as recommended by the manufacturer.

MIXING MORTAR AND GROUT

Mixing: Mortar and grout shall be mixed to comply with the requirements of referenced standards and manufacturers for accurately proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, and other procedures need to produce mortars and grout of uniform quality with optimum performance characteristics for application intended.

PART 3 - EXECUTION

PREPARATION

Concrete, mortar, or masonry substrate surfaces which are to receive a mortar bed shall not vary more than ¼ inch in 8 feet from the required plane and shall be true, plumb at vertical surfaces, and square at intersection edges.

Surfaces to receive a mortar setting bed or a bond coat shall be cleaned adequately to assure a tight bond to the applied material. Such cleaning shall leave the surface thoroughly roughened and free from laitance, coatings, oil, sand, dust and loose particles.

The cleaned surfaces which are to receive a mortar bed shall be saturated with water just prior to placing mortar or the cleaned surfaces shall be coated with fresh neat cement slurry. If the surface is saturated with water, excess water shall be removed and the wetted surfaces uniformly dusted with portland cement. The slurry or wetted cement dust shall be broomed to completely coat the surface with a thin and uniform coating just prior to placing the mortar.

Substrates shall be inspected to insure that grounds, anchors, plugs, recessed frames, bucks, drains, electrical work, mechanical work, and similar items in or behind the tile have been installed before proceeding with installation of the tiles.

INSTALLATION

Tile installation shall conform to applicable parts of ANSI 108 Series of the tile installation standards included under “American National Standard Specifications for the Installation of Ceramic Tile” and Tile Council of American, “Handbook for Ceramic Tile Installation.”

All tile shall be installed on a bond coat over a setting bed. The setting bed shall be a cured cement mortar bed or a prepared, dimensionally stable substrate of concrete, masonry, cementitious backer board, or other cementitious material.

The back face of the tile shall be free of paper, adhesives, fiber mesh, resins, or other materials affecting the bond of the tile to the bedding material.

Tile sheets shall have permanent edge bonding or temporary mounting materials on the exposed face. Water soluble or absorbent adhesives shall not be used for edge bonding. Temporary mounting materials shall allow observation during tile setting operations.

Tile work shall extend into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as shown on the plans. Work shall be terminated neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

Intersections and returns shall be accurately formed. Cutting and drilling of tile shall be performed without marring visible surfaces. Cut edges of tile abutting trim, finish or built-in items shall be carefully ground to produce straight aligned joints. Tile shall be closely fit to electrical outlets, piping, fixtures and other penetrations such that plates, collars, or covers overlap the tile.

Mortar Bed Placement:

The mortar bed, with or without reinforcement as shown on the plans, shall be placed, consolidated, and finished to the required thickness.

The surface of the mortar bed shall be true and pitched as shown on the plans, without high or low spots. The mortar bed surface shall not vary more than 1/8 inch in 8 feet from a plane parallel to the finished tile surface when tile is installed on a cured mortar bed.

In no case shall the allowed tolerances result in offsets between adjoining tiles, low spots on finished tile surfaces than can pond water, or finished tile surfaces that are not plumb or not true.

Pea gravel mortar shall be tightly compacted so as to fill all voids in the aggregate. Compaction shall be obtained using a stand-up wooden tamper weighing not less than 35 pounds or using a motor driven tamper and leveler.

Pea gravel mortar beds shall be damp cured under cover for not less than 72 hours at a temperature of not less than 70°F.

Cement mortar beds to receive a tile bond coat shall be damp cured under cover for a minimum of 48 hours at a temperature of not less than 70°F.

Cement mortar beds to receive an epoxy bond coat shall be damp cured under cover for a minimum of 96 hours at a temperature of not less than 70°F and allowed to dry thoroughly prior to setting tile.

Cementitious Backer Board: Cementitious backer board shall be installed in accordance with the provisions of ANSI Standard: A118.11.

Shower Pan:

Substrate shall be thoroughly cleaned prior to forming the shower pan. Drain shall be a bolt-down clamping ring type with weepholes, installed such that the lip of the drain is flush with the subfloor.

Shower pan shall be turned up for a distance of not less than 6 inches in room areas and 3 inches above curb level in curbed spaces, with sufficient material to fold over and fasten to outside face of curb. Corners shall be dog-earred and folded between pan and studs. Material shall only nailed in the top inch of the upstand.

Shower pan material shall be cut exactly to size of the drain opening, do not trim out to bolt holes, but pierce to accommodate bolts with a tight fit. Place adhesive or mastic between pan and subdrain.

Tile Bond Coat:

The tile bond coat mortar shall be mixed according to the manufacturer's recommendations. The consistency of the mixture shall be such that ridges formed with the recommended notched trowel shall not flow or slump. Reworking will be allowed provided no water or materials are added. The setting bed surfaces shall be dampened before placing the bond coat as necessary tile installation, but the setting bed shall not be soaked. The setting bed surfaces for epoxy bond coat shall be dry.

The bond coat shall be floated onto the cured mortar bed surface with sufficient pressure to cover the surface evenly with no bare spots. The surface area to be covered with the bond coat shall be no greater than the area that can be tiled while the bond coat is still plastic. The bond coat shall be combed with a notched trowel as recommended by the manufacturer within 10 minutes before installing tile. Tile shall not be installed on a skinned over bond coat.

Installing Tiles:

Tile shall be installed in accordance with the manufacturer's instructions and shall be set solid and shall be well bonded to the substrate.

Tile set on a tile bond coat shall be installed in accordance with ANSI Standard: A108.5, and tile set on an epoxy mortar shall be installed in accordance with ANSI Standard: A108.6.

If tiles are cut, the cuts shall be made with saws. Cut edges shall be rubbed with an abrasive stone to bring the edge of the glaze slightly back from the body of the tile. Cuts shall be accurately made to neatly fit the tile in place. Cut edges shall not be butted against other tile. Cut tile shall be at least half the size of a full size tile.

Tile shall completely cover wall areas behind mirrors and fixtures.

Tile shall be installed so that the finished tile surface does not vary more than 1/8 inch in 8 feet from the finished tile surface shown on the plans. In no case shall there be offsets in adjoining tiles, low spots on finished tile surfaces that can pond water, or finished tile surfaces that are not plumb or true in the completed tile work.

Tiles shall be firmly pressed into the freshly notched bond coat. Tile on interior surfaces shall be tapped and beat into a true surface and to obtain at least 80 percent coverage by the mortar on the back of each tile. Tile on exterior surfaces shall have 100 percent coverage and shall be back-buttered immediately prior to setting the tile.

If tile is face mounted, the paper and glue shall be removed within one hour after tile is installed and all tiles that do not meet the requirements for joints and surface tolerance shall be adjusted or replaced.

Mortar that exudes into the grout spaces between tiles shall be removed to the bottom of tile.

Joints: Joints between tile shall be continuous both vertically and horizontally. Joints shall be straight and of uniform and equal width. Where tiles on adjoining surface are the same size, the joints shall align, one with the other. Joint width shall be as recommended by the tile manufacturer.

Grouting Tile:

Grout shall be mixed, applied and cured in accordance with the manufacturer's recommendations and ANSI Standard: A108.10 for cement grout and ANSI Standard: A108.9 for epoxy grout.

Spacers, strings, ropes, pegs, glue, paper, and face mounting material shall be removed before grouting. Joints between glazed wall tile shall be wetted if they have become dry. Joints for epoxy mortar shall be dry.

Grouting shall not begin until at least 48 hours after installing tile.

A maximum amount of grout shall be forced into the joints between tiles in accordance with the manufacturer's recommendations. The grout shall be finished to the depth of the cushion for cushion edge tile and finished flush with the surface for square edge tile. All gaps and skips in the grout spaces shall be filled.

Mortar or mounting mesh shall not show through the grouted joints.

The finished grout shall have a uniform color and shall be smooth without voids, pinholes or low spots.

Expansion joints shall be kept free of grout or mortar.

Grout shall be protected from freezing or frost for a least 5 days after installation.

Expansion Joints:

Expansion joints shall be installed at the perimeter of all tile floors and at all substrate control joints and changes in the substrate material. Exterior expansion joint spacing shall not exceed 16 feet in any direction.

All expansion joints shall be made with sealant over backer rods. The thickness of sealant at the center of expansion joints shall not exceed the width of the joint. Joint edges shall be primed as recommended by the sealant manufacturer.

Edge Strips: Edge strips shall be installed at openings where the threshold has not been shown on the plans, but where tile floor abuts other flooring materials at the same level. Edge strips shall be installed centered under the closed door, or where there is no door, centered in the opening.

Sounding Tile: Tiled surfaces shall be sounded with a metal bar or chain for improperly bonded tile or setting bed. Tile or setting bed that emits a hollow sound shall be replaced.

Replacement: Cracked, chipped, broken, or otherwise defective tiles shall be removed and replaced. All tiles which differ more than 1/16 inch in elevation from adjacent tile edges shall be removed and replaced.

Curing:

After the installation of tile and the grouting of joints, the tile and grout shall be cured by keeping the surface continuously damp for at least 72 hours after grouting. Curing materials shall not stain the tile or grouted joints. Curing methods shall not erode away the grout.

After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours.

CLEANING AND PROTECTION

Cleaning Tile Surfaces:

All exposed tile surfaces shall be cleaned of all grout haze upon completion of grouting. Acids and chemicals used to clean tile shall conform to the tile manufacturer's recommendations. Cleaners shall not be harmful to materials on surfaces of abutting floors, walls, and ceilings. Tile work shall be rinsed thoroughly with clean water before and after using acid or chemical cleaners. After cleaning and rinsing, tile surfaces shall be polished using a soft cloth.

Tile work shall be cleaned and polished again immediately prior to completion of the contract. All dirt, grime, stains, paints, grease, and other discoloring agents or foreign materials shall be removed.

Protection:

After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours after.

Tile surfaces damaged by construction operations shall be retiled.

SCHEDULES

Wall Tile:

Wall tile shall be nominal 3" x 3" glazed wall tile.

Installation on mortar bed, using a tile bond coat and grout, shall conform to the requirements of Method W 222, "Handbook for Ceramic Tile Installation."

Installation on gypsum wallboard, using a tile bond coat and grout, shall conform to the requirements of Method W 243, "Handbook for Ceramic Tile Installation."

Installation on cementitious backer board, using a tile bond coat and grout, shall conform to the requirements of Method W 244, "Handbook for Ceramic Tile Installation."

Installation on concrete and masonry shall be on a mortar bed using tile bond coat and grout, and shall conform to the requirements of Method W 211, "Handbook for Ceramic Tile Installation."

Floor Tile: Floor tile shall be nominal 3" x 3" matte porcelain tile installed on a mortar bed using a tile bond coat and grout and shall conform to the requirements of Method F 112, "Handbook for Ceramic Tile Installation."

12-9.04 WOOD PANEL CEILING

PART 1 - GENERAL

Scope: This work consists of furnishing and installing wood veneer ceiling panels system including exposed grid suspension system, wire hangers, fasteners, main runners, cross tees, wall angle moldings and accessories in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION

Seismic Loads: Design and size components to withstand seismic loads in accordance with the California Building Code, Section 1621 for Category C.

SUBMITTALS

Manufacturer's descriptive data, installation instructions and 2 samples of the ceiling unit and suspension system shall be submitted for approval.

Samples: Minimum 3-1/2 inch x 5-1/2 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

Working Drawings: Layout and details of ceilings, showing locations of items which are to be coordinated with, or supported by the ceilings, shall be submitted for approval.

Certifications: Manufacturer's certifications that system complies with specified requirements:

1. For seismic performance: International Code Council Evaluation Report, ESR-1308.
2. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

Single Source Responsibility: Obtain tile through one source from a single manufacturer.

Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follow, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.

    a. Flame Spread: 25 or less
    b. Smoke Developed: 50 or less

2. HPVA (Hardwood Plywood and Veneer Association) certification and audit program per ASTM E 84 tunnel test.

Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.

Seismic Performance: Provide acoustical ceiling system that has been evaluated by an independent party and found to be compliant with the 2012 California Building Code, Seismic Category C.

1. Tested per International Code Council - Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components as evidence by International Code Council Evaluation Report, ESR-1308.

Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, and electrical systems.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

DELIVERY, STORAGE, AND HANDLING

Ceiling units shall be stored in a dry interior location in their cartons prior to installation to avoid damage, and shall be stored in a flat, horizontal position. The protector between the panels shall not be removed until installation.

Ceiling units must not be stored in unconditioned spaced with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Panel must not be exposed to extreme temperatures.

Ceiling units shall be handled carefully to avoid chipped edges or damage to units in any way.

PROJECT CONDITIONS

Wood veneer ceiling materials shall be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation. Plastic wrap shall be removed to allow panels to climatize.

The wood veneer panels shall not be installed in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.

The wood veneer panels shall be installed in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed and HVAC systems are functioning and will be in continuous operation. Relative humidity shall not fall below 25 percent or exceed 55 percent.

WARRANTY

Wood Veneer Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:

1. Ceiling Panels: Defects in materials or factory workmanship.
2. Grid System: Rusting and manufacturing defects.

Warranty Period:

1. Wood veneer panels: 1 year from date of installation
2. Grid: 10 years from date of installation

The Warranty shall not deprive Caltrans of other rights. Caltrans may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

WOOD VENEER CEILING UNITS

Ceiling panels Type AP-1:

1. Surface Texture: Smooth
2. Composition: Wood
3. Finish: Manufacturer's standard natural veneer
4. Species: Constants Cherry

5. Perforations:

   5.1. Hole size: 1/4 inch
   5.2. On center spacing: 7/8 inch
   5.3. Percent open area: 4.7

6. Size: 24" x 24" x 3/4"
7 Edge Profile: Square to interface with 9/16 inch dimensional Tee
8. Edge Banding and Trim: To match face veneer
9. Noise Reduction Coefficient (NRC): ASTM C 423; 0.40
10. Ceiling Attenuation Class (CAC): ASTM C 1414; 28
11. Flame Spread: ASTM E 1264; Class A (HPVA)
12. Dimensional Stability: Standard

Accessories:

1. Fiberglass Infill Panel
2. Edge Banding for field-modified panels: 1/2 inch wide Constants Cherry pre-finished pressure sensitive adhesive banding

SUSPENSION SYSTEMS

Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized steel, as per ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

1. Structural Classification: ASTM C 635 HD.
2. Color: Gun Metal Grey
3. Represented Systems: 9/16" dimensional tee system

Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12-gage.

Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

PART 3 - EXECUTION

EXAMINATION

Installation shall not proceed until all wet work has been completed and thoroughly dried out

PREPARATION

Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

INSTALLATION

Install suspension system and panels in accordance with the California Building Code, Section 1621, except as noted in Section 4.4.3.2 of ESR-1308, and with the authorities having jurisdiction.

ESR-1308, Section 4.4.3.2, Seismic Design Category C Installation:

1. Terminal ends of the runners are secured by attaching the BERC clip to the wall molding and attaching the runners to the BERC clip. The runners have zero clearance at the perimeter on two adjacent walls and with 3/8-inch clearance on the opposite walls. The clip is attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding. BERC clips installed in this manner are an acceptable means of preventing runners from spreading, in lieu of spacer bars required in CISCA 0-2, which is referenced in ASCE 7, Section 9.6.2.6.2.1, which is referenced in IBC Section 1621. Except for the use of the BERC clip as noted above, installation of the ceiling system must be as prescribed by the applicable code. Maximum ceiling weight permitted is 3.35 pounds per square foot. This construction is equivalent to that required by CISCA 0-2, which is referenced in ASCE-7, Section 9.2.6.2.1, and which is referenced in IBC Section 1621.

Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

ADJUSTING AND CLEANING

Replace damaged and broken panels.

Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

12-9.05 DETECTABLE WARNING SURFACE

PART 1 - GENERAL

SUMMARY

This work includes furnishing and installing detectable warning surfaces.

DEFINITIONS

Not Used

SUBMITTALS

Submit manufacturer's descriptive data, color and texture samples, installation instructions, and warranty documentation. Submit 2 samples, each at least 6" x 6".

QUALITY CONTROL AND ASSURANCE

Regulatory Requirements:

1. 2010 Americans with Disabilities Act Standards and 2004 Americans with Disabilities Act Guidelines, 705 "Detectable Warnings").
2. 2010 California Building Code (California Code of Regulations (CCR) Title 24, Part 2), Section 1102B Definition of "Detectable Warning," Section 1127B.7 "Detectable Warnings," and Section 1133B.8.5 "Detectable Warnings at Hazardous Vehicular Areas."
3. 2010 California Referenced Standards Code (CCR Title 24, Part 12), Chapter 12-11B "Building and Facility Access Specifications."

WARRANTY

Provide a warranty against material and installation deficiencies of the detectable warning surface. Warranty period shall be for 5 years from the date of acceptance of the work. Deficiencies include defective work, breakage, loosening of surface panels, and others as specified below. Detectable Warning product must ensure

consistency and uniformity in shape, color fastness, conformation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for at least 5 years. Significant degradation means that the product cannot maintain at least 90 percent of its approved design characteristics.

PART 2 - PRODUCTS

Detectable warning surfaces must be listed on the Department's Pre-Qualified Products List.

Detectable warning surfaces must be prefabricated, flush mounting, truncated dome panels. Dimensions and spacing must be as shown on the plans. The color of the detectable warning must be yellow complying with FED-STD-595, Color No. 33538.

Adhesives, fasteners, and sealant must comply with the manufacturer's instructions.

DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site in the manufacturer’s original and unopened containers that bear labels showing type of material. Package finished surfaces with protective wrappings to protect panels from residue before and during installation.

PART 3 - EXECUTION

Securely install the detectable warning surfaces under the manufacturer's installation instructions.

12-9.06 RUBBER TILE FLOORING

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing resilient flooring in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, color and pattern samples shall be submitted for approval. Samples of tile shall be 24" x 24" in size.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.3, Low-Emitting Materials—Flooring Systems: Submit manufacturer's certification that resilient floor covering is FloorScore certified.

PROJECT CONDITIONS

Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 °F or more than 85 °F in spaces to receive floor coverings during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

Until project completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 °F or more than 95 °F.

Close spaces to traffic during floor covering installation.

Close spaces to traffic for 48 hours after floor covering installation.

Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 – PRODUCTS

Available Manufacturers: Subject to compliance with performance and aesthetic requirements, manufacturers offering products that may be incorporated into the Work include the following:

Burke Mercer Flooring Products, Division of Burke Industries Inc.
Mondo Rubber International, Inc.
PRF USA, Inc.
Roppe Corporation, USA
or equal.

Tile Standard: ASTM F 1344 Class 1-B, homogeneous rubber tile, through mottled.

Hardness: Not less than 85 as required by ASTM F 1344 measured using Shore, Type A duronometer per ASTM D 2240.

Wearing Surface: Smooth.

Thickness: 0.125 inch.

Size: 18 or 36 inch square, varies with pattern and manufacturer.

Colors and Patterns: As selected by Engineer from full range of industry colors.

Slip Resistant Flooring: Slip resistant flooring shall have sufficient abrasives added such that the static coefficient of friction, wet or dry, shall be not less than 0.6 for walking surfaces and 0.8 for ramps when tested in accordance with ASTM Designation: D 2047.

INSTALLATION MATERIALS

Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

Adhesives: Water-resistant type recommended by manufacturer to suit flooring and substrate conditions indicated.

Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

PART 3 - EXECUTION

EXAMINATION

Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

PREPARATION

Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

Concrete Substrates: Prepare according to ASTM F 710 "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring."

Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

APPLICATION

Comply with manufacturer's written instructions for installing flooring.

Lay out flooring from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

Lay flooring square with room axis.

Match flooring material for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

Lay flooring with grain running in one direction.

Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

CLEANING AND PROTECTION

Comply with manufacturer's written instructions for cleaning and protection of floor tile.

Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.
4. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

12-9.07 RESILIENT BASE

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing resilient base in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, color palette, and samples of resilient base shall be submitted for approval. Samples shall be not less than 2 inches in length.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.3, Low-Emitting Materials—Flooring Systems: Submit the following:

1. Product data for wall base.
2. Certification of compliance with referenced standards:

   Wall Base: FloorScore.

3. Test results and certificate of compliance with testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.3, Low-Emitting Materials—Flooring Systems: Provide flooring materials which comply with the following standards. Comply with local requirements if more stringent.

1. Wall Base: FloorScore.

IEQ Credit 4.3, Low-Emitting Materials—Flooring Systems: Provide flooring materials which comply with the California Department of Public Health Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

PART 2 - PRODUCTS

Resilient Base: Resilient base shall be manufacturer's best grade, rubber or vinyl base, with premolded internal and external corner pieces. The height and color shall be as shown on the plans.

Adhesive: Adhesive shall be as recommended by base manufacturer.

PART 3 - EXECUTION

INSTALLATION

Bases shall be firmly and totally attached to walls with adhesive and shall be accurately scribed to trim, molding and cabinets. All joints shall be tight fitting. Bases between premolded corners or other termini may be installed continuous or installed using 4-foot minimum standard manufactured lengths. Filler pieces shall be not less than 18 inches.

12-9.08 CARPET TILE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing carpet tile, and installation accessories in accordance with the details shown on the plans and these special provisions.

Carpeting and carpeting materials shall be rated by the manufacturer as suitable for heavy pedestrian traffic and as suitable for use under chairs with casters.

SUBMITTALS

Product Data: Provide data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, and method of installation.

Manufacturer’s Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.

Samples: Carpet colors will be selected from the manufacturer's standard color and pattern line by the Engineer. After the color and pattern have been selected, one sample of carpet and carpet cushion at least 24" x 24" in size shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or

recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MR Credit 6, Rapidly Renewable Materials: For materials with rapidly renewable content, submit product data, qualifying percentage by weight, item cost, and cost attributable to rapidly renewable materials.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit pProduct data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

IEQ Credit 4.3, Low-Emitting Materials – Flooring Systems: Submit the following:

1. Product data for carpet, carpet cushion, and carpet adhesive.
2. Certification of compliance with referenced standards:

    2.1. Carpet: Carpet and Rug Institute Green Label Plus.
    2.2. Carpet Cushion: Carpet and Rug Institute Green Label.
    2.3. Carpet Adhesive: Complying with VOC limits under IEQ Credit 4.1.

3. Test results and certificate of compliance with testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

QUALITY ASSURANCE

Single Source Responsibility: Materials shall be produced by a single manufacturer for each type of carpet.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.3, Low-Emitting Materials—Flooring Systems: Provide flooring materials which comply with the following standards. Comply with local requirements if more stringent.

1. Carpet: Carpet and Rug Institute Green Label Plus.
2. Carpet cushion: Carpet and Rug Institute Green Label.
3. Carpet adhesive: VOC complying with IEQ Credit 4.1.

IEQ Credit 4.3, Low-Emitting Materials—Flooring Systems: Provide flooring materials which comply with the California Department of Public Health Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

QUALITY ASSURANCE

Single Source Responsibility: Materials shall be produced by a single manufacturer for each type of carpet.

Installer Qualifications: Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials.

Regulatory Requirement: Materials shall comply with CBC Section 1124B.3.

WARRANTY

Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

Failures include, but are not limited to:

1. Excessive Surface Wear: More than 10% loss of pile fiber weight
2. Excessive Static Electricity: More than 3.0 kV per AATCC 134
3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
4. Delamination
5. Edge Ravel
6. Zippering
7. Moisture Penetration by Impact @ 10-psi: No penetration of backing and seam after 10,000 impacts.

Warranty Period: 15 years from date of contract acceptance.

DELIVERY, STORAGE AND HANDLING

Delivery: Materials shall be delivered to the job site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and lot number.

Storage: Materials shall be stored in original undamaged packages and containers inside well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

Store materials in area of installation for minimum period of 48 hours prior to installation.

PROJECT CONDITIONS

The maximum amount of moisture evacuation from the floor is 3.0 pounds per 1,000 square feet in 24 hours. The acceptable pH level of the substrate is between 7.0 and 9.0. Contractor is responsible for floor testing.

Maintain minimum 65 ºF ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.

Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

MAINTENANCE

Maintenance Instructions: Contractor shall furnish the manufacturer’s instructions for maintenance of the installed work, including methods and frequency recommended for maintaining optimum condition under anticipated traffic and use conditions.

PART 2 - PRODUCTS

CARPET TILE

Carpet Fiber:

Nylon Fiber: Bulked Continuous Filament (BCF) Type 6,6 Nylon in a loop pile construction. Cut pile is not acceptable. The maximum pile height shall be 1/2-inch.

Fiber to contain carbon-core filament for permanent static control. Topical treatments are not acceptable.

Durable stain inhibitor should be applied to the fiber during product manufacturing to resist fiber staining and soiling.

1. Initial: Minimum 500 ppm Fluorine per CRI TM-102
2. After two hot water extractions per AATCC 171: Minimum 400 ppm Fluorine per CRI TM-102

Backing Characteristics:

Primary Backing: Synthetic Non-Woven.

Secondary Backing: Closed cell, vinyl cushion backing system

1. Density (ASTM D-1667): Min. 65 lbs/cu ft +/- 5%
2. Compression Set (ASTM D1667): Max 10%
3. Compression Deflection (ASTM D 1667); min. 7 psi @25%; Max 25 psi @ 25%
4. Standard Size: 18” x 18”
5. Fiberglass Reinforced
6. Fully fused secondary backing system that will not delaminate

Adhesive System: Low VOC, factory applied "dry" adhesive applied to backing and cured during manufacturing. Free-lay and stretch-in installations not allowed.

INSTALLATION ACCESSORIES

Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

Adhesives: Products to be supplied with a low VOC, factory applied, "dry" adhesive for "peel and stick" installation.

Edger Strips: Edger and transition strips shall be commercial quality stainless steel or aluminum.

PART 3 - EXECUTION

PREPARATION

Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Finished surface of floor slab shall comply with requirements specified in Section 12-3.01 "Cast-in-Place Concrete".
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

Prepare sub-floor to comply with criteria established in Manufacturer’s installation instructions. Use only preparation materials that are acceptable to the Manufacturer.

1. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation.
2. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.

Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.

Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.

Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.

There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

INSTALLATION

Installation- General:

Install product in accordance with Manufacturer's installation instructions.

Where demountable partitions or other items are indicated for installation on top of finished carpet tile floor, install carpet tile before installation of these items.

Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

Roll with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor. Carpet to be securely adhered in accordance with State Accessibility code requirements.

Trim carpet neatly at walls and around interruptions.

Completed carpet is to be smooth and free of bubbles, puckers, and other defects.

Edger strips shall be installed at free edges.

CLEANING AND PROTECTION

Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. All rubbish, wrappings, debris, trimmings, etc. to be removed from site and disposed of properly.
4. Vacuum carpet tile using commercial machine with face-beater element.

Remove excess adhesive and/or other from floor and wall surfaces without damage.

Clean and vacuum carpet surfaces using a beater brush/bar commercial vacuum.

Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

12-9.09 PAINTING

PART 1 - GENERAL

Scope: This work shall consist of preparing surfaces to receive coatings, and furnishing and applying coatings, in conformance with the schedules and details shown on the plans and these special provisions.

The coatings specified in this section are in addition to any factory finishes, shop priming, or surface treatment specified elsewhere in these special provisions.

DEFINITIONS

Detergent Wash: Removal of dirt and water-soluble chemicals by scrubbing with a solution of detergent and water, and removal of all solution and residues with clean water.

Hand Cleaning: Removal of dirt, loose rust, mill scale, excess base material, filler, aluminum oxide, chalking paint, peeling paint, or paint that is not firmly bonded to the surfaces by using hand or powered wire brushes, hand scraping tools, power grinders, or sandpaper and removal of all loose particles and dust prior to coating.

Mildew Wash: Removal of mildew by scrubbing with a solution of detergent, hypochlorite-type household bleach, and warm water, and removal of all solution and residues with clean water.

Abrasive Blasting:

Removal of loosely adhering paint, dirt, rust, mill scale, efflorescence, weak concrete, or laitance, shall be by the use of airborne abrasives. Loose particles, dust, and abrasives shall be removed by blasting with clean, oil-free air.

Abrasives shall be limited to mineral grit, steel grit, or steel shot, and shall be graded to produce the surface profile recommended in the manufacturer's data sheet.

Steam Cleaning: Removal of oil, grease, dirt, or other foreign matter by using steam generated by commercial steam cleaning equipment, from a solution of water and steam cleaning compounds, and removal of all residues and cleaning compounds with clean water.

TSP Wash: Removal of oil, grease, dirt, paint gloss, and other foreign matter by scrubbing with a solution of trisodium phosphate and warm water, and removal of all solution and residues with clean water.

Water Blasting: Removal of dirt, loose scale, chalking, or peeling paint by low-pressure water cleaning. Water blasting shall be performed in conformance with the requirements in SSPC-SP12 and shall produce a surface cleanliness meeting the requirements of SSPC-SP12-WJ4. Equipment used shall have a minimum flow rate of 1.5 GPM. If a detergent solution is used, it shall be biodegradable and shall be removed from all surfaces with clean water.

Protection:

The Contractor shall provide protective devices, such as tarps, screens or covers, as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations.

Paint or paint stains on surfaces not designated to be painted shall be removed by the Contractor at the Contractor's expense and the original surface shall be restored.

SUBMITTALS

Manufacturer's descriptive data, a materials list, and color samples shall be submitted for approval.

Product descriptive data shall include product description, manufacturer's recommendations for product mixing, thinning, tinting, handling, site environmental requirements, product application, and drying time.

Materials list shall include manufacturer's name, trade name, and product numbers for each type coating to be applied.

Color samples shall be manufacturer's color cards, approximately 2" x 3", for each color of coating shown on the plans. Color samples for stains shall be submitted on wood of the same species, color, and texture as the wood to receive the stain.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.2, Low-Emitting Materials – Paints and Coatings: Submit pProduct data for paints and coatings to be used on-site and inside the building weatherproofing system, indicating product name, manufacturer's generic description, chemical composition, and VOC content.

QUALITY ASSURANCE

Certificates of Compliance: Certificates of Compliance shall be furnished when products are required to conform with the requirements of The Society for Protective Coatings (SSPC) in conformance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: For interior application (inside the weatherproofing system and applied on-site), provide paints and coatings that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

REGULATORY REQUIREMENTS

Coatings and applications shall conform to the rules for control of Volatile Organic Compound (VOC) emissions adopted by the air quality control district in the air basin in which the coatings are applied.

SITE ENVIRONMENTAL REQUIREMENTS

Coatings shall be applied in conformance with the environmental constraints specified in the manufacturer's printed instructions. These conditions shall be maintained until the coating has cured and is ready for recoat.

Continuous ventilation shall be provided during application of the coatings.

Adequate lighting, as determined by the Engineer, shall be provided while surfaces are being prepared for coatings and during coating applications.

DELIVERY, STORAGE, AND HANDLING

Products shall be delivered to the site in sealed, labeled containers and stored in a well-ventilated area at an ambient air temperature of not less than 45°F. Container labeling shall include manufacturer's name, type of coating, trade name, color designation, drying time, and instructions for tinting, mixing, and thinning.

PART 2 - PRODUCTS

Products for each coating system shall be from a single manufacturer and shall conform to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI). Each product shall be shown on the MPI Approved Products List unless otherwise specified in these special provisions.

PART 3 - EXECUTION

INSPECTION

Coatings shall not be applied until surface preparation has been approved by the Engineer. The Contractor shall notify the Engineer at least 3 working days prior to the application of coatings.

SURFACE PREPARATION

Surfaces scheduled to be coated shall be prepared in conformance with the coating manufacturer's printed instructions unless otherwise specified in these special provisions.

Hardware, cover plates, light fixture trim, and similar items shall be removed prior to preparing surfaces for coating. Following the application of the finish coating, the removed items shall be reinstalled in their original locations.

Wood:

Coatings for exterior applications shall have the surface lightly sanded no more than 24 hours prior to the coating application.

A sealer recommended by the coating manufacturer shall be spot applied to knots, sap, pitch, tar, creosote, and other bleeding substances.

After the application of the prime coat, all nail holes, cracks, open joints, dents, scars, and surface irregularities shall be filled, hand cleaned, and spot primed to provide smooth surfaces for the application of finish coats.

Irregularities in wood surfaces to receive a transparent stain finish shall be filled and hand cleaned after the first coat of stain has been applied. The color of the filler shall match the color of the stained wood.

Irregularities in wood surfaces to receive a clear finish shall be filled and hand cleaned before the application of coatings. The color of the filler shall match the color of the coated wood.

Galvanized Metal:

New surfaces shall be roughened by hand sanding or light abrasive blasting. Galvanizing shall not be removed during cleaning or roughening.

Damaged or corroded areas shall be cleaned and given 2 spot applications of a coating that conforms to the requirements in the Detailed Performance Standards of the MPI, and listed on MPI List "Number 18, Primer, Zinc Rich, Organic."

Steel and Other Ferrous Metals: Surface shall be cleaned in conformance with the requirements in SSPC-SP 1. Surface profile shall be as required for the coating system specified.

Aluminum and Other Non-ferrous Metals: Surface shall be cleaned in conformance with the requirements in SSPC-SP 1.

Gypsum Board: Holes, cracks, and other surface imperfections shall be filled with joint compound or suitable filler prior to application of coatings. Taped joints and filled areas shall be hand sanded to remove excess joint compound and filler.

Cement Plaster: New plaster shall be cured a minimum of 14 days before coating. Cracks, holes, and surface imperfections shall be filled with patching plaster and hand textured to match adjacent surfaces.

Concrete and Concrete Masonry Unit: New material shall be cleaned and prepared in conformance with the requirements in SSPC-SP 13. Cracks and voids shall be filled with cement mortar patching material. Concrete shall be cured until the surface moisture is below the level specified in the coating manufacturer's printed instructions.

Previously Coated Surfaces:

Dirt, oil, grease, or other surface contaminants shall be removed by water blasting, steam cleaning, or TSP wash. Minor surface imperfections shall be filled as required for new work. Mildew shall be removed by mildew wash. Chalking paint shall be removed by hand cleaning. The surfaces of existing hard or glossy coatings shall be abraded to dull the finish by hand cleaning or light abrasive blasting. Abrasive blasting shall not be used on wood or non-ferrous metal surfaces.

Chipped, peeling, blistered, or loose coatings shall be removed by hand cleaning, water blasting, or abrasive blasting. Bare areas shall be pretreated and primed as required for new work.

APPLICATION

Coatings shall be applied in conformance with the printed instructions and at the application rates recommended by the manufacturer to achieve the dry film thickness stated in the coating technical data sheet.

Mixing, thinning and tinting shall conform to the manufacturer's printed instructions. After thinning, the coating shall conform to the regulatory requirements in these special provisions.

Coatings shall be applied only when surfaces are dry and properly prepared.

Cleaning and painting shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

Materials required to be coated shall have coatings applied to all exposed surfaces, including the tops and bottoms of wood and metal doors, the insides of cabinets, and other surfaces not normally visible from eye level.

Surface Finish Application:

Each coat shall be applied to a uniform finish. Finished surfaces shall be free of surface deviations and imperfections such as skips, cloudiness, spotting, holidays, laps, brush marks, runs, sags, curtains, ropiness, improper cutting in, overspray, drips, ridges, waves, and variations in color and texture.

Each application of a multiple application finish system shall closely resemble the final color coat, except each application shall provide enough contrast in shade to distinguish the separate applications.

Work Required Between Applications:

Each application of material shall be cured in conformance with the coating manufacturer's printed instructions before applying the succeeding coating.

Enamels and clear finishes shall be lightly sanded, dusted, and wiped clean between applications.

Stain blocking primer shall be spot applied whenever bleeding substances are visible through the previous application of a coating.

Timing of Applications: The first application of the coating system shall be during the same work shift that the final surface preparation was performed. Additional coats shall be applied as soon as the required drying time of the preceding coat, specified in the coating manufacturer's printed instructions, has been met.

Application Methods:

Coatings shall be applied by brush, roller or spray. Rollers shall be of a type which do not leave a stippled texture in the paint film. Extension handles for rollers shall not be greater than 6 feet in length.

If spray methods are used, surface deviations and imperfections such as overspray, thickness deviations, lap marks, and orange peel shall be considered as evidence the work is unsatisfactory and the Contractor shall apply the remainder of the coating by brush or roller, as approved by the Engineer.

Back Priming:

The first application of the coating system shall be applied to all wood surfaces (face, back, edges, and ends) of wood materials that are not factory coated, immediately upon delivery to the project site. Surfaces of interior finish woodwork that adjoin concrete or masonry shall be coated with one application of exterior wood primer before installation.

Patches in Previously Coated Surfaces: Where patches are made on surfaces of previously coated walls or ceilings, the entire surface to corners on every side of the patch shall be coated with a minimum of one application of the finish coat.

Finishing Mechanical and Electrical Components:

Shop primed mechanical and electrical components shall be finish coated in conformance with the coating system specified for the substrate material. Louvers, grilles, covers, and access panels on mechanical and electrical components shall be removed and coated separately.

Interior surfaces of air ducts which are visible through grilles or louvers shall be coated with one application of flat black enamel, to limit of the sight line.

Conduit, piping, and other mechanical and electrical components visible in the finished work shall be painted.

Both sides and all surfaces, including edges and back of wood mounting panels for electrical and telephone equipment shall be finish coated before installing equipment.

CLEANING

Upon completion of all operations, the coated surfaces shall be thoroughly cleaned of dust, dirt, grease, or other unsightly materials or substances.

Surfaces marred or damaged as a result of the Contractor's operations shall be repaired, at his expense, to match the condition of the surfaces prior to the beginning of the Contractor's operations.

COATING SYSTEM

The surfaces to be coated shall be as shown on the plans and as specified in these special provisions. When a coating system is not shown or specified for a surface to be finish coated, the coating system to be used shall be as specified below for the substrate material. The number of applications specified for each coating system listed herein is a minimum. Additional coats shall be applied if necessary to obtain a uniform color, texture, appearance, or required dry film thickness.

SYSTEM 1 - ALUMINUM AND OTHER NON-FERROUS METALS

2 Finish Coats:

Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163

SYSTEM 2 - CEMENT PLASTER AND CONCRETE

1 Prime Coat:

Block Filler: Latex, Interior/Exterior MPI List Number 4

2 Finish Coats:

Semi-Gloss: Latex, Exterior, MPI Gloss Level 5, MPI List Number 11

SYSTEM 3 - GALVANIZED METAL

2 Finish Coats:

Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163

SYSTEM 4 - GYPSUM BOARD

1 Prime Coat:

Primer Sealer: Latex, Interior, MPI List Number 50

2 Finish Coats:

Semi-Gloss: Latex, Interior, MPI Gloss Level 5, MPI List Number 54

SYSTEM 5 - STEEL AND OTHER FERROUS METALS, HIGHLY CORROSIVE ENVIRONMENT

2 Prime Coats:

Coating meeting the requirements of SSPC-Paint 29

2 Finish Coats:

Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163

SYSTEM 6 - WOOD, PAINTED

1 Prime Coat:

Primer: Latex for Exterior Wood, MPI List Number 6

2 Finish Coats:

Semi-Gloss: Latex, Exterior, MPI Gloss Level 5, MPI List Number 11

COLOR SCHEDULE

Colors shall be as shown on the plans.

12-9.10 FIBERGLASS REINFORCED PLASTIC PANELS

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing fiberglass reinforced plastic (FRP) panels and trim molding in accordance with details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, and finish options shall be submitted for approval.

Product descriptive data shall show the manufacturer's name and shall indicate conformance to these special provisions.

Installation instructions shall show the FRP panel manufacturer's recommended method of installation.

Finish options shall show the manufacturer's standard color palette for FRP panels and trim molding. Color shall be as shown on the plans.shall be selected from the manufacturer's standard color palette by the Engineer after the award of the contract.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials – Adhesives and Sealants: Submit product data for adhesives and sealants to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

FRP Panel: FRP panel shall have a Class A Flame-Spread rating of 25 or less determined by ASTM E 84, minimum nominal thickness of 0.090 inch; Marlite, Class I/A FRP; Kemlite, Fire-X Glasbord; or equal.

Trim Molding: Trim molding shall be manufacturer's standard vinyl molding with nailing flanges and a 3/8-inch deep channel of sufficient width to receive panels and sealant.

Adhesive and Sealant: Adhesive and sealant shall be as recommended by the FRP panel manufacturer.

PART 3 - EXECUTION

INSTALLATION

The FRP panels and trim molding shall be installed in accordance with the manufacturer's installation instructions.

Trim molding shall be nailed through the flange into solid wood backing. All nails shall be concealed by FRP panels in the completed installation. Trim shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard trim length. If more than one piece is used on one wall, the pieces shall be approximately equal length, with no piece less than 4 feet in length. All FRP panel edges shall be covered by a trim molding.

Panels shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard panel length. If more than one panel piece is used on one wall, the pieces shall be approximately equal length, with no piece less than 4 feet in length.

CLEAN-UP

Adjacent surfaces shall be protected from adhesive or sealant. Excess adhesive and sealant shall be removed as the installation progresses using a solvent or cleaning agent recommended by the FRP panel manufacturer.

12-9.11 SUSPENDED CEILINGS

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing suspended ceilings in accordance with the details shown on the plans and these special provisions.

Suspended ceilings shall consist of lay-in acoustical ceiling panels and an exposed grid suspension system. Listed fire rated assemblies shall be installed where shown on the plans.

Design:

The suspension system shall be designed to support the weight of ceiling panels, lighting fixtures, air terminals, service assemblies and such other items, not mentioned, which are supported by the suspended ceiling system.

The deflection of any component of the suspension system shall not exceed 1/360 of the span.

The suspension system shall be designed for seismic restraint in accordance with ASTM Designation: E 580.

Lighting fixture attachments shall be designed for a capacity of 100 percent of the lighting fixture weight acting in any direction.

SUBMITTALS

Manufacturer's descriptive data and installation instructions and complete working drawings of all supporting details, lighting fixture attachments, lateral force bracing, partition bracing and runner and panel layouts shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

Single Source Responsibility: Obtain tile through one source from a single manufacturer.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

Acoustical Panels: Acoustical panels shall be factory produced, lay-in panels, 24" x 48" x 5/8" thick with non-directional natural fissured random perforated surface texture and factory applied, washable, off-white, vinyl latex finish. Panels shall conform to ASTM E 1264 Type III (mineral base with painted finish), form 2 (water felted). Noise Reduction Coefficient (NRC) shall be minimum 0.65. Panels shall have a flame spread rating not exceeding 25. Tile shall be Armstrong World Industries, USG, or equal.

Suspension System: Suspension system shall be galvanized steel, tee shaped main runners and cross runners and wall molding angles or channels conforming to ASTM Designation: C 635, intermediate duty or heavy duty. Runners shall have exposed flanges approximately one inch wide and positive interlocks between main runners and cross runners. Wall moldings shall have a ¾-inch wide exposed face. Runners and moldings shall be bonderized and shall have a flat off-white color, factory painted finish unless otherwise shown on the plans.

Wire Hangers: Wire hangers shall be 12-gage minimum, galvanized, soft-annealed, mild steel wire.

Assembly Devices, Splices, Intersection Connectors and Expansion Devices: Assembly devices, splices, intersection connectors and expansion devices shall be as recommended by the suspension system manufacturer.

Acoustical Sealant: Acoustical sealant shall comply with requirements under "Sealants" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

PART 3 - EXECUTION

INSTALLATION

The suspended ceiling shall be installed square, level and true in accordance with the approved working drawings, the manufacturer's installation instructions and the requirements of ASTM C 635, C 636 and E 580 and ASCE 7, Section 13.5.6.2.

Hangers for the suspension system shall be spaced at not more than 48 inches on centers and shall be saddle tied or wrapped around the main runner members.

Except as specified herein, all lighting fixtures, air terminals, services or other ceiling supported items shall be positively attached to the suspension system.

Lighting fixtures, air terminals, services or other items weighing less than 56 pounds shall have, in addition to the requirements specified herein, two 12-gage hangers connected from the housing of the fixture, terminal, service or other items to the structure above. These hanger wires may be slack.

Lighting fixtures, air terminals, services or other items weighing more than 56 pounds shall be supported directly from the structure above.

The ceiling shall be leveled to within 1/8 inch in 12 feet.

12-9.12 EPOXY FLOOR SEALER

PART 1 - GENERAL

SUMMARY

This work includes high-performance, roller applied 100% solid epoxy coating systems for interior concrete floors.

REFERENCES

ICRI – International Concrete Repair Institute:

1. ICRI 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

SSPC – Society for Protective Coatings:

1. SSPC-SP 13/NACE 6 – Surface Preparation of Concrete

PERFORMANCE REQUIREMENTS

Provide epoxy coating system designed for interior concrete floors, subject to moderate abuse, wetness, and chemical spills.

SUBMITTALS

Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation requirements, and application instructions.

Certificates of Compliance: From manufacturer, under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, certifying that coatings:

1. Comply with requirements
2. Are suitable for the intended application
3. Are compatible with one another

Qualification Data for Manufacturer: Submit information on company history, product lines, and completed projects similar to this work.

Qualification Data for Applicator: Include company history, personnel qualifications, and list of 5 completed projects similar to this work, including for each project:

1. Project name and location
2. Name of owner
3. Name of contractor
4. Name of architect or engineer
5. Name of coating manufacturer
6. Approximate square footage of coatings applied
7. Date of completion

Warranty:

1. Manufacturer's standard warranty
2. Applicator's standard warranty

LEED Submittals:

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: Submit product data for paints and coatings to be used on-site and inside the building weatherproofing system, indicating product name, manufacturer's generic description, chemical composition, and VOC content.

QUALITY ASSURANCE

Manufacturer's Qualifications:

1. Manufacturer specializing in high-performance coatings with a minimum of 5 years' successful experience
2. Demonstrated record of successful performance on comparable projects
3. Single Source Responsibility: Coatings and coating application accessories must be products of a single manufacturer

Applicator's Qualifications:

1. Experienced in application of specified high performance coatings for a minimum of 5 years on projects similar in type, size, and complexity to this work
2. Applicator's Personnel: Trained and approved by manufacturer for application of specified coatings

Mock-Ups: Prepare 10' x 10' mock-up for each coating specified, using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Obtain Engineer's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be judged.

Preapplication Meeting: Convene a preapplication meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Engineer, applicator, and manufacturer's representative. Review the following:

1. Environmental requirements
2. Protection of surfaces not scheduled to be coated
3. Surface preparation
4. Application
5. Repair
6. Field quality control
7. Cleaning
8. Protection of coating systems
9. One-year inspection
10. Coordination with other work

LEED:

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: For interior application (inside the weatherproofing system and applied on-site), provide paints and coatings that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Product name
2. Manufacturer
3. Color name and number
4. Batch or lot number
5. Date of manufacture
6. Mixing and thinning instructions

Storage:

1. Store materials in a clean, dry area and within temperature range recommended in manufacturer's instructions
2. Keep containers sealed until ready for use

Do not use materials beyond manufacturer's shelf life limits.

PROJECT CONDITIONS

Weather: Prepare surfaces, apply coatings, and cure coatings within manufacturer's recommended ranges for:

1. Air temperature
2. Surface temperature
3. Relative humidity

Condensation: Surface temperature must be at least 5 degrees above dew point.

Ventilation: In confined or enclosed areas, provide ventilation during coating evaporation stage under manufacturer's instructions.

Dust and Contaminants:

1. Schedule work to avoid creation of dust and airborne contaminants during coating application and curing
2. Protect work areas from dust and contaminants

Maximum Moisture Content of Substrates:

1. Moisture vapor emission rate must not exceed 3 pounds per 1,000 sq. ft. in a 24-hour period when measured according to ASTM F 1869.
2. Moisture vapor emission rate must not exceed limit recommended by manufacturer, if lower.

WARRANTY

Manufacturer issued full one-year warranty against defects in materials, including coating system inspection before the end of the warranty period.

PART 2 - PRODUCTS

Initial Surface Preparation: Shot blast or mechanically abrade to a concrete surface profile (CSP) of 3-5 as defined in ICRI 310.2.

Primer: Primer must be a 100% reactive, epoxy based, penetrating primer that exhibits chemical resistance..

Topcoat: Topcoat must consist of an amber resistant, self-leveling 100% solid epoxy coating.

Finish Coat: Finish coat must be a color stable, high performance urethane that exhibits excellent chemical resistant properties; two coats must be applied.

Traction Grit: #36 or #60 white aluminum oxide granules.

Slip Resistance: As recommended by system manufacturer to provide slip resistance without adverse effects on maintenance or wear.

ACCESSORIES

Provide accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.

Accessories must be products of coating manufacturer.

PART 3 - EXECUTION

EXAMINATION

Examine substrates and conditions, with installer, for compliance with "Project Conditions" specified above, manufacturer's recommendations, and other conditions affecting the work. Test concrete moisture content under ASTM F 1869.

Protect surfaces that are not to be coated.

SURFACE PREPARATION

Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 310.2. For functional or expansion joint, these must be treated with 100% solids elastomeric resin having a minimum elongation of 150%.

Ensure that concrete surfaces are shot-blast, diamond grind or power scarify as to obtain clean, open porous concrete. Remove sufficient material to provide a cound surface, free of laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminants. Repair damaged and deteriorated concrete to acceptable condition; leave surface free of dirt, dust, laitance, and other contaminants.

Mix components when required, and prepare materials according to flooring system manufacturer's instructions.

APPLICATION

Prepare and apply coatings in accordance with manufacturer's instructions.

Concrete surfaces on grades must have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions and suitable for coating and substrate.

Uniformly apply coatings at spreading rate required to achieve specified DFT.

Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

REPAIR

Adjacent Surfaces: Repair or replace damaged materials and surfaces that were not scheduled to be coated.

Damaged Coatings: Touch up or repair damaged coatings. You may touch up minor damage if the result is not visibly different from adjacent surfaces. Recoat the entire surface where touch-up result is visibly different in sheen, texture, color, or profile.

Coating Defects: If coatings exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems, repair in accordance with manufacturer's instructions. Recoat the entire surface if repair result is visibly different in sheen, texture, color, or profile.

FIELD QUALITY CONTROL

Manufacturer's Field Services: Manufacturer's representative must provide technical assistance and guidance for surface preparation and application of coating systems.

The Engineer may invoke the following procedure at any time and as often as he deems necessary during periods when coatings are being applied:

1. The Engineer will engage a qualified testing agency to sample coating material being used. Samples of material delivered to project site will be taken, identified, sealed, and certified in your presence.
2. The testing agency will perform tests for compliance with specified requirements.
3. The Engineer may order you to stop applying coatings if test results show materials do not comply with specified requirements. You must remove noncomplying coating materials from the job site, pay for testing, and recoat surfaces coated with rejected materials. You will be required to remove rejected materials from previously coated surfaces if the manufacturer of the specified material so recommends or if, on recoating with complying materials, the two materials are incompatible.

CLEANING AND PROTECTION

At the end of each work day, remove and dispose of rubbish, empty cans, rags, and other waste. Comply with Section 5-1, "Construction Waste Management."

After applying coatings, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not damage adjacent surfaces. Remove temporary coverings and protection of surrounding areas and surfaces.

Protect work of other trades against damage from coating operations. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Engineer, and leave in an undamaged condition.

When other trades finish their work, touch up and restore damaged or defaced coating surfaces.

Protect coating systems from damage until Final Acceptance.

COATING SYSTEM INSPECTION

The coating system inspection before the end of the warranty period must be attended by the Department's representative and the manufacturer's representative.

Repair deficiencies in coating systems as determined by the Department's representative in accordance with manufacturer's instructions.

12-9.13 ELECTROSTATIC DISCHARGE EPOXY FLOOR COATINGS

PART 1 - GENERAL

SUMMARY

This work includes high-performance seamless, 100% solid epoxy, electrostatic discharge (ESD) static control flooring coating systems for concrete floors in electronics areas.

REFERENCES

ICRI – International Concrete Repair Institute:

1. ICRI 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

SSPC – Society for Protective Coatings:

1. SSPC-SP 13/NACE 6 – Surface Preparation of Concrete

PERFORMANCE REQUIREMENTS

Provide ESD epoxy coating system designed for concrete floors in conditions typical of electronic facilities, subject to moderate abuse, wetness, and chemical spills.

Floor coating system must be resistant to chemical-related substances:

Chemical Resistance: Good chemical resistance to 30% Hydrochloric Acid (Muriatic) and excellent chemical resistance to 50% Sodium Hydroxide with no adverse effects, based on 7-day spot testing on concrete.

SUBMITTALS

Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation requirements, and application instructions.

Certificates of Compliance: From manufacturer, under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications, certifying that coatings:

1. Comply with requirements
2. Are suitable for the intended application
3. Are compatible with one another

Qualification Data for Manufacturer: Submit information on company history, product lines, and completed projects similar to this work.

Qualification Data for Applicator: Include company history, personnel qualifications, and list of 5 completed projects similar to this work, including for each project:

1. Project name and location
2. Name of owner
3. Name of contractor
4. Name of architect or engineer
5. Name of coating manufacturer
6. Approximate square footage of coatings applied
7. Date of completion

Warranty:

1. Manufacturer's standard warranty
2. Applicator's standard warranty
3. Coating system inspection before the end of the warranty period

LEED Submittals:

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: Submit product data for paints and coatings to be used on-site and inside the building weatherproofing system, indicating product name, manufacturer's generic description, chemical composition, and VOC content.

QUALITY ASSURANCE

Manufacturer's Qualifications:

1. Manufacturer specializing in high-performance coatings with a minimum of 5 years' successful experience.
2. Demonstrated record of successful performance on comparable projects.
3. Single Source Responsibility: Coatings and coating application accessories must be products of a single manufacturer.

Applicator's Qualifications:

1. Experienced in application of specified high performance coatings for a minimum of 5 years on projects similar in type, size, and complexity to this work.
2. Applicator's Personnel: Trained and approved by manufacturer for application of specified coatings.

Mock-Ups: Prepare 10' x 10' mock-up for each coating specified, using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Obtain Engineer's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be judged.

Preapplication Meeting: Convene a preapplication meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Engineer, applicator, and manufacturer's representative. Review the following:

1. Environmental requirements
2. Protection of surfaces not scheduled to be coated
3. Surface preparation
4. Application
5. Repair

6. Field quality control
7. Cleaning
8. Protection of coating systems
9. One-year inspection
10. Coordination with other work

LEED:

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: For interior application (inside the weatherproofing system and applied on-site), provide paints and coatings that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Product name
2. Manufacturer
3. Color name and number
4. Batch or lot number
5. Date of manufacture
6. Mixing and thinning instructions

Storage:

1. Store materials in a clean, dry area and within temperature range recommended in manufacturer's instructions.

2. Keep containers sealed until ready for use.

Do not use materials beyond manufacturer's shelf life limits.

PROJECT CONDITIONS

Weather: Prepare surfaces, apply coatings, and cure coatings within manufacturer's recommended ranges for:

1. Air temperature
2. Surface temperature
3. Relative humidity

Condensation: Surface temperature must be at least 5 degrees above dew point.

Ventilation: In confined or enclosed areas, provide ventilation during coating evaporation stage under manufacturer's instructions.

Dust and Contaminants:

1. Schedule work to avoid creation of dust and airborne contaminants during coating application and curing.

2. Protect work areas from dust and contaminants.

Maximum Moisture Content of Substrates:

1. Moisture vapor emission rate must not exceed 3 pounds per 1,000 sq. ft. in a 24-hour period when measured according to ASTM F 1869.
2. Moisture vapor emission rate must not exceed limit recommended by manufacturer, if lower.

PART 2 - PRODUCTS

Electrically Insulating Primer: Two-component epoxy.

1. Volatile Organic Compound (VOC), ASTM D 3960: 0.04 lb/gal
2. Tensile Strength, ASTM D 2370: 8,000 psi
3. Percent Elongation, ASTM D 2370: 5

Electrostatic Dissipative Primer: Two-component epoxy.

1. Volatile Organic Compound (VOC), ASTM D 3960: 0.82 lb/gal
2. Percent Solids, ASTM D 2369:

    2.1. Part A - 87.74%
    2.2. Part B - 99.91%
    2.3. Combined A/B - 90.95%

Electrostatic Control Epoxy Top Coat: Two-component epoxy.

1. Volatile Organic Compound (VOC), ASTM D 3960: 0.11 lb/gal.
2. Percent Solids, ASTM D 2369:

    2.1. Part A - 98.29%
    2.2. Part B - 99.81%
    2.3. Combined A/B - 98.75%

3. Compressive Strength, ASTM D 695: 13,500 psi
4. Tensile Strength, ASTM D 2370: 8,000 psi
5. Surface Resistance @ Point to Point/Point to Ground, ANSI/ESD 7.1-2005

    5.1. Electrostatic conductive primer = 1.0×10^5 less than or equal to 1.0×10^6 ohms
    5.2. Electrostatic dissipative primer = 1.0×10^5 less than or equal to 1.0×10^9 ohms

6. Maximum Standing Voltage at 0% prob w/ESD Footwear

    6.1. Electrostatic conductive primer = less than 0.5 seconds
    6.2. Electrostatic dissipative primer = less than 0.5 seconds

7. Body Voltage Decay 1000V less than or equal to 50V (with ESD Footwear)

Surface Preparation: Comply with ICRI 310.2 and SSPC-SP 13/NACE 6.

Slip Resistance: As recommended by system manufacturer to provide slip resistance without adverse effects on maintenance or wear.

Finish Color: As selected by Engineer from manufacturer's standard and premium range.

ACCESSORIES

Provide accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.

Accessories must be products of coating manufacturer.

PART 3 - EXECUTION

EXAMINATION

Examine substrates and conditions, with installer, for compliance with "Project Conditions" specified above, manufacturer's recommendations, and other conditions affecting the work. Test concrete moisture content under ASTM F 1869.

Protect surfaces that are not to be coated.

SURFACE PREPARATION

Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 310.2.

Ensure that concrete surfaces are shot-blast, diamond grind or power scarify as to obtain clean, open porous concrete. Remove sufficient material to provide a cound surface, free of laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminants. Repair damaged and deteriorated concrete to acceptable condition; leave surface free of dirt, dust, laitance, and other contaminants.

Test concrete for moisture in accordance with ASTM D 4263 and ASTM F 1869.

Allow concrete to cure for a minimum of 28 days before coating.

Level protrusions and mortar spatter.

APPLICATION

Electrical Grounding: A grounding system needs to be connected to the common ground of the facility before applying the primers.

Prepare and apply coatings in accordance with manufacturer's instructions.

Do not use mixed coatings beyond pot life limits.

Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions and suitable for coating and substrate.

Uniformly apply coatings at spreading rate required to achieve specified DFT.

Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

REPAIR

Adjacent Surfaces: Repair or replace damaged materials and surfaces that were not scheduled to be coated.

Damaged Coatings: Touch up or repair damaged coatings. You may touch up minor damage if the result is not visibly different from adjacent surfaces. Recoat the entire surface where touch-up result is visibly different in sheen, texture, color, or profile.

Coating Defects: If coatings exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems, repair in accordance with manufacturer's instructions. Recoat the entire surface if repair result is visibly different in sheen, texture, color, or profile.

FIELD QUALITY CONTROL

Manufacturer's Field Services: Manufacturer's representative must provide technical assistance and guidance for surface preparation and application of coating systems.

The Engineer may invoke the following procedure at any time and as often as he deems necessary during periods when coatings are being applied:

1. The Engineer will engage a qualified testing agency to sample coating material being used. Samples of material delivered to project site will be taken, identified, sealed, and certified in your presence.
2. The testing agency will perform tests for compliance with specified requirements.
3. The Engineer may order you to stop applying coatings if test results show materials do not comply with specified requirements. You must remove noncomplying coating materials from the job site, pay for testing, and recoat surfaces coated with rejected materials. You will be required to remove rejected materials from previously coated surfaces if the manufacturer of the specified material so recommends or if, on recoating with complying materials, the two materials are incompatible.

CLEANING AND PROTECTION

At the end of each work day, remove and dispose of rubbish, empty cans, rags, and other waste. Comply with Section 5, "Construction Waste Management."

After applying coatings, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not damage adjacent surfaces. Remove temporary coverings and protection of surrounding areas and surfaces.

Protect work of other trades against damage from coating operations. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Engineer, and leave in an undamaged condition.

When other trades finish their work, touch up and restore damaged or defaced coating surfaces.

Protect coating systems from damage until Final Acceptance.

COATING SYSTEM INSPECTION

The coating system inspection before the end of the warranty period must be attended by the Department's representative and the manufacturer's representative.

Repair deficiencies in coating systems as determined by the Department's representative in accordance with manufacturer's instructions.

SECTION 12-10. SPECIALTIES

12-10.01 TACKBOARDS

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing tackboards in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, color and texture samples and installation instructions shall be submitted for approval. Color and texture will be selected by the Engineer after the award of the contract.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

PART 2 - PRODUCTS

Tackboards:

Tackboards: Tackboards shall be textured plastic coating on cotton-fabric, pressure laminated to ¼-inch thick cork underlayment. Cork underlayment shall be bonded to a ¼-inch thick hardboard backing. Tackboard dimensions shall be as shown on the plans.

Tackboard facing material and finish shall have a Flame Spread Rating of 25 or less and Smoke Developed Index of 450 or less when tested in accordance with ASTM E 84.

Border Moldings: Border moldings shall be factory applied, extruded clear anodized aluminum trim.

PART 3 - EXECUTION

INSTALLATION

Tackboards shall be installed rigidly, securely, plumb and true, and in accordance with the manufacturer's recommendations.

12-10.02 MARKER BOARDS

PART 1 – GENERAL

Scope: This work shall consist of furnishing and installing marker boards in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

PART 2 - PRODUCTS

Marker Board:

Marker board shall conform to Porcelain Enamel Institute PEI-1002, "Manual and Performance Specifications for Porcelain Enamel Writing Surfaces (Whiteboards and Chalkboards)," and shall be porcelain enamel surface on 0.024-inch thick (24-gage) sheet steel pressure laminated to ¼-inch thick tempered hardboard. Hardboard shall have a backing of 0.015-inch nominal thickness aluminum sheet. Enamel surface shall be suitable for marking with felt tipped liquid chalk markers and erasing with a felt eraser or dry cloth. The enamel surface shall be white in color.

Marker board dimensions shall be as shown on the plans.

Trim and marker tray: Trim and marker tray shall be factory installed, satin finish, clear anodized aluminum extrusions.

PART 3 - EXECUTION

INSTALLATION

Marker boards shall be installed rigidly, securely, plumb and true in accordance with the manufacturer's instructions.

12-10.03 METAL TOILET PARTITIONS

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing stainless steel metal toilet partitions in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION

Metal toilet partitions shall consist of panels, doors, pilasters and shoes, headrails, urinal screens, fasteners, anchorages, and hardware. Internal reinforcement shall be provided at all fasteners, anchorages, hardware, and accessories.

Doors, panels, pilasters, and urinal screens shall be stainless steel with a No. 4 satin finish.

SUBMITTALS

Manufacturer's descriptive data, catalog cuts, and installation instructions shall be submitted for approval.

Working drawings shall show the plan layout, door and panel elevations and all details required for the complete installation and anchorage of the partition system.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-

consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

Doors and Panels:

Doors and panels shall be flush, one-inch thick, formed of two 0.030-inch (22-gage) Type 304 stainless steel sheets over a honeycomb core. Doors and panels shall have formed edges sealed with a continuous oval crown locking strip, and shall be mitered, welded, and finished at the corners.

Doors shall have controlled action hinges, with vertical pintle and ball bearing roller operating on adjustable cams, or moving parts of nylon and stainless steel. Top pivots shall be recessed into edges of doors.

Doors shall be provided with slide bar latch and a combination coat/hat hook and door stop, except as otherwise specified.

In addition to the above, doors on stalls designated as accessible shall be furnished with an automatic door closing device and U-shaped door pulls, located immediately below the latch on the inside and outside of the door.

Pilasters: Pilasters shall be 1-1/4 inches thick, of the same construction as the doors and panels, except face sheets shall be 0.036-inch (20-gage) minimum thickness, with adjustable, leveling base.

Headrails: Headrails shall be anodized aluminum, 1" x 1-1/2" minimum, with exposed ends capped.

Urinal Screens: Urinal screens shall be wedge type, wall-mounted, and of the same construction as the doors and panels, except face sheets shall be 0.040-inch (20-gage) minimum thickness. All fasteners shall be concealed.

Fasteners and Anchorages: Fasteners and anchorages shall be stainless steel with vandal resistant heads.

Hardware: Hardware shall be highly polished chromium plated, cast alloy, or heavy duty anodized aluminum.

Pilasters Anchors: Pilasters anchors shall be integral stud anchor type or internally threaded expansion sleeve type with single cone expander. Self-drilling type anchorage shall not be used.

Pilaster Shoes: Pilaster shoes shall be one-piece, stainless steel, with concealed hold down clips, and of sufficient height to completely cover the base and anchors.

PART 3 - EXECUTION

INSTALLATION

Metal toilet partitions shall be installed rigidly, securely, plumb, true, and in accordance with the manufacturer's recommendations. Tops and bottoms of doors shall align with tops and bottoms of panels, and all horizontal lines shall be level.

Blocking shall be provided in walls to receive anchorages.

Panels shall be anchored with at least 3 brackets at each wall and pilaster. Two anchors shall be used to fasten each pilaster base to the floor.

Doors shall not bind during opening and closing. The clearance between the door edges and pilasters shall be uniform, equidistant, and shall not exceed 3/16 inch. Hinges shall be adjusted to hold doors ajar when unlatched. Doors on stalls designated as accessible shall return to the closed position.

Drilling, cutting, and fitting of wall and floor finishes shall be concealed by the completed installation.

CLEAN-UP

Toilet partitions shall be cleaned, polished, and free of all defects. Chipped, dented, scratched, or otherwise damaged work shall be replaced at the Contractor's expense.

12-10.04 LOUVERS

PART 1 - GENERAL

Scope: This work consists of furnishing and installing storm resistant fixed horizontal louvers, insect screens, structural support and attachment brackets in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, color chips and installation instructions shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Warranty: Provide written warranty that all products will be free of defective materials or workmanship for a period of 1 year from date of installation.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

Louvers:

Louvers shall be factory fabricated units of 6063-T6 aluminum alloy. Frames including heads, sills, jambs and mullions shall be not less than 0.081 inch thick (12-gage) and blades shall be not less than 0.060 inch (14-gage) thick extrusions. Louvers to be mechanically fastened using stainless steel or aluminum fasteners.

Heads, sills, jambs and mullions shall be one-piece structural aluminum members with integral caulking slot and retaining beads. Mullions shall be sliding interlock with integral drains. Blades shall be one-piece aluminum extrusion with front lip gutter and multiple secondary gutters designed to catch and direct water to jamb and mullion downspouts. Louvers shall be supplied with 4" high by full depth sill flashings formed from minimum 0.050" thick aluminum. Sill flashing shall have welded side panels. Louvers and sill flashings shall be installed in accordance with the manufacturer's recommended procedures to ensure complete water integrity performance of louver system.

Finishes:

The finish on louvers shall be powder coat, a coating to be 1.5 to 3 mil thick full strength 100% resin fluoropolymer coating. Finish to allow zero VOCs to be emitted into facility of application. Finish to adhere to a 4H hardness rating.

All finishing procedures shall be one continuous operation in the plant of the manufacturer. The coating shall meet or exceed all requirements of AAMA specification 2605 "Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels."

The louver manufacturer shall supply an industry standard 20 year limited warranty against failure of excessive fading of the fluoropolymer powder coat finish. This limited warranty shall begin on the date of material shipment.

Insect Screens:

Mill finish insect screens shall be 5/8" mesh, 0.050" thick expanded and flattened aluminum insect screen secured within 0.055" thick extruded aluminum frames with protective coating to withstand marine environment. Frames to have mitered corners and corner locks.

PART 3 - EXECUTION

INSTALLATION

Louvers shall be installed in accordance with the manufacturer's instructions. The completed louver installation shall be weather tight.

Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated and fitted to the structure.

Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.

Set units level, plumb and true to line, with uniform joints.

PROTECTION

Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

ADJUSTING AND CLEANING

Immediately clean exposed surfaces of the louvers to remove fingerprints and dirt accumulation during the installation process. Do not let soiling remain until the final cleaning.

Restore louvers and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Engineer, remove damaged materials and replace with new materials.

Touch up minor abrasions in finishes with a compatible air-dried coating that matches the color and gloss of the factory applied coating.

12-10.05 WALL PROTECTION

PART 1 - GENERAL

This work shall consist of furnishing and installing corner wall guard at the locations shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, and standard color palette shall be submitted for approval.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

PART 2 - PRODUCTS

Corner guard System:

Corner guards shall be 48-inches in height. Corner guards shall have a continuous aluminum alloy 6063-T5 retainer with fastening per manufacturers installation requirements. Assembly shall be a 90-degree square corner with 3-1/2 inch wings. Snap on covers and caps shall be chemical and stain resistant, high impact vinyl acrylic, compounded with an anti-microbial additive, and extruded in longest lengths practicable for each system. The finish shall be an embossed pebble-grain, matte surface.

PART 3 - EXECUTION

INSTALLATION

The wall guards shall be installed and fastened securely in accordance with the manufacturer’s recommendations.

12-10.06 FLAGPOLE

PART 1 - GENERAL

Scope: This work shall consist of designing, furnishing, and installing a groundset flagpole and foundation in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PART 2 - PRODUCTS

Flagpole: Flagpole shall be tapered, 35-foot exposed height, 6063-T6 aluminum alloy pole with 6-inch diameter aluminum ball, ball bearing non-fouling truck with aluminum body and 4-inch diameter aluminum sleeves, 9-inch cast aluminum cleat and 5/16-inch polypropylene rope halyards with flag clasps. Aluminum shall be clear anodized after fabrication.

Metal Sleeve, Sand, Wedges and Sealant for Flagpole Foundation: Metal sleeve, sand, wedges and sealant for flagpole foundation shall be as recommended by the flagpole manufacturer. Metal sleeve shall be capped and shall have a ground spike with support plate.

Concrete: Concrete shall be as specified "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions and shall contain not less than 564 pounds of cement per cubic yard.

PART 3 - EXECUTION

The flagpole shall be erected plumb and rigid in accordance with the manufacturer's recommendations. Sand shall be consolidated before placing sealant.

12-10.07 METAL SIGNS

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing metal emergency pump shutoff signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, colors, graphics and fastening details shall be submitted for approval.

PART 2 - PRODUCTS

Signs:

Signs shall be sheet steel, not less than 0.048 inch thick (18-gage) with a baked-on enamel coating.

Signs shall have a white background with contrasting red letters. Red letters shall be 2 inches minimum in height.

Fasteners: Fasteners shall be as recommended by the sign manufacturer.

PART 3 - EXECUTION

Sign inscriptions shall read as shown on the plans.

Each sign shall be located as shown on the plans and shall be fastened in place with a minimum of 6 fasteners for each sign.

12-10.08 SIGNS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data for sign materials, graphics, and fastening hardware shall be submitted for approval.

Manufacturer's standard color palette for acrylic signs shall be submitted. The Engineer will select background and character colors from the standard color palette.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Regulatory Requirements: Identification, directional, informational, exit, and accessibility signs and symbols shall conform to the requirements in Identification symbols, 24 CA Code of Regs Pt 2, Identification Symbols, § 1115B.6, and Signs and identification, § 1117B.5.

Certificate of Compliance: The Contractor shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the sheet aluminum.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

Sign Colors: The color white shall conform to FED-STD-595, Color No. 17886. The color blue shall conform to FED-STD-595, Color No. 15090. The color black shall conform to FED-STD-595, Color No. 17038. Sign color shall have a minimum of 70% contrast with door or wall color.

Signs:

Signs shall be scratch resistant, non-static, fire retardant, washable acrylic laminate with a non-glare surface, not less than 1/8-inch thick.

International symbol of accessibility entrance sign may be a pressure sensitive decal.

Symbols: Symbols shall be scratch resistant, non-static, fire retardant, washable acrylic. Symbol colors shall be in contrast to door color. Text and pictogram color shall have a minimum of 70% contrast with adjacent sign color

Self-Luminous Sign (Exit):

Self-luminous sign shall be internally illuminated, self-luminous exit sign powered by permanent integral tritium gas source. Sign shall be approved by the California State Fire Marshal.

Sign housing shall be ABS molding. Faceplate shall be acrylic.

Vehicle Parking Signs:

Vehicle parking signs shall be sheet aluminum alloy, 6061-T6 or 5052-H38, not less than 0.063-inch (14-gage) with rounded corners and bake-on enamel coating. Alloy and temper designations for sheet aluminum shall conform to the requirements in ASTM B 209. Sheet aluminum shall be cleaned and pretreated in conformance with the requirements in ASTM B 449, Class 2.

Sign finishes shall conform to "Accessible Parking Signs" in Section 12-2, "Sitework," of these special provisions.

Vehicle parking signs shall read as shown on the plans. Sign size shall be 12 inches wide by 18 inches high with text sizes as shown on the plans.

Fastening Hardware and Material: Fastening hardware and material shall be as recommended by the sign manufacturer. Fasteners shall be noncorrosive.

PART 3 - EXECUTION

INSTALLATION

Signs and symbols shall be fastened or secured to clean, finished surfaces in accordance with the sign manufacturer's instructions. Signs shall be installed at a location and height as shown on the plans.

Metal signs shall be attached securely with galvanized or cadmium plated fasteners.

12-10.09 WARDROBE LOCKERS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing wardrobe lockers in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data:

Manufacturer's descriptive data, installation instructions, and standard color palette shall be submitted for approval.

Unless otherwise shown on the plans, the color will be selected by the Engineer from the standard color palette after the award of the contract.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Available Manufacturers: Subject to conformance with the contract provisions, metal lockers shall be Art Metal Products; Lyon Metal Products; Republic Storage Systems; or equal.

Lockers:

Lockers shall be standard, factory fabricated steel units. Framing shall be 0.060 inch thick (16-gage) and face sheets shall be 0.024 inch (24-gage), except door face sheets shall be 0.060 inch (16-gage).

Lockers shall be equipped with the following: hat shelf located approximately 10 inches below the top of the wardrobe locker, side to side coat rod, coat hook, louver vents at top and bottom of door, nonbreakable grip and turn handle, provisions for a padlock, lockbar with 3-point latching contact with door frame and 1 1/2 pair full looped leaf hinges.

Accessible lockers shall have coat rod and coat hook at maximum height of 48 inches, hat shelf at maximum height of 48 inches and minimum height of 15 inches, and accessible door hardware mounted between 34 inches and 44 inches from the ground.

The approximate dimensions of the full length wardrobe lockers shall be 15 inches wide, 18 inches deep and 72 inches high. Half size wardrobe lockers shall be approximately 15 inches wide, 18 inches deep and 36 inches high.

Closed Base: Closed base shall be the manufacturer's standard continuous 6-inch base, fabricated of the same material and designed for use with the lockers provided. Bottoms shall be flanged inward for stiffening. Bases shall have the same finish as the locker units.

Top: Top shall be the manufacturer's standard continuous sloping top with end closure as needed, fabricated of the same material and designed for use with the lockers provided. Tops shall have the same finish as the locker units.

FABRICATION

Shop Assembly:

Lockers shall be fabricated square, rigid, and without warp, with metal faces flat and free of dents or distortion.

Frame joints and seams shall be welded. Exposed welds shall be ground smooth. Hinge and latch connections shall be welded or riveted.

Bolts shall be used for assembly and mounting lockers components. Bolt or rivet heads on fronts of locker doors or frame shall not be exposed.

Factory Finish: Lockers shall be chemically pretreated with degreasing and phosphatizing process. Wardrobe lockers shall have a baked enamel finish on all surfaces, exposed and concealed.

PART 3 - EXECUTION

INSTALLATION

Lockers shall be mounted on closed bases at locations shown in accordance with the manufacturer's instructions for plumb, level, rigid, and flush installation.

Wardrobe lockers shall be bolted together at tops and bottoms. The backs of the end lockers shall be bolted to wall anchors with ¼-inch bolts installed near the tops of the wardrobe lockers as recommended by the locker manufacturer.

Trim, sloping tops, and metal filler panels, if required, shall be installed using concealed fasteners to provide flush, hairline joints against adjacent surfaces.

The number of lockers shall be as shown on the plans.

12-10.10 WOOD BENCHES

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing fixed wood benches in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

MR Credit 7, Certified Wood: For materials with certified wood content, submit product data and vendor invoices showing products on a line item basis, with cost, and identifying FSC-certified products as FSC Pure, FSC Mixed Credit, or FSC Mixed (NN) %; chain of custody certification; and spreadsheet(s) calculating cost of wood-based construction materials qualifying as certified wood.

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

MR Credit 7, Certified Wood: Use materials with certified wood content to contribute toward achieving MR Credit 7.

PART 2 - PRODUCTS

Acceptable Manufacturers: Subject to compliance with these requirements, manufacturers shall be Penco Products, Inc.; Republic Storage Systems, Inc.; Interior Steel Equipment Co.; or equal.

Seat: Seat shall be factory fabricated, laminated seat units of solid birch or other suitable, dense hardwood and manufacturer's standard two coats of clear lacquer. Seat units for wall fixed wood benches shall be 24 inches wide by 1-1/4 inches full finished thickness, and 48 inches in length. Seat units for floor fixed wood benches shall be approximately 9-1/2 inches wide by 1-1/4 inches full finished thickness, in lengths as shown on the plans. Edges of the seat shall be rounded and all surfaces shall be smooth and free of splinters which would snag clothing or skin.

Seat surface of 24”x48 wall fixed wood bench shall be slip resistant, factory fabricated in teakwood or solid phenolic with drainage slots. Teakwood slats shall be factory stained and varnished.

Supports Assemblies:

Fixed Wood Bench: Supports assemblies shall be standard steel pedestal assemblies, with continuously welded top and bottom flange fittings. Flanges shall have provisions for fasteners to the floor and securing to the bench. Pedestal diameter shall be not less than 2-1/4 inches. Overall bench height shall be no less than 17-1/2 inches. Pedestal color and finish shall be selected from the manufacturer's standard colors.

Fasteners: Fasteners for fastening seat units and support assemblies shall be the manufacturer's standard fasteners for the purpose intended.

Structural strength of 24”x48” wall fixed wood bench and attachments shall comply with the California Building Code, Section 1115B.7.2

PART 3 - EXECUTION

INSTALLATION

Bottom flange fittings of the support assemblies shall bear solidly on the floor without rocking, and fixed wood benches shall be fastened rigidly and securely to the floor in accordance with the manufacturer's recommendations.

12-10.11 FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing fire extinguishers with cabinets or mounting brackets in accordance with the details shown on the plans and these special provisions.

REFERENCES

Fire Extinguishers shall conform to the requirements in California Code of Regulations, Title 19 Division 1, Chapter 3, "Portable Fire Extinguishers."

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions shall be submitted for approval.

QUALITY ASSURANCE

Codes and Standards: Fire extinguishers shall be Underwriters Laboratories or Factory Mutual Laboratories approved for the type, rating and classification of extinguisher specified.

PART 2 - PRODUCTS

MANUFACTURER'S

Acceptable Manufacturers: Subject to contract compliance, manufacturers shall be J. L. Industries; Larsen's Manufacturing; Potter-Roemer; or equal.

COMPONENTS

Fire Extinguisher: Fire extinguisher shall be fully charged, multi-purpose dry chemical type, with charge indicator, hose and nozzle, and attached service record tag. Fire extinguisher shall be of the capacity and type rating shown on the plans.

Mounting Bracket: Mounting bracket shall be the manufacturer's standard painted, surface mounted type.

Fire Extinguisher Cabinet:

Fire extinguisher cabinet shall be factory fabricated, constructed of steel with a clear plastic panel in a steel door frame, and shall have a baked enamel finish. Color to be selected by the Engineer from the manufacturer's standard colors.

Fire extinguisher cabinet shall be surface mounted, semi-recessed or fully recessed as shown on the plans.

PART 3 - EXECUTION

INSTALLATION

Fire extinguishers shall be installed in locations and at mounting heights shown on the plans, or if not shown, at a height of 48 inches from the finished floor to the top of the fire extinguisher.

Fire extinguisher mounting brackets and cabinets shall be attached to structure, square and plumb, in accordance with the manufacturer's recommendations.

IDENTIFICATION

Bracket-mounted: Extinguishers shall be identified with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface. Letter size, style and location as selected by the Engineer.

Cabinet-mounted: Extinguishers in cabinets shall be identified with letter spelling "FIRE EXTINGUISHER" applied to the cabinet door. Letter size, styles, and color shall be selected by the Engineer from manufacturer's standard arrangements.

SERVICING

Fire extinguishers shall be serviced, charged, and tagged not more than 5 days prior to contract acceptance.

12-10.12 PREFABRICATED WIRE MESH PARTITIONS

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing prefabricated wire mesh partitions in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, working drawings and installation instructions shall be submitted for approval.

Working drawings shall show partition layout and details and anchoring and fastening details.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

PART 2 - PRODUCTS

Wire Mesh: Wire mesh shall be galvanized woven steel wire mesh with 1 1/2-inch square shaped openings. Wire shall be 10-gage and shall be double crimped at intersections.

Framing and Miscellaneous Steel Components: Framing and miscellaneous steel components shall be standard steel shapes, plates and bars as specified under "Building Miscellaneous Metal" in Section 12-5, "Metals," of these special provisions.

Hinges, Padlock Hasp and Padlock Staple: Hinges, padlock hasp and padlock staple shall be as recommended by the partition manufacturer.

Lock: Lock shall be mortise latchset as specified under "Finish Hardware" in Section 12-8, "Doors and Windows," of these special provisions.

PART 3 - EXECUTION

FABRICATION

Partition frames shall be of welded construction and shall be fabricated full height with horizontal and vertical framing members at the top and bottom edges, at the ends, around openings and at the intermediate locations specified herein.

Partition panels with door openings shall have an intermediate horizontal framing member located at the mid-height of the door opening. Panels shall have intermediate vertical framing members spaced at not more than 3 feet.

Partition assemblies shall be fabricated of sufficient size to minimize the number of field connections.

Panel frames shall be galvanized after fabrication.

All corner and tee connections of the frames shall be fully welded.

Doors and door openings shall be fabricated with sufficient clearance to permit the door to operate freely without binding or rubbing.

Workmanship, welding and galvanizing shall be in accordance with the requirements specified under "Building Miscellaneous Metal" in Section 12-5, "Metals," of these special provisions.

INSTALLATION

Partition panels shall be installed rigidly and securely in accordance with the approved working drawing and the manufacturer's instructions. Panel components shall be fastened to wood framing with lag screws, to steel with bolts and to concrete with expansion anchors.

12-10.13 FREE STANDING STEEL SHELVING

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing heavy duty free standing steel shelving and heavy duty steel bin shelving in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions and standard color palette shall be submitted for approval. The color will be selected by the Engineer after the award of the contract.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or

recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

PART 2 - PRODUCTS

Shelving: Shelving shall be factory fabricated steel shelves and supports capable of supporting loads of 25 pounds per square foot of shelf area. Shelves shall not deflect more than 5/16 inch when subjected to the loads specified herein and shall show no permanent deflection after removal of such loads. Shelves shall be supported and attached by means of clips. Studs or bolts shall not be used. Shelves shall be adjustable in vertical increments of 3 inches or less. Shelving shall be of the approximate dimensions and number shown on the plans and shall have a baked enamel finish.

Steel Bin Shelving: Bin shelving shall be factory fabricated with 14-gage steel uprights and 18-gage, 18-inch deep 12-inch high, steel shelves. Bin shelves shall be adjustable in vertical increments of 3-inch or less. Bin dividers shall be adjustable in horizontal increment of 1-inch on center. Shelving shall be of the approximate dimensions and number shown on the plans, and shall have a factory applied baked enamel finish.

1. Shelf unit shall have minimum of 17 bin openings sized as follows:

1 each	36" x 12"
6 each	18" x 12"
4 each	9" x 12"
6 each	12" x 12"

PART 3 - EXECUTION

Free standing steel shelving and steel bin shelving shall be installed in accordance with the manufacturer's instructions. The complete installation shall be rigid and secure.

12-10.14 CANTILEVER STEEL SHELVING

PART 1 - GENERAL

This work shall consist of furnishing and installing cantilever steel shelving in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, and standard color palette shall be submitted for approval. The color shall be selected by the Engineer from the submitted standard color palette.

PART 2 - PRODUCTS

Shelving and Supports: Shelving shall be heavy duty factory fabricated shelves and supports capable of supporting loads of 200 pounds per square foot of shelf area. Shelves shall be approximately eight feet high and shall have a minimum capacity of 22,000 pounds. Arms shall be approximately 37-inches in length and have a minimum capacity of 2,500 pounds. Base shall be approximately 4'-5" in length. Shelves shall not deflect more than 5/16 inch when subjected to the loads specified herein and shall show no permanent deflection after removal of such loads. Shelves shall be adjustable in vertical increments of 3 inches or less. Shelving shall be of the approximate dimensions and number shown on the plans and shall have a factory applied baked enamel finish.

PART 3 - EXECUTION

Cantilever steel shelving shall be installed and fastened in accordance with the manufacturer's instructions. The completed installation shall be rigid and secure.

12-10.15 WALL RACKS

PART 1 - GENERAL

This work shall consist of furnishing and installing custom length wall mounted coat racks in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PART 2 - PRODUCTS

MATERIALS

Wall strips shall be 1/2-inch extruded aluminum 24-inch long, powder coated black.

Brackets shall be solid cast aluminum powder coated black. Bracket screws are to be included to allow for height adjustment.

Shelf slat shall be extruded aluminum. Finish selection shall be submitted and selected by the Engineer.

Wall racks shall include double-pronged polycarbonate hook locked in place in second and forth slat of lower shelf. The number and arrangement are as per manufacturer's standards. Hook color selection to submitted and selected by the Engineer.

PART 3 - EXECUTION

INSTALLATION

Install wall blocking and wall trip using fasteners by others appropriate for wall type.

The wall strip height shall be based upon the details shown on the plans.

Install bracket in wall strip and slat using manufacturer approved fasteners.

CLEANUP

Wipe down shelves to remove dust.

Remove all trash and debris.

12-10.16 SUNSHADE

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing fixed custom sunshades with airfoil blade, including but not limit to horizontal, vertical, fixed, and extruded aluminum exterior sun control devices, in accordance with the details shown on the plans and these special provisions, and as needed for a complete and proper installation.

SUBMITTALS

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

Working Drawings:

Submit working drawing for each product required including the following:

1. Layout of the sunshade system, including plans, elevations, sections, profiles, angles, and spacing of blades, frames, anchorage, connection, and specific details for all the component parts.
2. Sectional details showing adjacent construction, including flashing, wall finish and sealants.
3. Indicate materials, thicknesses, types, connection details and methods, reinforcements and anchoring methods.
4. Provide engineering calculations to support design showing compliance with all local codes.

Working drawings and design calculations shall be stamped and signed by a Civil Engineer who is registered in the State of California. The expiration date of the registration shall be shown.

Samples:

Submit samples for color selection, minimum 24 inches of material with appropriate finish. Submit samples of manufacturer's color charts showing full range of colors and finishes available.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

IEQ Credit 4.1, Low-Emitting Materials: Adhesives and Sealants: Submit certification by the manufacturer confirming that products meet or exceed the volatile organic compound (VOC) limits set by specific agencies or other requirement as outlined in the LEED Green Building System. VOC limits shall be clearly stated in the submittal.

IEQ Credit 4.2, Low-Emitting Materials: Paints and Coatings: Submit product data for paints and coatings to be used on-site and inside the building weatherproofing system, indicating product name, manufacturer's generic description, chemical composition, and VOC content.

IEQ Credit 8.1, Daylight & Views: Daylight 75 Percent of Spaces: Submit certification by the manufacturer confirming that products provide the building occupants a connection between indoor spaces and outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

QUALITY ASSURANCE

Performance Requirements: Design sunshades to accommodate local requirements for snow and wind loading.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

IEQ Credit 4.2, Low-Emitting Materials—Paints and Coatings: For interior application (inside the weatherproofing system and applied on-site), use wallboard sealers and coatings that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in supplier's or manufacturer's original wrappings and containers.

Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

PROJECT CONDITIONS

Field Measurements: Take field measurements prior to fabrication of the work and preparation of working drawings, to ensure proper fitting of the work. Show recorded measurements on final working drawings. Notify the Engineer, in writing, of any dimensions found which are not within specified dimensions in the Contract Documents, prior to proceeding with the fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1. Established Dimensions: Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabricating of exterior sun control assemblies without field measurements. Coordinate construction to ensure that exterior sun control assemblies correspond to established dimensions.

WARRANTY

Provide written warranty that all screen products will be free of defective materials or workmanship for a period of 1 year from date of installation.

Provide 20 years warranty on applicable finishes and other pertinent Warranties on Materials and Labor.

PART 2 - PRODUCTS

MATERIALS

Aluminum Extrusions: ASTM B 211, Alloy 6063-T5 or 6061-T6

Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to produce required finish.

Internal and External Metal Fasteners: Fasteners shall be aluminum or stainless steel. Neoprene washers to be used to separate dissimilar materials. Do not use metals which are corrosive or incompatible with materials joined. Provide types, gages and lengths to suit unit installation conditions. Use flat-head machine screws for exposed fasteners, unless otherwise indicated.

Anchors and Inserts: Use non-Ferrous metal or hot dip galvanized anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or lead expansion bolt devices for drill-in place anchors.

SUNSHADE FABRICATION

Assemble exterior sun control assemblies in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitation. Clearly mark units for reassembly and coordinated installation.

Blades shall be 10-inches high, extruded aluminum airfoil design. Blades shall be factory assembled to outriggers using stainless steel, type F, thread cutting screws through internal screw slop in blades. Welding is not acceptable. Fasteners to be hex head, Blades must be removable for repair and replacement. Maintain equal blade spacing, including, but not limited to, separation between blades and frames to produce a uniform appearance. Blades shall be fixed.

Secure components in field using concealed fasteners.

ALUMINUM FINISH

Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products assembly. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces, which will be visible after completing finish process.

Aluminum Finishes: Finish designations prefixed by AA comply with system established by Aluminum Association for designating aluminum finishes.

Polyvinylidene Difluoride (PVDF) Resin-Based Coating System: PPG Duranar series thermoplastic organic coating system containing minimum 70 percent Kynar 500 or Hylar 5000 polyvinylidine fluoride (PVDF) resin combined with proprietary ceramic/ inorganic pigments for factory application to aluminum extrusions. Coating system shall comply with the following :

1. American Architectural Manufacturers Association (AAMA) standard AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
2. Architectural Spray Coaters Association (ASCA) standard ASCA 96 – Voluntary Specification for Superior Performance of Organic Coatings.

Touch – Up Paint: For minor field repairs to finish, air drying coating as produced and recommended by finish coating manufacturer’s specifications.

Factory Application: Prepare Aluminum Extrusions and factory apply aluminum pretreatment according to finish coating manufacturer’s specifications.

1. High Performance Organic Coating:

    1.1. Pretreatment: AAMA 606-98

        High Temperature Alkaline Wash
        Ambient Rinse
        Deoxidizer
        Chromium Chromate Coat
        Ambient Rinse and Dry Off

2. Standard Two-Coat Fluropolymer Finish Coating: Manufacturer's standard thermocured system, complying with AAMA 2604 Standards, inhibitive primer and fluoropolymer color topcoat.

Pretreatment, Primers, PVDF coating and topcoats in compliance with coating manufacturer's instructions and recommendations and in compliance with applicable provisions of referenced standards.

1. Primer: According to finish coating manufacturer's specifications as integral components of overall finish system.
2. Finish Coat: PVDF resin based coating according to finish coating manufacturer's specifications, thermoset after application.
3. Coating Thicknesses:

    3.1. Primer: Dry film thickness shall be 0.3 mil ± 0.1 mil
    3.2. Color coat: Dry film thickness shall be 1.0 mil ± 0.1 mil

Visual Performance Criteria: Coating finish shall be uniform in thickness and color, smooth and free from blemishes which might impair the serviceability or which are visible when viewed from a distance of 10 feet under normal daylight conditions at the project site.

PART 3 - EXECUTION

INSTALLATION

Install exterior sun control devices in accordance with reviewed product data, final working drawings, and engineering calculations.

Install assemblies plumb, level, and in proper alignment with adjacent Work

Assemble units with slip fit interconnections and mechanical fasteners for handling ang shipping.

Isolate aluminum from steel and incompatible materials with field applied bituminous coating, insulators, vinyl of plastic gaskets.

Use countersunk, concealed anchorages or intersection material and make hairline joints as inconspicuous as possible.

Provide neoprene washers fitted to screws in order to protect metal surfaces and to make a point of compression a weather resistant connection.

Anchor to substrate using fasteners as recommended by sunshade manufacturer, as indicated on reviewed working drawings and in accordance with general anchoring requirements.

Form closely fitted joints with exposed connections accurately located and secured.

Corrosion Protection : Protect galvanized and nonferrous metal surfaces which will be in contact with concrete, masonry, or dissimilar materials.

On wall penetration, following the pilot hole drilling procedure, installer is to apply a small quantity of sealant into hole or on thread or anchor bolt to provide water resistant bond.

Following any installation, the Contractor, must secure the services of a professional sealing company with at least 5 years of experience. Sealants of a type related to the local climatic conditions and suitable for the purpose for which they are intended together with any preferred flashing is to be applied by a professional in such a manner to provide a water tight seal against weather penetration at all points of anchor curtain wall, substrate, backing, decking or roofing as necessary.

Where possible design units with minimum welding to avoid heat applications which will change the tensile strength of the material.

Build in expansion capacity to minimize distortion and oil canning of surfaces.

Erection Tolerances:

1. Variation from level: Maximum variation from level shall be plus or minus 1/8 inch in any column to column space or 20'-0" runs, non cumulative.
2. Offset in end-to-end or edge-to-edge alignment of consecutive members shall be 1/32 inch.

Cut and trim component parts during erection only when the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming as impaired the strength or appearance of the assembly as directed.

Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly as directed.

ADJUSTING AND PROTECTION

Protection: Protect louvered sun control devices from damage during construction period including use of temporary protecting coverings where needed and approved by sun control device manufacturer. Remove protective covering at time of contract acceptance.

CLEANING

Progress Cleaning: Periodically clean exposed surfaces of sunshade which are not protected by temporary covering, and remove dust and soiling during construction period; do not let dust or soiling accumulate until final cleaning

Final Cleaning: Before Completion Review, clean exposed surfaces with water and with a mild soap or detergent not harmful to finishes. Rinse thoroughly and dry surface.

Do not walk over or bare loads on units during or after installation.

12-10.17 METAL AWNINGS

PART 1 GENERAL

SUMMARY

Scope: This work consists of the requirements to engineer, fabricate, and install metal awning system complete with necessary fasteners, accessories, and trim.

DESIGN REQUIREMENTS

Structural Performance: Provide aluminum canopy system capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under the conditions indicated:

Design Loads: As required by California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 16, “Structural Design Requirements”.

Wind Load: 85 mph exposure "C"
Live Load: per code
Seismic: See design notes on the plans for seismic information.
Load Combinations: Design awning system to withstand the most critical effects of load factors and load combinations.

Awnings to be attached at each 16 gage vertical framing stud 24 inch on-center max.

Thermal Movements: Provide metal awning system that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of

joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

SUBMITTALS

Product Data: Submit manufacturer's product data, specifications, component performance data and installation instructions. Provide samples of manufacturer's standard metal finishes for selection by the Engineer.

Working Drawings: Submit detailed drawings, layout of the awning system, and all mechanical joint locations with complete details, connections, jointing and accessories.

Calculations: Provide structural calculations for the proposed awning canopy fastening systems.

Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. The expiration date of the registration shall be shown. The Engineer's signature shall be original.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Qualifications:

Manufacturer Qualifications: The manufacturer firm shall have not less than 5 years experienced in products or systems similar to the size and complexity indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.

DELIVERY STORAGE AND HANDLING

Deliver awning components and other manufactures items to the site in unopened cartons, crates, or other protective containers bearing the manufacturer's labels.

Materials delivered to the site shall be immediately unloaded in a manner to prevent bending, warping, twisting, and surface damage.

Store materials in a clean dry environment and cover with suitable weathertight and ventilated covering. Stack canopy system components in a manner to prevent contact with other materials which might cause staining, denting, or other surface damage.

PROJECT CONDITIONS

Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with awning system by field measurements before fabrication and indicate measurements on Working Drawings.

COORDINATION

Coordinate installation of anchorages for awning system items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to project site in time for installation.

Coordinate installation of metal awning system with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

PART 2 – PRODUCTS

MATERIALS

Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to produce required finish and profile.

Aluminum Extrusions: 6063 alloy heat treated to a T-6 temper and not less than the strength and durability properties specified in ASTM B221 for 6063-T6.

Fascia: Manufacturer's standard extruded aluminum fascia sections as indicated and as required to complete the installation resulting in a neat finished appearance.

Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

Structural Bolts: ASTM F593; alloy 304 with nuts and washers of same material.

Blind Fasteners: High-strength aluminum or stainless-steel rivets.

FABRICATION

General: Fabricate awning canopy components to comply with indicated profiles, dimensions and structural requirements and the approved working drawings. Fabricate sections true to details with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, free from defects impairing strength and durability.

Shop Assembly: Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

Aluminum Finishes: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

High-Performance Organic Finish: Three coat fluoropolymer finishes complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 – EXECUTION

EXAMINATION

Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

Proceed with erection only after unsatisfactory conditions have been corrected.

CLEANING AND PROTECTION

Damaged Units: Replace roof deck panels and other components of the work, which have been damaged or have deteriorated beyond successful minor repair.

Cleaning: Remove protective coverings at time in project construction sequence which will afford greatest protection of work. Clean finished surfaces as recommended by the manufacturer. Maintain in a clean condition during construction.

12-10.18 TOILET AND SHOWER ACCESSORIES

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing toilet and shower accessories in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data, installation instructions, and details shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY CONTROL AND ASSURANCE

Regulatory Requirements: Accessibility products shall conform to Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Publicly Funded Housing, 24 CA Code of Regs Pt 2 §§ 1101B-1135B. Grab bars and folding shower seats shall conform to Grab bars, tub and shower seats, 24 CA Code of Regs Pt 2 § 1115B.7.

Certificates of Compliance: Certificate of Compliance shall be furnished for grab bars and folding shower seat in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. Certificate of Compliance shall include written confirmation that the grab bars and folding shower seat, backing, mounting devices, fasteners and their installation conform to the requirements in Structural strength, 24 CA Code of Regs Pt 2 § 1115B.7.2.

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content to contribute toward achieving MR Credit 5.

PART 2 - PRODUCTS

Toilet Tissue Dispenser: Toilet tissue dispenser shall be dual roll, surface mounted, stainless steel with satin finish, and approximately 6" x 11-1/2" x 6" in size. Dispenser shall utilize standard toilet tissue rolls. The top roll shall automatically drop into place after the bottom roll is depleted. One dispenser per toilet stall.

Combination Paper Towel Dispenser and Waste Receptacle: Combination paper towel dispenser and waste receptacle shall be semi-recessed, stainless steel with satin finish, and approximately 17" x 56" x 7-1/2" in size with 4-inch skirt. The paper towel dispenser shall have a capacity of 1,000 single fold paper towels. The waste receptacle shall have a capacity of at least 8 gallons. Quantity shall be as shown on the plans.

Toilet Seat Cover Dispenser: Toilet seat cover dispenser shall be surface mounted, stainless steel with satin finish, approximately 15" x 11-1/2" x 2" in size. One dispenser per toilet stall and wheelchair accessible compartment.

Napkin Receptacle: Napkin receptacle shall be surface mounted, stainless steel with satin finish, hinged top and bottom, approximately one-gallon capacity container with disposable liner. One receptacle per women's toilet stall.

Waste Receptacle: Waste receptacle shall be surface mounted, stainless steel with satin finish, and a capacity of at least 12 gallons. One receptacle per toilet room.

Clothes Hook: Clothes hook shall be stainless steel with two prongs. Quantity shall be as shown on the plans.

Paper Towel Dispenser: Paper towel dispenser shall be surface mounted, stainless steel with satin finish, with a capacity of 1,000 single fold paper towels. One dispenser per lavatory.

Liquid Soap Dispenser: Liquid soap dispenser shall be surface mounted, heavy-duty plastic dispenser for industrial use with a capacity of at least 24 ounces. Maximum operating force shall be 5 pounds. One dispenser per lavatory. Heavy duty pressure-sensitive adhesive backing shall be used for mounting to mirror where shown on the plans. Liquid soap dispenser shall be installed in the restrooms.

Powdered Soap Dispenser: Powdered soap dispenser shall be surface mounted, white enameled sheet steel dispenser with a capacity of at least 30 ounces. The dispenser shall have an adjustable soap dispensing mechanism and a lockable top. Maximum operating force shall be 5 pounds. One dispenser per lavatory. Powdered soap dispenser shall be installed in the shops and storage bays.

Mirror, Wall Hung: Mirror, wall hung shall be Number 1 quality, 1/4-inch thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror shall have a heavy gage galvanized steel back and stainless steel frame. The frame shall have a satin finish and shall be mitered and welded and the corners shall be ground smooth. Fasteners shall not penetrate surfaces of the frame exposed to view. Mirror shall be guaranteed against silver spoilage for not less than 10 years. Quantity shall be as shown on the plans.

Grab Bar: Grab bar shall be stainless steel with satin finish, and concealed, integral mounting flanges.

Folding Shower Seat: Folding shower seat shall be factory fabricated in teakwood or solid phenolic with drainage slots, Type 304 stainless steel tube frame with satin finish, wall bracket, and hinge. Teakwood slats shall be factory stained and varnished.

Shower Curtain: Shower curtain shall be flame resistant, one-way draw, nylon reinforced, anti-bacterial vinyl fabric. Curtain shall be approximately 72 inches x 72 inches.

Shower Curtain Rod: Shower curtain rod shall be stainless steel, fixed mounted shower rod with stainless steel mounting plates.

PART 3 - EXECUTION

INSTALLATION

Toilet and shower accessories shall be installed in accordance with the manufacturer's recommendations. Fasteners for mounting accessories shall be concealed and vandal resistant.

Expansion anchors shall be used for mounting accessories on masonry or concrete walls.

Toilet and shower accessories shall be mounted after painting work is complete.

All toilet room accessories shall be mounted plumb, secure, and rigid.

Grab bars, folding shower seats, and their fasteners shall be installed in conformance with the requirements in Grab bars, tub and shower seats, 24 CA Code of Regs Pt 2 § 1115B.7.

12-10.19 SUNSHADE/TRELLIS

PART 1 – GENERAL

SUMMARY

Scope: This Work shall consist of furnishing and installing aluminum sunshade/trellis in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer’s descriptive data and installation instructions along with manufacturers standard color chart shall be submitted for approval.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content, to contribute toward achieving MR Credit 4.

MR Credit 5, Regional Materials: Use materials with regional content, to contribute toward achieving MR Credit 5.

PART 2 – PRODUCTS

MATERIALS

Sunshade /trellis shall be constructed entirely of painted aluminum extrusions. All sections shall have integral caulking slot and retaining bead. The structure shall be capable of resisting all code required live loading including seismic and wind, and resists loading and damage from hail and being walked upon. Structural supports shall be designed by the sunshade/trellis manufacturer to carry a wind load of not less than 20 psf.

All sections shall be 6063 alloy heat-treated to a T-6 temper. Screws shall be type 18-8 stainless steel with neoprene O rings beneath stainless steel. Trim rivets shall be aluminum. Provide a dip coat of clear acrylic enamel to insulate column ends from electrolytic reaction with grout. Grout shall be 3:1 Portland cement to sand, with 2,000 psi compressive strength. Column ends shall be pierced to key grout to bent for maximum uplift protection.

FINISHES

Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products assembly. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces, which will be visible after completing finish process.

Aluminum Finishes: Finish designations prefixed by AA comply with system established by Aluminum Association for designating aluminum finishes.

Polyvinylidene Difluoride (PVDF) Resin-Based Coating System: PPG Duranar series thermoplastic organic coating system containing minimum 70 percent Kynar 500 or Hylar 5000 polyvinylidine fluoride (PVDF) resin combined with proprietary ceramic/ inorganic pigments for factory application to aluminum extrusions. Three coat application coating system shall comply with the following :

1. American Architectural Manufacturers Association (AAMA) standard AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

2. Architectural Spray Coaters Association (ASCA) standard ASCA 96 – Voluntary Specification for Superior Performance of Organic Coatings.

Visual Performance Criteria: Coating finish shall be uniform in thickness and color, smooth and free from blemishes which might impair the serviceability or which are visible when viewed from a distance of 10 feet under normal daylight conditions at the project site.

Sunshade/trellis shall be manufactured by Dittmer Architectural Aluminum, model ditt-deck; ASCA; Perfection ArchitecturalSystems, or approved equal.

PART 3 – EXECUTION

The Contractor shall filed confirm field column locations, bolt patterns, and elevations prior to fabrication. Columns shall be aligned prior to grouting. Aluminum sunshade/trellis shall be installed in accordance with the manufacturer’s instructions.

SECTION 12-11. EQUIPMENT

12-11.01 HIGH PRESSURE WASHER (PORTABLE)

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a portable high pressure washer and accessories in accordance with these special provisions.

SUBMITTALS

Product Data:

Manufacturer's descriptive data for a portable high pressure washer, accessories, and equipment shall be submitted for approval.

Manufacturer's descriptive data shall include a complete description, performance data and installation instructions for the materials and equipment specified herein.

CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals: Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

WARRANTY

Warranties and Guarantees: Manufactures warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2 - PRODUCTS

MANUFACTURED UNITS

High Pressure Washer:

High pressure washer shall be portable type, electric motor driven, No. 2 diesel oil fired. The washer shall have a capacity of not less than 3.9 gpm of hot water solution at 2,000 psi. The washer burners shall be UL or FM Listed, pressure atomizing type, with automatic electric ignition at the trigger control, rated for not less than 340,000 BTU/Hour. Washer shall be equipped with gas tank of not less than 8 gallons with integral fuel gage.

High pressure washer shall be equipped with a 150°F maximum adjustable temperature controller, ON/OFF pump motor and water heater switches, safety controls, safety valve, vent stack, and the following accessories: swivel cleaning gun with trigger control and 30-inch extension; wire braid hot water hose, 3/8-inch inside diameter, rated at not less than 2,000 psi working pressure, 50 feet in length with safety coupling; adjustable spray nozzle with spray pattern from 0 to 80 degree spray pattern.

PART 3 - EXECUTION

INSTALLATION

Install high pressure washer and accessories at the exact location as directed by the Engineer.

FIELD QUALITY CONTROL

Testing:

Testing of the high pressure washer shall be conducted by the Contractor in the presence of the Engineer.

The Contractor shall notify the Engineer in writing not less than 5 days prior to the time that testing is to be conducted.

12-11.02 FUEL STORAGE AND DISPENSING EQUIPMENT

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a cylindrical, dual compartment above ground fuel tank, fuel dispensing equipment including fuel pumps, fuel dispensers, totalizers, gasoline vapor recovery system, fuel supply lines, valves and appurtenances, and fire extinguishers. Work shall also consist of relocating an existing E-85 fuel storage tank, removing existing filling and dispensing equipment and installing new filling and dispensing equipment. A standby generator refueling system, including fuel pump, totalizer, fuel lines, valves and all appurtenances shall also be furnished and installed. All work shall be done in accordance with the details shown on the plans and these special provisions.

Foundations, supports, mechanical and electrical work, and all other work incidental to, and necessary for, the proper installation and operation of the items of equipment shall conform to the requirements specified for similar work elsewhere in these special provisions.

Permits to Operate: The Contractor shall provide all required permits for Vapor Recovery Systems for the gasoline fuel system in accordance with the requirements of the local air pollution control district in accordance with the requirements of the California Code of Regulations, Title 23, Chapter 3, Subchapter 16, or the local agency regulations, shall pay all costs for such permits, and shall perform all the required tests. Such permits shall be posted under glass at the site of the work before any equipment is installed. The Contractor shall also request Research and Development Status for an E-85 compatible Vapor Recovery System for the relocated E-85 fuel tank and new filling and dispensing equipment from the California Air Resources Board. The Contractor shall provide a vapor recovery system for the dispensing system if required by the California Air Resources Board or the local air pollution control district.

All work shall comply with the requirements of the 2010 Edition of the CFC, 2008 Edition of NFPA 30 and NFPA 30A.

SUBMITTALS

Product Data:

Manufacturer's descriptive data for all equipment, including installation instructions, shall be submitted for approval.

Manufacturer's descriptive data shall be submitted for the following:

Above ground fuel storage tank
Gasoline fuel pump

Bio-diesel 5 fuel pump
Fuel dispensers
Fill pipe spill container
Vapor recovery system
Ball valve
Check valve
External emergency shutoff valve
Solenoid valve
Mechanical tank level gauge
Anti-siphon valve
Overfill prevention valve
Expansion relief valve
Spill container hand pump
Pipe and fittings

CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals: Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Documentation: The following documentation shall be submitted prior to completion of the contract:

Tank UL listed numbers
Complete tank test log

WARRANTY

Warranties and Guarantees: Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

Manufacturer's warranty for the primary and secondary containment of the aboveground fuel tank shall be for 30 years from the date of delivery. All other components and accessories shall be covered for a 1 year period from the date of final acceptance testing, with a guarantee against material defects and faulty workmanship. Corrective action, at no additional cost to the State, shall be taken by the contractor or vender within 72 hours after notification of defect.

Workmanship: The aboveground fuel storage tank shall be free from defects that will adversely affect the appearance or serviceability. Exposed surfaces, including edges, shall be free from unsightly weld, weld splatter, dents, roughness, discoloration and irregularities in finish. Alignment shall be true and straight.

PART 2 - PRODUCTS

All products and appurtenances shall be listed for use by the type of fuel specified.

Aboveground Fuel Storage Tank:

Aboveground fuel storage tank system shall be assembled by a single manufacturer and furnished as a complete factory unit, and shall be listed for protected secondary containment (UL 2085). All components listed shall be factory installed.

The tank shall be horizontal, cylindrical type, dual compartment with capacities as shown on the plans. The tank secondary containment shall have the capacity to be pressure tested at 5 psi. Tank shall have a 2-hour fire rating.

Primary containment shall be a minimum of 1/4" steel, UL 142 listed, complying with NFPA 30 for aboveground storage tanks, and capable of on-site pressure testing for verification of primary tank integrity.

The secondary containment shall be separated from the primary containment by an annular space. The annular space shall have the capability of being physically monitored for leaks from the primary containment, be field pressure testable to ensure the integrity of the secondary containment and contain a means to remove liquid from the annular space.

The exterior of the tank shall be painted with three coats of petroleum resistant, white epoxy paint.

Primary and secondary containments shall be equipped with atmospheric and emergency vents as required by NFPA 30 and UL 142. A flame arrestor shall be installed on the main vent.

The tank assembly shall be equipped with seismic anchorage brackets integral with the tank assembly.

The tank contents shall be identified and tank shall be labeled per the CFC and NFPA requirements.

Fill ports shall be provided with a 20 gallon, ground mounted spill container and overfill prevention valve, designed for aboveground tanks and capable of stopping fuel delivery at 95%, or less, of tank capacity. Modified underground shutoff valves are not acceptable.

All openings to the primary and secondary containments shall be on top only.

Tank shall be labeled on all sides with signs that read "FLAMMABLE - NO SMOKING", and fuel sign "Bio-Diesel 5" or "Unleaded Gasoline," as applicable.

Tank, valves, equipment and all appurtenances shall be certified by the California Air Resources Board, as required.

Tank Level Gauge:

Tank level gauge shall be mechanical with numerical counter readout. Gauge shall have angled face for improved visibility from the ground, shall be corrosion resistant and shall include drop tube. Gauge enclosure shall be powder-coated aluminum and the float and hardware shall be stainless steel. Gauge shall read in feet and inches and be accurate to within plus or minus 2 inches.

Liquid Level Overfill Alarm:

Liquid level overfill alarm shall provide an audible and visual alarm for overfilling of the unleaded gasoline and bio diesel 5 compartments of the new aboveground storage tank upon reaching 90% of capacity. Alarm shall be self powered with a 10 year lithium battery and be intrinsically safe. Alarm shall include float switch and tank adapter.

Fuel Dispensers:

Fuel dispensers shall be equipped to communicate with and be controlled by a fuel control terminal. Fuel dispensers shall have single front mount nozzle and hose, listed shear/fire safety shut off valve with stabilizer bar assembly, listed shear/fire vapor safety shutoff valve (for dispensers with vapor recovery), automatic shut-off nozzles, ground supported overhead hose retractors, registers displaying 99.9 gallons minimum per filling, 100,000-gallon electronic totalizers, and shall be supplied with brand panels factory labeled "BIO DIESEL 5", "E-85" or "GASOLINE," as applicable.

Each dispenser hose shall be provided with an electrically operated solenoid valve for controlling the dispensing of fuel from a remote location. The solenoid valve shall be rated for 120 volts operation and be installed in series with the fuel dispensing hose. In addition, each dispenser unit shall have a pulser unit for communicating with the fuel control terminal, as shown on the electrical plans. The pulser unit shall comply with the following:

Gallon to pulse ratio	1:10
Input frequency	0-1500 Hz
Supply voltage	12-12.5 Volts DC at no load
Supply current	1000 Ma DC maximum
Pulser voltage	0.5-12 Volts DC
Pulser current	20 Ma DC maximum
Contact rating	20 Ma minimum @ 12 Volts DC

Gasoline nozzles and hoses shall be vapor recovery type unless not required by the local air pollution control district. For the E-85 nozzle and hose (and vapor recovery system), a "Request for Research and Development Status for an E-85 Compatible Vapor Recovery System" shall be sent to the California Air Resources Board, Monitoring and Laboratory Division, Engineering and Certification Branch, for obtaining a 2 year Research and Development Permit. The request shall include a complete equipment list for all new and existing equipment, components and appurtenances associated with the E-85 fuel storage and dispensing system. Documentation shall be provided if vapor recovery nozzles are not required. Gasoline dispensers shall be single product, single hose type. Each outlet shall have 12 feet of ¾-inch hose.

Diesel dispensers shall be single product, single hose units with 15 feet of one-inch hose.

Fuel dispensers shall be freestanding type; Wayne, Tokheim, Gasboy, or equal. Safety shut off valve shall be Emco Wheaton, OPW, or equal.

Pipe and Fittings:

All double wall fuel piping and fittings shall be reinforced thermosetting resin pipe (RTRP) machine made with glass fiber reinforced epoxy resin. RTRP shall conform to NFPA Standard No. 58-2001 for underground piping for petroleum products and shall be listed and labeled for said use. Pipe and fittings shall be marked with manufacturer's name, nominal size and RTRP classification type, grade and class.

Fittings for double wall secondary containment piping shall be 2 piece, glued and bolted together in accordance with the RTRP manufacturer's recommendations.

Pressure/vacuum vent piping shall be Schedule 40 galvanized steel pipe; ASTM Designation: A 53 or A 120 with 150-pound galvanized malleable iron fittings. The weight of the zinc coating shall not be less than 90 percent of that specified in ASTM Designation: A 53 or A 120.

All single wall fuel supply and vapor return lines shall be schedule 40 black steel pipe conforming to ASTM designation: A 53 grade B. All fittings shall be 150-pound ANSI B16.3, threaded and approved for use with petroleum products.

Submersible Pumps: Submersible pumps shall be suitable for the fuel being pumped and be furnished with continuous duty motors, centrifugal type pumping unit with screen, extractable manifold and controller with built-in check valve, relief valve, leak detector, air eliminator, built-in thermal overload and safety disconnect switch. Pumps and solenoid valves supplying dispensers shall be controlled by the by the dispenser and the fuel control terminal. The pump and solenoid valve supplying the standby generator fuel tank shall be controlled by a control box, upon demand by the standby generator (fuel tank float switch). Submersible pump shall be sized and rated as shown on the plans. Submersible pumps shall be FE Petrol, Veeder-Root or equal.

Biodiesel Meter and Totalizer: Bio diesel meter and totalizer shall be mechanical with resettable 4-wheel register and master 999,999.9 gallon totalizer. Meter shall be aluminum construction with seals suitable for bio diesel fuel.

Vapor Recovery Nozzles: Vapor recovery nozzles shall meet all requirements and be certified by the California Air Resources Board, be single hose type with automatic shut-off and swivel; OPW, Healy or equal (if certified by the California Air Resources Board).

Diesel Nozzles and Non-vapor Recovery Gasoline Nozzles: Diesel nozzles and non-vapor recovery gasoline nozzles shall have automatic shut-off and swivel, OPW, Husky or equal.

Fire Extinguisher: Fire extinguisher shall be Underwriters Laboratories or Factory Mutual Laboratories listed, fully charged, dry chemical type, with charge indicator and attached service record tag. Fire extinguisher shall be of the capacity and type rating shown on the plans.

Warning Signs and Emergency Procedures Signs: Signs shall be sheet steel, not less than 0.048 inch (18-gage) thick with a baked enamel coating and shall have red letters on a white background.

PART 3 - EXECUTION

INSTALLATION

Pipe Installation:

Double wall fuel piping for supplying the standby generator shall be graded slightly toward the fuel island without loops or traps. Double wall piping shall be installed where shown on the plans.

Single wall fuel supply, vapor recovery and vent piping shall be installed as shown on the plans. Piping support shall be installed as shown on plans and as required for stability

Fire Extinguisher Installation: The fire extinguishers shall be installed with a manufacture supplied mounting bracket. Fire extinguisher handle shall be 4 feet above finished floor.

Warning signs and Emergency Procedures Signs: Sign sizes, messages, lettering type and size shall be as shown on the plans. Warning signs shall be installed at the locations shown on the plans.

FIELD QUALITY CONTROL

Testing:

Double wall RTRP shall be pressure tested according to manufacturer's recommendations for not less than 4 hours. Testing procedures shall be submitted to the Engineer prior to testing. Tank shall be isolated from piping during pipe pressure tests. The RTRP shall not be covered until testing is successful and approved by the Engineer.

Single wall galvanized steel pipe and black steel pipe shall be pressure tested to 100 psig with air for 4 hours.

A general performance test to demonstrate the proper operation of the fuel island equipment shall be made by the Contractor in the presence of the Engineer. A test to demonstrate the proper operation of the standby generator refueling system shall also be performed. The pumps shall be tested to verify the delivery rate, 15 GPM without vapor recovery equipment and 8 GPM with vapor recovery equipment.

The fuel for testing the pumps will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

12-11.03 LUBRICATION AND COMPRESSED AIR SYSTEMS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing lubrication and compressed air systems in accordance with the details shown on the plans and these special provisions.

The lubrication system shall include drums and spill pallets, overhead hose reels and pneumatic pumps for dispensing chassis lubricant, light weight motor oil, heavy weight motor oil, automatic transmission fluid, gear

lubricant hydraulic fluid, and anti-freeze; overhead electric light; and all connecting pipelines, hoses, accessories and mounting assemblies.

Drum Spill Pallets: Drum spill pallets shall be designed for secondary containment and engineered to meet EPA 40 CFR 264.175 standard. The pallets shall be constructed of 100% polyethylene material for chemical resistance, complete with non-skid removable grates, drain hole and plug, access ramp as shown on the plans, and shall be forkliftable.

Each spill pallet shall be equipped to hold two 55-gallon drums, have a minimum load bearing capacity of 2000lbs, sump holding capacity of 58 gallons and a dimensions of 54”L x 29”W x 16.5”H.

The compressed air system shall include a compressor, regulators, gauges, refrigerated air dryer as shown on the plans, and compressed air piping.

Pipes and fittings shall be in accordance with the requirements specified under "Pipes, Fittings, and Valves," in Section 12-15, "Mechanical," of these special provisions.

Permits to Operate:

Attention is directed to the latest Division of Industrial Safety (DIS) regulations regarding tank mounted air compressors.

The Contractor shall provide all permits to operate pressure vessels in accordance with the requirements of the DIS and shall pay all costs for such permits. Such permits shall be posted under glass at the work site.

SUBMITTALS

Product Data:

Manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include a complete description, performance data and installation instructions for the materials and equipment specified herein. Performance data shall include the product delivery rate and discharge pressure for each type of pump assembly.

CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals: Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

WARRANTY

Warranties and Guarantees: Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2 - PRODUCTS

OVERHEAD HOSE REEL ASSEMBLIES

Overhead hose reel assemblies shall be heavy duty assemblies of steel construction with connecting hoses, locking automatic ratchets, dual arm hose guide with guide rollers and heavy duty spring activated hose pickups. Reels shall have bushings, swivels, ball stops, delivery hoses and control valves. The reels shall have a baked enamel finish. Manufacturers reel mounting brackets shall be supplied with reels.

Chassis Lubrication Reel Assembly: The chassis lubricant reel assembly shall have a 40-foot minimum length, minimum ¼-inch outside diameter, high pressure delivery hose and outlet control valve. The delivery hose shall be rated for 5,000 psi working pressure and 20,000 psi bursting pressure. The chassis lubricant reel assembly shall be Lincoln, 85051; Graco, 224-363, 224-417, and 202-577; or equal.

Light Weight Motor Oil Reel Assembly: The motor oil reel assembly shall have a 16-quart metering shutoff valve assembly with totalizer, non-drip nozzle extension, strainer and a 40-foot minimum length of ½-inch inside diameter, medium pressure delivery hose. The delivery hose shall be rated for 800 psi working pressure and 4,000 psi bursting pressure. The motor oil reel assembly shall be Lincoln, 83464 and 899; Graco, 224-057, 218-549, 222-648, 203-265, 157-958, and 108-478; or equal.

Heavy Weight Motor Oil Reel Assembly: The motor oil reel assembly shall have a 16-quart metering shutoff valve assembly with totalizer, non-drip nozzle extension, strainer and a 40-foot minimum length of ½-inch inside diameter, medium pressure delivery hose. The delivery hose shall be rated for 800 psi working pressure and 4,000 psi bursting pressure. The motor oil reel assembly shall be Lincoln, 83464 and 899; Graco, 224-057, 218-549, 222-648, 203-265, 157-958, and 108-478; or equal.

Automatic Transmission Fluid Reel Assembly: Automatic transmission fluid (ATF) reel assembly shall have a volume control valve, non-drip nozzle and 40-foot minimum length of ½-inch outside diameter, medium pressure delivery hose. The delivery hose shall be rated for 800 psi working pressure and 4,000 psi bursting pressure. The ATF reel assembly shall be a Lincoln, 83464 and 776; Graco, 224-057, 218-549, and 222-413; or equal.

Hydraulic Fluid Reel Assembly: Hydraulic reel assembly shall have a volume control valve, non-drip nozzle and 40-foot minimum length of ½-inch outside diameter, medium pressure delivery hose. The delivery hose shall be rated for 800 psi working pressure and 4,000 psi bursting pressure. The hydraulic reel assembly shall be a Lincoln, 83464 and 776; Graco, 224-057, 218-549, and 222-413; or equal.

Gear Lubricant Reel Assembly: Gear lubricant reel assembly shall have an 10-quart metering shut-off valve assembly with totalizer, non-drip nozzle and a 40-foot minimum length of ½-inch outside diameter, medium pressure delivery hose. The delivery hose shall be rated for 800 psi working pressure and 4,000 psi bursting pressure. The gear lubricant reel assembly shall be Lincoln, 83464 and 881; Graco, 224-057, 218-549,222-648, 201-701, 157-958 and 108-478; or equal.

Anti-freeze Reel Assembly: The anti-freeze reel assembly shall have a shutoff valve assembly with totalizer, non-drip nozzle extension, strainer and a 40-foot minimum length of ½-inch outside diameter, medium pressure delivery hose. The delivery hose shall be rated for 800 psi working pressure and 4,000 psi bursting pressure. The anti-freeze reel assembly shall be Lincoln, 83464 and 899; Graco, 224-057, 218-549, 222-648, 203-687, 157-958 and 108-478; or equal.

PUMP ASSEMBLIES

Pump assemblies shall be lubricant and oil type pump assemblies with air driven motors and shall be suitable for operation with stationary, exposed drums. Pump assemblies shall include pressure relief kits. Air connector hose shall be rated for 250 psi minimum working pressure. Product connector hose shall be as specified for the individual reel assembly. Pump assemblies shall produce the flowrates and pressures as specified under "Testing."

Chassis Lubricant Pump Assembly: Chassis lubricant pump assembly shall be suitable for use with stationary, exposed 120-pound drums, complete with drum cover, air coupler and follower plate, and shall have a minimum pressure ratio of 45:l and a maximum pressure ratio of 50:l. The chassis lubricant pump assembly shall be Lincoln, 918; Alemite, 8550; Graco, 225-014; or equal.

Motor Oil, ATF and Gear Oil Pump Assemblies: Chassis lubricant pump assembly: Motor oil, ATF hydraulic fluid pump assemblies, and gear oil pump assemblies shall be suitable for use with stationary, exposed 55-gallon drums and equipped with a bung bushing and an air expeller in the pump tube and shall have a 3-inch air motor. The motor oil pump assembly shall be equipped with a flow compensator. Pump assemblies shall be Lincoln, 424; Alemite, 8569; Graco, 225-640; or equal.

Anti-freeze Pump Assembly: Anti-freeze pump assemblies shall be suitable for use with stationary, exposed 55-gallon drums and equipped with a bung bushing, 316 stainless steel construction, and teflon packing. Pump assemblies shall be Lincoln, 84830; Aro, 612041; Graco, 226-942 and 213013; or equal.

Recyclable Oil Transfer Pump: Recyclable oil transfer pump shall be an air operated double diaphragm pump with one-inch inlet and outlet and a minimum pressure ratio of 1:1. Pump shall have aluminum housing with Buna-N trim. Recyclable oil transfer pump shall be Lincoln, Model 84852; Graco, Model D73-525; or equal.

Waste Coolant Transfer Pump: Waste Coolant Transfer Pump shall be an air operated double diaphragm pump with one-inch inlet and outlet and a minimum pressure ratio of 1:1. Pump shall have aluminum housing with Buna-N trim. Recyclable oil transfer pump shall be Lincoln, Model 84852; Graco, Model D73-525; or equal.

MISCELLANEOUS COMPONENTS

Recyclable Oil Storage Tank: Recyclable oil storage tank shall be upright and shall be constructed from cross linked polyethylene materials. Recyclable oil transfer tank shall be equipped with a translucent vessel and shall be sized as shown on the plans.

Waste Coolant Storage Tank: Waste Coolant Storage Tank shall be upright and shall be constructed from cross linked polyethylene materials. Waste Coolant Storage tank shall be equipped with a translucent vessel and shall be sized as shown on the plans.

Light Reel Assembly: Light reel assembly shall be overhead type light reel with a positive reel latch cord lock mechanism, release mechanism, reel cord retractor, 50-foot minimum length of 3-wire cord, 2-foot pigtail, ball stop, vapor-tight high impact phenolic plastic holder without switch or receptacle with heavy duty lamp guard and l5-watt LED bulb. The light reel assembly shall be Hi Reel, Bayco or equal.

Air Compressor: Air compressor shall be 2-stage, 175 psig design, 17 psi output, mounted on an ASME code 120 gallon verticle type receiver. The air compressor shall be complete with magnetic motor starter, NEMA 1 and ODP motor, oil sight glass, air cooled aftercooler, unloader, V-belt drive, belt guard, oil and air pressure gauges, automatic pressure controller, outlet valve, ASME relief valve, air intake filter, ball valve drain and an automatic tank drain operated by either the compressor unloader or a governor. Motor shall be high efficiency type, open dripproof with class B insulation. Air compressor shall be Champion, Ingersol Rand, Kellogg, or equal.

Air Compressor Receiver: Air compressor Receiver shall be ASME code 120 gallon verticle type receiver.

Refrigerated Air Dryer: Refrigerated Air Dryer shall have a corrosion resistant heat exchanger, built in stainless steel demister, microprocessor control with graphic interface, variable speed fan, fully hermetic compressor, and fully adjustable programmable electronic drain valve. The Refrigerated Air Dryer shall be rated for a minimum of 40 SCFM with an inlet air temperature of 140 degree F. Refrigerated Air Dryer shall be Ingersol Rand, Atlas Copco, or equal.

Pressure Regulator:

Pressure regulator shall be combination type with filter, bowl, pressure regulator and pressure gauge.

The filter bowl shall be the quick disconnect type, plastic with metal guard, manual drain, and 5-micron filter.

Pressure regulator shall be diaphragm controlled, balanced valve type, rated for 0 to 175 psig operation and shall be equipped with pressure gage, bottom clean-out plugs and internal strainers. Regulator shall be Wilkerson, Lincoln, Wabco, or equal.

Flexible Coupling: Flexible coupling shall be brass flexible metal hose with threaded union ends and a minimum working pressure of 200 psig.

Pressure Gage: Pressure gage shall be rotary type ANSI Standard: B40.1, Grade A, with 3½-inch dial, liquid filled with cover, plain case, reset screw and bottom inlet. Pressure gage movement shall be phosphor bronze

bushed. Gage shall read from 0 psi to 200 psi. Each gage shall be equipped with a gage cock. Pressure gage shall be Marsh, Ashcroft, US Gage, or equal.

Drum Dolly: Drum dolly shall have welded steel construction with a cross braced bottom and a 2-inch continuous perimeter lip, 4 ball bearing casters with steel or semi-steel wheels. Drum dolly shall be sized for 120-pound drums or 55-gallon drums as applicable.

PART 3 - EXECUTION

INSTALLATION

The hose reels shall be installed rigidly and securely to the reel mounting bracket. The mounting bracket shall be attached to the overhead structure as shown on the plans.

The recyclable oil and waste coolant storage tank and transfer pump, and refrigerated air dryer shall be installed as shown on the plans.

Pipelines shall be cleaned and flushed immediately prior to connecting the control valves.

Pressure relief kits shall be installed on the discharge side of all the pumps as recommended by the pump manufacturer.

Air compressor and refrigerated air dryer shall be installed with drain piping, vibration isolation pads and expansion anchors.

Unions shall be installed before and after the pressure regulator/ball valve assembly.

Each pump assembly drum shall be supplied with a drum dolly.

FIELD QUALITY CONTROL

Testing:

All tests, including general performance tests to demonstrate the proper operation of the lubrication systems, refrigerated air dryer, and the air compressor, shall be performed by the Contractor in the presence of the Engineer.

The air compressor, and refrigerated air dryer systems shall be tested for the operational range, the cut-off pressure and the operation of air drops and system components.

The lubrication system, including piping and hoses, shall be tested for leaks and the rates of delivery specified herein. The lubrication connections shall show no visible signs of leaks when the system is filled with the specified lubricant and tested at 150 psi lubricant pump inlet air pressure.

The Contractor shall demonstrate that the completed lubrication system will deliver the given product at the flowrate and discharge pressure specified by the pump assembly manufacturer. If no specification is given the lubricants shall be delivered at the following rates at 150 psi lubricant pump inlet air pressure:

Lubricant Material	Delivery Rate
Chassis lubricant NLGI No. 2 grease	25 ounces per minute
Light Weight Motor oil (10W/40) Heavy Weight Motor oil (20W/50)	8 quarts per minute
Gear oil (85W/140)	7 quarts per minute
ATF (SAE 10), Hydraulic Fluid	9 quarts per minute
Anti-freeze (50 % solution)	9 quarts per minute

The required delivery rate values may be adjusted, as determined by the Engineer, when testing for delivery rates with different materials or at temperatures other than 70°F.

The drums and lubricating material for testing the lubrication system will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

12-11.04 EXHAUST EVACUATION HOSE REEL AND FAN

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing exhaust evacuation hose reel and fan equipment, including overhead fume exhaust fan, hose reel, hose and remote operating station. All work shall be done in accordance with the details shown on the plans and these special provisions.

Supports, Mechanical and Electrical work and all other work incidental to, and necessary for, the proper installation and operation of the items of equipment shall conform to the requirements specified for similar work elsewhere in these special provisions.

SUBMITTALS

Product Data: Manufacturer's description data, installation recommendations, working drawings, schematic diagram, interconnection diagram, including reel installation mounting brackets, shall be submitted for approval. Fan, hose reel and push button station shall be from same manufacturer. System shall be Monoxivent, Nederman, CarMon or equal.

PART 2 - PRODUCTS

Exhaust Evacuation Fan: Exhaust evacuation fan shall be centrifugal TEFC, AMCA certified exhaust fan suitable for diesel or gasoline powered vehicle exhaust applications. Fan parts exposed to air stream shall be coated to prevent acid corrosion. The exhaust evacuation fan shall be mounted with vibration isolators on the reel. The fan size and performance shall be as shown on plans.

Hose Reel Assembly: Hose reel assembly shall be provided with 30 feet minimum of 6-inch diameter flexible hose. The hose reel shall be motor operated and shall be capable of unwinding and recoiling the hose from a remote operating station. All electrical equipment necessary for operation shall be mounted on the hose reel assembly except for the remote operating station. The hose reel motor shall be interlocked with an adjustable limit switch that stops the reel when the tubing has been fully extended or fully retracted.

Hose: Exhaust hose shall be fabricated of a high strength woven glass fiber cloth supported by a helically wound spring steel wire. The hose shall be capable of withstanding temperatures of 300°F and shall be supplied with a rubber nozzle of the same size as hose provided.

Pushbutton Station: Pushbutton operating station shall consist of a 3 button (up, down, on/off) controller wired directly to the hose reel assembly. The up and down buttons shall be momentary push button type.

Control Panel:

Control panel shall be a complete system routinely advertised, furnished and guaranteed by the exhaust evacuation hose reel and fan manufacturer.

Control panel shall include circuit breakers, starters, fan motor contactor, power supply, limit switch and controls that are required for proper operation.

PART 3 - EXECUTION

INSTALLATION

The exhaust evacuation hose reel and fan shall be installed in accordance with the manufacturer's recommendations. The exhaust evacuation units and pushbutton station shall be located as shown on the plans.

FIELD QUALITY CONTROL

Testing: The test shall consist of a general performance test to demonstrate the proper operation of the exhaust evacuation hose reel and fan system. The test shall be performed by the Contractor in the presence of the Engineer.

12-11.05 SAND-OIL SEPARATOR AND CLARIFIER TANK

PART 1 - GENERAL

SUMMARY

Scope: This work consists of furnishing and installing sand-oil separator and clarifier tanks in accordance with these special provisions.

Other appurtenances or details, not mentioned, which are required for the construction and proper operation of the tanks must be furnished, placed, constructed, or installed as required.

Related work:

Pipes, fittings, manhole frames and covers, and similar equipment must conform to the requirements under "Sewage Pipes and Fittings" in Section 12-2, "Sitework," of these special provisions.

Concrete must conform to Section 90-10, "Minor concrete," of the Standard Specifications excluding measurement and payment.

Excavation, trenching, and backfill must conform to the requirements under "Earthwork for Building Work" in Section 12-2, "Sitework," of these special provisions.

SUBMITTALS

Product data: Manufacturer's product data must be submitted for all manufactured materials and equipment. Manufacturer's product data must include catalog cuts, complete description, performance data, and installation instructions.

Working Drawings: Working drawings and design calculations for the precast concrete tank used in the work must be submitted for approval. The drawings and calculations must be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. Bedding, assembly, installation and backfilling instructions for the precast tank must be submitted for approval.

Closeout Document Submittals:

Closeout documents must be furnished for the all equipment prior to completion of the project:

Each closeout document must contain the following information:

1. Parts list.
2. Installation Instructions.
3. Operating instructions.
4. Maintenance instructions.
5. Wiring schematics.

Closeout documents must be submitted in the following manner:

1. One CD containing PDF files.
2. Two individual 3-ring binders containing paper copies.

Incomplete or inadequate documentation must be returned to the Contractor for correction and resubmittal.

PART 2 - PRODUCTS

MANUFACTURED UNITS

Precast Tanks and Sampling Box:

Sand-oil separator, clarifier tank, and sampling box must be precast reinforced concrete tank of the size shown on the plan. The design and details must comply with the minimum requirements of the American Concrete Institute (ACI) 318 Code. Minimum concrete compressive strength (f'c) must be 3,000 psi. Tanks and sampling box must be designed for all loads and pressures resulting from the vertical and lateral loadings listed below:

1. Minimum earth cover over the tanks as shown on the plans.
2. Earth density: 120 pounds per cubic foot.
3. Equivalent fluid pressure for lateral pressure due to earth: 30 pounds per square foot per foot.
4. H-20 loadings.
5. Buoyancy due to groundwater. Groundwater is expected from 4 feet to 7 feet below existing ground surface.

COMPONENTS

Cement Mortar: Cement mortar must conform to the provisions in Section 65-1.06, "Joints," of these Standard Specifications.

Epoxy Mortar: Epoxy mortar must be a commercial quality, trowelable, 3-component epoxy mortar consisting of two pourable epoxy components and a chemically resistant aggregate filler of silica quartz sand with maximum water absorption of 0.1 percent. Epoxy must have a pull-off strength of not less than 1,000 psi and a 90 percent cure in 24 hours. Epoxy mortar must be the type that requires no primer as a bonding agent.

Sealant: Sealant for precast concrete tank must offer protection against saltwater upon curing. Sealant must be designed for continuous immersion.

Oil absorbent pillows: Oil absorbent pillows must be approximately 2' x 4' in dimension. Pillows must absorb hydrocarbon-based liquids and repel aqueous-based liquids. They must float on water. Booms of the same surface area may be substituted for pillows. Pillows must be designed with a scrim that encases particulate sorbent materials.

Oil detecting system: Oil detecting system consists of controller and an electromagnetic absorption sensor for detecting the presence of hydrocarbons in the tank. Power input voltage of controller must be 120 VAC. The sensor must be capable of detecting 0.04 inch to 4 inches thick of hydrocarbon on water and withstand temperatures from 32 to 150°F. The controller must have a signal processor and power supply in a NEMA 4X enclosure. The controller must have two alarm relay contacts and one fail contact: SPDT rated 4A (3A for fail contact) at 250 VAC or 30 VDC, includes built-in diagnostics feature.

Sludge sensing system: Sludge sensing system consists of controller and underwater ultrasonic acoustic sensor for detecting sludge thickness inside tank. The sensor must have 4-20mA output, 120 VAC, PVC enclosure, epoxy coating, and shielded twin pair connection to the controller. The controller must have NEMA 4X enclosure, cable length suitable for installation and display with minimum of four formats. Relays must be UL approved and with 10A switching capacity at 120 VAC.

PART 3 - EXECUTION

INSTALLATION

Manufactured precast tanks, sampling box, and other appurtenances must be installed in accordance with the manufacturer's recommendations and the approved working drawings.

Sealant must be applied to the exterior surfaces of concrete structures, including the bottom. Sealant must be applied as recommended by the manufacturer and protected from damage during transport and installation. Concrete surfaces to be coated with sealant must be at least 28 days after fabrication.

Oil absorbent pillows must be installed inside the precast tanks around the outlet pipe.

The oil detecting system and sludge sensor must be installed to comply with the manufacturer's recommendations and as shown on the plans.

TESTING

The clarifier tank must be tested for leakage by filling the tank with water to the level of the outflow line for a period of 24 hours. All seams and joints must be left exposed (except the bottom of the tank) for inspection purposes. The tank must remain watertight. Repairs, if necessary, must be made at the Contractor's expense.

The oil detecting system must be tested according to the manufacturer's recommendations.

Sludge sensor must be tested according to the manufacturer's instructions.

12-11.06 INDUSTRIAL VACUUM SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work consists of furnishing and installing an industrial vacuum system in accordance with these special provisions.

All the components and appurtenances necessary for operation must be supplied by the same manufacturer as a packaged unit.

SUBMITTALS

Product data: Manufacturer's product data must be submitted for all manufactured materials and equipment. Manufacturer's product data must include catalog cuts, complete description, performance data, and installation instructions.

Closeout Document Submittals:

Closeout documents must be furnished for all the equipment prior to completion of the project:

Each closeout document must contain the following information:

1. Parts list.
2. Installation instructions.
3. Operating instructions.
4. Maintenance instructions.
5. Wiring schematics.

Closeout documents must be submitted in the following manner:

1. One CD containing PDF files.
2. Two individual 3-ring binders containing paper copies.

Incomplete or inadequate documentation must be returned to you for correction and resubmittal.

Warranties and Guarantees: Manufacturer's warranties and guarantees for materials or equipment used in the work must be delivered to the engineer at the jobsite prior to acceptance of the contract.

PART 2 - PRODUCTS

Industrial Vacuum System:

Industrial vacuum system must be stationary, consisting of a vacuum unit and an air station unit.

Vacuum must have two electric motors requiring 20A, 120VAC input.

Air station must have 3/4-horsepower air compressor.

Exterior housing must be 18-gage minimum stainless steel.

Equipped with a toggle switch to activate and deactivate the unit.

Equipped with four filter bag system.

Airflow must be at least 160 cubic feet per minute.

Built-in electrical disconnect inside the unit.

Vacuum hose must be 2" diameter by 15 feet long, clog and crush resistant. The air hose must be 1/4" diameter by 25 feet long, cut resistant, and includes inline air gauge.

ACCESSORIES

Vacuum Nozzles: Vacuum nozzles include Crevice Connection, Upholstery Nozzle, Brushes and Floor Nozzles.

Plastic Bag Liner:

PART 3 - EXECUTION

INSTALLATION

Industrial vacuum system must be installed in accordance with the manufacturer's recommendation and as shown on the plans.

FIELD QUALITY CONTROL

Testing must be conducted by the Contractor in the presence of the Engineer. The Engineer must be notified 5 days in advance of the test date.

12-11.07 WORKBENCH

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a workbench with steel or wood countertop in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product data: Manufacturer's descriptive data and installation instructions along with manufacturers standard color palette shall be submitted for approval.

PART 2 - PRODUCTS

Workbench with steel top: Workbench shall be standard, factory fabricated and factory painted heavy duty workbench unit with plywood reinforced steel top, back and end stops, drawers, and shelves. Steel top shall be 13-gage hot rolled steel with 1-3/4" face and 1" (90 degrees) return flange. Plywood top reinforcement shall consist of two layers of securely fastened ¾-inch thick exterior type plywood. The drawers, shelves and back and end stops shall be as shown on the plans. Paint shall be an industrial grade enamel.

Workbench with laminated hardwood top: Workbench shall be standard, factory fabricated and factory painted heavy duty workbench unit with laminated hardwood bench top, drawers, riser, back and end stops, curb, and shelves. Wood top shall be made from high quality northern hard maple, kiln dried; laminated construction with rails or strips approximately 1-3/4" wide; top and edge surface sanded and finished with two coats and bottoms surface with one coat of varnish type product clear and moisture resistant. The drawers, riser, back and end stops, and shelves shall be as shown on the plans. Paint shall be an industrial grade enamel.

Leg anchors: Leg anchors shall be ICC approved, integral stud type expansion anchors or internally threaded type anchors with independent stud.

PART 3 - EXECUTION

Installation:

The workbench shall be installed with the top level and the legs rigidly and securely fastened to the floor.

Anchors for the legs shall be installed in accordance with the manufacturer's instructions.

SECTION 12-12. FURNISHINGS

12-12.01 ENTRANCE FLOOR GRIDS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing recessed entrance floor grids and frames in accordance with the details shown on the plans and these special provisions.

COORDINATION

Coordinate size and location of recesses in concrete to receive floor grids and frames.

SYSTEM DESCRIPTION

Floor Grid:

Floor grid shall consist of a series of tread rails spaced 1-1/2" on center and running counter to the traffic flow.

Maximum allowable uniform load on floor grid shall be 300 psf.

Floor grid shall be removable and replaceable without disassembly of entire grid and without damage to grid

Floor grid shall be provided with carpet inserts and a uniform sightline.

Floor grid shall allow debris to fall to sub-floor.

Floor grid tread bars shall be separately removable and replaceable without disassembly of all tread bars. I-beam support legs shall run parallel to the tread rails.

QUALITY ASSURANCE

Manufacturer: Obtain floor grid assemblies from a single manufacturer. Manufacturer shall be ISO 9001:2000 Certified.

SUBMITTALS

Product Data: Manufacturer's descriptive data, construction details, dimensions of individual components and profile, finishes and installation instructions shall be submitted for approval.

Working Drawings: Working drawings of layout, types of grids and frames; full-scale section of typical installation; anchors and accessories. Working drawings shall be coordinated with concrete work working drawings showing oversize recess for deferred installation of frame.

Minimum two samples of 12 inch square of the specified system.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

CLOSEOUT SUBMITTALS

Maintenance Data: For floor grids and frames to include in maintenance manuals.

FIELD CONDITIONS

Field Measurements: Indicate measurement on Working Drawings.

DELIVERY, STORAGE AND HANDLING

Delivery floor grid system to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.

Store components in original containers in a clean, dry location.

PART 2 - PRODUCTS

GENERAL

Structural Performance: Provide floor grids and frames capable of withstanding uniform floor load of 300 psf.

Regulatory Requirements: Comply with applicable provisions in the U. S. Architectural & Transportation Barrier Compliance Board's ADA-ABA Accessiblity Guidelines for Buildings and Facilities and ICC A117.1.

MATERIALS

Floor Grid Systems:

1. Tread rails: Aluminum, ASTM B221, alloy 6063-T5.
2. "U" channels: Aluminum, ASTM B221, alloy 6063-T5.
3. Frames: Aluminum, ASTM B221, alloy 6063-T5.
4. Angle frames: Aluminum, ASTM B221, alloy 6063-T5.
5. Locking bars: Aluminum, ASTM B221, alloy 6063-T5.
6. Pan adapter: Aluminum, ASTM B221, alloy 6063-T5.
7. I-beam supports: Aluminum, ASTM B221, alloy 6063-T5.
8. Leg support: Aluminum, ASTM B221, alloy 6063-T5.

Carpet: Carpet shall be standard, 3900 Denier nylon yarn, 0.350 inch pile height with a double coat backing of polypropylene. Anti-static treatment, anti-stain treatment, heat set 28 oz/sq. yd. minimum, 13 picks per inch.

Fasteners, Accessories, and Other Materials: Fasteners, accessories and other materials indicated as provided by the manufacturer on the manufacturer's details and in the manufacturer's installation instructions and required for complete installation to manufacturer's instructions.

FABRICATION

Fabricate floor grid assemblies as detailed.

Provide necessary and related parts, devices, anchors and other items required for proper installation.

Provide components in single size where possible, minimize site splicing.

Fabricate grid units to maximum size recommended bye the manufacturer for units intended for removal and cleaning. Where joints in grid are necessary, space them symmetrically and away from normal traffic flow patterns.

Provide frames with hairline joints, equally spaced, complete with corner pin, splice plates and installation anchors.

Frame, aluminum plan and I-beam supports shall be shop fabricated as an assembled unit for installation in the field.

Shop assemble components and package with anchors and fittings.

FINISHES

Aluminum:

Tread Rails, "U" Channels, Frames, I-beam Support Legs: Mill finish, standard.

Embedded Frames: Shop coating of clear acrylic.

Carpet: Color to be selected by the Engineer from manufacturer standard colors.

PART 3 - EXECUTION

INSTALLATION

Install floor grid system in accordance with the governing regulations, the industry standards applicable to the work and the manufacturer's written installation instructions.

Work shall be aligned plumb, level, and where required, flush with adjacent surfaces.

Carpet shall be positively locked into tread rails.

Anchors shall be spaced at 24 inches on center.

ADJUSTING AND PROTECTION

Inspect system components for proper fit. Adjust, repair or replace components not conforming to requirements. Repair or replacement of an individual unit shall be as approved.

Finished product shall be protected from damage during the remainder of the construction period per manufacturer's instructions.

Finished units shall be without damage. Units damaged during shipping or construction shall be repaired or replaced without additional cost.

Protect installation from damage by work of other Sections. After installation of frame, install temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of Substantial Completion.

12-12.02 ROLLER SHADES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing manually operated, roll-up fabric interior window shades with single rollers including mounting and operating hardware in accordance with the details shown on the plans and these special provisions.

Roller shades shall be standard, factory manufactured assemblies suitable for use on interior wall windows.

SUBMITTALS

Product Data: Manufacturer's descriptive data, color chips, style, construction details, dimension of individual components and profile, features, finishes, operating instructions, mounting details, and installation instructions shall be submitted for approval.

Working Drawings: Plans, elevations, sections, product details, installation details, and operational clearances for roller shades, including shade materials, the orientation to rollers, and the seam and batten location.

LEED Submittals: Provide documentation of how the requirements of Credit will be met.

Window Treatment Schedule: Use same room designations as indicated on the plans, field verified window dimensions, quantities, type of shade controls, fabric, and color, and include opening sizes and key to typical mounting details.

Samples: 12-inch x 12-inch square color of shade material and aluminum finish color samples. Mark face of material to indicate interior faces.

Closeout Submittals: Operating instructions, maintenance manuals,

QUALITY ASSURANCE

Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum 20 years experience manufacturing products comparable to those specified in this section.

Flame-Test: Passes California Code of Regulations Title 19, Division 1, Chapter 8. Materials tested shall be identical to products proposed of use.

Mockups: Build mockup to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution. Do not proceed with remaining work until mockup is accepted by the Engineers.

DELIVERY, STORAGE, AND HANDLING

Windows shades shall not be delivered until building is enclosed and construction within spaces where shades will be installed is substantially complete. Roller shades shall be delivered in original unopened, undamaged factory packages, marked with manufacturer, product names, and location of installation using same designations indicated on the window schedules and plans. Store products in manufacturer's unopened packaging until ready for installation.

PROJECT CONDITIONS

Environmental Limitations: Roller shads shall not be installed until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels when occupied for its intended use.

Field Measurement: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurement before fabrication and indicate measurements on Working Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

MANUALLY OPERATED WINDOW SHADES WITH INDEPENDENT CONTROL

Manually operate, vertical roll-up, fabric window shade with components necessary for complete installation,

Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.

Clutch Mechanism: Fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon.

Bead Chain Loop: Stainless steel bead chain hanging at side of window.

Idler Assembly: Provide roller idler assembly of molded nylon with adjustable length idler pin to facilitate easy installation, and removal of shade for service.

Mounting: Mounting brackets, endcaps, and headbox.

Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Fabric connected to the roller tube with low surface energy double sides adhesive specifically developed to attached coated textiles to metal.

Ceiling Mounted Brackets: Plated stamped steel. Provide size compatible with roller size

Shade Slat: Slat encased in heat seamed hem.

Headbox Ceiling Style: Aluminum fabrication with removable closure, endcaps, and back and top cove piece.

Finish: Custom powder coat as approved through submittals.

FABRIC

Color and Pattern: As indicated in Color Schedule on the plans.

PART 3 - EXECUTION

EXAMINATION

Installation shall not begin until substrates have been properly prepared.

If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

PREPARATION

Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

INSTALLATION

Roller shades shall be installed level, plumb, square, and aligned with adjacent units in accordance with the manufacturer's instructions.

Install closure panels to conceal roller and operating mechanism. Do not use exposed fasteners.

TESTING AND DEMOSTRATION

Test and adjust window shades to verify that chain and clutch operating mechanism, fabric retainer, and other operating components are balanced, operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

CLEAING AND PROTECTION

Clean roller shade surfaces after installation, according to manufacturer's written instructions.

Protect installed products until completion of project.

Touch-up, repair, or replace damaged products before contract acceptance.

12-12.03 HORIZONTAL BLINDS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing horizontal blinds in accordance with the details shown on the plans and these special provisions.

Horizontal blinds shall be standard, factory manufactured assemblies suitable for use on exterior wall windows.

SUBMITTALS

Product Data: Manufacturer's descriptive data, color chips, and installation instructions shall be submitted for approval.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

PART 2 - PRODUCTS

Horizontal Blinds:

Horizontal blinds shall be nominal one inch wide, spring tempered virgin aluminum alloy horizontal slats supported by braided polyester ladders. Braided ladders shall hold slats at equal spaces, parallel, straight, and shall provide tilt control and adequate overlap of slats. The distance between ladders shall not exceed 23 inches. Slat tilt shall be adjustable by a transparent wand. Blinds shall be adjustable to any height using lift cords.

Hardware shall be enclosed in a metal head and the opening hardware shall be clinched to the head. All metal parts shall have a corrosion resistant coating.

PART 3 - EXECUTION

INSTALLATION

Horizontal blinds shall be installed in accordance with the manufacturer's instructions.

SECTION 12-13. SPECIAL CONSTRUCTION

12-13.01 PAINT MIXING ROOM

PART 1 – GENERAL

Scope: This work consists of the requirements to design, fabricate, and install pre-fabricated paint mixing room complete with modular enclosure, mechanical and electrical equipment and controls, and auxiliary components.

Related Sections:

1. Basic electrical materials shall conform to the requirements specified under "Basic Materials And Methods" in Section 12-16 "Electrical," of these special provisions.
2. Basic plumbing materials shall conform to the requirements specified under "Pipes, Fittings and Valves" in Section 12-15 "Mechanical," of these special provisions.
3. Basic HVAC materials shall conform to the requirements specified under "Heating, Ventilating And Air Conditioning Equipment And Systems" in Section 12-15 "Mechanical," of these special provisions.

SYSTEM DESCRIPTION

Industrial Paint Mixing Room Booths used for mixing of paint only- no spraying.. Air is drawn through the filter plenum, located in the ceiling, and downward through the work area and into the exhaust chamber located at the other side of the room. The filtered air is then discharged through the exhaust stack.

Design Requirements:

1. General: The paint mixing room shall consist of a pre-fabricated model built to code to meet environmental regulations, ETL listed meets NFPA 33 standards for fire resistance as well as OSHA CFR 29.1910.107 guidelines.
2. Size: 8-foot wide by 8-foot long by 8-foot high

REFERENCES

ETL: The ETL Listed Mark is proof of product compliance to North American safety standards.

NFPA 33: Standard for Spray Application Using Flammable or Combustible Materials

Paint Mixing Room design and installation must comply with the CBC, CFC, and CMC for requirements of a paint spray booth.

SUBMITTALS

Product Data: Provide manufacturer’s product data for environmental room components, control systems, and equipment indicating compliance with the contract documents. Include manufacturer's installation instructions.

Working Drawings: Provide detailed drawings indicating plans, elevations, and sections and details for all components. Include rough-in, clearance and maintenance requirements. Indicate utility requirements and connections.

Operation and Maintenance Manual: Submit complete instruction and maintenance manual for each environmental room that includes sequential operating instructions, routine preventative maintenance instructions, and complete schematic drawings of operating systems.

Warranties: Submit the manufacturer's warranty for the performance of the equipment for a 5 year period following final acceptance of the work, and for a 12 month period after the equipment is put into normal and continuous operation. Furnish labor, materials and equipment to adjust the mechanical equipment during the warranty period.

LEED Submittals:

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

QUALITY ASSURANCE

LEED:

MR Credit 4, Recycled Content: Use materials with recycled content to contribute toward achieving MR Credit 4.

QUALITY ASSURANCE

Qualifications:

1. Manufacturer's Qualifications: The manufacturer of the environmental rooms shall be regularly engaged in the design and fabrication of controlled environmental rooms for a period of not less than 5 years. The manufacturer shall be capable of furnishing compatible auxiliary building components and accessories shown or specified.
2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by the environmental room system manufacturer to erect and install the manufacturer's product.

Provide products and installation conforming to NFPA 70, National and the California Electrical Code; ASHRAE 15, and the California Mechanical Code.

Test and rate the air-conditioning equipment in accordance with ARI 210/240, 310, 340, and 380 as applicable.

Equipment shall be manufactured and tested in accordance with applicable UL requirements.

DELIVERY STORAGE AND HANDLING

Deliver environmental room products in manufacturer's unopened marked packaging until ready for installation.

Store products in a clean weathertight location. Use methods to prevent contact with other materials that may cause staining, denting, or other surface damage.

PART 2 - PRODUCTS

MANUFACTURED UNITS

Meet NFPA 33 standards for fire resistance

Meet OSHA CFR 29.1910.107 guidelines

Size: 8 foot wide x 8 foot long x 8 foot tall. Configuration shall match plans.

Modular Wall and Roof Panels:

Interior and exterior metal surfaces precision formed in standard width increments.

Air-tight 18-gage galvanized steel construction with nut and bolt construction and pre-punched panels.

Lighting: (2) 48", 4-tube Class I, Division II Light Fixtures

Mechanical Ventilation:

Twelve inch fan, 3/4 H.P. 1700 CFM motor.

Ventilation Ductwork through roof.

Filtered air intake plenum and filtered exhaust plenum.

Door:

Opening: 36 inches by 78 inches.

Swinging Door: 1-3/4 inches thick; tubular-frame design fabricated from galvanized steel; with top half of door glazed. Equip door with deadlock, three butt hinges, closer, and full weather stripping.

Glazing: Fixed unit with clear tempered float glass.

PART 3 - EXECUTION

EXAMINATION

Examine area where modular panels and equipment will be installed before the work of this section begins, assuring that the in place construction and surfaces are complete and capable of supporting the weight of the equipment.

Surfaces that will become inaccessible after the equipment installation shall be completed before the equipment is installed. Assure that plumbing and electrical facilities and services, that serve the equipment, have been installed, tested, and approved before installation of modular rooms and equipment.

Examine roughing-in for electrical systems to verify actual locations of connections before control booth installation.

INSTALLATION

Install control booths according to manufacturer's written instructions.

Set paint mixing room plumb and aligned. Level baseplates true to plane with full bearing on concrete bases.

Fasten control booths securely to concrete base with anchorage per manufacturer.

Connect to electrical power service systems.

Perform startup checks of mechanical units according to manufacturer's written instructions.

ADJUSTING

Adjust doors, operable windows, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.

Lubricate hardware and other moving parts.

After completing installation, inspect exposed finishes and repair damaged finishes

FIELD QUALITY CONTROL

The Engineer may witness and confirm test results. Notify the Engineer in writing, 72 hours prior to all testing.

INSTRUCTION OF DEPARTMENT'S PERSONNEL

Prior to completion of performance tests, provide manufacturer's representative to conduct demonstration for designated Department's personnel with respect to room's controls and related systems. Manufacturer's representative shall inform Department's personnel of proper room operation and maintenance. Notify the Engineer at least 72 hours in advance to permit Department's authorized representative to schedule such an instruction period.

CLEANING AND PROTECTION

Repair or remove and replace defective work, equipment, and accessories as directed upon completion of installation.

Remove and refinish damaged or soiled areas. Clean exposed and semi-exposed surfaces, touch-up finish as required.

Protection: Adequately protect the work from damage until final acceptance by the Department.

SECTION 12-14. CONVEYING SYSTEMS

12-14.01 HYDRAULIC ELEVATOR

PART 1 - GENERAL

This work shall consist of furnishing and installing 2-stage twinpost telescopic holeless hydraulic elevator equipment, complete in place, in accordance with the details shown on the plans and these special provisions.

The Contractor shall do all the work and furnish all materials necessary for the complete installation, and shall perform and provide the following work, facilities and services in accordance with the requirements of these special provisions:

1. Construction Facilities and Temporary Controls; protection of floor openings and personnel barriers, temporary power and lighting.
2. Cast-In-Place Concrete; elevator pit elevator motor and pump foundation, and grouting sills.
3. Elevator enclosure: Concrete/light gage metal framing with gypsum wall board shaft liner panels.
4. Metal Fabrications; pit ladder, divider beams, supports for entrances and guide rails, hoist beam at top of hoistway.
5. Cementitious Waterproofing; waterproofing of elevator pit.
6. Heating, Ventilating, and Air Conditioning; ventilation and temperature control of elevator equipment room.
7. Electrical; electrical service to main disconnect in elevator machine room, electrical power for elevator installation and testing, electrical disconnecting device to elevator equipment prior to activation of sprinkler system, electrical service for machine room, machine room and pit receptacles with ground fault current protection, lighting in machine room and pit, wiring for telephone service to machine room.
8. Fire Alarm Systems; fire and smoke detectors, fire alarm signal lines to contacts in the machine room.
9. Telephone Systems; ADAAG-required emergency communications equipment installed and connected to telephone system.
10. Dry contacts for remote annunciation outputs to the Supervisory Control and Data Acquisition (SCADA) System.

The size of the hoistway shown on the plans shall be verified by the Elevator Manufacturer prior to construction. Elevator Cab shall be designed to fit within hoistway shown on the plans.

The elevator equipment, apparatus and material shall be furnished and installed by the Otis Elevator Company, The KONE Corporation, The ThyssenKrupp Elevator Company, or by another manufacturer, who has been operating successfully of not less than 10 years in the manufacture and 10 years in the installation of similar elevators, who maintains a continuous checking and repair service within a radius of 50 miles of the project, and who is the manufacturer of the basic elevator equipment, such as the elevator platform sling, cab and basic controller. All items furnished by the manufacturer shall be erected, installed adjusted, tested, and placed in operation by competent personnel under the supervision and direct employ of the elevator system manufacturer.

The facilities shown on the plans are diagrammatic and do not show offsets, fittings, and accessories that may be required. Cutting of walls, floors, etc. and removal of such obstructions may be necessary for proper installation of the elevators; settings of anchors and sleeves; and pockets or blockouts for signal fixtures shall be provided as a part of this contract.

Design requirements:

Elevators shall be capable of operating when temperature ranges outside or inside the hoistways or machine rooms is 32 to 120 ˚F.

All equipment including motors, wiring, conduits, pipes, and counterweights shall be designed to fit with the confines of the hoistways and their clearances. Particular attention shall be paid to visual aesthetics.

All elevators, parts and accessories shall be designed to be protected from fire sprinkler-activated water and inclement weather within the hoistways and other operating areas.

Permits and fees: The Contractor shall obtain and pay for all necessary State and local permits and make all tests as required by the governing bodies.

SUBMITTALS

Product data: Manufacturer's technical data, including certified test re[ports, and installation instructions for each principal product or component of the elevator system shall be submitted for approval. Features of control system, performances and operating characteristics shall be listed and described.

Working drawings:

Working drawings for elevators shall be submitted for approval.

Working drawings for elevators shall show elevations of car enclosures and, and hoistway entrances, calculations and specifications for elevator rails and rail attachments to the structures. Elevator diagrams shall show service to each level. Drawings shall show minimum struts, connections and structure to support the elevators. Layout of mechanical and electrical work shall be shown as well as plans for wiring and control diagrams.

Samples: Samples of exposed finished for elevator car enclosures, hoistway entrances, and signal equipment shall be submitted for approval. Samples of sheet materials shall be 6" x 6" and running trim members shall be 24" in length.

LEED Submittals

MR Credit 4, Recycled Content: For materials with recycled content, submit product data and certification letter documenting post-consumer and pre-consumer recycled content. For each item, indicate cost, post-consumer recycled content, pre-consumer recycled content, and recycled content value based on weight (counting pre-consumer recycled content at half actual value).

MR Credit 5, Regional Materials: For materials with regional content, submit product data indicating location and radius distance from job site of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the percentage by weight that is considered regional.

QUALITY ASSURANCE

Manufacturers qualifications:

The elevator system shall be by manufacturer's regularly engaged in the business of engineering, design and manufacturer of elevators of the type and character described in these special provisions for a period on not less than 10 years.

The entire power unit, signal panel, power panel and all other parts of the elevator system operating equipment, including door operating mechanisms and signal apparatus and signal fixtures, as well as all mechanisms constituting various electrical and mechanical safety systems and shall be manufactured,

provided and installed by the single manufacturer, except that motor, pump, and controller relays may be manufactured by recognized manufacturers of these items to the elevator manufacturers recommendations.

Standards compliance:

Where equipment or materials are specified to conform to requirements of the standards of organizations such as ASTM, ANSI, ASME, or UL, submit evidence of such conformance to the Engineer.

The label or listing of the specified agency will be acceptable evidence.

In lieu of the label or listing, the Contractor may submit a written certificate from an approved testing organization stating that the items have been tested and the units conform to the specified standard.

Evidence of compliance with the seismic safety requirements in the California State Building Code, Title 24 and International Building Code with all applicable supplements to each shall be submitted to the Engineer.

Certificates of Compliance: Certificates of compliance shall be submitted for all coatings, sealing and protective material. Certificates shall include material identification, quantity, batch number, date of manufacturer, and all laboratory data covering requirements of specifications, standards and codes under which the material is being furnished.

DELIVERY, STORAGE AND HANDLING

General:

Materials, tools, and equipment shall be delivered to the jobsite and stored in a dry and protected location on site.

Coated, polished, and other factory finished surfaces shall be protected to prevent damage to the finished surfaces.

INITIAL MAINTENANCE AND GUARANTEE

Maintenance service: Maintenance and call back service for the elevators shall be provided after they have been completed and placed in operation for a period of 12 months. This service shall consist of examinations of equipment, adjustments, lubrications, cleaning, supplies and parts to keep equipment in proper operation, except such adjustments, parts or repairs made necessary by abuse, misuse or any other causes beyond control of the elevator installer. All work shall be done by trained employees of the installer during regular working hours of the trade.

Maintenance manuals: Prior to completion of the contract, 5 bound and identified copies of the operation and maintenance instructions with parts lists, recommended parts inventory, purchase source listing for major and critical components, emergency instructions and similar information for the equipment specified therein shall be delivered to the Engineer.

Special tools: The Contractor shall furnish to the Engineer at the time of instruction, two (2) each of any tools including diagnostic tool, designed specifically for tasks associated with elevator examinations, maintenance and repair or are required for these tasks and are not readily available through normal purchasing channels.

DEFINITIONS

All terms in this section shall have the meaning defined in the A17.1 Safety Code for Elevators as approved by ANSI and hereinafter referred to as the ANSI Code, including all revisions and authorized changed to date.

CODES AND STANDARDS

Design criteria shall be in accordance with the provision of Title 8 and Title 24, California Code of Regulations and the National Fire Protection Association (NFPA).

Work shall be performed in accordance with the latest edition of American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks (ANSI A17.1) and such other State and local codes as may be applicable.

All work performed and materials installed shall be in accordance with the National Electrical Code; California Code of Regulations, Title 24, Part 3; "California Electric Code, " and Title 8, Chapter 4, "Electrical Safety Orders, " and all State and local ordinances.

Welding shall be in accordance with the requirements in American Welding Society (AWS) D 1.1, "Structural Welding Code-Steel. "

PERMITS AND TESTS

The Contractor shall obtain and pay for all necessary Municipal and state permits and, at his expense, make all tests as required by the governing codes.

PAINTING

All exposed metal work furnished under this section, except as otherwise specified, and shall be properly painted.

EQUIPMENT

Equipment shall be as follows:

Quantity	One
Capacity (lb)	3,500
Up-speed with rated load	150 feet per minute
Travel in feet	As shown on plans
Number of landings	Two (in-line)
Number of openings	Two (in-line) side opening
Operation	Simplex collective automatic
Car size (Interior dimensions)	80-inch wide x 66-inch in depth
Guide rails	Manufacturer's standard shapes
Buffers	Shapes
Cab enclosure	Steel structural cab
Car doors	42-inch clear by 84-inch high single slide opening, front right and rear left, 2 openings
Door operation	Power
Signals	Car operation station, call registered lighted buttons, service/telephone cabinet, and car direction signs with audible signal, hall lantern.
Machine room location	Adjacent
Main power supply	480-volt, 3-phase, 60 Hz
Lighting power supply	120-volt, single phase, 60 hz

PART 2 - PRODUCTS

CAR FRAMES AND PLATFORMS

Car frames shall be made of formed steel or structural steel members, having the factor of safety required by the ANSI Code. The members shall be securely fastened by welding or bolts to form a rigid assembly to support the specified load, the car enclosure and all necessary accessories.

Each platform shall consist of a steel frame and necessary wood or steel stringers and a substantial wood floor, or shall be constructed entirely of steel suitably reinforced. The underside of wood platforms, if used, shall be fireproofed by sheet steel or not less than 28-gage. The platform shall be mounted within the car frame.

MECHANICAL EQUIPMENT

A hydraulic power unit, especially designed and manufactured for these services, shall be furnished. The motor and pump shall be submersed under the oil inside the tank in order to provide for sound isolation. A muffler designed to reduce pulsation and noise, which may be present in the flow of hydraulic oil, shall be provided in the oil line at the top of the pump.

Control valves shall be mounted in a compact unit assembly. These valves include a safety check valve; up-direction valve with high pressure relief, including up leveling and soft stop features; lowering valve, including down leveling and manual leveling features. Automatic two-way leveling shall be provided to automatically stop and maintain the car approximately level with the landing, regardless of change in load. An up-traveling car shall automatically descend to the lower terminal landing if the hydraulic system does not have a sufficient reservoir of oil. Power-operated and hoistway doors will automatically open at the lowest terminal landing, permitting passenger egress. The doors shall then automatically close and all control buttons, except the Door Open Button in the car-operating panel, shall be made ineffective.

A valve designed to shut off the flow of oil between the cylinder and the Power Unit shall be provided in the oil line in the machine room.

HYDRAULIC EQUIPMENT

Hydraulic Plunger: Two accurately ground and polished, two-stage fully synchronized telescopic hydraulic plungers shall be provided. The bottom of each jack stage shall be fitted with a cushioned, positive stop designed to prevent the plungers from leaving their cylinders. The top of the second stage plunger shall be fitted with a backup ring and gland containing the oil seals and air bleeder valve. The first stage plunger shall be made from a solid steel shaft and shall be fastened to the car frame.

Hydraulic Cylinders: Two hydraulic cylinders designed to stand upright on the pit floor, on either side of the car, shall be provided for the second stage of each jack unit. Each cylinder shall be constructed from steel pipe with a machined steel flange at the upper end and a heavy steel bulkhead at the lower end. Each cylinder shall be connected to the oil line. A packing gland with guide bearing, wiper ring and packing especially designed for hydraulic elevator service shall be mounted at the top of each cylinder along with an air bleeder valve. Provisions shall be made to collect any oil seepage and drain it away. Each cylinder shall be finished with a coat of rust inhibiting air-dry enamel.

Tank Heater: A hydraulic oil viscosity control system shall be provided to maintain a minimum oil temperature.

Seismic Provisions: In accordance with the proposed Project Location and applicable Seismic Risk Zone, all applicable material and equipment provided and installed by the elevator manufacturer, as explained within this part, shall be designed and installed to be earthquake resistant in accordance with the zone location and governing Code(s) requirements.

Guide Rails: Elevator car guide rails shall be provided, erected plumb, and securely fastened to the hoistway framing. Design and provision of hoistway framing shall be of adequate strength and properly positioned to withstand loads applied in conjunction with data provided by the elevator contractor.

Platform Isolation: The top of the plungers shall be mounted to the car frame with suitable sound dampeners designed to isolate the plungers from the car. The elevator contractor shall provide spring buffers in the elevator pit.

Logic Control: The logic control operation will be accomplished utilizing microprocessor computer logic control contained in a cabinet. The elevator control program will be contained in non-volatile, programmable, read only memory. Control will be constructed such that future alterations in elevator operation may readily be made by altering the read only memory. Safety circuits will be monitored and controlled by the programmable Logic Control for redundant protection.

Controller:

A microprocessor based controller shall be provided, including necessary starting switches together with all relay , switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.

The controller shall govern starting and stopping, as well as preventing damages to the motor from overload or excessive current. It shall automatically cut off the power supply and bring the car to rest in the event any of the safety devices are activated. The controller shall be monitored in a vented cabinet within the machine room.

Selective Collective Operation: Pressure upon one or more car buttons shall send the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed, provided the hoistway door interlock and car door switch circuits are completed. During this operation, the car shall also answer calls from the landings, which are in the prevailing direction of travel. Each landing call shall be canceled when answered.

SIGNAL DEVICES AND FIXTURES

Car Operation Station:

Each elevator shall be equipped with a Main Car Operating Station, located integrally in a vertical swing panel and containing call registration buttons in accordance with the logic operation specified. The Main Car operating Station shall also include a stop switch, door open and door close buttons, alarm button, tactile plates, and light switch, as well as any other devices required by applicable code and/or as explained within this part.

Each Car Operating Station shall be equipped with illuminating pushbuttons which, when pressed, shall signal the car passenger that the call has been registered. The button shall remain illuminated until the call has been answered.

Service/Telephone Cabinet:

A combination Service Cabinet/Telephone Cabinet, integral to the Main Car Operating Station, with a flush door, concealed hinge, and pull handle shall be provided. Within this cabinet, specialized controls shall be installed for restricted elevator functions.

A telephone complying with ADA requirements shall be installed in the telephone box.

Car Position Indicator: A dot-matrix car position indicator(s) consisting of a red LED display shall be provided in the car and also with an audible signal which shall sound when the car passes each floor or stops at a floor. The position indicator shall be located above the Car Operation Station.

Hall Pushbutton Stations: One hall pushbutton station shall be provided at each landing served by the elevator system proposed. Illuminating pushbuttons shall be provided in each hall pushbutton station which, when pressed, shall signal the waiting passenger that the call has been registered. The button shall remain illuminated until the call has been answered.

Hall Lanterns: Hall lanterns, including audible signals, shall be provided. As soon as the car has reached a predetermined distance from a landing and is set to stop a that landing, the hall lantern corresponding to the direction the car shall travel shall be illuminated and the audible signal shall sound once for up and twice for down. The lantern shall remain illuminated until the doors have closed. Single lanterns shall be furnished at terminal landings and Up/Down lanterns shall be furnished at intermediate landings.

Hall Position Indicator: A dot-matrix hall position indicator consisting of a red LED display shall be provided at (indicate floors where required). The position of the car shall be indicated by single or dual numeral and/or letter floor designations along with an arrow indicating direction of car travel.

Signal Fixture Finishes: All metal used on exterior surfaces of the signal fixtures shall be #4 brushed stainless steel.

PASSENGER CAB ENCLOSURE

The elevator cab(s) shall meet the requirements of the ASME/ANSI A17.1 Elevator Code, and all Elevator Code Supplements issued to date, including Code restrictions pertaining to flame spread and smoke generation. The elevator cab(s) shall accommodate a gurney or ambulance stretcher per 2010 CBC 3002.4.1a.

Elevator cabs shall be of the steel structure type or equal. The cab frame, walls, ceiling and both sides of the doors shall be faced with stainless steel. The thickness of the stainless steel and the mounting and fastening details shall be as recommended by the elevator manufacturer. The surfaces of the stainless steel exposed to view shall have a No. 2D finish with “Rigidized” surface texture. The thickness of the stainless steel and the mounting and fastening details shall be as recommended by the elevator manufacturer.

Pipes for handrails shall be No. 304 stainless steel pipe, No. 4 Satin finish with stainless steel mounting bracket.

Ceiling shall be stainless steel support system including stainless steel ceiling panels, exhaust fan, public address system speaker and a hinged access panel.

Elevator fluorescent fixture shall be the manufacturer’s standard recessed fluorescent lighting fixture.

Hardware for access panels shall be standard US 32D finish accurately fitted and securely applied.

Threshold plate shall be extruded aluminum.

Car doors shall be horizontal sliding , center opening, flush hollow metal, No. 4 stainless steel panels hung on sheave hangers with polyurethane tires and sheaves not less than 3-1/2 inches diameter running on a polished steel track and guided at the bottom by non-metallic shoes sliding in a smooth threshold groove. Sight guards shall hatch the door finish.

An emergency power unit employing a 12 volt sealed rechargeable battery shall be provided.

TELEPHONE CABINETS

Telephone cabinets shall be flush design of finish and appearance to match car opening panel, complete with wiring to controller. Instrument and connections shall be provided by others.

PASSENGER TYPE HOISTWAY ENTRANCES (UL "B" LABELED)

Hollow metal, horizontal sliding hoistway entrances shall be provided.

Entrance type and clear opening entrance size shall be as specified elsewhere in these special provisions. Sills, struts, headers, hanger covers and unit frames shall be erected by the elevator contractor and set in proper relation to the car guide rails. Such erection is to be accomplished prior to construction of rough walls. Door panels shall be installed by the elevator contractor after the wall erection is completed.

Entrances shall include unit frames, flush design door panels, sight guards, sills, strut angles, headers, hanger covers, fascia plates, toe guards, dust covers, and necessary hardware. Necessary support for entrance sills shall be included.

Material and finish for fascia, hanger covers, toe guards, dust cover and structural members shall be fabricated and finished in accordance with the elevator contractor standards.

Hoistway entrance frame shall be finished in #4 brushed stainless steel. Kick plates fabricated from #4 brushed stainless steel shall be mounted directly to hoistway entrance frames and landings and shall be 6 inches high.

Hoistway door panels and sight guards shall be finished in #4 brushed stainless steel.

Entrance sills shall be constructed of silver nickel.

Standard entrance jamb tactile markings (jamb plates) shall be supplied on both jambs, at all floors. Plates shall be finished to match #4 brushed stainless steel.

DOOR OPERATOR EQUIPMENT

A gearless master door operator with direct current motor shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. An electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by the local code.

Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

The car door shall be provided with a protective device extending the full height. This device shall be designed to sense an obstruction in its path while the doors are closing and automatically cause the car and hoistway doors to return to the open position. The doors shall remain open until the expiration of the time interval; the doors will then close automatically.

Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and prefabricated and sealed-for-life bearings.

ELECTRONIC DOOR SAFETY DEVICE

The elevator car shall be equipped with an electronic sensing device, which operates across the car entrance. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening. This device shall include a self-contained diagnostic system that shall display a code to indicate the exact nature of any problems that may occur.

PART 3 - EXECUTION

PREPARATION

Take field dimensions and examine condition of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

INSTALLATION
Install all elevator components except as specifically provided for elsewhere.

ACCEPTANCE INSPECTION AND TESTS

General:

Final inspection of the installation of elevator shall be made only after all field inspections have been made, tests are complete, all submittals and certificates have been received and the Engineer is satisfied that the following have been satisfactorily completed:

Workmanship and equipment comply with the specifications.

Contract speed and capacity comply with the specifications.

Starting and running performance is satisfactory and equipment noise levels are within acceptable limits.

In all test conditions, speed and performance time specified shall be met and general riding quality shall be acceptable to the Engineer.

Performance guarantee: Should these tests develop any defects or poor workmanship, any variance or non-compliance with the requirements of the specified codes and/or ordinances or any variance of non-compliance with the requirements of the specifications, all faulty equipment or workmanship shall be repaired, replaced and retested at no cost to the State.

INSTRUCTION

The Contractor shall instruct designated maintenance personnel in the proper use, operation and preventative maintenance of the elevator including normal procedures to b followed in checking for the source of operational failure or malfunction.

TEMPORARY USE OF ELEVATOR

If temporary use of an elevator is required by the contractor before the elevator is placed in service, temporary enclosures, guards or other protection of hoistway openings, elevator operations, and such other items as are necessary to permit temporary operation of the elevator, shall be furnished and installed. The Contractor shall provide all maintenance during the period of temporary operation, and shall return the elevator to the same condition of repair and maintenance as existed prior to such temporary use.

12-14.02 BRIDGE CRANE AND HOIST

PART 1 - GENERAL

SUMMARY

Scope: This work consists of designing, constructing, furnishing and installing a 3-ton electric bridge crane with an electric powered hoist on a motorized trolley, in accordance with the details shown on the plans, the requirements specified in these special provisions, and the recommendations and instructions of the hoist manufacturer.

The work shall also include the design, construction, furnishing and installation of the crane runway rails and the bridge girder for the trolley and hoist.

SYSTEM DESCRIPTION

Runway and Girder Design Requirements:

The crane runway rails and the bridge girder shall be designed to support the crane and hoist loads, including the required safety factors, as recommended by the crane and hoist manufacturer for the crane capacity specified herein and as recommended by the Materials Handling Institute Standard No. 74, "Top Running and Underhung Single Girder Electric Overhead Traveling Cranes," and as required by the CBC, and Title 8 of the California Code of Regulations.

The crane runway rails shall be located as shown on the plans and shall be designed based on points of support at the primary structural support frames of the building. The approximate spacing of the structural steel support frames is as shown on the plans. The minimum vertical clearance shall be as shown on the plans.

The building structure and crane support beams have been designed to handle the bridge crane and rails.

The bridge girder shall be designed for the span between the crane runways. The approximate length of span between the crane runways shall be as shown on the plans. Final span length shall be determined by the building manufacturer. The length of travel of the trolley at each end shall be determined by the Contractor and shall be the maximum that can be attained while maintaining adequate operating clearances between the crane assembly and any existing building support component or other appurtenance that would interfere with the proper installation and safe operation of the crane.

Before fabrication, the bridge crane and hoist manufacturer shall coordinate with the manufacturer of the pre-engineered steel building regarding span length, crane and hoist loads, runway rail support locations, and connection details.

SUBMITTALS

Product Data: Manufacturer's descriptive data, performance data, parts list and installation instructions for the bridge crane and hoisting equipment shall be submitted for approval.

Working Drawings:

Working drawings and design calculations for the crane runway rails and bridge girder shall be submitted for approval.

Working drawings shall include control panel schematic and wiring diagram, and a listing of electrical equipment and devices to be furnished.

Working drawings and design calculations for the crane runway rails and bridge girder shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California.

CONTRACT CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals: Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

QUALITY ASSURANCE

Certificate of Compliance: Certificates of compliance shall be furnished for the crane runway rails and bridge girder in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Codes and Standards: All welding shall be in accordance with the requirements in American Welding Society (AWS) D14.1, "Specifications for Welding Industrial and Mill Crane and Other Material Handling Equipment."

PART 2 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturers: Subject to project conditions, bridge crane and hoist shall be American Crane and Equipment Corp.; CraneVeyor Corp.; Detroit Hoist; Lift-Tech International, Inc.; or equal.

MANUFACTURED UNITS

BRIDGE CRANE

The electric bridge crane with a 3-ton capacity shall include an electric powered hoist on a motorized trolley, power bar conductors, and pendant-type electrical controls.

The hoist and trolley shall be a 3-ton, low headroom, wire rope hoist mounted on a single-speed, electric motor driven trolley.

Crane control system shall consist of a bridge girder mounted control panel, festooned bridge conductor system, conductor bar system, travel limit switches for all directions of travel, fully solid-state softstart for the bridge crane and trolley motors, and 7 button pendant station complete with strain relief hardware for full operation of hoist, trolley and bridge. Controls shall be actuated by the pendant station.

COMPONENTS

Bridge Girder and Trucks:

Bridge girder shall be fabricated from structural steel conforming to ASTM Designation: A 36, and shall have a maximum deflection of 1/600 of the span length under maximum loading conditions. The bridge girder shall be provided with travel stops.

The end trucks shall be designed to run on the lower flange of the runway rails and shall be constructed of welded structural steel shapes conforming to ASTM Designation: A 36. The end trucks shall be motorized and shall have not less than 4 forged steel wheels with sealed, tapered roller bearings.

The drive motor shall be a single gear driven motor with a common drive shaft or a dual drive motor system. The drive motor shall be rated for Class C Service, crane travel duty, and shall be reversible with motor brake. Horsepower, voltage and phase shall be as shown on the plans.

The crane drive shaft for single motor operation shall be supported on lubricated pillow blocks with precision ball bearings.

Hoist and Trolley:

The trolley shall be motorized and shall have not less than 4 hardened forged steel wheels with sealed, tapered roller bearings. The trolley frame shall be of rigid construction. The trolley operating speed shall be nominal 40 feet per minute. The trolley motor shall be continuous duty, reversible, with motor brake. Horsepower, voltage and phase shall be as shown on the plans.

The hoist shall be oil bath gear driven flanged drum with machined grooves, mechanical type disc brake, heavy duty ball bearings, have a high limit switch for the hook travel, and shall be equipped with a load limiting clutch to prevent damage from overloads. Hook shall be forged steel, with 360-degree swivel and spring latch. The hoist motor shall be continuous duty, reversible, with motor brake. Horsepower, voltage and phase shall be as shown on the plans.

Runway Rails: Runway rails shall include all beams, rails, and stiffeners required to span between primary framing members of the building. Runway rails shall be fabricated from structural steel conforming to ASTM Designation: A 36. The rails shall have a maximum deflection of 1/600 of the span length under maximum loading conditions. The runway rails shall be provided with travel stops.

Control Panel:

Control panel shall be UL or FM listed for crane operation and shall include main disconnect, mainline contactor, hoist motor disconnect, bridge motor disconnect, trolley motor disconnect, hoist motor reversing starter, bridge motor reversing starter, trolley motor reversing starter, thermal overload relays, control transformer disconnect, control transformer, control relays, power terminal block and control terminal block. All contactors and starters shall be NEMA rated. Components shall be mounted on the interior mounting panel.

Control panel shall be a NEMA 12 enclosure, with interior mounting panel and hinged exterior dead front door. Control panel shall be factory prewired in conformance with Class-II Type 1C wiring. All wires entering or leaving the control panel shall terminate on terminal blocks. Control wires shall be 7 strand No. 14 Type MTW wires. Wiring shall be arranged such that any component may be removed without removing any wiring except that component's leads.

Control panel shall be a complete system, routinely advertised, furnished by the bridge crane and hoist manufacturer.

Power and Control Cable: Power and control cable shall be as recommended by the bridge crane and hoist manufacturer.

Festooned Bridge Conductor System: Festooned bridge conductor system shall consist of multiconductor cable, cable grip, messenger chain, tag-line wire, 2-inch (inside diameter) conductor cable rings, take up brackets, 3/8-inch eye-bolts and other necessary hardware. Conductor sizes shall be as recommended by the hoist and trolley manufacturer.

Conductor Bar System: Conductor bar system shall consist of enclosed power conductors, collectors and related covers, hangers, couplings and appurtenances. Conductor bar system shall be rated for 600 volts, 90 amperes continuous duty and 135 amperes intermittent duty. Conductor bars shall be one piece, copper conductors with thermoplastic insulating covers. End covers shall be provided. Collectors shall be spring loaded, replaceable shoe type rated for 500 feet per minute (minimum) travel.

FABRICATION

Shop Finishing: Bridge crane and hoist shall be cleaned and receive 2 coats of the manufacturer’s standard paint.

Identification: An information plate, with the following information, shall be attached to the bridge crane hoist and trolley.

Manufacturer's name and address
Model number
Serial number
Crane capacity
Hoist capacity
Date of installation

PART 3 - EXECUTION

INSTALLATION

The bridge crane and hoist shall be installed in accordance with the manufacturer's instructions and the approved working drawings.

Crane runway sections shall be installed with couplings at joints to provide flush and level connections with a maximum gap between adjacent ends at the load-carrying flange not exceeding 1/16 inch except at free ends.

The bottom flanges of all crane runways shall be parallel and level with one another within a tolerance of plus or minus ¼ inch throughout their entire length.

Means shall be provided to allow for vertical adjustment of the crane runways so that the runways can be erected and maintained within level tolerance.

The crane control panel shall be mounted on the crane bridge and shall be actuated from a pendant station, suspended 4 feet above the floor. Main power and trolley power shall be by festooned bridge conductor system and shall be installed along the bridge crane from the control panel to the conductor bar system and trolley motor.

Each soft start unit for the bridge and trolley motors shall be enclosed in a NEMA 12 enclosure and may be installed near the bridge or trolley motor.

Power and control cables shall be fastened to the structural members with one-hole steel straps at a spacing of not to exceed 3 feet on center.

Field Painting: After installation, damaged and abraded areas of the shop paint shall be repainted using the same materials as applied in the shop.

FIELD QUALITY CONTROL

Tests:

The bridge crane and hoist shall be tested in the presence of the Engineer. Any equipment failure or malfunction shall be corrected by the Contractor at his expense.

Tests shall be as described herein:

NO LOAD TEST: The trolley and hoist shall be operated to throughout the full length of the crane runways and the limits of hook travel. Travel limit switches shall be engaged.

LOAD TEST: The minimum test load shall be 125 percent of the rated load capacity. The trolley shall be operated for the full length of the crane runways under the test load. The test load shall be raised to the hook height limit and lowered until the cable is slack. After a 5-minute waiting period, the test load shall be raised one foot and held in that position, without slipping, for a minimum time period of ten minutes.

LOSS OF POWER TEST: The main power switch shall be opened while the test load is being lowered. The test load shall stop completely and immediately when the power switch is opened.

Manufacturer's Field Service: The Contractor shall arrange for the bridge crane manufacturer's representative to be present during testing.

SECTION 12-15. MECHANICAL

12-15.01 MECHANICAL WORK

PART 1 - GENERAL

Scope: This work shall consist of performing mechanical work in accordance with the details shown on the plans and these special provisions.

Mechanical work shall include furnishing all labor, materials, equipment and services required for providing heating, ventilating, air conditioning, plumbing and natural gas distribution systems.

Earthwork, foundations, sheet metal, painting, electrical, and such other work incidental and necessary to the proper installation and operation of the mechanical work shall be in accordance with the requirements specified for similar type work elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of pipes, ducts, etc., and location of equipment is to be governed by structural conditions and obstructions. Equipment requiring maintenance and inspection is to be readily accessible.

Roof penetrations shall be flashed and sealed watertight in accordance with the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Comply with requirements under Section 5, "Department Commissioning," of these special provisions and coordinate with commissioning authority for commissioning of mechanical systems.

SUBMITTALS

Product Data:

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for plumbing fixtures, and component layout shall be included where applicable.

Manufacturer's descriptive data shall be submitted for the following:

Air Compressor systems
Refrigerated Air Dryer
Lube Reels and Pumps
Low Intensity Radiant Heaters
Dust Collection System, Hoses, Fittings, and Attachments
Vehicle Engine Exhaust Fan and Hose Reel
Bridge Crane and Hoist
Supply Fan with Duct Heater
Instant Water Heaters
Mechanical Insulation and associated items
Tank Type Water Heater
Digital Gas Meters
Package Rooftop HVAC units
Split Ductless Air Conditioners and Heat Pump
Exhaust Fans
HVAC Control System and Equipment
Ductwork, Diffuser, Grilles Dampers, Fittings, Hangers, and Supports
Electric Water Cooler
Emergency Eye Wash and Shower
Pipe, Pipe fittings, Valves, Hangers, and Supports
Plumbing Fixtures, Drains, and Cleanouts
Waste Oil and Waste Coolant Storage Tanks
Fuel Tank, Pumps, and Dispensing Equipment
Flush valve
Faucet and Hydrants
Hot Water Recirculation Pump
Fire Protection Equipment and Sprinkler System
Backflow Preventer

Shower Unit
Temperature and Pressure Gages

CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals:

Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Operation and maintenance manuals shall be submitted for the following equipment:

Air Compressor systems
Refrigerated Air Dryer
Lube Reels and Pumps
Low Intensity Radiant Heaters
Dust Collection System, Hoses, Fittings, and Attachments
Vehicle Engine Exhaust Fan and Hose Reel
Bridge Crane and Hoist
Supply Fan with Duct Heater
Instant Water Heaters
Tank Type Water Heater
Digital Gas Meters
Package Rooftop HVAC units
Split Ductless Air Conditioners and Heat Pump
Exhaust Fans
HVAC Control System and Equipment
Electric Water Cooler
Emergency Eye Wash and Shower
Plumbing Fixtures, Valve, and Faucet
Fuel Tank, Pumps, and Dispensing Equipment
Hot Water Recirculation Pump
Fire Hydrant
Backflow Preventer

QUALITY ASSURANCE

Codes and Standards: Mechanical work, including equipment, materials and installation, shall conform to the CBC: CMC; CPC; CEC; the California Building Energy Efficiency Standards; and California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety (DIS).

WARRANTY

Warranties and Guarantees: Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

SYSTEM IDENTIFICATION

Piping, Ducts, Valves and Equipment:

Identification of piping, ducts, valves and equipment shall be as shown on the plans or these special provisions:

Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate, which bears the unit mark number as indicated on the drawings (for example, A/C-4B). Provide ½-inch high lettering, white on black background. Nameplates shall be permanently secured to the unit with brass fasteners.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION (Not applicable)

12-15.02 PIPE, FITTINGS AND VALVES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing pipes, fittings and valves in accordance with the details shown on the plans and these special provisions. Pipe, fittings and valves shall include such plumbing and piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the plumbing and piping systems.

All piping insulation and wrapping material shall be in accordance with the requirements specified under "Mechanical Insulation," in this Section 12-15, "Mechanical," of these special provisions.

The pipe sizes shown on the plans are nominal inside diameter. No change in the pipe size shown on the plans shall be permitted without written permission from the Engineer.

The pipe and fitting classes and material descriptions shall be as specified herein. No change in class or description shall be permitted without written permission from the Engineer.

Comply with requirements under Section 5, "Department Commissioning," of these special provisions for commissioning of mechanical systems.

SUBMITTALS

Test Reports: Certified test reports signed by Contractor and supervisor who performed testing work.

LEED Submittals:

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building, indicating VOC content.

QUALITY ASSURANCE

Codes and Standards: Pipe, fittings and valves shall be installed in accordance with the requirements in the CPC, the manufacturer's recommendations and the requirements specified herein.

LEED:

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

MATERIALS

PIPE AND FITTINGS (Class and Description)

A1: Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with 150 psi galvanized malleable iron banded screwed fittings and galvanized steel couplings. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

A2: Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with black cast iron recessed drainage fittings. For rainwater leaders, neoprene-gasket compression couplings, Smith Blair, Dresser, or equal, may be used. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

A3: Schedule 5 steel pipe conforming to ASTM Designation: A 135 with pressfit fittings and couplings for service as designated.

A4: Pipe and fittings shall be UL or FM listed, ferrous (Schedule 20 minimum) or copper (Type L minimum), suitable for the working pressure involved but not less than 175 psi. Pipe and fittings shall be in accordance with NFPA 13, "Standard for the Installation of Sprinkler Systems" (2010 Edition with California Amendments), requirements.

B1: Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with screwed fittings suitable for working pressure involved, but not less than 175 psi. Fittings shall be listed for fire protection.

B2:

Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with 150 psi black malleable iron banded screwed fittings and black steel couplings.

Steel pipe coating, where required, shall be factory applied plastic. Pipe coating shall be X-Tru-Coat (20-mil thickness); 3M Company, Scotchkote 6533 fusion bonded epoxy powder coating (12-mil thickness); or equal.

B3: Schedule 80 black steel pipe conforming to ASTM Designation: A 53 grade B, pipe 2 inches in diameter and smaller shall have 3,000 psi WOG socket welding fittings and couplings or 2,000 psi WOG threaded forged steel, ASTM Designation: A 105. Pipe 2½ inches in diameter and larger shall be extra strong weight butt welding fittings and couplings.

C1: Hub and plain end cast iron soil pipe with neoprene gaskets conforming to Cast Iron Soil Pipe Institute's Standard 301. Pipe, fittings and gaskets shall be of one manufacturer.

C2: Hubless cast iron soil pipe with neoprene gaskets, corrugated stainless steel shields and stainless steel clamps conforming to Cast Iron Soil Pipe Institute's Standard 301. Joint materials shall be furnished by pipe manufacturer.

D1: Ductile iron push on joint pipe conforming to AWWA Designation: C151. Fittings shall be push on ductile iron conforming to AWWA Designation: C153. Joints shall be rubber gasketed and designed for a working pressure of 350 psi. Pipe and fittings shall be supplied with bituminous outer coating and cement lining. Pipe shall be listed for fire protection.

H1: Type DWV hard copper tubing conforming to ASTM Designation: B 306, with DWV drainage fittings, stop type couplings and threaded adapters.

H2: Type K hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

H3: Type L hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

LP1: 0.083-inch thick seamless steel tubing with high pressure flareless steel tube fittings. Bends, if required, shall be made with tube bender on 4½-inch minimum radius.

LP2: 0.035-inch thick seamless steel tubing with high pressure flareless steel tube fittings. Bends, if required, shall be made with tube bender on 4½-inch minimum radius.

P1: Polyvinyl chloride (PVC) gravity sewer plastic pipe and fittings conforming to ASTM Designation: D 3034, Standard Dimension Ratio (SDR) 35, with integral bell and bell and spigot rubber gasketed joints or conforming to ASTM Designation: D2665 with solvent welded fittings. Rubber gaskets shall conform to ASTM Designation: F 477. Stainless steel clamps with rubber boots shall not be used.

P2: Polyvinyl chloride (PVC) plastic pipe and fittings conforming to ASTM Designation: D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 200 psi working pressure at 73°F, NSF approved. Pipe shall have bell ends conforming to ASTM Designation: D 3139 with triple edge rubber sealing ring. For pipe sizes 2-inch diameter and smaller, plain end pipe with solvent welded fittings ASTM Designation: D 2241, Type I, Grade 1, Standard Dimension Ratio (SDR) 21, rated for 200 psi may be used.

P3: Polyvinyl chloride (PVC) standard weight pipe and fittings, Schedule 40, conforming to ASTM Designation: D 1785. Pipe shall meet or exceed requirements of NSF Standard No. 14. Pipe shall have bell ends conforming to ASTM Designation: D 2672. For pipe sizes 3 inches and smaller, plain end pipe with solvent welded fittings conforming to ASTM Designation: D 2241, may be used.

P4: Polyvinyl chloride (PVC) plastic pipe and fittings shall conform to AWWA Designation: C900, Class 150, Standard Dimension Ratio (SDR) 18. Pipe shall have bell end with a solid cross section elastomeric ring conforming to ASTM Designation: D 1869. Pipe shall be listed for fire protection.

P5: Polyethylene plastic gas pipe and fittings conforming to ASTM Designation: D 1248 and D 2513 with Standard Dimension Ratio (SDR) 11, rated for 60 psi working pressure at 73°F, socket type fittings, joined by heat fusion.

P6: Polyvinyl chloride (PVC) natural gas pipe, Class 315, conforming to ASTM Designation: D 2513. Fittings shall be Schedule 40 conforming to ASTM Designation: D 2513, and shall be primed and glued. Primer shall conform to ASTM Designation: F656. Solvent cement shall conform to ASTM Designation: D2564. Approved adapters shall be used for transition to other pipe materials.

P7: Cross-linked Polyethylene tube (PEX) with oxygen barrier conforming to ASTM Designation: F876/F877 and International Standard 9001. Tubing shall be flexible thermoplastic type rated for 100 psi working pressure at 180°F. Tube shall have a 25 year warranty. Tube shall be purple in color for recycled water piping.

P8: Chlorinated Polyvinyl Chloride (CPVC). The material used in the manufacture of the pipe shall be a rigid chlorinated polyvinyl chloride (CPVC) compound, Type IV Grade I, with a Cell Classification of 23447 as defined in ASTM D1784. CPVC Schedule 40 and Schedule 80 pipe shall be manufactured in accordance to the requirements of ASTM F441 for physical dimensions and tolerances. Each production run of pipe manufactured in compliance to this standard, shall also meet the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM F441. Product marking shall meet the requirements of ASTM F 441 and shall include: the manufacturers name (or the manufacturers trademark when privately labeled); the nominal pipe size; the material designation code; the pipe schedule and pressure rating in psi for water at 73°F; the ASTM Designation F 441; and the independent laboratory's seal of approval for recycled water usage. Marking shall also include the flame spread rating and smoke development rating when tested and listed for surface burning characteristics per CAN/ULC S102.2 (Flame Spread (F.S.) of <25 and Smoke Development (S.D.) of <50). Pipe shall be purple in color.

Unions (for Steel Pipe): Unions (for steel pipe) shall be 250 psi, threaded malleable iron, ground joint, brass to iron seat, galvanized or black to match piping.

Unions (for Copper or Brass Pipe): Unions (for copper or brass pipe) shall be 150 psi cast bronze, ground joint, bronze to bronze seat with silver brazing threadless ends or 125 psi cast brass, ground joint, brass to brass seat with threaded ends.

Unions (for Brass Waste and Flush Pipes): Unions (for brass waste and flush pipes) shall be slip or flange joint unions with soft rubber or leather gaskets. Unions shall be placed on the fixture side of the traps.

Dielectric Waterway: Dielectric waterway shall be a premanufactured unit that incorporates an insulated interior lining at least 3 inches in length between the 2 pipes being connected while maintaining metal to metal contact on the exterior surface. Dielectric water way shall be listed by IAPMO (International Association of Plumbing and Mechanical Officials).

Insulating Union: Insulating union or flange as applicable shall be suitable for the service on which used. Connections shall be constructed such that the 2 pipes being connected are completely insulated from each other with no metal to metal contact. Insulating couplings shall not be used. Insulating union shall be F. H. Maloney; Central Plastics; EPCO; or equal.

Insulating Connection (to Hot Water Tanks): Insulating connection (to hot water tanks) shall be 6-inch minimum, flexible copper tubing with dielectric union at each end and designed to withstand a pressure of 150 psi and a temperature of 200°F.

VALVES

Gate Valve (2½-inch and smaller):

> Gate valve (2½-inch and smaller) shall be bronze body and trim, removable bonnet and non rising stem, threaded ends, Class 125 and same size as pipe in which installed. Gate valve shall be Crane, 438; Nibco, T-113; Jenkins, 310J; or equal.
>
> Gate valve in nonferrous water piping systems may be solder joint type with bronze body and trim. Valve shall be Crane, 1330; Nibco, S-111; Jenkins, 452J; or equal.

Gate Valve (3-inch and larger, above ground): Gate valve (3-inch and larger, above ground) shall be iron body with bronze trim, removable bonnet and non-rising stem, flanged ends, Class 125 and same size as pipe in which installed. Gate valve shall be Crane, 461; Nibco, F-619; Jenkins, 452J; or equal.

Gate Valve (3-inch and larger, below ground): Gate valve (3-inch and larger, below ground) shall be AWWA double disc, hub or rubber ring type, removable bonnet and non-rising stem, equipped with operating nuts, 200 psi working pressure, and Tee handle wrench for each valve. Valve shall be Mueller, A-2380; American Valve, Model 28; or equal.

Ball Valve: Ball valve shall be two piece, minimum 400 psi WOG, bronze body and chrome plated or brass ball with full size port, threaded ends. Valve shall be Nibco, T-580; Watts, B-6000; Kitz, 58; or equal.

Gas Valve: Gas valve shall be natural gas service type, bronze body, quarter turn, flathead and rated for 125 psi. Gas valve shall be Crane, American or equal.

Check Valve (1½-inch and smaller): Check valve (1½-inch and smaller) shall be silent spring loaded type, threaded bronze body, nylon or teflon disc, beryllium or stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve shall be Nibco/Scott, T-480; CPV, 36; Kitz, 26; or equal.

Check Valve (2-inch and larger): Check valve (2-inch and larger) shall be silent wafer type, full faced for installation between 125 psi flanges, iron body with bronze trim, nylon or teflon disc, stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve shall be APCO, Series 300; CPV, 10D; Metraflex, Series 900; or equal.

Pressure Reducing Valve (PRV): Pressure reducing valve (PRV) shall be direct acting, spring loaded diaphragm type control valve with balanced single seat, bronze body, bronze trim and screwed connection.

PRV shall be completely self-contained and shall require no external sending pipes or outside control medium. The outlet pressure of the PRV shall be adjustable within a range of 25 psi to 60 psi.

Pressure Relief Valve: Pressure relief valve shall be designed for domestic hot water system. Valve shall have bronze body, and stainless steel components. Valve shall be ASME construction and is tested, listed and certified by the National Board of Boiler and Pressure Vessel Inspectors. Pressure range 75-150 psi.

FAUCETS AND HYDRANTS

Hose Faucet: Hose faucet shall be compression type, angle pattern, wall flange at exterior locations, box and stop at interior locations, tee handle, ¾-inch female thread with hose end, chrome finish for locations inside building, rough brass finish for others. Hose faucet shall be supplied with an integral or nonremovable threaded outlet vacuum breaker which meets the requirements of the American Society of Sanitary Engineering (ASSE) Standard: 1011. Hose faucet shall be Nibco; Chicago; or equal.

Wall Hydrant:

Wall hydrant shall be ¾-inch, exposed, nickel bronze head with bronze casing, and integral vacuum breaker. Operating key shall be provided. Wall hydrant shall be J. R. Smith, Model 5609 QTSAP; Josam, Model 71070; Wade, Model 8630-89; or equal.

Box Hydrant:

Box hydrant shall be ¾-inch, nickel bronze box with hinged, locking cover, bronze casing and hydrant, integral vacuum breaker and minimum ¼-inch drain port. Operating key shall be provided. Box hydrant shall be J. R. Smith, Model 5709 QTSAP; Josam, Model 71020; Zurn, Model 1330; or equal.

Fire Hydrant: Fire hydrant shall conform to the requirements of AWWA Designation: C503. Fire hydrant shall have 6-inch inlet, and have one 4-inch outlet steamer hose and two 2½-inch outlets. Fire hydrant shall be Jones, Model J-3765; Rich, Model 960; American Cast, Darling Division, Mark-73; or equal.

CLEANOUTS

Cleanout Through Wall: Cleanout through wall shall be cast iron cleanout tee type with polished stainless access plates. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, No. W-8460; Smith, No. 4532; Zurn, No. 1445; or equal.

Cleanout Through Floor:

Cleanout through floor shall have nonslip scoriated nickel bronze access plate and adjustable frame with square pattern top for ceramic tile and round pattern top for other finishes. Where floors are constructed with a membrane, access frame shall be provided with membrane clamping flange. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, 6000 Series; Smith, 4021 Series; Zurn, No. 1400; or equal.

Cleanout through floors in exterior locations shall be heavy duty, floating pipe type with cast iron cover. Cleanouts shall be Wade, No. 6000 TY; Smith, No. 4231; Zurn, No. 1474; or equal.

Cleanout to Grade: Cleanout to grade shall be cast iron ferrule type. Plug shall be countersunk brass or bronze with tapered threads. Cleanout to grade shall be Wade, No. W-8450; Smith, 4420; Zurn, No 1440; or equal.

MISCELLANEOUS ITEMS

Water Hammer Arrestor: Water hammer arrestor shall be Type "K" hard-drawn copper body with piston. Arrestor compression chambers shall be pneumatically charged. Water hammer arrestors shall be tested and certified in accordance with Plumbing and Drainage Institute Standard: PDI-WH201 or ASSE 1010 and sized as shown on the plans.

Sump Pump: Sump pump shall be submersible type, automatic with integral vertical float switch and sized and rated as shown on the plans. Sump pump shall be constructed entirely of cast iron, have a 1 1/2 inch vertical discharge and be rated to pass 1/2 inch solids. Sump pump shall have a mechanical seal, be thermally protected and shall have a 15 foot electrical cord.

Automatic Trap Primer Valve: Valve must:

1. Be made of cast bronze
2. Include an integral vacuum breaker
3. Have a non-liming internal operating assembly with gasketed bronze cover
4. Have an access panel installed in an accessible location

Provide Zurn Z1022; Precision Plumbing Products Inc. P2-500 for 2 drains or P1-500 for 4 drains; Wade W2400; or equal.

Access Door: Access door shall be 16-gage prime coated steel, face mounting square frame, minimum 12" x 12" door with concealed hinge and screwdriver latch.

Compression Stop (Exposed): Compression stop (exposed) shall be metal full free waterway, angle type, ground joint union, non-rising stem, molded rubber seat and wheel handle.

Compression Stop (Concealed): Compression stop (concealed) shall be long neck, built-in compression stops for required wall thickness, loose key and exposed parts polished chromium plated. Supplies shall be Chicago, 1771; Zurn, BC40; Precision Plumbing Products, 500; or equal.

Pex Manifold: Pex Manifold shall be non metallic, zone manifold with minimum 1/2" distribution ports and 1" inlet connections. Manifold shall include port compression or crimp type connections, shutoff valves, drill templates, mounting straps, supply caps, faceplate and port labels. Pex Manifolds shall have the number of ports as shown on the plans, and shall be accessible through stainless steel access panel sized to allow access to all shutoff valves. Pex Manifold shall be Minibloc, Nibco, or equal.

Pressure Gages (for PRV) : Pressure gages (for PRV) shall have 0 to 100 psi scale with 3½-inch minimum diameter dial. Gages shall be installed within 6 inches of the inlet and outlet sides of the pressure reducing valve. Pressure gages shall be provided with a brass gage cock.

Temperature Gauges: Temperature gauges shall be vapor actuatored with rotary adjustable stainless steel movement and shall have an aluminum case and ring with black finish and shall have a separate socket connection of 3-½ inch stem length with ¾ inch NPT. Each dial thermometer shall have 6 inch white dial, shall be connected with 3/16 inch seamless stainless steel capillaries protected with stainless steel armor. Dial thermometers shall be United States Gauge; American Dial Thermometers; Trerice Co., or equal.

Gas Regulator: Gas regulator shall be listed as suitable for gas and equipped with full capacity relief valve, low pressure safety shut-off and weatherproof and insect proof vent for outside installation. Capacity shall be as shown on the plans. Gas regulator shall be Fisher; Reliance; Rockwell; or equal.

Digital Gas Meter: Digital Gas Meter, shall be insertion thermal mass flow meter type, suitable for use with natural gas, with an accuracy of 1% from 500-7000 SFPM, with either an analog 4-20mA output or scalable pulse output, visual display, stainless steel components, aluminum enclosure, 24 volts DC transformer, capable of logging daily usage data for a minimum of one month.

Wye Strainer: Wye strainer shall be wye pattern, cast iron body and Type 304 stainless steel or monel strainer screen. The strainer screen shall have an open area equal to at least 3 times the cross sectional area of the pipe in which it is installed and shall be woven wire fabric with 20 mesh or perforated sheet with 0.032-inch maximum diameter holes.

Backflow Preventer: Backflow preventer shall be factory assembled with 2 check valves, one pressure differential relief valve, 2 ball valves and 4 test cocks. Backflow preventers shall be approved reduced pressure principle devices listed by the County of Los Angeles Department of Health Services, Environmental Health,

Cross-Connection and Water Pollution Control Program, 5050 Commerce Drive, Baldwin Park, California 91706, Telephone (626) 430-5290.

Water Meter: Water meter shall be multi-jet type, suitable for water service with a magnetic coupling and a minimum 125 psi working pressure. Meter shall be sized according to the plans and have a pressure drop of no more than 3 psi at a flow of 10 GPM. Readout shall be in gallons. Water meter shall be Master Meter, Badger; Neptune; Rockwell; Hersey; or equal.

Underground Tracer Tape: Under tracer tape shall provided for all buried piping having permanent, bright colored, continuous printed plastic tape with copper wire or aluminum foil intended for direct burial service; not less than 2 inch wide x 0.004 inch thick; lettering shall read "CAUTION WATER PIPE BURIED BELOW" or "CAUTION SEWER PIPE BURIED BELOW."

Pipe Hanger (for piping supported from overhead): Pipe hanger (for piping supported from overhead) shall be Anvil International, Model RH260; Super Struct, C711; or equal.

Pipe Wrapping Tape and Primer:

Pipe wrapping tape shall be pressure sensitive polyvinyl chloride or pressure sensitive polyethylene tape having nominal thickness of 20 mils. Wrapping tape shall be Polyken, 922; Manville, Trantex VID-20; Scotchrap, 51; or equal.

Pipe wrapping primer shall be compatible with the pipe wrapping tape used.

Floor, Wall, and Ceiling Plates: Floor, wall, and ceiling plates shall be chromium plated steel or plastic plates having screw or spring clamping devices and concealed hinges. Plates shall be sized to completely cover the hole.

Valve Box: Valve box shall be precast high density concrete with polyethylene face and cast iron traffic rated cover marked "WATER," "GAS" or "CO-SS" as applicable. Extension shall be provided as required. Valve box shall be Christy, B24; Brooks Products Company, Dual-11; BES, C24W; or equal.

Roof Drain: Roof drain shall be cast iron body, with integral flashing clamp and gravel stop with seepage openings, 15-inch nominal polyethylene low profile dome, 3-inch caulk or no-hub outlet and underdeck clamp. Roof drain shall be Jay R. Smith, 1010; Zurn, Z-100; Wade, W-3500; or equal.

Floor Drain: Floor drain shall be dura-coated cast iron body and adjustable flashing collar, adjustable nickel bronze 6-inch strainer head with seepage openings and caulk or no-hub outlet. Floor drain shall be round or square as shown on the plans. Floor drain shall be Jay R. Smith, 2005/2010; Wade, W-1100; Zurn, Z-415; or equal.

Funnel Drain: Funnel drain shall be dura-coated cast iron body and top . Floor drain shall be Jay R. Smith, Wade, Zurn, or equal.

Sealants: Provide sealant for pipe installation that is:

1. One component
2. Low modulus
3. Non-acid curing
4. Compliant with ASTM C 920
5. Tack-free in one hour
6. Not subject to sag or flow
7. Capable of 100 percent extension and 50 percent contraction without failure
8. Compliant with VOC requirements of LEED and the local air district

If other types of sealants are used for other applications, comply with requirements under "Sealants" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

PART 3 - EXECUTION

INSTALLATION

INSTALLATION OF PIPES AND FITTINGS

Pipe and Fittings: Pipe and fittings shall be installed in accordance with the following designated uses:

Designated Use	Pipe and Fitting Class
Domestic water (CW and HW) in buildings	H3
Domestic water underground within 5 feet of the building	H2
Domestic water underground 5 feet beyond the building	P2, P3, P4
Recycled water (CW) in buildings	P7
Recycled water underground within 5 feet of the building	P7, P8
Recycled water underground 5 feet beyond the building	P2, P3, P4, P8
Fire protection water, underground	B1,D1 or P4
Fire protection water riser	B1, D1 or H3
Fire protection sprinkler piping in building	A1, A3, A4 or B1
Sanitary drain piping above ground in building	H1, C1, or C2
Sanitary drain and vent piping underground within 5 feet of the building	C1 or C2
Sanitary vent piping above ground in building	A2, H1, C1, or C2
Sanitary drain pipe, 5 feet beyond the building	J1, C1, C2, or P1
Natural gas, above ground	B2
Natural gas, underground	B2 (plastic coated), P5 or P6
Lubrication piping, less than 100 feet in length	LP1 (5/8” outside diameter)
Lubrication piping, over 100 feet in length	LP1 (7/8” outside diameter)
Gear oil, motor oil, and automatic transmission fluid (ATF) piping; less than 25 feet in length	LP2 or H3 (5/8” outside diameter)
Gear oil, motor oil, and ATF piping; over 25 feet in length	LP2 or H3 (7/8” outside diameter)
Compressed air	A1
Rainwater leaders	A2
Equipment drains and relief valve discharge	H3 or A1

Installing Piping:

Water piping shall be installed generally level, free of traps and bends, and arranged to conform to the building requirements.

Pex piping shall consist of continuous runs from the pex manifold to the plumbing fixture with as few fittings as possible. All pex fittings shall be stainless steel or non metallic compression, or crimp type suitable for use with recycled water applications.

Piping installed underground shall be tested as specified elsewhere in these special provisions before backfilling.

Public use areas, offices, rest rooms, locker rooms, crew rooms, training rooms, storage rooms in office areas, hallway type rooms, and similar type use areas shall have concealed piping.

Warehouse rooms, equipment bays, and loft areas shall have exposed piping.

Piping shall not be run in floor fill, except as shown on the plans.

Piping shall be installed parallel to walls. All obstructions shall be cleared, headroom preserved and openings and passageways kept clear whether shown or not. Piping shall not interfere with other work.

Where pipes pass through exterior walls, floors, and grade beams, a PVC pipe sleeve around pipe shall be provided. Space between sleeve and pipe shall be caulked water tight with silicone sealant.

Underground copper pipe shall have brazed joints. Underground plastic pipe shall be buried with No. 14 solid bare copper wire. Wire ends at pipe ends shall be brought up 8 inches and looped around pipe.

Exposed supply and drain piping in rest rooms shall be chrome finished.

Compressed air piping shall be pitched to low point. Ball valved drips shall be provided at all low points. Branches shall be taken off top of main.

Gas piping shall not be installed under building concrete slabs or structure. An insulating connection and valve shall be installed above ground at each building supply.

Gas piping shall be pitched to equipment or to low point and provided with an 8-inch minimum dirt leg.

Plastic pipe used for natural gas shall be below grade outside of building only. Transition to Class B2 plastic coated shall be before meter, regulator, or building wall with approved metal to plastic transition fitting. PVC natural gas pipe shall be installed in accordance with International Association of Plumbing and Mechanical Officials (IAPMO) Standard: IS10.

Forty-five degree bends shall be used where offsets are required in venting. Vent pipe headers shall be sloped to eliminate any water or condensation.

Vent piping shall extend a minimum of 8 inches above the roof.

Horizontal sanitary sewer pipe inside buildings shall be installed on a uniform grade of not less than ¼ inch per foot unless shown otherwise on the plans.

Drainage pipe shall be run as straight as possible and shall have easy bends with long turns.

Condensate drain piping shall be run as straight as possible and shall have easy bends with long turns, and shall be sloped no less than 1/8" per foot.

Wye fittings and 1/8 or 1/16 bends shall be used where possible. Long sweep bends and combination Wye and 1/8 bends may be used only for the connection of branch pipes to fixtures and on vertical runs of pipe.

Water pipe near sewers:

Water pipe shall not be installed below sewer pipe in the same trench or at any crossing, or below sewer pipe in parallel trenches less than 10 feet apart.

When a water pipe crosses above a sewer pipe, a vertical separation of at least 12 inches between the top of the sewer and the bottom of the water pipe shall be maintained.

When water and sewer pipe is installed in the same trench, the water pipe shall be on a solid shelf at least 12 inches above the top of the sewer pipe and 12 inches to one side.

Pipe Sleeves:

The Contractor shall provide sleeves, inserts and openings necessary for the installation of pipe, fittings and valves. Damage to surrounding surfaces shall be patched to match existing.

PVC pipe sleeves shall be provided where each pipe passes through concrete floors, footings, walls or ceilings. Inside diameter of sleeves shall be at least ¾ inch larger than outside diameter of pipe. Sleeves

shall be installed to provide at least 3/8-inch space all around pipe the full depth of concrete. Space between pipes and pipe sleeves shall be caulked watertight.

Pipe Penetrations in Fire Rated Assemblies: Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping," in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Cutting Pipe: Pipe shall be cut straight and true and the ends shall be reamed to the full inside diameter of the pipe after cutting.

Damaged Pipe: Pipe that is cracked, bent or otherwise damaged shall be removed from the work.

Pipe Joints and Connections:

Joints in threaded steel pipe shall be made with teflon tape or a pipe joint compound that is nonhardening and noncorrosive, placed on the pipe and not in the fittings.

The use of thread cement or caulking on threaded joints will not be permitted. Threaded joints shall be made tight. Long screw or other packed joints will not be permitted. Any leaky joints shall be remade with new material.

Exposed polished or enameled connections to fixtures or equipment shall be made with special care, showing no tool marks or threads.

Cleaning and Closing Pipe: The interior of all pipe shall be cleaned before installation. All openings shall be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs shall remain in place until their removal is necessary for completion of the installation.

Securing Pipe: Pipe in the buildings shall be held in place by iron hangers, supports, pipe rests, anchors, sway braces, guides or other special hangers. Material for hangers and supports shall be compatible with the piping or neoprene isolators shall be used. Allowances shall be made for expansion and contraction. Steel pipe shall have hangers or supports every 10 feet. Copper pipe one inch or less in diameter smaller shall have hangers or supports every 6 feet and sizes larger than one inch shall have hangers or supports every 10 feet. Plastic pipe shall have hangers or supports every 3 feet. Cast iron soil pipe with neoprene gaskets shall be supported at each joint. Vertical pipes shall be supported with clamps or straps. Horizontal and vertical piping shall be securely supported and braced to prevent swaying, sagging or flexing of joints.

Hangers and Supports:

Hangers and supports shall be selected to withstand all conditions of loading to which the piping and associated equipment may be subjected and within the manufacturer's load ratings. Hangers and supports shall be spaced and distributed so as to avoid load concentrations and to minimize the loading effect on the building structure.

Hangers and supports shall be sized to fit the outside diameter of pipe or pipe insulation. Hangers shall be removable from around pipe and shall have provisions for vertical adjustment after erection. Turnbuckles may be used.

Materials for holding pipe in place shall be compatible with piping material.

Hanger rods shall be provided with locknuts at all threaded connections. Hanger rods shall be sized as follows:

Pipe Size	Minimum Hanger Rod Diameter
½" to 2"	3/8"
2½" to 3½"	1/2"
4" to 5"	5/8"
6"	3/4"

Wrapping and Coating Steel Pipe:

Steel pipe buried in the ground shall be wrapped or shall be plastic coated as specified herein:

1. Wrapped steel pipe shall be thoroughly cleaned and primed as recommended by the tape manufacturer.
2. Tapes shall be tightly applied with 1/2 uniform lap, free from wrinkles and voids with approved wrapping machines and experienced operators to provide not less than 40-mil thickness.
3. Plastic coating on steel pipe shall be factory applied. Coating imperfections and damage shall be repaired to the satisfaction of the Engineer.
4. Field joints, fittings and valves for wrapped and plastic coated steel pipe shall be covered to provide continuous protection by puttying and double wrapping with 20-mil thick tape. Wrapping at joints shall extend a minimum of 6 inches over the adjacent pipe covering. Width of tape for wrapping fittings shall not exceed 2 inches. Adequate tension shall be applied so tape will conform closely to contours of fittings. Putty tape insulation compounds approved by the Engineer shall be used to fill voids and provide a smooth even surface for the application of the tape wrap.

Wrapped or coated pipe, fittings, and filed joints shall be approved by the Engineer after assembly. Piping shall be placed on temporary blocks to allow for inspection. Deficiencies shall be repaired to the satisfaction of the Engineer before backfilling or closing in.

Thrust Blocks:

Thrust blocks shall be formed by pouring concrete between pipe and trench wall. Thrust blocks shall be sized and so placed as to take all thrusts created by maximum internal water pressure.

Plastic pipe underground shall be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains 2 inches and larger, and all capped connections.

Union: Unions shall be installed where shown and at each threaded or soldered connection to equipment and tanks. Unions shall be located so piping can be easily disconnected for removal of equipment or tanks. Unions shall be omitted at compression stops.

Dielectric Waterway: Dielectric waterway shall be provided between metal pipes of different material, and between brass or bronze valves and steel piping.

Insulating Union and Insulating Connection:

Insulating union and insulating connection shall be provided where shown and at the following locations:

1. In metallic water, gas and air service connections into each. Insulating connections shall be installed on the exterior of the building, above ground and after shut-off valve.
2. In water, gas and air service connections in ground at point where new metallic pipes connect to existing metallic pipes. Install valve box above insulating connection.
3. At points of connections of copper or steel water pipes to steel domestic water heaters and tanks.
4. At each end of buried ferrous pipe protected by cathodic protection.

Bonding at Insulating Connections: Interior water piping and other interior piping that may be electrically energized and are connected with insulating connections shall be bonded in accordance with the CEC. Bonding shall all be coordinated with electrical work.

Compression Stop: Each fixture, including hose faucets, shall be equipped with a compression stop installed on water supply pipes to permit repairs without shutting off water mains. Ball valves may be installed where shown on the plans or otherwise permitted by the Engineer.

INSTALLATION OF VALVES

Pressure Reducing Valve: A capped tee connection and strainer shall be installed ahead of the pressure reducing valve.

Exterior Valves: Exterior valves located underground shall be installed in a valve box marked "Water." Extensions shall be provided as required.

INSTALLATION OF FAUCETS AND HYDRANTS

Hose Faucet and Hydrants: Faucets and hydrants shall be installed with outlets 18 inches above finished grade.

INSTALLATION OF CLEANOUTS

Cleanouts:

A concrete pad 18 inches long and 4 inches thick shall be placed across the full width of trench under cleanout Wye or 1/8 bend. Cast iron soil pipe (C1 or C2) and fittings shall be used from Wye to surface. Required clearance around cleanouts shall be maintained.

Cleanout risers outside of a building installed in a surface other than concrete shall terminate in a cleanout to grade. Cleanout to grade shall terminate in a valve box with cover marked "CO-SS". Top of box shall be set flush with finished grade. Cleanout plug shall be 4 inches below grade and shall be located in the box to provide sufficient room for rodding.

Cleanout risers installed in tile and concrete floors, including building aprons and sidewalks, shall terminate in a cleanout through floor.

INSTALLATION OF MISCELLANEOUS ITEMS

Water Hammer Arrestor: Water hammer arrestor shall be installed so that they are vertical and accessible for replacement. Water hammer arrestor shall be installed with access door when in walls or there is no access to ceiling crawl spaces. Access door location shall be where shown on the plans or as approved by the Engineer.

Gas Appliance Connection: Gas valve and flexible connector shall be provided for gas piping at each appliance. Appropriately rated gas cocks may be used in ½-inch gas pipe. Cock or valve shall be within 3 feet of the appliance.

Gas Regulator: Gas regulator shall be installed complete with dirt leg, capped test tee, union, insulating union, gas valve and fittings.

Backflow Preventer:

Backflow preventer assembly shall include a wye strainer, backflow preventer, fittings and pipe. Assembly components shall be the same size as the pipe in which they are installed unless otherwise shown on the plans.

Backflow preventer shall be installed a minimum of 12 inches above ground and shall be the same size as the pipe in which it is installed unless otherwise shown on the plans.

Water Meter: Water meter shall be installed in horizontal piping run with no fittings located within 6 inches of either side of the meter.

Flushing Completed Systems: All completed systems shall be flushed and blown out.

Potable Water Piping: Clean and flush domestic water systems with potable supply water. Continue to flush until potable water is maintained throughout entire system.

Drainage and Vent System: Clean and flush with potable supply water until free of all foreign matter.

Chlorination:

The Contractor shall flush and chlorinate all domestic water piping and fixtures.

Calcium hypochlorite granules or tablets, if used, shall not be applied in the dry form, but shall first be dissolved into a solution before application.

The Contractor shall take adequate precautions in handling chlorine so as not to endanger workmen or damage materials. All pipes and fittings shall be completely filled with water containing a minimum of 50 ppm available chlorine. Each outlet in the system shall be opened and water run to waste until a strong chlorine test is obtained. The line shall then be closed and the chlorine solution allowed to remain in the system for a minimum of 24 hours so that the line shall contain no less than 25 ppm chlorine throughout. After the retention period, the system shall be drained, flushed and refilled with fresh water.

FIELD QUALITY CONTROL

Testing:

The Contractor shall test piping at completion of roughing in, before backfilling, and at other times as directed by the Engineer.

The system shall be tested as a single unit, or in sections as approved by the Engineer. The Contractor shall furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 working days in advance of testing. After testing, the Contractor shall repair all leaks and retest to determine that leaks have been stopped. Surplus water shall be disposed of after testing as directed by the Engineer.

The Contractor shall take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor shall repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

General Tests:

All piping shall be tested after assembly and prior to backfill, pipe wrapping, connecting fixtures, wrapping joints and covering the pipe. Systems shall show no loss in pressure or visible leaks.

The Contractor shall test systems according to the following schedule for a period of not less than 4 hours:

Test Schedule		
Piping System	Test Pressure	Test Media
Sanitary sewer and vent	10-foot head	Water
Water	125 psig	Water
Gas (except P6)	100 psig	Air
Gas (P6)	50 psig	Air
Air	125 psig	Air
Lubrication piping	125 psig	Air and Product

During testing of water systems, valves shall be closed and pipeline filled with water. Provisions shall be made for release of air.

Sanitary sewers shall be cleared of obstructions before testing for leakage. The pipe shall be proved clear of obstructions by pulling an appropriate size inflatable plug through the pipe. The plug shall be moved slowly through the pipe with a tag line. The Contractor shall remove or repair any obstructions or irregularities.

Sanitary sewer pipes beyond 5 feet perpendicular to the building shall be tested for leakage for a period of not less than 4 hours by filling with water to an elevation of 4 feet above average invert of sewer or to top of manholes where less than 4 feet deep. The system shall show no visible leaks The sewer may be tested in sections with testing water progressively passed down the sewer as feasible. Water shall be released at a rate that will not create water hammer or surge in plugged sections of sewer.

Test Procedures:

Rough Plumbing (Soil, Waste, and Vent): Verify piping materials and test upon completion of rough piping installation to ensure watertight system.

Water Test: Apply water test to drainage system in its entirety or in sections after rough piping is installed. If applied to the complete system, tightly close each opening in piping, except highest opening, and fill with water to the point of overflow. If the system is tested in sections, tightly plug each opening except the highest opening of the section under test, and fill with water.

1. Do not test a section with less than 10 feet head of water.
2. In testing successive sections, test at least the upper 10 feet of the following section so that each joint or pipe in the building, except the uppermost 10 feet of the system, is subjected to a test with more than a 10 foot head of water.
3. Keep water in system or in the portion under test for at least 15 minutes prior to inspection; the system shall be tight at each point.

Sanitary Systems: After plumbing fixtures and floor drains are set and traps filled with water, verify drainage system materials and test. Ensure that system is gas tight by a smoke test or peppermint test.

Water Systems: When roughing in is completed and before fixtures are set, test hot water return and cold water piping systems at hydrostatic pressure of 150 psi for at least 4 hours to permit inspection of each joint. Where a portion of water piping system is concealed before completion, test portion separately the same as specified for system.

Exceptions: Exclude equipment and accessories such as plumbing fixtures or water heaters which may be damaged if subjected to full test pressure.

Testing Backflow Preventers:

Backflow preventers installed by the Contractor shall be tested at the completion of the supply system installation for proper operation by a certified Backflow Preventer Tester.

The tester shall hold a valid certificate as a Backflow Preventer Tester from the county in which the device to be tested is located or, if the county does not have a certification program for Backflow Preventer Testers, the tester shall have a certificate from one of the following:

1. The American Water Works Association.
2. A county which has a certification program for Backflow Preventer Testers. The certification under which the tester has been certified shall be acceptable to the water purveyor and the local agency having jurisdiction.

Testing for proper operation shall conform to the procedures of the county in which the testing is being performed, or, if such procedures are not available in the county, such tests shall conform to registration and guidance available from the California Department of Public Health, Division of Drinking Water and Environmental Management, Drinking Water Program, 1616 Capital Avenue, P. O. Box 997377, MS 7400, Sacramento, CA 95899, at:

www.cdph.ca.gov/programs/Pages/DWP.aspx .

The Contractor shall notify the Engineer at least 5 days prior to testing backflow preventers. Such tests shall be satisfactorily completed after installation of the backflow preventer assemblies and before operation of the systems.

One copy of all test results for each backflow preventer shall be furnished to the Engineer.

Full compensation for providing the certified Backflow Preventer Tester and for testing the backflow preventers shall be considered as included in the lump sum price paid for building work and no additional compensation will be allowed therefor.

12-15.03 MECHANICAL INSULATION

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing mechanical insulation in accordance with the details shown on the plans and these special provisions.

Piping insulation shall be installed on all domestic hot water piping, above grade.

P-trap, hot water supply pipes and angle valves for lavatories and sinks, except in janitor closets or similar enclosed spaces, shall be insulated. There shall be no sharp or abrasive surfaces under lavatories or sinks.

Duct insulation shall be installed on all rigid ductwork installed in concealed non-conditioned spaces.

Duct liner shall be installed in all rectangular ductwork installed in exposed non-conditioned spaces and in exterior locations. Plenum liner shall be installed in all plenums in non-conditioned spaces or in walls facing a non-conditioned space.

SUBMITTALS

LEED Submittals:

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building, indicating VOC content.

QUALITY ASSURANCE

Codes and Standards:

Mechanical insulation shall conform to California State Energy Commission regulations and, where applicable, shall meet ASTM standards.

All materials shall bear the label of UL or other approved testing laboratory indicating that the materials proposed for use conform to the required fire hazard ratings.

Pipe safety insulation shall conform to Section 1115B.2.1.2.2 of the CPC.

LEED:

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

MATERIAL

All pipe insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread rating of not more than 25 and smoke development rating of not more than 450 when tested in accordance with ASTM Designation: E 84.

Duct insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread of not more than 25 and smoke development rating of not more than 50 when tested in accordance with ASTM Designation: E 84.

Pipe Insulation: Pipe insulation shall be closed cell, elastomeric material in a flexible tubular form. Insulation shall have a service temperature range between -40°F and 200°F, a minimum vapor transmission rating of 0.20 perm-inch, and a minimum thermal resistance of R-3.

Pipe Safety Insulation: Pipe safety insulation for P-traps, hot water supply pipes and angle valves shall be molded closed cell vinyl or closed cell foam with exterior vinyl surface. Pipe safety insulation shall be configured to protect against contact. Pipe safety insulation shall be Truebro Inc., Handi Lav-guard; Plumberex Specialty Products, Handy Shield; or equal.

External Duct Insulation: External duct insulation shall be 1½ inch thick, one-pound density glass-fiber blanket type. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. External duct insulation shall be Fiberglas, Type PF-336; Ultralite, No. 100; Pittsburgh Plate Glass, Superfine; Johns-Manville, Microlite; Silvercote, Silvercel; or equal.

Acoustic, Plenum and Duct Liner: Liner shall be one inch minimum thickness. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. Liner shall be mold and mildew resistant and have a smooth air stream surface. Liner surfaces (faces and edges) exposed to air stream shall be coated. Liner shall be suitable for duct velocities up to 4000 feet per minute and have a density of 1.5 pounds per cubic foot. Liner shall be Owens Corning, Johns Manville or equal.

Adhesive: Adhesive shall be non-flammable type, water-based, high solids, fast-tacking, pressure-sensitive adhesive recommended by manufacturer for use with insulation, with VOC content not to exceed 50 g/L.

Studs: Studs shall be cement-in-place type, pneumatic driven type or percussive welding type, and shall have one-inch minimum diameter washers.

Insulation Inserts: Insulation inserts at pipe hangers supports for pipes 2 inches or larger shall be calcium silicate, cellular glass, or other acceptable material of the same thickness as the adjacent insulation and not less than 13-pound density.

PART 3 - EXECUTION

INSTALLATION

Insulation materials shall be neatly installed with smooth and even surfaces, jackets drawn tight and smoothly cemented down.

Insulation material shall not be installed until all pipes or surfaces to be covered are tested for leaks, cleaned and dried, and foreign materials, such as rust, have been removed.

Piping Insulation:

Piping insulation shall be in accordance with the following, except that unions, unless integral with valves, and flexible connections shall not be insulated:

1. Where insulation butts against flanges or is discontinued, insulation shall be tapered to pipe to allow for covering jacket to completely seal off end of insulation.

   Insulation shall be extended on the valve bodies up to the valve bonnet.

   Extend insulation continuous through pipe hangers and pipe sleeves. At hangers where pipe is supported, provide an insulated protection shield.

   Insulating cement shall be applied to fittings, valves, and strainers and troweled smooth to thickness of adjacent covering. Strainer cleanout plugs shall remain accessible. Covers fabricated from molded pipe covering may be used in lieu of cement, provided covers are neat and well secured.

Pipe insulation, shall be installed on hot water piping before connections are made or the insulation may be slit lengthwise, applied to pipe and sealed with adhesive.

Pipe Safety Insulation: Pipe safety insulation shall be installed in accordance with the manufacturer's recommendations.

Duct Insulation:

Ragged edges shall be repaired or taped. Coverings shall be neatly finished at joints and edges. Each joint shall have a 2-inch minimum lap.

Where transitions are made between externally covered ducts and lined ducts, the lined duct shall be overlapped 8 inches with external covering.

Insulation shall be flush with but not cover control devices, damper controls or access doors.

Before insulation is wrapped around concealed ducts, an adhesive shall be spot applied at a maximum of 4-inch centers on each side of the ducts to prevent sagging of the insulation. Insulation shall be wrapped entirely around the ducts and shall be wired securely in place with No. 16 copper clad wire, metal bands at least ½ inch wide or plastic ties. Supports shall be spaced a maximum of 12 inches on center. Metal bands shall be installed with the use of a banding machine. Seams in the insulation shall be taped.

The finished insulation covering shall be even and level and shall not contain humps.

Plenum and Duct Liner:

Plenums and exposed ducts shall be lined with plenum and duct liner. Plenums and ducts shall be sized to provide the clear inside dimensions shown on plans after the liner is installed.

The insulation shall be applied with coated side exposed to air stream to prevent surface erosion.

The lining shall be fastened in place with adhesive and with studs with washers spaced a maximum of 18 inches on center each way.

Applying Adhesive: The adhesive shall be liberally applied over entire interior surfaces of ducts or plenums.

Stud Installation:

Studs shall be installed as follows:

1. Cement-In-Place Type Studs: Cement-in-place type studs shall be cemented in place with adhesives manufactured for this purpose and shall be as recommended by the stud manufacturer. Cement-in-place type studs shall be used where concrete walls form part of plenum.
2. Percussive Welding Type Studs: Percussive welding type studs shall be carefully welded in place with current settings that will not appreciably burn galvanizing on opposite side of the sheet metal.
3. Pneumatic Driven Type Studs: At locations where pneumatic driven type studs are used, hardened steel backup plates or dollies shall be used under the sheet metal.

12-15.04 AUTOMATIC FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of designing, furnishing and installing an automatic wet pipe type fire sprinkler system, complete and ready for use, in accordance with the details shown on the plans and these special provisions.

The automatic fire sprinkling system shall include water flow indicator, check valve, electric alarm bell, valves, sprinkler heads and related appurtenances, valves, piping and fittings.

Design:

The design of the sprinkler system shall be in accordance with the code requirements for light hazard occupancies for Building 1A; ordinary hazard occupancies, group 1 for Building 1B, and shall provide coverage of the building area shown on the plans, except otherwise indicated.

The Contractor shall provide, and modify as required, a hydraulic design and calculations to provide a sprinkler system to have adequate protection to the buildings in accordance with NFPA 13 2010 with California Amendments. The sprinkler system shall be based on the hydraulic conditions (available flow and pressure) as determined in the flow test conducted by the Contractor and/or obtained from the utility company's flow analysis.

The water pressure and flow rate shall be verified by the Contractor with the local agency having jurisdiction.

SUBMITTALS

Working Drawings: Complete working drawings, including written verification of the water pressure and flow rate, shall be submitted for approval.

State Fire Marshal Approval: Prior to the submittal of the working drawings, the Contractor shall have said drawings stamped "APPROVED" by the State Fire Marshal.

QUALITY ASSURANCE

Codes and Standards: All work shall be in accordance with the requirements of the State Fire Marshal, the National Fire Protection Association (NFPA) Standard No. 13-2010, "Installation of Sprinkler Systems," and the requirements of other regulatory authorities having jurisdiction.

PART 2 - PRODUCTS

Water Flow Indicator: Water flow indicator shall be UL or FM listed for fire protection, vane type switch designed for wet pipe systems. Water flow indicator shall be designed for minimum flow rate of 10 GPM, and shall have an adjustable delay setting of from 0 to 90 seconds. Water flow indicator shall be Viking, Model VSR-D; Grinnell, Model F620; Reliable, Model A; or equal.

Check Valve: Check valve shall be UL or FM listed, swing type, self draining, iron body with brass trim and rubber clapper with removable cover plate. Check valve shall be Viking, Grinnell, Groeniger, or equal.

Alarm Bell: Alarm bell shall be UL or FM listed electric bell type, 115 volt AC with a minimum sound rating of 95 decibels at 10 feet. Alarm bell shall have a die cast aluminum housing with built-in rubber gasket for dust proof seal for bell striking mechanism. Alarm bell shall be Viking, Grinnell, Reliable, or equal.

Pipe and Fittings:

Pipe and fittings shall be in accordance with the requirements specified under "Pipe, Fittings and Valves," elsewhere in this Section 12-15.

Pipe and fittings for drain lines shall be as recommended by the valve manufacturer.

Pipe Hangers: Pipe hangers shall be of types listed as acceptable for specific applications in NFPA No. 13.

Valves:

Valves shall be UL or FM listed, outside screw and yoke (OS&Y) rising stem type.

Valves (OS&Y) 2½ inches and larger in size shall be Crane, 467; Walworth, 8713F; Nibco Scott, F-607-0; or equal.

Valves (OS&Y) 2 inches and smaller in size shall be Crane, 459; Walworth, 873; Nibco Scott, T-104-D; or equal.

Detector Check Valve shall be UL listed and FM approved. Valve shall be completed with water meter and trim package as manufactured by Mueller Co., A-2132-6; Grinnell Corp., Figure 1371P; or equal.

Indicator Post:

Indicator post shall be the adjustable vertical type as manufactured by Mueller Co., model A-20806; American Flow Control, model IP-71; or equal.

Optional; Valves 4 inches and larger may be butterfly type, UL or FM listed, working pressure 175 psi, gear operated, indicator flag, ductile iron body, bronze trim, with provisions for locking. Valve shall be provided with mounting block for supervisory switch.

Supervisory Switch: Supervisory switch shall be UL or FM listed, for the type of valve supplied, single contact set with tamper resistant cover. Supervisory switch shall be suitable for exterior installations.

Sprinkler Head: Sprinkler head shall be upright type above ceiling and pendant type below ceiling. Sprinkler head shall be brass body, chemical or solder fusing type, with proper temperature rating element. Sprinkler head shall be Viking, Grinnell, Reliable, or equal.

Spare Sprinkler Cabinet: Spare sprinkler cabinet shall be metal cabinet as recommended by the sprinkler head manufacturer and conforming to NFPA requirements. The cabinet shall be painted red.

Fire Department Connection: Fire department connection shall be UL or FM listed, horizontal single or double Siamese as required, with 2½-inch inlets, drain cock, caps, chain, and brass nameplate. Inlets shall have national standard fire hose coupling screw threads. The fire department connection shall be Potter-Roemer, Grinnell, or equal.

Accessories: Drains, test connection, flush connections, pressure gauges, and other accessories shall be supplied as required.

Sign: Sign shall be sheet steel, not less than 0.030 inch (22-gage) thick, with red letters on a white background and a baked enamel coating.

PART 3 - EXECUTION

INSTALLATION

General: Sprinkler piping and equipment shall be installed in accordance with the approved working drawings and shall be located to avoid interference with the lighting system, HVAC systems, duct work, and access openings, or other piping.

Reductions in pipe size shall be made with one piece reduction fittings. Bushings shall not be used.

Piping:

Fire sprinkler piping shall be installed level.

Drain piping and test connections shall discharge into the nearest floor drain or to the outside of the building. Discharge piping shall not drain across walkways.

Pipe Penetrations in Fire Rated Assemblies: Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Spare Sprinkler Cabinet: The spare sprinkler cabinet shall be installed where temperatures will not exceed 100°F at any time. Such location shall be approved by the Engineer. Six spare sprinklers and 2 sprinkler head wrenches shall be furnished and placed in the cabinet.

Securing Main Shutoff Valve: A galvanized chain, with a nominal material diameter of at least 7/32 inch, shall be provided to lock the main shutoff in the open position. The lock will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

Signs: Signs and messages shall be as required by NFPA No. 13 and the regulatory authorities having jurisdiction. Lettering shall be standard-type of the following heights:

Item	Minimum Lettering Height
Nameplate date	¼”
Drain signs	¾”
Tamper sign	¾”

FIELD QUALITY CONTROL

Acceptance Tests:

The Contractor shall arrange for testing of the automatic fire sprinkler system in the presence of the Engineer and the State Fire Marshal. Three days written notice of said testing shall be provided by the Contractor.

The system shall be pressure tested for 2 hours at 200 psig. A successful test shall have no visible leaks or loss of pressure.

The Contractor shall perform such other tests as may be required by the State Fire Marshal.

12-15.05 PLUMBING FIXTURES

PART 1 - GENERAL

SUMMARY

Scope: This work includes furnishing and installing plumbing fixtures.

DEFINITIONS

gpf: Gallons per flush.

MaP: Maximum Performance Testing Program, http://www.map-testing.com.

SUBMITTALS

Product Data: Submit for all products. Include the following:

1. Manufacturer's technical information and catalog cuts for each item. Indicate model numbers, water consumption, required options, size, and finish.
2. Fasteners, carriers, supports, and other pertinent information.
3. Explanation of abbreviations, symbols, and codes contained in schedules.
4. NSF 61 certification where required.
5. Maintenance and operating instructions, including spare parts list.
6. Certified test results and certificates of compliance as required to verify LEED compliance.

LEED Submittals:

WE Credit 2, Innovative Wastewater Technologies: Submit documentation for plumbing fixture water consumption under the USGBC's LEED 2009 for New Construction Rating System, WE Credit 2.

WE Credit 3, Water Use Reduction: Submit documentation for plumbing fixture water consumption under the USGBC's LEED 2009 for New Construction Rating System, WE Credit 3.

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

Commissioning: Comply with requirements under Section 5-1, "Commissioning," of these special provisions. Coordinate with the commissioning agent to carry out commissioning of plumbing fixtures.

The Engineer will inspect all fixtures for proper installation and test for proper operation after all plumbing activities are complete.

PART 2 - PRODUCTS

GENERAL

Plumbing fixtures must be bisque colored, commercial grade, and of vandal-resistant design. Plumbing fixtures must comply with ASME A 112.19.2 unless otherwise specified in these special provisions.

Plumbing fixtures in contact with potable water must be certified under NSF 61.

Furnish plumbing fixtures with suitable fasteners to complete work. Exposed metal on fixtures, including wall flanges, bolts, nuts, and washers must be polished chrome plated. Exposed metal surfaces on fixture supports must be enameled to match fixtures.

WATER CLOSETS

Water Closet (Standard and Disabled Accessible, 1.28 gpf, Floor Mounted with Tank): Standard and disabled accessible water closets must be "low consumption" (1.28 gpf maximum), bisque colored vitreous china, Pressure-Assist, 16-inch to 17½-inch high elongated bowl, close coupled tank, floor mounted, with solid plastic open front elongated seat with check hinges. Tank must be water pressurized air reservoir type. Water closet must meet or exceed Americans with Disabilities Act Accessibility Guidelines (ADAAG) and ANSI Standards: A117.1 and A112.19.2. Water closet and accessories shall be of the following types or equal: Toilet shall be manufactured by American Standard, Crane, Kohler, Sloan, or equal. Water closets must be listed and labeled under the EPA "WaterSense" program.

URINALS

Urinals:

Urinal (1-pint): Urinal (1-pint) must be "ultra-low consumption" [1 pint per flush (0.125 gpf)], wall hung, bisque colored vitreous china, washout type, 3/4 inch back spud, integral shields, spreader, and trap; compliant with ASME A112.19.2; with concealed, diaphragm or piston type flushometer, including vacuum breaker suitable for 3/4 inch spud urinals; controlled by hard-wired, AC-powered infrared sensor with indicator light and manual override; including 120-24 volt transformer(s) and wiring. Urinal shall be manufactured by American Standard, Crane, Kohler, Sloan, or equal.

Urinal must be disabled accessible type as shown on the plans, and rim projection from wall having minimum and maximum dimension as indicated on details.

Urinals must be listed and labeled under the EPA "WaterSense" program.

LAVATORIES AND SINKS

Lavatories (Wall Mounted):

Lavatory must be bisque colored vitreous china, integral perforated grid drain, drilled for 4-inch centers, nominal bowl size 20" x 18", AC-powered infrared sensor type faucet with 4" Centerset solid brass construction.

Faucet must be including 120-24 volt transformer(s) and hard-wired for single or multi lavatory, as shown. Faucet must be equipped with temperature controls to limit the hot water supply to 110°F. Faucet must limit the total flow rate of water to no more than 0.4 gpm. Lavatory and faucet must comply with ADAAG and ANSI A117.7 and completed with chair carrier with concealed arm(s). Lavatory and faucet shall be as manufactured by Kohler; Zurn; Eljer; Sloan; Moen; or equal.

Lavatory supports must be concealed type, wall mounted carrier with leveling screws and locking devices. Carriers must be adjustable for type of wall. Include required hardware.

Lavatory (Counter Mounted):

Lavatory must be disable accessible type, self-rimming bisque colored vitreous china, integral perforated grid drain, drilled for 4-inch centers, nominal bowl size 10" x 18", AC-powered infrared sensor type faucet with 4" Centerset solid brass construction.

Faucet must be including 120-24 volt transformer(s) and hard-wired, as shown. Faucet must be equipped with temperature controls to limit the hot water supply to 110°F. Faucet must limit the total flow rate of water to no more than 0.4 gpm. Lavatory and faucet shall be as manufactured by Kohler; Zurn; Eljer; Sloan; Moen or equal.

Gang Sink: Gang sink (wash fountain) must be constructed of Terreon (solid surface material composed of polyester resin and pre-consumer recycled granules), or terrazzo. The wash fountain must be a three-station semi-circular unit, with infrared-actuated spray nozzles, and solenoid valve powered by 24Volt power supply. The sink must be equipped with liquid soap dispenser, thermostatic mixing valve and appurtenances to complete the unit. Gang sink must be ADA compliant as manufactured by Bradley, Tri-Fount W2933, Willoughby, WAF-3300; Acorn, Wash-Ware 3603 Series; or equal.

Mop Sink: Mop sink must be acid resisting enameled cast iron, 28" x 28" outside dimensions, 3-inch trap, vinyl coated rim guard, vacuum breaker faucet with hose and wall hook. Sink and accessories shall be as manufactured by Kohler; Zurn; Eljer; or equal.

Service Sinks:

Service Sink: Service sink must be acid resisting enameled cast iron, sink type, plain undrilled back, stainless steel strainer, stainless steel or chrome plated sheet brass rim guard on three sides, size approximately 28" x 28" with 3-inch trap with cleanout and floor mounting flange.

Faucets for service sinks must be:

1. Solid brass construction and polished chrome plate finish
2. Wall mounted with center brace
3. Equipped with dual handles on 8-inch centers, integral stops, and vacuum breaker
4. Equipped with bucket hook and threaded hose spout that extends at least 8 inches from the wall
5. Compliant with ASME A112.18.1

Sink and accessories shall be as manufactured by Kohler; Zurn; Eljer; or equal.

Kitchen sink: Kitchen sink must be disabled accessible type, constructed of 18-gage minimum stainless steel with full undercoating. Sink must be single compartment, self-rimmed with ledge for faucet. Normal bowl size must be 21-inch x 15-inch with an outside depth of 6 1/2-inches or less. Sink must be supplied with stainless

steel strainer and chrome p-trap. Kitchen sink faucet must be metal body, chrome plate, single lever mixing type with 8-inch long swing spout aerator and replaceable ceramic cartridge.

Kitchen Sink Faucet: Kitchen sink faucet must be metal body, chrome plated, single lever mixing type with 8" long swing spout and replaceable cartridge.

Food Waste Disposer: Food waste disposer must be 3/4 HP-115V power, continuous feed type. The unit must have stainless steel grinding elements and permanently lubricated upper and lower bearings.

WATER HEATERS

Water Heaters:

Hot Water heater must be minimum storage capacity, BTU input, and first-hour recovery rating as shown on plans. Unit must be a condensing type water heater with thermal efficiency of 97%. Unit must have a maximum temperature setting of 185 degrees, and must include; LCD control system with scrollable, operational history. The heat exchanger must be multi leg triple pass, wet base design, with exchanger tubes coated inside and out with porcelain enamel. The tank must have hot and cold water inlets and outlets on both sides of the unit, and factory installed brass drain valve. The unit must have direct spark to fire ignition system and a CSA/ASME rated T&P valve. The unit must meet Bay Area Air Quality Management District Regulation 9 rule 6, and SCAQMD Rule 1146.2. Water heater must meet the requirements of the California Building Energy Efficiency Standards (Title 24, Part 6) and must comply with the California Energy Commission's Appliance Efficiency Regulations. Hot Water Heater shall be Rheem, GE, Bosch, or equal.

Water heaters must comply with ANSI Z 21.10.3.

Water heaters must be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

Instant Water Heater (Electric):

Instant water heater must have the voltage, kW rating and temperature rise as shown on the plans. Unit must have ABS UL 94 Vo rated cover, heater body and element must be glass reinforced Noryl or equal. Element must be replaceable cartridge insert type. Unit must have a replaceable filter in the inlet connector, element must be iron free, nickel-chrome material, heater must be fitted with 1/2" compression nuts and sleeves. Unit must have a maximum operating pressure of 150 psi.

MISCELLANEOUS EQUIPMENT

Hot Water Recirculation Pump:

Hot water recirculation pump must be in-line, plug in type, stainless steel components must be; inlet cone, bearing plate, bearing retainers, rotor can, rotor cladding, shaft retainer, and pump housing. Other components must be non ferrous type. Pump must be supplied with 24 hour 7 day programmable timer, and integral check valve. The pump must be suitable for circulation of, maximum 185°F and maximum 145 psi working pressure, domestic hot water. Pump motor must have built in thermal or impedance protection and be non-overloading at any point on the pump curve. Pump must be completed with gaskets, and ceramic bearing. Pump capacity must be as shown on plan.

The hot water recirculation pump shall be as manufactured by Grundfos; ITT Industries-Bell & Gossett; or equal.

Potable Water Expansion Tank:

Potable water expansion tank must be designed for domestic hot water system to absorb the increased volume of water created when the hot water heater is heated and keeps the system pressure below relief setting of the temperature and pressure relief valve. The potable water expansion tank must be of drawn

steel construction and include a rigid polypropylene reservoir liner. The tank must be completed with a butyl diaphragm to separate the air and water chambers, stainless steel lined inlet connector, wall or floor mounting hardware and supports, and be FDA approved.

Electric Water Coolers:

Electric water cooler must be wall mounted, "Hi-Lo" type, wheelchair accessible, and must produce a minimum of 7.6 gallons of 50°F water per hour based upon an inlet water temperature of 80°F and an ambient room temperature of 90°F. Cooler must have self closing, front and side mounted pushbar actuators or electronic sensor activation, shielded bubbler, automatic stream regulator, loose key stop, adjustable thermostat and cast brass P-trap. Compressors must be hermetically sealed, positive start with fan cooled condenser. Electric water coolers must have a 3-wire grounded cord and plug.

Electric water cooler must have heavy duty galvanized steel frame, stainless steel top of one-piece construction, and stainless steel cabinet.

Electric water coolers must produce a minimum of 7.6 gallons of 50 °F water per hour based on an °F.

Electric water cooler shall be Haws, HWUACP8LSS; Sunroc, ADA8ACB; Elkay, EZSTL8C; or equal.

Emergency Eyewash and Showers:

Emergency eyewash and showers must be combination drench shower and eyewash, with 1-1/4 inch minimum powder-coated galvanized or stainless steel pipe stand with 9-inch floor mounting flange. Shower heads must have at least a 10-inch diameter ABS plastic head with a stay-open ball valve operated by a rigid pull-rod with triangular handle and equipped with 8-1/2 by 11 inch emergency identification sign complying with ANSI Z 358.1 § 7.4.3.

Eyewash units must have a at least a 10-inch diameter stainless steel bowl, with anti-surge heads and circular chrome-plated spray ring operated by a stay-open ball valve operated by a flag or push handle. Eyewash units must be mounted on the pipe stand and include a dust cover assembly.

Emergency eyewash and showers must comply with 8 CA Code of Regs § 5162 and must be designated accessible and barrier-free by the manufacturer.

Sealant: Sealant must be:

1. One component, low modulus silicone
2. Non-acid curing
3. Designed for plumbing fixture applications
4. Compliant with ASTM C 920
5. Compliant with VOC requirements of LEED IEQ Credit 4.1 and the local air district
6. Not subject to sag or flow and tack-free in 1 hour
7. Capable of 100 percent extension and 50 percent contraction without failure

PART 3 - EXECUTION

GENERAL

Seal fixtures to the wall and floor with sealant bead.

Install wall mounted fixtures on concealed carriers designed to support weight of fixture from the floor. Carriers must be made for the specific fixture to be supported and for the installation conditions.

Furnish fixtures with accessible compression stops.

Wrap hot water supply, trap and tailpiece on lavatories under "Pipe Insulation," of these special provisions.

INSTALLATION

Install flush valves for fixtures shown on the plans as disabled accessible so that the valve handle is on the widest side of the toilet space.

Install water closets under the manufacturer's instructions. Water closets shown on the plans as disabled accessible must be installed with disabled accessible flush valve. Install water closet seats.

Install urinals under the manufacturer's instructions.

Install transformers for lavatory faucets and flushometers as shown on the plans. Install a plastic junction box extension to cover the transformer.

Install service sink faucets on the wall above the sink-back with the spout outlet 16 inches above the service sink rim.

Install mop sink faucets on the wall above the sink-back with the spout outlet 36 inches above the floor.

Install water heaters with seismic restraints, inlet ball valve, insulating connections, and 3/4-inch pressure and temperature relief valve. Install relief valve drain pipe as shown on the plans.

Install Instant Water Heater in accordance with the manufacturer's recommendations by a qualified installer, service agency or the equipment supplier.

Install emergency eyewash and shower with a rigid bracket located 48 inches above the floor. Bracket must be at least 16-gage galvanized or powder coated steel and attached to the wall.

12-15.06 WHEELCHAIR ACCESSIBLE SHOWER UNIT

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a wheelchair accessible shower unit and fittings in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data, installation instructions and color palette shall be submitted for approval. The color shall be selected from the manufacturer's standard product line by the Engineer after approval of the contract.

LEED Submittals:

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY CONTROL AND ASSURANCE

Codes and Standards: Shower units shall conform to the requirements of the California State Accessibility Standards contained in the CBC and to ANSI Z124.1.2.

LEED:

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

Shower Stall:

Shower stall shall be single unit, single piece construction with clear interior dimensions of 60 inches wide, 30 inches deep, with a full opening width on the long side, and no obstruction at the threshold. Shower stall shall be fabricated from gel-coated fiberglass or acrylic with a Class I Flame Spread. Shower unit shall be reinforced to accommodate the grab bars and seat.

Shower unit shall have no threshold or recessed drop. The floor shall be slip-resistant, sloping a maximum of ½ inch per foot to a drain located near the rear wall.

Shower unit shall be provided with the following fittings and accessories: stainless steel corner grab bar and folding teakwood or woodgrain phenolic wheelchair transfer seat, each capable of resisting 250 pounds of lateral, vertical and tensile load, stainless steel soap dish, chromium plated or stainless steel curtain rod, chromium plated steel hand-held shower head with ball joint, chromium plated 60-inch long flexible shower spray hose, chromium plated fixed shower head, chromium plated metal outlet drain with removable strainer, chromium plated single lever control thermostatic mixing valve with control cartridge with no metal to metal wearing surface, a lever operated diverter valve selector for either hand-held shower or fixed shower head, and vinyl shower curtain with corrosion resistant hooks. The hand-held shower shall be centrally mounted on the long wall of the shower stall. The fixed shower head shall be centrally mounted on the short wall, opposite to folding seat. The thermostatic mixing valve and diverter valve shall be installed on the long wall with levers at the same level, per ADA requirements.

Shower stall units shall be Crane; Florestone; Fiberfab; or equal.

PART 3 - EXECUTION

INSTALLATION

Shower shall be installed with the manufacturer's instructions. All joints shall be sealed and caulked watertight.

12-15.07 SHOWER STALL

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a shower stall in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data, installation instructions and color palette shall be submitted for approval. The color and finish will be selected from the manufacturer's standard product line by the Engineer after the award of the contract.

LEED Submittals:

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY CONTROL AND ASSURANCE

Codes and Standards: Shower units shall conform to the requirements of ANSI Z124.1.2.

LEED:

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

Shower Stall: Shower stall shall be single unit, one-piece construction with minimum clear interior dimensions of 36 inches x 36 inches, fabricated from glass fiber reinforced polyester resin and provided with the following fittings and accessories: soap dish, chromium plated metal or stainless steel curtain rod, chromium plated steel showerhead with ball joint, chromium plated steel bent arm and wall flange, chromium plated metal outlet drain with removable strainer, chromium plated single-handle control thermostatic mixing valve that has control cartridge with no metal to metal wearing surfaces, and vinyl plastic shower curtain with noncorrosive curtain hooks. Shower stall unit shall be Fiberfab, Model 38BF ; Florestone Florentine, Model 36-3W; or equal.

PART 3 - EXECUTION

INSTALLATION

The shower stall shall be installed in accordance with the manufacturer's recommendations. Installation shall be sealed and caulked watertight.

12-15.08 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT AND SYSTEMS

PART 1 - GENERAL

Scope: This work shall consist of furnishing, and installing and testing heating, ventilating and air conditioning (HVAC) equipment, controls and systems in accordance with the details shown on the plans and these special provisions.

The performance rating and electric service of the HVAC equipment shall be as shown on the plans.

Comply with requirements under "Indoor Air Quality Management" in Section 5-1 of these special provisions.

Codes and Standards:

Comply with codes and other requirements specified under "Mechanical Work" elsewhere in this Section 12-15, "Mechanical."

Equipment and systems shall conform to California Energy Commission regulations including the California Building Energy Efficiency Standards and the Appliance Efficiency Regulations and, where applicable, shall comply with standards of the Air-Conditioning, Heating, and Refrigeration Institute (AHRI), Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association International (AMCA). Gas-fired equipment shall be CSA certified as complying with applicable ANSI standards.

Cooling and refrigeration equipment and components shall be certified by AHRI for the performance rating shown on the plans, under the AHRI or ARI rating systems. Performance of space heating equipment and components shall be certified by AHRI under the GAMA, I=B=R, ARI, or AHRI rating systems as applicable.

Safety: Equipment shall be certified compliant with UL 1995 or with ASHRAE 15, NFPA 90A, and NFPA 90B.

Motors: Motors shall be premium type, of highest efficiency available.

SUBMITTALS

Product Data: Submit product literature and installation instructions for all products including ductwork, dampers, controls, piping, and accessories. Include energy efficiency ratio (EER) and seasonal energy efficiency ratio (SEER) for cooling equipment, coefficient of performance (COP) for heating equipment, annual fuel utilization efficiency (AFUE) for gas-fired heating equipment, and type and quantity of refrigerant for each cooling unit.

LEED Submittals:

EA Prerequisite 3, Fundamental Refrigerant Management:

Submit product data for HVAC and refrigeration systems and certification of absence of CFC refrigerants.

EA Credit 4, Enhanced Refrigerant Management:

Submit product data for new HVAC and refrigeration systems indicating specific refrigerant type and charge (quantity per ton of gross cooling capacity) for each equipment item, for review and approval by Engineer.

Submit completed LEED template for EA Credit 4, listing all HVAC and refrigeration equipment covered by the credit and showing compliance with credit requirements.

IEQ Credit 1, Outdoor Air Delivery Monitoring: Submit product data for CO2 monitors and direct outdoor airflow measurement devices.

IEQ Credit 4.1, Low-Emitting Materials—Adhesives and Sealants: Submit product data for adhesives, sealants, and sealant primers to be used on-site and inside building weatherproofing system, indicating VOC content.

QUALITY ASSURANCE

Single Source Responsibility: HVAC equipment in each of the following categories shall be the products of a single manufacturer:

Heating and cooling units
Fans and ventilators
HVAC controls
Controls
Ductwork
Diffusers, registers, and grilles
Dampers
Smoke detectors
Sensors
Air filters
Zone Temperature Sensors

CO2 Sensors
CO Sensors
Pressure and Temperature Sensors
Thermostats

Controls subcontractor shall be certified by the controls manufacturer as an authorized representative and installer.

LEED Provisions:

EA Prerequisite 3, Fundamental Refrigerant Management:

Provide refrigerants that do not contain chlorofluorocarbons (CFCs) for HVAC and refrigeration systems.

Replace equipment using CFC-based refrigerants with systems using refrigerants that are not CFC-based.

EA Credit 4, Enhanced Refrigerant Management:

For HVAC and refrigeration systems containing 0.5 pounds or more of refrigerant, select units using refrigerants with low combined potential for contributing to global warming and ozone depletion, as calculated under the LEED Reference Guide.

Provide fire suppression systems that do not contain CFCs, hydrochlorofluorocarbons (HCFCs), or halons.

IEQ Credit 4.1, Low-Emitting Material—Adhesives and Sealants: For interior application (inside the weatherproofing system and applied on-site), provide adhesives, sealants, and sealant primers that comply with LEED limits for VOC content. Comply with local requirements if more stringent.

PART 2 - PRODUCTS

HEATING AND COOLING UNITS

Combination Heating/Cooling Rooftop Unit

Combination Heating/Cooling Rooftop Unit shall be high efficiency, commercial quality, single package, dual compressor, roof curb mounted unit. Units shall have a Sea Coast Coating and shall be suitable for use in a marine environment. Units shall have anti-short cycle timer, colored and numbered wiring, convertible airflow, direct drive plenum fan, low voltage terminal board, microprocessor controls, filters, foil faced and edge captured insulation, high pressure control, removable drain pans, liquid line refrigerant drier, low pressure control, multispeed direct drive motors, operating charge of R-410A refrigerant, harmonic phase monitor / balancer, stainless steel heat exchanger, through the base; gas, electrical, and disconnect switch, hinged access doors, return air sensor, filter status, powered convenience outlet, economizer, BACnet communications interface, C02 and CO sensor, motorized outside air damper, powered exhaust, roof curb, two stage heating, supply and return air smoke detectors, and scroll compressors. Units shall have a normally open auxiliary contact to interlock with exhaust fans as shown on the electrical drawings. Interlocked exhaust fans shall be on when the associated HVAC unit is on and off when it is off. Units shall be Trane Precedent and Voyager with Varitrac control systems, Carrier Weather maker with VVT controls, or equal. Unit without zone control shall have a programmable thermostat.

Unit shall be provided with positive pressure combustion and mechanical flue gas venting and furnace safety controls.

Compressors shall be scroll type vibration isolated, with short cycling protection, pressure relief valve, high and low pressure switches, and liquid-line filter-dryer.

Motors shall have integral thermal overload protection.

Unit shall be provided with an economizer and modulating exhaust fan.

Economizer shall include an air measuring device for outside air.

Economizer: Economizer shall be modulating type assembly provided by the manufacturer of the package roof top unit. The economizer shall be complete with damper motor and linkage for full range modulation of the outdoor and return air dampers, modulating exhaust fan, screened rain hoods, factory wiring for convenient connections, automatic compressor lockout, minimum position damper control, and air filters sized to have a maximum velocity of 400 feet per minute, all installed in an enclosure similar in color to the basic unit with paint applied by the manufacturer of the economizer. Modulating exhaust fan shall be capable of relieving 100 percent of the rated air conditioning unit. The economizer shall be constructed to meet SMACNA requirements and shop drawings shall be submitted prior to fabrication. Economizer controls shall be fully integrated with cooling system controls and shall be. CO sensor shall override operation of the economizer, and the economizer shall fully close in the event CO levels exceed indoor air quality standards. Economizer shall return to normal operation when CO levels return to normal.

Economizer shall include an air measuring device for outside air.

Low Intensity Radiant Heater:

Low intensity radiant heater shall be two stage type, and include stainless steel burner, 16 ga. 4" O.D aluminized coated steel radiant emmiter tube with corrosion resistant black coating and downstream turbulator baffle for maximum thermal efficiency, highly polished aluminum rotatable reflector with reflector tension springs, power exhaust unit, controls, stainless steel flexible gas connector, hangers, and appurtenances as necessary for proper installation and operation. System shall be CSA certified and rated for natural gas.

Burner shall be equipped with direct spark ignition, flame safety control and combustion chamber inspection sight glass.

Power exhaust shall be suitable for multiple burner usage as shown on the plans. Exhaust unit fan shall have stainless steel fan wheel, 16-gage aluminized steel housing, with vibration isolating mounts, discharge bird screen, and flexible supply connection. Power exhaust motor shall have built-in thermal overload protection. Units sharing the same exhaust flu must be wired with the same time switch.

Low intensity radiant heater controls shall consist of two stage gas valve, air proving safetly switch, sillicon carbide igniter, 24 V thermostatic control voltage and self diagnostic LED.

Reflectors, hangers, supports and fasteners shall conform to the low intensity radiant heater manufacturer's recommendations. The Contractor is responsible for purchasing all optional accessories necessary for installation of the heaters according to the manufacturer's instructions, and as indicated on the plans.

Split System Heat Pump: Heat pump shall consist of an outdoor condenser unit with an indoor fan/coil unit. The condenser unit shall consist of a compressor, condenser coil, fan and all controls, tubing and appurtenances required for a complete operating system. The indoor fan coil units shall consist of an evaporating coil, expansion control device, fan, and thermostat. In addition, the indoor unit shall come with a plug or local disconnect. The system shall provide heating or cooling as required by the thermostat. The outdoor unit shall have sea coast, or other coating to make them suitable for use in a marine environment and shall include a local disconnect. Units shall be Mitsubishi Electric, Sanyo, Daikin, or equal.

Split System Air Conditioner: Split Ductless Air Conditioner shall consist of an outdoor condenser unit with an indoor fan/coil unit. The condenser unit shall consist of a compressor, condenser coil, fan and all controls, tubing and appurtenances required for a complete operating system. The indoor fan coil units shall consist of an evaporating coil, expansion control device, fan, and thermostat. In addition, the indoor unit shall come with a plug or local disconnect. The outdoor units shall have sea coast, or other coating to make them suitable for use in a marine environment and shall include a local disconnect. The system shall provide cooling as required by the thermostat. Units shall be Sanyo, Mitsubishi Electric, Daikin, or equal.

FANS AND VENTILATORS

Supply Fan with Duct Heater: Supply Fan with Duct Heater shall be a self contained unit consisting of; a variable speed blower with permanent split capacitor (PSC) motor, permanent washable filter, modulating electric heating element, duct mounted outlet air temperature sensor and built in controller. The unit shall be capable of maintaining a specific temperature set point as indicated on the plans. The unit shall be wired to a programmable thermostat capable of disabling the unit during unoccupied building hours, and disabling the heating element when the programmed temperature set point is reached. Unit shall be Electro Industries Inc., Spacepak, or equal.

Declassification Fan (Roof Mounted): Fan shall be of aluminum or steel construction with sea coast coating suitable for continuous operation in a marine environment, roof mounted, upblast type, direct drive, centrifugal exhaust fan, AMCA certified and shall be equipped with stainless steel fasteners, grille, and back draft damper. Exhaust fan motor shall be fully enclosed outside of exhaust air stream, with permanently lubricated sealed bearings, have integral thermal overload protection and NEMA-1 disconnect switch, and mounted on vibration isolators. Fan housing shall have a one-piece wind band continuously welded to the curb cap. Fan shall be; Loren Cook Company, Greenheck Fan Corp.or equal.

Exhaust Fan Roof Mounted: Exhaust fan shall be of aluminum or steel construction with sea coast coating suitable for continuous operation in a marine environment, roof mounted, upblast type, direct or belt drive, centrifugal exhaust fan, AMCA certified and shall be equipped with stainless steel fasteners, grille, and back draft damper. Exhaust fan motor shall be fully enclosed outside of exhaust air stream, with permanently lubricated sealed bearings, have integral thermal overload protection and NEMA-1 disconnect switch, and mounted on vibration isolators. Fan housing shall have a one-piece wind band continuously welded to the curb cap. Fan shall be; Loren Cook Company, Greenheck Fan Corp.or equal.

Roof Ventilator: Roof ventilator shall be stationary, gravity type, and shall have a damper and chain type operating device. Roof curb shall be supplied by the ventilator manufacturer.

Dust Collector: Dust Collector shall be vertical, wall or stand mounted type, and shall have a Class F TEFC motor with a 1.15 service factor, magnetic starter with on/off switch and amperage overload protector. The unit shall have a cast aluminum alloy 356-51 non-sparking, non-ferrous fan wheel and housing, the fan shall be backward incline design and shall be dynamic two-plane balanced to ISO 6.3 specifications. The dust collector body shall be cyclone type 16-gage solid welded construction with rotatable outlet. The unit shall have a minimum 110 sq. ft. of filter area, filter shall be HEPA type MERV 16+ rated and come with a grounding wire, and removable fine dust bin. The unit shall have a built in silencer and shall produce a maximumof 85 dBA. The unit shall be supplied with two 55 gallon dust drums.

HVAC CONTROLS

HVAC Control System: Shall be a change over-bypass VAV type system. The HVAC units will deliver a constant volume of supply air to the system. Each zone will have a zone temperature sensor and in some areas CO2 sensor as shown on the plans. The zone temperature sensors (ZTS) and CO2 sensors will communicate information to the unit control module (UCM) on each zone damper. The UCM will then modulate the zone damper (ZD) open or closed supplying conditioned air to the zone. The individual UCMs will communicate zone temperature information to a central control panel (CCP). The CCP also gathers information from the system, including duct static pressure and supply air-temperature, and acts as the central source of communications and decision making between the individual zones and the HVAC unit. The CCP determines zone heating or cooling needs using voting / polling logic, then requests heating or cooling from the HVAC unit. The CCP directs its HVAC unit to provide ventilation air to zones where the CO2 sensors call for increased air volume, or free cooling when the outside air sensor indicates an air temperature below the temperature set point. As the volume of air required by the zones change a pressure sensor in the bypass duct as shown on the plans communicates to the bypass damper to open or close directing supply air into the return duct. See the control diagrams and sequence of operations on the plans.

Central Control Panel: Central Control Panel shall act as the central source of communications and decision making for each HVAC unit. The CCP shall have 24VAC power, and communication wiring to the zone dampers and bypass control as shown on the control diagram. Binary inputs shall consist of priority shutdown and occupied/unoccupied modes. The CCP shall control heating, cooling, and the fans with a communication link tied to an interface board mounted in the HVAC unit. It shall also display status information from the electronic controller in the HVAC unit. The CCP shall be capable of communicating with as many zones as required on the plans, make heating and cooling decisions based on set points and temperature information received from individual zones, automatically calibrate all zone dampers, provide diagnostic information for all system components via the operator display, provide status and diagnostic information for the HVAC unit.

Operator Display: Operator Display shall be a backlit, liquid crystal display with touch screen programming capability. The display shall allow the operator to access system and zone status, and perform setup of zone UCMs and CCP system parameters, provide a level of control for the daily operator and a second level for commissioning and service. The system shall have a seven day time clock for stand-alone time of day scheduling capability.

Unit Control Module: Unit Control Module shall be the individual zone controller for the zone damper and shall be mounted on each damper. The UCM shall continually monitor the zone temperature and where indicated on the plans CO2 levels. The UCM shall vary the zone damper position as required to meet zone setpoints and shall communicate current space requirements and system operation modes to the CCP.

Bypass Damper Controller: Bypass Damper Controller shall be a single control enclosure with integrated UCM board, static pressure sensor, and discharge air temperature sensor. The controller shall directly control the position of the bypass damper and communicate duct conditions to the CCP. The Bypass Damper shall be an integrated fully modulating 24 VAC electric actuator with quick-connect wiring harness, and shall be sized and located according to the plans.

Zone Damper: Zone Damper shall be a fully modulating, pressure-dependent VAV device. Each damper shall have a UCM control board and actuator in one enclosure, and shall be designed to operate to a static pressure of 1.75 in. wg. The zone damper shall be rectangular, with a heavy gage G60 galvanized steel frame, single-ply, heavy gage G60 galvanized steel blades, nylon bearings and metal drive link, with factory installed 24 VAC direct coupled actuator.

Zone Temperature Sensor: Zone Temperature Sensor shall have an LCD display, two button control of space setpoint, and shall display setpoint adjustment and space temperature in degrees F. ZTS shall be capable of disabling setpoint control and room temperature display.

CO2 sensor: CO2 sensor shall be a wall mounted sensor of Carbon Dioxide levels in parts-per-million (ppm), and shall be located as indicated on the plans. The sensor shall have a measurement range of 2000 ppm with an output of 0-10 Vdc.

Supply Fan Duct Heater Thermostat: Supply Fan Duct Heater thermostat shall be low voltage type, 24 hour 7 day programmable dual set point range internally adjustable from 40°F to 80°F, and provided with a blank cover.

Thermostat (Ground floor Building A Only): Thermostat shall be 24-volt, 7-day programmable, electronic heating/cooling thermostat, with the ability to program the fan-on mode during normal working hours, and fan-off mode during unoccupied periods. Thermostat shall be provided with sub-base selector switches for "AUTO-HEAT-OFF-COOL" and fan "AUTO-ON." Thermostat shall be auto-changeover type, and have full temperature range setback capacity. Thermostat shall be Robertshaw, 7900; Honeywell, T7300; or equal.

Time Switch: Time switch shall be one-hour, spring-wound, "OFF" type time switch without a "HOLD" feature. Time switch shall be Intermatic; Tork, A500 Series; or equal. LIRH units with combined dual exhaust shall be controlled by the same Time Switch.

AUXILIARY HVAC COMPONENTS

Unless specified herein, all components shall be sized and have the characteristics as shown on the plans.

Rigid Ductwork: Rigid ductwork shall be galvanized steel sheet metal conforming to ANSI/SMACNA 006, "HVAC Duct Construction Standards—Metal and Flexible." Galvanized steel shall be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.

Spiral Duct: Spiral duct shall be prefabricated type.

Duct Supports: Duct supports shall be hot-dip galvanized steel.

Flexible Ductwork: Flexible ductwork shall be UL 181, Class 1 air duct rated and shall meet the requirements of NFPA 90A. Duct shall have steel helix wire, flexible insulation, minimum thermal resistance of R-8, and flame resistant vapor barrier. Inner and outer surfaces shall be non-metallic. Outer surface shall be copolymer or mylar, factory applied.

Flexible Connection: Flexible connection shall be prefabricated type and shall be commercial quality flexible glass fabric coated on both sides with neoprene or hypalon.

Ceiling Diffuser (for gypsum board ceilings): Ceiling diffuser for gypsum board ceilings shall be square type. Diffuser shall be steel with oven baked-on enamel bone white dull finish, equipped with a removable core and a standard flanged frame with sponge rubber or felt gasket. Diffuser shall have individually adjustable curved blades, counter-sunk screw holes, shall be surface mounted, with face velocity less than 600 feet per minute; Titus, MCD; Krueger 1240; or equal.

Ceiling Diffuser (for wood panel ceilings): Ceiling diffuser for wood panel ceilings shall be square type. Diffuser shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, shall be modulat slot type and be able to have ceiling material inserted in the diffuser face, shall be lay in mounted, with hood, hangers, and have adjustable air flow patterns with face velocity less than 600 feet per minute; Titus, MFI10; Krueger ASDT, or equal.

Return Grille (for gypsum board ceilings): Return grille for gypsum board ceilings shall be square, and shall be steel with oven baked-on enamel bone white dull finish, with a perforated screen and standard flange frame. Grille shall have counter sunk screw holes, be surface mounted, with face velocity less than 600 feet per minute; Titus, 8R; Krueger S80P; or equal.

Ceiling Diffuser (for suspended ceilings): Ceiling diffuser for suspended ceilings shall be 24 inches square. Diffuser shall be steel with oven baked-on enamel bone white dull finish equipped with a removable core and a standard flanged frame. Diffuser shall have individually adjustable curved blades, shall be lay in mounted, with face velocity less than 600 feet per minute; Titus,MCD; Krueger 1240; or equal.

Return Grille (for suspended ceilings): Return grille for suspended ceilings shall be 24 inches square, and shall be steel with oven baked-on enamel bone white dull finish, with a perforated screen and standard flange frame. Grille shall be lay in mounted, with face velocity less than 600 feet per minute; Titus, 8R; Krueger S80P; or equal.

Wall Supply Register: Wall supply register shall be double-deflecting adjustable type, with vertical face bars and horizontal rear louvers, steel with oven baked-on enamel bone white finish or extruded aluminum, flanged frame with sponge or felt gasket; Hart and Cooley; Air Mate or equal.

Smoke Damper: Smoke damper shall be approved or listed by the State Fire Marshal. Damper assembly shall be a UL class 1 smoke dampertested and listed under UL 555 and UL 555S. Damper actuator shall be 120 VAC, power open, spring close, external mounted. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Damper and actuator shall be supplied as a single entity which meets all applicable UL standards. Damper shall have all galvanized steel parts and be suitable for round ductwork. Damper shall be installed at the locations shown on the plans.

Balance Damper: Balance damper shall be butterfly type, 16-gage (minimum) galvanized steel blade, end bearings with steel shaft and locking and indicator operator.

Air Filter (for HVAC Units): Air filters shall be disposable filters with a minimum efficiency reporting value (MERV) of not less than 13 when tested under ASHRAE 52.2. Filters shall be located to process both return and outside air that is delivered as supply air.

Vents and Flues (for heaters): Vents and flues for heaters shall be approved Type B or approved plastic vents for condensing furnaces and hot water heaters, and shall be routed to avoid PV panels on the roof.

Refrigerant and Condensate Drain Piping: Refrigerant and condensate drain piping shall be rigid, Type L copper tubing with brazed solder fittings. The suction line shall be insulated, with vapor barrier and shall be weatherproofed for exterior installation. Factory sealed tubing shall not be used. Refrigerant and condensate drain piping shall be routed to avoid PV panels on the roof.

PART 3 - EXECUTION

INSTALLATION

Heaters:

Radiant heaters and duct heaters shall be installed in such a manner as to insure adequate clearance and separation of combustion air and circulating air. Appliances shall be connected to a rigidly mounted gas pipe supply system by a CSA approved stainless steel flex connector and gas valve.

Radiant heaters shall be suspended by ¼-inch minimum carbon steel chain and eye bolts. Heaters shall be angled to minimize heating of adjacent walls and as indicated on the plans. No more than two 45 elbows and one 90 shall be used on radiant heater exhaust vent ducting. All heater fresh air intake, and exhaust roof penetrations shall be located clear of PV panels, with a minimum separation of 2.5 times the height of the vent in the west, east, and southerly directions.

Ventilators:

Exhaust ducts connected to exhaust fans shall be routed as shown on the plans and to avoid PV panels on the roof, and shall terminate in a weatherproof cap. Duct sizes shall be as shown on the plans or as recommended by the manufacturer, whichever is larger.

Roof fans Ventilators shall be curb mounted and shall be located clear of PV panels with a minimum separation of 2.5 times the height of the fan or ventilator, in the west, east, and southerly directions.

Condensate Drains: Air conditioning units and heat pumps shall be provided with condensate drain trap and piping. Outdoor piping shall extend to the nearest roof drain, gutter or as shown on the plans. Air gap shall be installed where required by code. Interior condensate drain piping shall be insulated with foam insulation.

Mounting Heights: Thermostats, zone temperature sensors, central control panels, and time switches shall be installed as shown on the plans and consistent with accessibility requirements.

Temperature Controls:

Temperature control for each radiant heater shall be provided by a time switch as shown on the plans.

Install thermostats on interior walls.

The time switch shall be installed where shown on the plans.

Air Outlets: Volume dampers shall be furnished and installed for all diffusers. Blocking shall be provided on all sides of air outlets between ceiling or wall joists. Collars shall be supplied for all outlets and shall be taped and sealed in place.

Vents and Flues: Vents and flues shall be securely fastened to the building construction, shall be provided with a collar at all ceiling penetrations and shall terminate with a stainless steel weather cap .

Access Door: Access doors shall be provided in rigid ducts and plenums for access to volume dampers, smoke dampers and control devices located within such ductwork; and shall be provided at such other locations as shown on the plans.

Ducts and Vents:

Ductwork within the building shall be installed to clear lighting fixtures, doors, windows and other obstructions. Ductwork shall preserve head room and shall keep openings and passageways clear whether shown on plans or not.

Ductwork shall be installed and braced according to the latest edition of the SMACNA "HVAC Duct Construction Standards—Metal and Flexible."

Slopes in sides at transitions shall be approximately one to five. The ductwork system shall not contain abrupt changes or offsets of any kind unless otherwise shown on the plans.

Where ducts pass through walls, floors or ceilings, galvanized sheet metal or steel angle collars shall be installed around the ducts.

Duct sections shall be connected by beaded sleeve-type couplings using joint sealer as recommended by the duct manufacturer. Duct sections shall be mechanically fastened with pop rivets or sheet metal screws and sealed with mastic or insulated, reinforced silver tape.

Flexible connections shall be provided at both inlet and outlet of fan coil and ventilating units.

Sheet metal plenums shall be adequately braced and supported from the floor or structure with structural steel angles to prevent sagging, flexing and vibration.

All standing seams and transverse joints of supply, return and exhaust ducts and seams around plenums, fan and coil housings shall be sealed with sealant and taped.

Ductwork Identification:

Ductwork shall be identified as follows:

Duct Description	Identification Symbol
Supply duct	S
Bypass duct	B
Return duct	R
Exhaust duct	EXH
Outside air duct	OA

Identification symbol letters shall be stenciled at locations visible from the access routes to be used by maintenance workers. Such letters shall be painted with black colored paint and shall be a minimum of 2 inches high.

FIELD QUALITY CONTROL

Pre-test Requirements:

Before starting or operating systems, equipment shall be cleaned and checked for proper installation, lubrication and servicing, package roof top units shall have manufacturer's start up service.

In each system, at least one air path, from fan to final outlet, shall have all balance dampers open. The final air quantities shall be achieved by adjusting the volume dampers or the fan RPM.

Final adjustments and balancing of the systems shall be performed in such a manner that the systems will operate as specified and as shown on the plans.

The Contractor shall replace or revise any equipment, systems or work found deficient during tests.

All automatic operating devices which are pertinent to the adjustment of the aforementioned air systems shall be set and adjusted to deliver the required quantities of air and at temperatures specified by the Engineer. All control work shall be done in collaboration with the control manufacturer's representative.

Project Completion Tests:

The Engineer shall be notified at least 3 working days in advance of starting project completion tests.

The project completion tests shall consist of the following:

1. Air Systems: All air systems shall be tested and balanced to the conditions set forth on the plans and in these special provisions. This work shall be performed by an Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) certified contractor. The air systems include, but are not necessarily limited to, the following:

    a. Supply air systems
    b. Return air systems
    c. Exhaust air systems

2. Operational Data: The tests shall include operation of the heating, cooling, and ventilating systems for not less than two 8-hour days, each system shall operate at not less than 90 percent of their full specified capacities.

    The required data shall be accurately measured. The data shall be measured during one operational cycle in the presence of the Engineer and shall be submitted for approval.

    The following data shall be measured and tabulated:

    a. Ambient temperatures and conditions, °F
    b. Supply and return air quantities, CFM, each room
    c. Thermostat, zone temperature sensor set point, °F
    d. Air temperatures at room center, °F
    e. Fan motor amperages and voltages
    f. System static pressures, inches of water column

Comply with additional requirements under "Testing, Adjusting, and Balancing" elsewhere in these special provisions.

12-15.09 TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

SUMMARY

This work includes:

1. Testing, adjusting, and balancing (TAB) of HVAC equipment and systems
2. Testing of sound and vibration levels
3. Preparing TAB report

TAB work is to cover all HVAC equipment and systems including:

1. Air moving equipment
2. Air distribution systems
3. Heating and cooling systems
4. Control systems (verification)

RELATED WORK

Commissioning: Comply with "Department Commissioning" in Section 5-1 of these special provisions.

Building Flush-Out: Comply with "Indoor Air Quality Management" in Section 5-1 of these special provisions.

SUBMITTALS

Qualifications: For TAB agency and its personnel who will supervise and perform this work. Include references for 5 assignments completed within the last 2 years for projects of similar type, size, and complexity, with contact person's name and phone number. Include evidence of certification for agency and personnel.

Contract Documents Review: Report by TAB agency of its review of the plans and specifications. Submit within 45 days after Notice to Proceed.

TAB Plan: Submit within 60 days after Notice to Proceed. Include:

1. Complete set of applicable Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or Testing, Adjusting and Balancing Bureau (TABB) publications
2. Narrative identifying proposed materials, methods, procedures, forms, diagrams, and report format
3. Identification of standard procedures required and proposed for each system
4. System diagrams for each air system. Diagrams may be single line.

Instrumentation calibration reports.

TAB Reports: Certified by the TAB agency. Submit draft report for review within 10 days after completion of testing. Submit final report within 5 days after the Department completes its review. All instruments to be used for TAB shall have been calibrated within 1 year from the start of testing, calibration certification shall be submitted for approval prior to testing.

LEED Submittals:

IEQ Prerequisite 1, Minimum Indoor Air Quality Performance: Submit additional three copies of final TAB report documenting work performed in accordance with ASHRAE 62.1-2007.

QUALITY ASSURANCE

TAB Agency: Certified by AABC, NEBB, or TABB.

TAB Agency Employees: Field supervisor and TAB technicians certified by AABC, NEBB, or TABB.

Standards: Comply with either the AABC National Standards for Total System Balance, the NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, or the TABB Certification Policies and Procedures Manual. Also comply with ASHRAE 11, Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

SCHEDULING

Review contract documents within 45 days after Notice to Proceed to identify potential design problems, including lack of necessary balancing devices and lack of access to locations where measurements or adjustments must be made. The purpose of this review is to correct problems before construction starts.

Coordinate with project phasing so that TAB on each phase will be finished before completion of that phase. Schedule TAB for completion 4 weeks before completion of building or area served by air system.

Coordinate with work under "Indoor Air Quality Management" in Section 5-1 of these special provisions to complete TAB in a timely manner to avoid delay of building flush-out.

Coordinate with work under "Department Commissioning" in Section 5-1 of these special provisions to complete TAB in a timely manner to avoid delay of the post-construction phase of commissioning.

PROJECT CONDITIONS

In addition to preliminary procedures required under AABC, NEBB, or TABB standards, ensure that the following conditions are met before beginning TAB work:

1. Water heating and water cooling systems have been flushed, cleaned, filled, and high points vented
2. Hot water heaters are filled
3. Refrigerant systems are fully charged with specified refrigerant
4. Over-voltage and current protection have been provided for motors
5. Equipment has been labeled
6. Curves and descriptive data on each piece of equipment to be adjusted and tested are available
7. Operation and maintenance manuals have been supplied
8. Controls manufacturer and boiler-burner representatives are available for consultation and supervision of adjustments during tests
9. Coil fins are cleaned and combed and air filters of required MERV rating are clean and installed
10. Duct systems are clean of debris and leakage is minimized, access doors are closed; duct end caps are in place, and fire and volume dampers are in place and open
11. Automatic control systems are completed and operating
12. Start-up and initial testing of HVAC equipment except fans has been conducted by the manufacturer
13. Work is complete, clean, and operable and conditions are satisfactory for TAB

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

INSTALLATION

Perform TAB work under procedures outlined in applicable standards and these special provisions.

Include all work described under applicable standards, including:

1. Sound and vibration testing
2. Building/zone pressurization testing
3. Verification of HVAC controls
4. Temperature testing
5. Exhaust Fan testing
6. Smoke damper testing
7. Life safety controls testing (test in presence of State Fire Marshal)
8. Air balancing
9. Final tabulation

Take readings not less often than every hour for 4 hours, during normal work hours, for 3 days. Start up heating units in advance to meet design conditions during testing.

Record information required by applicable standards for each system component, identified by manufacturer, type, model, and location.

Measurements at final tabulation must be within 5 percent of design requirements. Balance system to these tolerances:

1. Fans: Design volume plus 5 percent
2. Outlets: Design volume plus 5 percent
3. Leakage: 3 percent

Where duct joints present leakage, reseal joints.

Prepare report in format recommended by applicable standards. Outline recommendations for correcting unsatisfactory mechanical performance when system cannot be successfully balanced, including, where necessary, modifications which exceed requirements of the contract documents. Submit report to Engineer. Perform corrective modifications approved by Engineer. Retest, adjust, and balance systems and resubmit report.

Patching: Engage original installer of insulation, ductwork, housings, and other improvements to patch holes cut or drilled for test purposes and repair other damage. Repair to like new condition.

Markings: Permanently mark equipment to show final settings at completion of TAB work. Include damper control positions, valve indicators, fan speed control levers, and similar controls and devices.

Seasonal Adjustment: Within warranty period, complete TAB of equipment which was not thoroughly tested under maximum obtainable load conditions before final acceptance.

SECTION 12-16. ELECTRICAL

12-16.01 ELECTRICAL WORK

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of performing electrical work including furnishing all labor, materials, equipment and services required to construct, connect and install the complete electrical system in accordance with the details shown on the plans, Section 86, "Electrical Systems," except 86-8, "Payment," of the Standard Specifications, and these special provisions.

Related Work: Earthwork, foundations, sheet metal, painting, mechanical and such other work incidental to and necessary for the proper installation and operation of the electrical system shall be done in conformance with the provisions elsewhere in these special provisions.

SYSTEM DESCRIPTION

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of conduits and other facilities and location of equipment is to be governed by structural conditions and other obstructions, and shall be coordinated with the work of other trades. Equipment requiring maintenance and inspection shall be located where it is readily accessible for the performance of such maintenance and inspection.

QUALITY ASSURANCE

Regulatory Requirements: All electrical work performed and materials installed shall be in conformance with the provisions in Section 74-1.02, "Regulations and Code," of the Standard Specifications, and the requirements in the CA Code of Regs, Title 24, Part 6, "California Energy Code."

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

SEISMIC ANCHORING

All electrical equipment including panelboards, starters, switchboards, integrated facilities switchboard, lighting fixtures, control panels, cable ladders, communication equipment racks, UPS, standby generator and raceways shall be mounted and braced to withstand, without damage, seismic acceleration forces in the horizontal and vertical directions. The forces in the vertical direction shall be at least 66% of those in the horizontal direction. The entire seismic anchoring installation shall meet all applicable seismic requirements of the latest version of the California Building Code (CBC). The equipment anchoring methods and details shall be submitted for review and approval by the Engineer. The equipment anchorage details shall be coordinated with the equipment mounting provisions, prepare and stamped by a licensed civil engineer in the State of California. The attachment methods shall not damage any structural member. The installation shall meet requirements of the Essential Building Seismic Safety Act, Senate Bill 230, Title 24.

TESTING

After the installation work for the various systems has been completed, each electrical system shall be tested in the presence of the Engineer to demonstrate that the electrical systems function properly. The Contractor shall make necessary repairs, replacements, adjustments and retests at his expense.

Final inspection for the completed electrical system will take place after all the various systems have been tested.

The Engineer shall be notified 15 days in advance of testing and State personnel training on the jobsite. When a Manufacturer's Representative is required on the jobsite as specified in these special provisions, the Engineer shall be notified 15 days in advance.

12-16.02 SYSTEM STUDIES AND FIELD TESTING

PART 1 – GENERAL

Scope: The following systems studies and field testing work shall be performed by independent firms hired and paid by the Contractor. The Contractor shall cooperate with these independent firms as required to accomplish the work. The work will include furnishing labor and material to perform the following tasks:

Engineering services for the electrical systems studies including short-circuit analysis and protective device coordination;

Electrical Arc Flash Hazard Calculations and Analysis, Personnel Protective Equipment (PPE) and Clothing, and Arc Flash Hazard Training;

Independent field protective device setting and testing services for all electrical equipment and systems; and

Commissioning assistance shall be provided by the independent firm for final coordinated systems.

Data Collection: The Contractor shall furnish all data as required by the firm performing the power system studies. The Electrical Engineer performing the short-circuit and arc flash hazard analysis studies shall furnish

the Contractor with a listing of required data immediately after the award of the contract. The contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the service and distribution equipments working drawings and prior to the release of the equipment for manufacturing. Source combination may include present and future motors and generators. Load data utilized may include proposed loads obtained from the contract plans. Include fault contribution of motors less than 100 hp grouped together. The Contractor shall obtain required equipment data if necessary to satisfy the study requirements.

SHORT-CIRCUIT AND PROTECTIVE DEVICE COORDINATION STUDIES

Short-circuit and protective device coordination shall include the following:

Complete single-line diagram of system studied with all buses identified to report data;

Utility company maximum expected three-phase fault with X/R ratio and utility company maximum expected single-line to ground fault currents with X/R ratio at the rated voltage at incoming supply location indicated shall be used in short circuit studies.

Short-circuit study including three phase and line to ground short-circuit currents at major buses extended down to system buses. Relay settings and protection device coordination studies shall include:

1. Coordinated composite time-current characteristic curves including recommended ratings and settings of all protective devices in tabulated form; and associated calculations to demonstrate that the power system protection will be selectively coordinated by the use of devices or equipment submitted.
2. Situations where system coordination is not achievable due to device limitations along with inadequate interrupting ratings will be noted.
3. The studies will consider operation during normal conditions, alternate operations, and during emergency power conditions, and will include ground fault protective device settings.
4. A registered Electrical Engineer in the State of California shall perform these studies.
5. Settings of main breaker relays on the incoming supply feeders from Pacific Gas and Electric Company (PG&E) shall be coordinated and approved by the State.

Data consisting of manufacturer's time-current characteristic curves for individual protective devices, recommended settings of adjustable protective devices, and recommended ratings of non-adjustable protective devices.

The power systems study will be required within 30 days after the electrical equipment submittals by the Contractor have been received for review by the Engineer. The electrical submittals will be reviewed but will not be approved until the power systems studies have been received and reviewed.

ELECTRICAL ARC FLASH HAZARD ANALYSIS, WORKING LABELS AND TRAINING

Work shall be complete in the form of technical reports, PPE recommendations, relay coordination properly adjusted based upon the arc flash hazard analysis and training.

As a minimum the work shall include the following:

1. Electrical Arc Flash Hazard Calculation and Analysis. This includes reviewing tripping time of the protective devices and associated arc energy during arc fault. Any recommendations for equipment modifications or replacement of tripping devices inside the electrical service and distribution system and electrical equipments shall be made prior to making shop submittals for inclusion into the shop submittals at no cost to the State of California. During system study, every effort such as equipment selection and proper selection of AC magnetic trip adjustment of all circuit breakers shall be considered and put into practice so that Category of Hazard at any location under consideration is either "0 or 1." Category of hazard greater than these values will be rejected. If the firm performing studies end up performing multiple studies to comply with these requirements, no additional compensation will be made and cost of performing all studies will be considered as part of the lump sum payment for the building work.
2. Electrical equipment warning labels based upon the arc hazard energy. Labels shall comply with the requirements of CEC and NFPA 70

3. Arc Flash Hazard Training by a qualified professional in the field of electric arc hazard with a minimum of 3 years experience in providing training classes and providing appropriate class room material. Training will be for a minimum of 4 hours on site for a maximum of 25 designated State employees.
4. Instructor will make one site trip to the SFOBB Maintenance Complex and will show how to make use of PPE recommended by the arc flash hazard study.

Software program such as SKM, EDSA, or EasyPower shall be used in conducting arc flash hazard study. Study shall be complete including proper list of actual data of the installed equipment and any assumption made in case where actual equipment data was not available. Before finalizing the study analysis provide a draft copy to the Engineer for reviews and approval.

SUBMITTALS

Submittals for review and approval: The system studies shall be submitted to the design engineer prior to receiving final approval of the service and distribution equipment working drawings and prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittals of sufficient study data to ensure that the selection of device and characteristic will be satisfactory.

Submittals for construction: The results of the system studies shall be summarized in a final report. One CD with PDF files and two bound copies of the complete final comprehensive report shall be submitted.

Final comprehensive report that includes:

Report summary with analysis methology, findings and recommendations

Summary of input data for Utility source, equipment and cables

Available fault at each equipment location with comparison to equipment rating

Overcurrent device settings (e.g. pick-up, time delay, curve)

Incident energy level (calories/cm^2) for each equipment location and PPE

Overcurrent device coordination curves including related section of the single line diagram

Working Labels in accordance with ANSI Z535.4 which will include as a minimum the following:

Arc hazard boundary, working distance, arc flash incident energy at the working distance, PPE category and description of glove rating, voltage rating of the equipment, limited approach distance, prohibitive approach distance, equipment/bus name, date prepared, Arc Flash hazard study prepare name and address.

ENGINEER'S QUALIFICATIONS

The power systems studies shall be performed by a registered Professional Electrical Engineer in the State of California with at least 5 years of current experience in the design of coordinated power system protection and arc flash hazard calculations and analysis. Experience data shall include at least five references for work of a magnitude comparable to this contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

FIELD SETTINGS

Adjust protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturing

under Acceptance and Testing contract portion. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination and arc flash hazard performance goals. Notify the Engineer in writing of any required major equipment modifications.

FIELD TESTING

Field testing will be performed by an independent firm which is a recognized electrical testing firm. The field testing firm will furnish all test instruments, materials and labor necessary to perform the following tests. All tests will be performed in the presence of the Engineer. All instruments will have been calibrated within a period of 2 years preceding testing. Calibrations will be traceable to applicable industry recognized standards. Testing will conform to the following:

1. All protective devices with field adjustable settings will be set and tested in the field after installation. This work will be performed as part of the testing requirements specified in the individual specification sections, and will be conducted by the approved independent testing agency.
2. All testing requirements specified in the individual specification sections will be performed in accordance with an approved Test Plan. The Test Plan will consist of complete field test procedures including inspections and tests to be performed, test equipment required, and tolerance limits, including complete testing and verification of protective device settings, ground fault and motor protection equipment.
3. Performance test reports: Test Reports will be in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report will indicate the final positions of controls and a summary of the test results.
4. Suitability of test equipment, test instrument calibration, and test reports will comply, as a minimum, with NETA ATS, Section 5.
5. Certificates: Certificates will be provided by the independent firm certifying that all devices and equipment meet the requirements of the contract documents.

WARRANTY

Following completion of studies, acceptance testing and the startup by the field engineering service of the equipment manufacturer, a 2 year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

TESTING AGENCY QUALIFICATIONS

Testing agency will be a member company of the International Electrical Testing Association (NETA) and acceptable to authorities having jurisdiction.

Testing agency's field supervisor will be a person currently certified by the International Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in these special provisions.

SYSTEMS COMMISSIONING ASSISTANCE

Upon completion of all equipment field testing and protective device setting, the independent testing agency will supply qualified manpower to assist in the complete mechanical and electrical system commissioning conducted by the Contractor. The independent testing agency will also assist the Contractor with commissioning problems which may occur.

QUALITY ASSURANCE

The short circuit and coordination studies will be performed in accordance with applicable ANSI and IEEE Standards. Field testing will be performed per NETA ATS specifications, manufacturer's recommendations, and these special provisions.

The Electrical Arc Flash Hazard will be performed in accordance with CEC and NFPA 70E, 29 CFR 1910 Subpart S, "Electrical," IEEE 1584 and IEEE 1584a.

The independent testing agency will examine utilization equipment nameplates and installation instructions; install fuses of sizes and with characteristics appropriate for each piece of equipment, and evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings. Proceed with field testing only after unsatisfactory conditions have been corrected. The independent testing agency will perform field testing as specified in these special provisions.

PART 4 – PAYMENT

Full compensation for system studies and field testing shall be considered as included in the contract lump sum prices paid for building work and no additional compensation will be allowed therefor.

12-16.03 BASIC MATERIALS AND METHODS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing the basic materials of the electrical work, including conduits, conductors, fittings, and wiring devices, in accordance with the details shown on the plans and these special provisions. The basic materials shall include those accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the electrical system.

Related Work:

Roof penetrations shall be flashed and sealed watertight in conformance with the provisions in "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Where conduits pass through fire rated walls, floor or ceiling assemblies, the penetrations shall be protected in conformance with the provisions in "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

SUBMITTALS

Product Data:

A list of all materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include catalog cuts with exact part number and data (voltage, phase, and rated amperes or watts or horsepower), complete description, performance data and installation instructions for the materials and equipment specified herein.

Before shipping pull boxes to the jobsite, submit a list of materials, Contract number, pull box manufacturer, manufacturer's instructions for pull box installation, and your contact information to the Transportation Laboratory.

Submit reports for pull box from an NRTL-accredited lab to the Engineer.

Pull Box Quality Control and Assurance

Pull boxes may be tested by the Department. Deliver pull boxes and covers to the Transportation Laboratory and allow 30 days for testing. When testing is complete, you will be notified. You must pick up the boxes and covers from the test site and deliver it to the job site.

Any failure of the pull box or the cover that renders the unit noncompliant with these specifications will be a cause for rejection. If the unit is rejected, you must allow 30 days for retesting. Retesting period starts when the

replacement pull box is delivered to the test site. You must pay for all retesting costs. Delays resulting from submittal of noncompliant materials does not relieve you from executing the contract within the allotted time.

If the pull box submitted for testing does not comply with the specifications, remove the unit from the test site within 5 business days after notification that it is rejected. If the unit is not removed within that period, it may be shipped to you at your expense.

You must pay for all shipping, handling, and transportation costs related to the testing and retesting.

Functional Testing

The pull box and cover must be tested under ANSI/SCTE 77, "Specifications for Underground Enclosure Integrity."

Warranty

Provide a 2-year manufacturer replacement warranty for pull box and cover from the date of installation of the pull box and cover. All warranty documentation must be submitted to the Engineer before installation.

Replacement parts must be provided within 5 business days after receipt of failed pull box, cover, or both at no cost to the Department and must be delivered to the Department's Maintenance Electrical Shop at 30 Rickard Street, San Francisco, CA 94134.

PART 2 - PRODUCTS

CONDUITS AND FITTINGS

Rigid Steel Conduit and Fittings: Rigid steel conduit and fittings shall be Type 1 in conformance with the provisions in Section 86-2.05A, "Material," of the Standard Specifications.

Type 1 conduit shall have steel or malleable iron fittings.

Split or three-piece couplings shall be electroplated, malleable cast iron couplings.

Insulated grounding bushings shall be threaded malleable cast iron body with plastic insulated throat and steel, lay-in ground lug with compression screw.

Insulated metallic bushings shall be threaded malleable cast iron body with plastic insulated throat.

PVC Coated Rigid Steel Conduit and Fittings: PVC coated rigid steel conduit and fittings shall be Type 2 in conformance with the provisions in Section 86-2.05A, "Material," of the Standard Specifications.

Electrical Metallic Tubing (EMT) and Fittings:

EMT shall be formed of cold rolled strip steel, zinc coated, and interior lined in conformance with the requirements in UL Standard 797 and ANSI C 80.3.

Couplings shall be electroplated, rain and concrete tight, gland compression type, steel body couplings with malleable iron nuts.

Connectors shall be electroplated, rain and concrete tight, gland compression type, steel body connectors with male hub, malleable iron nut and insulated thermoplastic throat.

Flexible Metallic Conduit and Fittings:

Flexible metallic conduit shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design.

Fittings shall be electroplated screw-in type with malleable cast iron body and threaded male hub with insulated throat.

Rigid Non-Metallic Conduit and Fittings: Rigid non-metallic conduit and fittings shall be Type 3 in conformance with the provisions in Section 86-2.05A, "Material," of the Standard Specifications. Type 3 conduit shall be Schedule 80.

Couplings shall be PVC, socket type or thread on one end and socket type on the other end as required for the particular application.

Terminal adapters for adapting PVC conduit to boxes, threaded fittings, or metallic conduit system shall be PVC adapters with threads on one end and socket type on the other end.

Liquidtight Flexible Metallic Conduit and Fittings: Liquidtight flexible metallic conduit and fittings shall be Type 4 in conformance with the provisions in Section 86-2.05A, "Material," of the Standard Specifications.

Fittings shall be electroplated, malleable cast iron body, with cap nut, grounding ferrule, and connector body with insulated throat.

CONDUCTORS

Conductors:

Conductors shall be stranded copper wire of the size shown on the plans. Conductors shall conform to the requirements in ASTM B3 and ASTM B8. Conductor size shall be based on AWG, except that conductor diameter shall be not less than 98 percent of the specified AWG diameter.

Conductor insulation types shall be as follows:

1. Conductors in control panel enclosures shall be Type MTW.
2. Conductors in wet, underground, or outdoor locations shall be Type XHHW-2.
3. All conductors other than Type MTW and XHHW-2 shall be Type THHN.

Wire Connections and Devices: Wire connections and devices shall be pressure or compression type, except that connectors for No. 10 AWG and smaller conductors in dry locations may be preinsulated spring-pressure type.

ELECTRICAL BOXES

Outlet, Device and Junction Boxes:

Boxes shall be galvanized steel boxes with knock-outs and shall be the size and configuration best suited to the application indicated on the plans. Minimum size of outlet, device, or junction boxes shall be 4 inches square by 1-1/2 inches deep. Flush-mounted single device and surface mounted light fixture boxes shall have four inch square single raised device covers.

Flush-mounted boxes shall have stainless steel covers, 0.04 inches thick. Surface-mounted boxes shall have galvanized steel covers with metal screws. Cover screws shall be metal with finish to match cover finish.

Sectional device plates will not be permitted.

Cast boxes and weatherproof boxes shall be cast iron boxes with threaded hubs in conformance with the requirements in NEMA FB-1, and shall be of the size and configuration best suited to the application shown on the plans. Minimum size of outlet, device, or junction boxes shall be 4 inches square by 1-7/8 inches deep.

Cast boxes and weatherproof boxes shall have cast iron covers with gaskets.

Weatherproof device boxes shall have gasketed covers with gasketed hinged flaps to cover switches and receptacles.

Pull Boxes and Underground Vaults:

Pull boxes shall be in conformance with the provisions in Section 86-2.06, "Pull Boxes," of the Standard Specifications.

The pull box and cover must comply with ANSI/SCTE 77, "Specifications for Underground Enclosure Integrity," for Tier 22 load rating and must be gray or brown in color.

Each pull box cover must have an electronic marker cast inside.

Extension for the pull box must be of the same material as the pull box and attached to the pull box to maintain the minimum combined depths as shown.

Include recesses for a hanger if a transformer or other device must be placed in a pull box.

The bolts, nuts, and washers must be a captive bolt design.

The captive bolt design must be capable of withstanding a torque range of 55 to 60 ft-lb and a minimum pull out strength of 750 lb. Perform the test with the cover in place and the bolts torqued. The pull box and cover must not be damaged while performing the test to the minimum pull out strength.

Stainless steel hardware must have an 18 percent chromium content and an 8 percent nickel content.

Galvanize ferrous metal parts under Section 75-1.05, "Galvanizing."

Manufacturer's instructions must provide guidance on:

1. Quantity and size of entries that can be made without degrading the strength of the pull box below Tier 22 load rating
2. Where side entries cannot be made
3. Acceptable method to be used to create the entry

Tier 22 load rating must be labeled or stenciled by the manufacturer on the inside and outside of the pull box and on the underside of the cover.

Traffic rated pull boxes shall be in conformance with the provisions in Section 86-2.07, "Traffic Pull Boxes," of the Standard Specifications.

Electrical pull box covers and traffic rated pull box covers shall be marked "ELECTRICAL." Telephone pull box covers shall be marked "COMMUNICATION."

Main communication vaults shall be made of reinforced concrete with service lid, pump sump, and of the size and details as shown on the plans.

Electrical and communication vaults shall be made of reinforced concrete with size and type as shown on the plans.

RECEPTACLES AND SWITCHES

Ground Fault Circuit Interrupter Receptacle, (GFCI): GFCI receptacle shall be NEMA Type 5-20R, feed-through type, ivory color, 3-wire, 20-ampere, 125-volt, specification grade, duplex receptacle suitable for wiring with stranded conductors. Receptacle shall detect and trip at current leakage of 5 mA and shall have front mounted test and reset buttons.

Duplex Receptacle: Duplex receptacle shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt, ivory color, specification grade duplex receptacle suitable for wiring with stranded conductors.

Fourplex Receptacle: Fourplex receptacle shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt, ivory color, specification grade fourplex receptacle suitable for wiring with stranded conductors.

Single Receptacles: Single receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, safety grounding, ivory color, specification grade single receptacle suitable for wiring with stranded conductors.

Management Information System (MIS) Receptacle: MIS receptacle shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt, isolated ground, orange color, specification grade duplex receptacle suitable for wiring with stranded conductors.

Reel Light Receptacle: Reel light receptacle shall be NEMA Type L5-20R, 3-wire, 20-ampere, 125-volt, twist-lock, single, specification grade receptacle suitable for wiring with stranded conductors.

Reel Receptacle: Reel receptacle shall be NEMA Type L5-20R, 3-wire, 20-ampere, 125-volt, twist-lock, single, specification grade receptacle suitable for wiring with stranded conductors.

Multioutlet Assemblies: Multi-outlet assemblies shall be a two-piece steel surface raceway and shall include receptacles and spaced 12 inches on center. Raceway shall be a two piece design ivory color, with a metal base and snap-on on metal covers. Base shall be a minimum of 0.050 inch wall thickness and cover shall be a minimum of 0.040 inch wall thickness. Assembled base shall be 2.75 inches wide by 1.50 inches high with a cross section area of 4.9 square inches. The assembly shall be provided with the necessary entrance end fitting, wire clip, cover clip, support clip, device bracket and blank end fitting. Dimensions and type of receptacles in the multi-outlet assemblies shall be as shown on the plans.

Welding receptacle shall be surface-mounted, 480 V, switch rated receptacle and disconnect switch with female interior assembly. Welding receptacle shall be a combination switch rated receptacle and disconnect switch in one device all encased in a reinforced thermoplastic polyester casing. The welding receptacle shall be listed for branch circuit and motor circuit disconnect switching. The welding receptacle shall have enclosed arc chamber, spring loaded butt contacts made of silver-nickel contact materials, dead front construction and self-ejecting connector release. The switch rated receptacle shall be complete with padlockable mushroom pawl, metal back box, nylon angle adapter, and spring-loaded cap. A mating plug for each receptacle installed shall be provided. Types, ampere rating, color of casing, gasket and number of wires shall be as shown on the plans.

Special Purpose 208 V Receptacle: Special purpose 208V receptacle shall be a combination switch rated receptacle and disconnect switch in one device similar to the welding receptacle except the special purpose receptacle shall be rated 208-volt. A mating plug for each receptacle installed shall be provided. Types, ampere rating, color of casing, gasket and number of wires shall be as shown on the plans.

Special Purpose 480 V Receptacle: Special purpose 480 V receptacle shall be a combination switch rated receptacle and disconnect switch in one device similar to the welding receptacle. A mating plug for each receptacle installed shall be provided. Types, ampere rating, color of casing, gasket and number of wires shall be as shown on the plans.

Vehicle Lift Receptacle: Vehicle lift receptacle shall be a combination switch rated receptacle and disconnect switch in one device similar to the welding receptacle except the vehicle lift receptacle shall be rated 240-volt. A mating plug for each receptacle installed shall be provided. Ampere rating, color of casing, gasket and number of wires shall be as shown on the plans.

Special Purpose 240 V Receptacle: Special purpose 240 V receptacle shall be a combination switch rated receptacle and disconnect switch in one device similar to the welding receptacle except the special purpose receptacle shall be rated 240-volt. A mating plug for each receptacle installed shall be provided. Types, ampere rating, color of casing, gasket and number of wires shall be as shown on the plans.

Single Phase Special Purpose Receptacle: Single phase special purpose receptacle shall be grounding type, single, receptacle. A mating plug for each receptacle installed shall be provided. Types (twist lock or parallel

blade), voltage rating, ampere rating, number of poles, number of wires, NEMA configuration, voltage connection, color and type shall be as shown on the following table:

Single Pole Switch: Single pole switch shall be 20-ampere, 120/277-volt, quiet type, specification grade, ivory color switch with silver alloy contacts. Switch shall be suitable for wiring with stranded conductors.

Timer Switch: Timer switch for radiant heater shall be a spring wound mechanical timer with a rotary dial. Contacts shall be rated 20 amperes at 120 volts. Time adjustments shall range from zero to two hours.

MISCELLANEOUS MATERIALS

Warning Tape: Warning tape shall be 4 inches wide and contain the printed warning "CAUTION ELECTRICAL CONDUIT" in bold 3/4-inch black letters at 30-inch intervals on bright orange or yellow background. The printed warning shall be non-erasable when submerged under water and resistant to insects, acids, alkali, and other corrosive elements in the soil. The tape shall have a tensile strength of not less than 155 pounds per 4-inch wide strip and shall have a minimum elongation of 700 percent before breaking.

Pull Rope: Pull rope shall be nylon or polypropylene with a minimum tensile strength of 1800 pounds.

Watertight Conduit Plug: Watertight conduit plug shall be a hollow or solid stem expansion plug complete with inner and outer white polypropylene compression plates and red thermoplastic rubber seal. Seal material shall be non-stick type rubber resistant to oils, salt, and alkaline substances.

Anchorage Devices: Anchorage devices shall be corrosion resistant, toggle bolts, wood screws, bolts, machine screws, studs, expansion shields, or expansion anchors as required by the supporting device.

Electrical Supporting Devices:

Electrical supporting devices shall be one hole conduit clamps with clamp backs, hot-dipped galvanized, malleable iron.

Construction channel shall be 1-5/8 inches x 1-5/8 inches, 12-gage galvanized steel channel with 17/32-inch diameter bolt holes, 1-1/2 inches on center in the base of the channel.

Ground Rod: Ground rod shall be a 3/4-inch (minimum) galvanized or copper clad steel rod, 10 feet long, and shall conform to the requirements in NEMA GR-1.

PART 3 - EXECUTION

INSTALLATION

Conduit:

Conduits shall be installed as specified in Section 86-2.05C, "Installation," of the Standard Specifications and the following:

1. All conduits shall be rigid steel except as follows:

    1.1 EMT may be used in walls and furred spaces and for exposed work indoors above the switch height.
    1.2 Flexible metallic conduit shall be used to connect suspended lighting fixtures, motors, HVAC equipment, and other equipment subject to vibration in dry locations.
    1.3 Liquidtight flexible metallic conduit shall be used to connect motors, HVAC equipment, and other equipment subject to vibration in wet or exterior locations.
    1.4 PVC coated rigid steel conduit shall be used on all underground and underslab conduits for fuel islands and for all base elbows and all vertical risers through concrete slabs inside and outside the building.
    1.5 Rigid non-metallic conduit shall be used in underground, exterior locations.

1.6 Rigid non-metallic conduit shall be used in underground and underslab locations inside the building only at locations where the PVC symbol are shown on the plans. All base elbows and vertical risers shall be PVC coated steel conduit.

2. Rigid non-metallic conduit bends of 30 degrees or greater shall be factory-made long radius sweeps. Bends less than 30 degrees shall be made using an approved heat box.
3. Locations of conduit runs shall be planned in advance of the installation and coordinated with the ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
4. Where practical, conduits shall be installed in groups of parallel, vertical or horizontal runs and at elevations that avoid unnecessary offsets.
5. Exposed conduit shall be installed parallel and at right angles to the building lines.
6. Conduits shall not be placed closer than 12 inches from a parallel hot water or steam pipe or 3 inches from such lines crossing perpendicular to the runs.
7. All raceway systems shall be secured to the building structures using specified fasteners, clamps and hangers.
8. All metal conduits, fittings, and elbows in contact with soil or concrete shall be wrapped with a double layer of 20-mil thick pipe wrapping tape.
9. Single conduit runs shall be supported by one hole conduit clamps. Single conduit runs on walls in damp or wet locations shall be installed with clamp backs to space conduit off the surface.
10. Multiple conduit runs shall be supported with construction channel secured to the building structure. Conduits shall be fastened to construction channel with channel compatible pipe clamps.
11. Raceways of different types shall be joined using approved couplings or transition fittings.
12. Expansion couplings shall be installed where conduit crosses a building separation or expansion joint.
13. All floor and wall penetrations shall be sealed watertight.
14. Rigid steel conduit runs on bridge column or structure shall be supported using steel wedge expansion anchors.
15. All raceway systems run on the I-beams and vertical columns shall be secured using fasteners, clamps and hangers without drilling holes on the structure.

Conduit Terminations:

Rigid steel conduits shall be securely fastened to cabinets, boxes and gutters using 2 locknuts and insulating metallic bushing. EMT shall be securely fastened to cabinets, boxes and gutters using connectors. Conduit terminations at exposed weatherproof and cast boxes shall be made watertight using hubs.

Grounding bushings with bonding jumpers shall be installed on all conduits terminating at concentric knockouts and on all conduits containing service conductors, grounding electrode conductor, and conductors feeding separate buildings.

Rigid non-metallic conduit shall be terminated inside the underground pull boxes with an approved conduit bushing or fitting. All conduits shall enter vertically through the bottom of pull boxes.

All future conduits terminated in underground pull boxes or left exposed indoors and outdoors shall be provided with watertight conduit plugs.

Warning Tape: Warning tape shall be placed over each conduit in a trench. Each warning tape shall be centered over the conduit and shall be placed over the 6 inch layer of sand covering the conduit as specified elsewhere in these special provisions.

Conductor Installation:

Conductors shall not be installed in conduits until all work of any nature that may cause injury is completed. Care shall be taken in pulling conductors so that insulation is not damaged. An approved non-petroleum base and insulating type pulling compound shall be used as needed.

Splices and joints shall be insulated with insulation equivalent to that of the conductor.

Six inches of slack shall be provided at each outlet and device connection. If the outlet or device is not at the end of a run of conductor, connection shall be made with correctly colored pigtails tapped to the runs with splices as specified herein.

All pressure type connectors and lugs shall be retightened after the initial set.

Splices in underground pull boxes and similar locations shall conform to the provisions in Section 86-2.09C, "Connectors and Terminals," and Section 86-2.09E, "Splice Insulation," of the Standard Specifications.

Junction boxes in furred or accessible ceiling spaces shall be identified on the cover plate with permanent marking pen denoting the circuits contained in the box.

Conductor Identification:

The neutral and equipment grounding conductors shall be identified as follows:

1. Neutral (grounded) conductor No. 6 and smaller shall be identified as follows:

    1.1 White insulation for 120/208 V system.
    1.2 Orange insulation with 3 continuous white stripes along its entire length for 120/240 V system.
    1.3 Gray insulation for 277/480 V system.

2. Neutral (grounded) conductor No. 4 and larger for 120/208 V system may be identified by distinctive white markers such as paint or white tape at all accessible locations over the entire exposed conductor length at each termination.
3. Neutral (grounded) conductor No. 4 and larger for 120/240 V system may be identified by distinctive orange markers with continuous white stripes such as paint or orange tape with continuous white stripe at all accessible locations over the entire exposed conductor length at each termination.
4. Neutral (grounded) conductor No. 4 and larger for 277/480 V system may be identified by distinctive gray markers such as paint or gray tape at all accessible locations over the entire exposed conductor length at each termination.
5. Equipment grounding conductor may be bare or insulated. Insulated equipment grounding conductors shall be green over its entire length. Isolated equipment grounding conductors for MIS receptacles shall be green with one or more yellow stripes over its entire length. Conductors No. 4 and larger may be permanently identified by distinctive green markers such as paint or green tape at all accessible locations over the entire exposed conductor.

Ungrounded feeder and branch circuit conductors shall be color coded by continuously colored insulation, except conductors No. 6 AWG or larger may be color coded by colored tape at each connection and where accessible. Ungrounded conductor color coding shall be as follows:

SYSTEM	COLOR CODE
120/240 volt-Three phase	Black with orange stripe, orange, blue with orange stripe
120/208 volt-Three phase	Black, red, blue
277/480 volt-Three phase	Brown, purple, yellow

Once grounded and ungrounded insulated conductors are identified with a specific color code, that color code shall be used for the entire length of the circuit. Conductors with gray insulation shall not be used as ungrounded circuit conductors and/or for wiring control panels and stations.

Where more than one branch circuit enters or leaves a conduit, integrated facilities switchboard, main switchboard, panelboard, control panel, control station, gutter, or junction box, each conductor shall be identified by its panelboard and circuit number. All control conductors including control conductors of manufacturer supplied and field wired control devices shall be identified at each termination with the

conductor numbers shown on the plans, working drawings, and as directed by the Engineer where deemed necessary. Identification shall be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Pre-printed, white, heat-shrinkable tubing.

The identifying numbers of the terminating conductors, as shown on the plans or the working drawings, shall be identified on the terminal block marking strip.

Outlet, Device and Junction Box Installation:

Where exposed rigid steel conduits are connected to an exposed outlet, device, or junction box at or below switch height, the box shall be a cast box.

All boxes shall be finished flush with building walls, ceiling and floors except where exposed work is called for.

Raised device covers shall be installed on all boxes concealed in concrete, masonry or stud walls.

No unused openings shall be left in any box. Knockout seals shall be installed to close openings.

Adjustments to locations of outlet, device and junction boxes may be made as required by structural conditions and to suit coordination requirements of other trades.

Boxes in stud walls and partitions shall not be mounted back to back. Through-wall boxes will not be allowed.

Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on heavy gage galvanized steel, snap-in box supports.

Fixture outlet boxes installed in suspended ceilings of gypsum board or lath and plaster construction shall be mounted on 16-gage metal channel bars attached to main ceiling runners.

Fixture outlet boxes for pendant-mounted fixtures installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structures above.

Multiple switches shall be installed in standard boxes.

Outlet boxes installed on I-beams and vertical columns shall be secured using fasteners, clamps and hangers without drilling holes on the structure.

Pull Box Installation:

Pull box installation shall be in conformance with the provisions in Section 86-2.06C, "Installation and Use," of the Standard Specifications and the following:

Do not place grout in the bottom of the pull box.

Do not install pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place a pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

Top of pull boxes shall be flush with surrounding grade or top of curb. In unpaved areas where pull box is not immediately adjacent to and protected by a concrete foundation, pole or other protective construction, the top of pull box shall be set at plus one inch above surrounding grade. Pull boxes shown on the plans in the vicinity of curbs shall be placed adjacent to the back of curb. Pull boxes shown on the plans adjacent to lighting standards shall be placed on the side of foundation facing away from traffic.

Ground Rod Installation: The ground rod shall be driven vertically until the top is 6 inches above the surrounding surface. When vertical penetration of the ground rod cannot be obtained, an equivalent horizontal grounding system, approved by the Engineer, shall be installed.

Anchorages:

Hangers, brackets, conduit straps, supports, and electrical equipment shall be rigidly and securely fastened to surfaces by means of toggle bolts on hollow masonry; expansion shields and machine screws, or expansion anchors and studs or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood or lag screws on wood construction.

Anchorage devices shall be installed in conformance with the anchorage manufacturer's recommendations.

Mounting heights: Electrical system components shall be mounted at the following mounting heights, unless otherwise shown on the plans. The mounting height dimensions shall be measured above the finished floor to the bottom of the device or component.

Thermostats	3'-8"
Wall switches	3'-4"
Convenience outlets	1'-6", all areas except 3'-8", at Repair Service Bays/Machine Shop/Welding Bay/Storage Equipment Bays and Building Exterior Areas
Electric water cooler outlet	As recommended by the water cooler manufacturer.
Communication outlets	1'-6", all areas except 3'-8", at Repair Service Bays/Machine Shop/Welding Bay/Storage Equipment Bays
Welding Receptacles, Vehicle lift Receptacles and Special Purpose Receptacles,	3'-8"

WASTE MANAGEMENT

Contractor shall comply with provisions of "Construction Waste Management" as specified in Section 5-1 of these special provisions. Recycle scrap metal, plastic, and packaging materials. Dispose of other products without contaminating soil, water, or other materials.

12-16.04 SERVICE AND DISTRIBUTION

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing service and distribution equipment in accordance with the requirements of the serving utilities, the details shown on the plans and these special provisions.

Related Work:

Permits, licenses, charges, fees and costs for arranging utility connections and extensions shall conform to the provisions in "Utility Connection," in Section 12-1, "General Requirements," of these special provisions.

Concrete and reinforcement for service and distribution equipment shall conform to the provisions in Section 12-3, "Concrete and Reinforcement," of these special provisions.

Attention is directed to the requirements specified under Section 12-16, "System Studies and Field Testing," of these special provisions.

Attention is directed to the requirements specified under Section 12-16, "Integrated Facilites Switchboard," of these special provisions.

Attention is directed to the requirements specified under Section 12-16, "Lighting," of these special provisions for the power monitoring gateway, power monitoring network switch and serial control cables that are associated with the power monitoring devices installed in the service equipment.

SUBMITTALS

Installation Details:

After the short circuit, coordination, protection and arc flash hazard study has been approved, the Contractor shall first submit complete service installation working drawings to the Engineer for approval. When these drawings have been reviewed and stamped "Approved" by the Engineer, the Contractor shall then submit the "Approved" copy of the service installation working drawings to the serving utility for review. The Contractor shall resubmit service installation working drawings as needed until approved. No additional payment will be made for resubmittals. Submittals shall be approved by the serving utility prior to commencing work with the service installation.

Product Data:

A list of all materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials, front view, and plan view of the assembly, assembly ratings and equipment specified herein. Assembly ratings shall include withstand and closing rating, voltage, continuous current and short circuit rating.

Working Drawings: Working drawings shall show the shape, size, and method of attachment for each component used in the work. Control and wiring diagrams shall include rough-in dimensions, component layout and conductor number identification.

Test Reports: Test results for service and distribution equipment shall be delivered to the Engineer within 3 business days of completion.

PART 2 - PRODUCTS

Service Equipment:

Service equipment shall be an integrated facilites switchboard, IFS-MSB, as shown on the plans. Enclosure shall be NEMA 3R enclosure consisting of an underground pull section, metering and current transformer section, power monitoring section, service disconnect switch section, PV disconnect switch section, standby generator wiring section, automatic transfer switch (ATS) section, transformer section, surge protection devices section, distribution section and Panelboard M section as shown on the plans. Exterior shall be 12-gage sheet steel. The interior shall be 14-gage sheet steel. All screws, latches, hasps, hinge pins and similar hardware shall be stainless steel. Exterior door shall be deadfront and lockable with a padlock. Circuit breaker shall be operable with the exterior door open and the interior door closed. Enclosure finish shall be baked enamel or baked thermosetting polyester finish. Switchboard shall include a factory installed heater package complete with heater, thermostat and fused disconnect. All major components within the switchboard shall be manufactured by the maker of the enclosure. All major components in the switchboard shall be supplied, installed cabled or bussed at the factory.

Service disconnect switch shall be 3-pole, 600-volt, 2000-ampere trip, UL1066 listed, insulated case power circuit breaker with shunt trip and ground fault protection. The interrupting capacity of the circuit breaker shall be not less than 65,000 amperes (symmetrical) at 480 volts. The ground fault protection system shall be of the residual sensing method type. The main circuit breaker shall be provided with a microprocessor based electronic trip unit. The trip unit shall have integrally mounted phase current sensors and one identically rated current sensor mounted on the neutral bus. Under normal operating conditions, the vectorial sum of all phase currents will total zero. Underground fault conditions, the residual sum of the sensors will not be zero, initiating an internally powered shunt trip of the circuit breaker.

Distribution circuit breakers and PV disconnect switch shall be a molded case circuit breaker complete with an adjustable AC magnetic trip unit. The ampere trip ratings, number of poles and interrupting capacity shall be as shown on the plans. Distribution circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

Automatic transfer switch shall be a fixed mount power molded case switch for 480/277 V, 3-phase, 4-wire system and shall be rated at 2000-ampere. Transfer switch shall have an interrupting capacity of not less than 100,000 amperes (symmetrical) at 480 volts. The switch shall be UL 1008 listed. The switch and all its components shall be designed, manufactured and tested in accordance with the latest applicable standards of UL and NEMA as follows: UL 1008 (Transfer Switches), UL 489 (Molded Case Switches), NFPA 110 (Emergency and Standby Power Systems, 2005 Edition), and NEMA ICS10 (Transfer Switch Equipment). The switch shall utilize a microprocessor based logic controller. The controller shall provide the operator with an overview of the transfer switch status, parameters and diagnostic data.

The transfer switch shall meet or exceed the following specifications:

Compatible with standby generator provided in the project
Rated as suitable for use as service equipment
Power switch overcurrent protection (normal and emergency)
Microprocessor based logic controller
Time delay normal to emergency (adjustable 0-1800 seconds)
Time delay engine start (adjustable 0-120 seconds)
Time delay emergency to normal (adjustable 0-1800 seconds)
Emergency source sensing –phase reversal, under voltage/under frequency
Emergency source sensing- over voltage/over frequency
Test pushbutton
Pilot lights – normal position, emergency position
Auxiliary contacts-emergency source available
Automatic plant exerciser with Load/No Load conditions
Time delay neutral
Normal source sensing phase reversal, undervoltage, under frequency
Normal source testing overvoltage/over frequency
Emergency source three phase voltage unbalance/loss
Rated for 100 % equipment rating for continuous duty
Position indicating contacts (normal and emergency)
LED indicators (source available/tripped)
MODBUS communication

Panelboards and transformers installed inside the main switchboard shall conform to the requirements specified under Section 12-16, "Electrical Equipment," of these special provisions. Ratings and sizes of circuit breakers shall be as shown on the plans.

Surge Protection Device, SPD, shall be Type 2, Category C type device conforming to latest IEEE standards and designed for connecting at the point of entry and suitable for three -phase, 480 volt service. The SPD shall be able to withstand 250 kA surge current. The surge protective device shall be provided with a disconnect that has been directly integrated into the suppressor and assembly bus using bolted bus

bar connections. The surge protective device unit shall be designed, manufactured and tested in accordance to UL 1449 and UL 1283. The surge protective device shall be complete with status indicator lights on each phase, audible alarm, enable/disable transient counter and push to test pushbutton.

The power monitoring section shall include factory supplied and factory installed devices and shall include the following:

Power Monitoring Type 1
Power Monitoring Type 2

Power Monitoring Type 1 shall be UL listed, microprocessor based power quality meter consisting of a power quality meter base, with an integrally mounted power quality meter display. Power quality meter base shall be NEMA 1 rated and power quality meter display shall be NEMA 12 rated. The device shall meet or exceed the following specifications:

1. Meter shall be supplied suitable for standard 120/208 V(ac) input.
2. Current inputs for each channel shall be from standard instrument current transformers.

    2.1 The analog current input shall be converted to 4096 samples per cycle with a delta-sigma converter digitally filtered down to 512 samples per cycle for anti-aliasing.
    2.2 Meter burden shall be less than 10 milliohms.
    2.3 Overload withstand capability shall be a minimum of 500A for 1 second, non-repeating.

3. Voltage inputs for each channel shall allow for connection into circuits with the following parameters:

    3.1 Input range of 600V L-L, 347V L-N direct connected.
    3.2 Nominal full-scale value of 700 volts rms.
    3.3 Input impedance of 2 megohms.

4. The Power Metering Type 1 shall be capable of monitoring, displaying, and communicating the below true RMS minimum information where applicable with the accuracy as indicated of read or calculated values based on 3 to 300% full scale. The Power Metering Type 2 shall be measure the following:

    4.1 AC current (amperes) - phase, neutral and ground currents
    4.2 AC voltage (volts) -line to line, line to neutral and line to ground voltages.
    4.3 Real Power (Watts), Reactive Power (vars), Apparent Power (VA), for each phase and system.
    4.4 Accumulated, Incremental and conditional measurement for Real Energy (WH), Reactive Energy (VARH), Apparent Energy (VAH) for each phase and system.
    4.5 Frequency (Hz) Accuracy +/- 0.01 hertz.
    4.6 Power Factor for both apparent and displacement.
    4.7 Current percent Total Harmonic Distortion (THD) - phase and neutral.
    4.8 Voltage percent THD - line to line, line to neutral and line to ground.

5. The Power Metering Type 1 shall provide the following advanced analysis features:

    5.1 Calculation of harmonic magnitudes and phase angle for each phase voltage and current through the 85th harmonic.
    5.2 Energy Profile: Energy profile data shall include recording of real and reactive energy forward, reverse, net and absolute sum as well as apparent energy (KVAH). Up to eight (8) status inputs shall be configurable as energy accumulators for counting KYZ pulse inputs. These readings shall be stored over a configurable interval from 1 to 60 minutes as well as in daily and weekly totals.

6. The Power Monitoring Type 1 shall be provided with multiple communications ports and protocols, including the following capability:

    6.1 TIA-485 remote display port.
    6.2 TIA-485 Modbus RTU.

6.3 8P8C modular Selectable 100FX or 10/100Base-T Ethernet network port.
6.4 TIA-232.
6.5 TIA-485 Modbus RTU selectable master/slave port.
6.6 Modbus TCP.
6.7 Ethernet TCP/IP.
6.8 NTP(Network Time Protocol) support.

7. The power quality meter graphical display shall utilize a simple "twist and click" navigation control dial to easily navigate the menus, select links to related pages, ad to drill down into increasing levels of further details. A "back" key shall be provided for easy navigation to higher level screens. The graphical display shall have the following features:

   7.1 Backlight LCD remote graphics display with 320 x 240 pixels.
   7.2 Allow basic device setup and password protected resets.
   7.3 An audible alarm to annunciate alarm conditions.

8. The WEB server shall provide the user with remote WEB access to all the metered, trend and waveform information. The WEB server shall include real time monitored information in both numeric and graphical visual formats.
9. The meter shall be capable of providing the graphically display of the following Main Meter Menu Screens:

   9.1 Meter Screen providing: Voltage, Frequency and Current.
   9.2 Power Screen providing: Energy, Demand and Power Factor.
   9.3 Quality Screen providing: Total Harmonic Distortion (THD) of volts and current and Percent Nines (9s) reliability.
   9.4 Events screen providing: Latest event, Enabled triggers, Historical events, Calendar view of events and Events timeline screen.
   9.5 Set-up screen providing: View set-up, Login and Logout.

Power Monitoring Type 2 shall be UL listed, revenue grade accurate, power and energy metering device. The device shall meet or exceed the following specifications:

1. The device shall be suitable for mounting within a panelboard, switchboard, integrated facilities switchboard, or control panel by bolting directly to load side or line side of molded case circuit breakers.
2. The device shall meter the following parameters:

   2.1 Phase currents – per phase and average.
   2.2 Phase-to-phase and Phase-to-neutral voltages – per phase and average.
   2.3 Real Power (kW) – total and per phase.
   2.4 Reactive Power (kVAR) – total and per phase
   2.5 Apparent Power (kVA) – total and per phase.
   2.6 Power Factor – total and per phase.
   2.7 Real Energy (WHr) – forward, reverse, and net.
   2.8 Reactive Energy (VARHr) – forward, reverse, and net.
   2.9 Apparent Energy (VAHr) – forward, reverse, and net.

3. Accuracy for voltage and current readings shall be 0.5% of reading over the full scale range.
4. The device shall be configurable for reverse feed and CBA phase rotation applications.
5. The power metering and monitoring device shall monitor and communicate the following additional status information:

   5.1 Breaker open/close status.
   5.2 Breaker tripped status.
   5.3 Unit Health.

6. The device shall have front mounted diagnostic LEDs for easy viewing of unit health and transmit / receive communication status.

7. Unit address shall be settable from the face of the unit.
8. Communications: The unit shall include built-in [INCOM] [Modbus RTU] serial communications over a shielded-twisted-pair network. Multiple power metering and monitoring devices shall be networkable with a simple, daisy- chain connection.

    8.1 The device shall automatically sense the line voltage and shall power itself directly from the monitored circuit for applications up to 480 V(ac).

    8.2 The unit shall have an additional 24 V(dc) auxiliary input for applications requiring communications capability when the breaker is de-energized.

SOURCE TESTING

Prior to shipping, the Manufacturer shall test the assembled service and distribution equipment for proper operation.

PART 3 - EXECUTION

Foundation for service and distribution equipment shall be as shown on the plans.

Installation of service equipment shall be in accordance with the requirements of the serving utilities as shown on the approved installation details. The Contractor shall provide seismic anchoring and equipment anchorage details coordinated with the equipment mounting provisions, prepared and stamped by a licensed civil engineer. Adequate ventilation for the transformer and other installed components shall be provided within the switchboard.

WASTE MANAGEMENT

Comply with provisions of "Construction Waste Management" in Section 5 of these special provisions. Recycle scrap metal, plastic, and packaging. Dispose of other products without contaminating soil, water, or other materials.

12-16.05 INTEGRATED FACILITES SWITCHBOARD

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing integrated facilities switchboards (IFS) in accordance with the details shown on the plans and these special provisions.

Related Work:

Concrete and reinforcement for integrated facilities switchboards shall conform to the provisions in Section 12-3, "Concrete and Reinforcement," of these special provisions.

Panelboards, building disconnect, power monitoring Type 3 devices and transformers installed inside the integrated facilities switchboards shall conform to the requirements specified under "Electrical Equipment" in Section 12-6, "Electrical," of these special provisions.

Power monitoring Type 2 devices, surge protection devices and distribution circuit breakers installed inside the integrated facilities switchboards shall conform to the requirements specified under "Service and Distribution" in Section 12-6, "Electrical," of these special provisions.

Lighting Network Panels installed inside the integrated facilities switchboard, shall conform to the requirements specified under "Lighting" in Section 12-6, "Electrical," of these special provisions.

Serial control cables, power monitoring gateway and power monitoring switch that are associated with the power monitoring devices inside the integrated facilities switchboards shall conform to the requirements specified under "Lighting" in Section 12-6, "Electrical," of these special provisions.

SUBMITTALS

Installation Details: The Contractor shall submit complete installation working drawings to the Engineer for approval.

Product Data:

A list of all materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials, front view and plan view of the assembly, assembly ratings and equipment specified herein. Assembly ratings shall include withstand and closing rating, voltage, continuous current and short circuit rating.

Working Drawings: Working drawings shall show the shape, size, and method of attachment for each component used in the work. Control and wiring diagrams shall include rough-in dimensions, component layout and conductor number identification. Master drawing index, front view, floor plans, top view, single line diagram, schematic diagram, assembly ratings, major component ratings, cable terminal sizes and product data sheets shall be included.

Test Reports: Test results for integrated facilities switchboards shall be delivered to the Engineer within 3 business days of completion.

Closeout Document Submittals:

Closeout documents shall be furnished for the following equipment prior to completion of the project:

1. Integrated Facilities Switchboard assembly
2. Transformers
3. Panelboards
4. Circuit Breakers
5. Automatic Transfer Switch
6. Power Monitoring Devices and Related Communication Devices
7. Surge Protection Devices

Each closeout document shall contain the following information:

1. Parts list.
2. Operating instructions.
3. Maintenance instructions.
4. Wiring schematics.
5. Component Layout.
6. Index

Each closeout document shall be submitted in the following manner:

1. One CD with PDF files.
2. Two individual 3-ring binders containing paper copies.

Incomplete or inadequate documentation shall be returned to the Contractor for correction and resubmittal.

PART 2 - PRODUCTS

Integrated Facilities Switchboard:

Integrated facilities switchboard shall be a free standing, dead front type, service and distribution switchboard, utilizing group mounted circuit protective devices, power monitoring devices, integrated panelboards, lighting network panels, transformers and other equipment as shown on the plans. The integrated facilities switchboard shall be designed, manufactured and tested in accordance with NEMA PB-2 and UL Standard 891. IFS-MSB shall be suitable for use as a service equipment and be labeled in accordance to the UL requirements.

Integrated facilities switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Adequate ventilation shall be provided within the enclosure. All sections of the integrated facilities switchboard shall be rear aligned as shown on the plans. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboards to be mounted against a wall. Equipment supplied shall be equal to or less then the dimensions on the floor plans, elevations, and electrical equipment details as shown on the plans.

All bus bars shall be silver-plated copper. Full capacity neutral bus shall be provided where a neutral bus is indicated on the plans. A copper ground bus (minimum 1/4 by 2 inch) shall be furnished and firmly secured to each vertical section structure and shall extend the entire length of the switchboard. All hardware used on conductors shall be high-tensile strength and zinc plated. All bus joints shall be provided with conical spring-type washers. Feeders in between units shall be copper.

The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current as shown on the drawings.

The integrated facilities switchboards shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to contractor supplied floor sills to be set level in concrete per manufacturer's recommendations.

FABRICATION AND SOURCE TESTING

The integrated facilities switchboards shall be completely assembled, wired, adjusted and tested at the factory. All major components within the integrated facilities switchboard shall be manufactured by the maker of the enclosure. All major components shall be installed, bussed and cabled at the factory. All cables in between structures shall be installed at the factory. After assembly, the complete switchboard shall be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one minute between live parts and ground and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one minute between live parts and ground. The manufacturer shall provide 3 certified copies of the factory test reports.

PART 3 - EXECUTION

Foundation for integrated facilities switchboards shall be as shown on the plans and as recommended by the manufacturer.

Integrated facilities switchboards shall be installed as shown on the plans.

Installation of the integrated facilities switchboard shall be in accordance with the manufacturer's requirements to comply with seismic anchoring requirements and anchorage details. The Contractor shall provide seismic anchoring and equipment anchorage details coordinated with the equipment mounting provisions, prepared and stamped by a licensed civil engineer. The manufacturer of the IFS assembly shall be the manufacturer of the major components within the assembly.

The integrated facilities switchboards shall integrate and assemble panelboards, power monitoring devices, surge protection devices and lighting network panels into the unit as shown on the plans. Each panelboard and lighting network panel shall contain a trim with lockable door. The panelboards shall be recessed in the switchboard enclosure a minimum of 4 inches from the front of the switchboard to allow easy access to line and/or load conductors. Trim doors shall assure proper fit. Three quarter inch (3/4-inch) breakers shall not be used in any part of the panelboard. Panelboards shall have a wire management system inside wireway to accommodate branch circuit wiring passing through vertically in that section. Panelboards shall have bolted cover trims.

A back mounting panel with spacer shall be provided for the lighting network panels. Six- inch full depth barriers shall be provided on both side of the lighting network panel to isolate the low voltage conductors from the power conductors.

The integrated facilities switchboards shall integrate and assemble transformers into the unit as shown on the plans. The transformers shall be secured in a manner that assures the structural integrity of the vertical section and the transformer. Adequate ventilation for the transformer and other installed components shall be provided within the switchboard.

Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons and switches shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 167 degrees F of the size as indicated on the drawings. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided. All control wire shall be type MTW, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

The Contractor shall perform field adjustments of the protective devices in the presence of the Engineer as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device evaluation study and protective device evaluation study. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with approved short circuit and protective device coordination study shall be carried out by the contractor at no additional cost to State.

WASTE MANAGEMENT

Comply with provisions of "Construction Waste Management" in Section 5-1 of these special provisions. Recycle scrap metal, plastic, and packaging. Dispose of other products without contaminating soil, water, or other materials.

12-16.06 ELECTRICAL EQUIPMENT

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing panelboards, starters, disconnect switches, transformers, control panels and related accessories in conformance with the details shown on the plans and these special provisions.

Related Work: Anchorage devices shall be as specified under "Basic Materials and Methods" elsewhere in Section 12-16.

SUBMITTALS

Product Data:

A list of materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval. Any other data as requested by the Engineer shall also be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the shop drawings shall be identified with wire numbers.

PART 2 - PRODUCTS

PANELBOARDS

General:

Panelboards shall be factory assembled panelboards at least 20 inches wide with hinged door and molded case circuit breakers as shown on the plans. Panelboards voltage ratings, capacity rating and short circuit current ratings (SCCR) shall be as shown on the plans. Panelboards shall be designed, manufactured and tested in accordance with UL 67 (Panelboards), UL 50 (Cabinets and boxes) and NEMA PB1 (Panelboards). Unless otherwise shown on the plans, panelboards shall be fully rated. Main bus bars shall be copper. Panelboards with neutrals shall have full-size (100 percent) insulated groundable neutrals. Panelboards shall have door-in-door trim. Both hinged trim and trim door shall utilize a 3-point latching.

Main circuit breakers for 277/480-volt rated panelboards shall be thermal-magnetic type molded case circuit breaker complete with an adjustable AC magnetic trip unit and shall be vertically mounted and connected to the bus bar. The main circuit breakers ampere trip ratings, number of poles and interrupting capacity shall be as shown on the plans.

Main circuit breakers for 120/208-volt rated panelboards or 120/240-volt rated panels boards that are 100 amperes or less shall be thermal-magnetic type molded case circuit breakers. Main circuit breakers for panelboards rated greater than 100 amperes shall be thermal magnetic type with adjustable AC magnetic trip units. The main circuit breakers ampere trip ratings, number of poles and interrupting capacity shall be as shown on the plans.

Feeder circuit breakers with trip rating equal to or greater that 100-amperes shall be thermal-magnetic type molded case circuit breaker complete with an adjustable AC magnetic trip unit with common handle for all multiple pole circuit breakers. The feeder circuit breakers ampere trip ratings, number of poles and interrupting capacity shall be as shown on the plans.

Branch circuit breakers shall be thermal-magnetic type molded case circuit breakers with common handle for all multiple pole circuit breakers. The branch circuit breakers ampere trip ratings and number of poles shall be as shown on the plans. Handle lock-off branch circuit breakers shall be provided as shown on plans to lock the circuit breaker in OFF position for maintenance purpose. Branch circuit breaker feeding the fire alarm control panel shall have RED color handles.

Unless otherwise shown on the plans, the interrupting capacity of the branch circuit breakers for 120/240 V or 120/208 V panelboards shall be not less than 22 k AIC. Unless otherwise shown on the plans, the interrupting capacity of the branch circuit breakers for 277/480 V panelboards shall be not less than 14 k AIC. Series combination ratings shall not be allowed.

Circuit breakers feeding lighting panelboards and photovoltaic systems AC disconnect shall be suitable to accept the power monitoring type 2 as shown on the plans. The main circuit breakers ampere trip ratings, number of poles and interrupting capacity shall be as shown on the plans. Power monitoring type 2 shall be as specified under "Service and Distribution" of these special provisions.

STARTERS

Air Compressor Starter: Air compressor starter shall be combination 3-pole, 480-volt, NEMA Size 1, NEMA rated, line voltage starter and motor circuit protector in a NEMA-1 enclosure. Air compressor starter shall have two, 2-ampere, dual element, 600-volt fuses with 2-pole barrier type fuse base; 480-volt coil, double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Reset button shall be externally operable.

Combination Motor Starter: Combination motor starter shall be combination NEMA rated, line voltage starter and motor circuit protector in a NEMA-1 enclosure. Combination motor starter shall have start-stop push button, 120-volt coil, double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Start-stop and reset button shall be externally operable. Number of poles, voltage rating and NEMA sizes shall be as shown on the plans. Operating coil voltage other than 120 V shall be as shown on the plans or specified in these special provisions.

Manual Motor Starter: Manual motor starter shall be manual motor starter with pushbutton type operator in a surface mounted enclosure complete with thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Number of poles, HP rating, voltage rating and enclosure type shall be as shown on the plans.

Manual Motor Starting Switch: Manual motor starting switch shall be a manual motor starter without overload with toggle type operator in a NEMA-1 enclosure. Number of poles, HP rating, voltage rating and enclosure type shall be as shown on the plans.

Exhaust Fan Motor Starter: Exhaust fan motor starter shall be NEMA rated, horsepower rated full voltage contactor with start-stop push button, 120-volt coil and double break silver contacts in a NEMA-1 enclosure. Number of poles, voltage rating, HP rating and NEMA sizes shall be as shown on the plans.

SWITCHES

Building Disconnect: Building disconnect in IFS-M shall be 3-pole, 600-volt, 1200-ampere trip, UL1066 listed, insulated case power circuit breaker with shunt trip and ground fault protection.The interrupting capacity of the circuit breaker shall be not less than 42,000 amperes (symmetrical) at 480 volts. The ground fault protection system shall be of the residual sensing method, "vectorial summation" type. The main circuit breaker shall be provided with a microprocessor based electronic trip unit. The trip unit shall have integrally mounted phase current sensors and one identically rated current sensor mounted on the neutral bus. Under normal operating conditions, the vectorial sum of all phase currents will total zero. Underground fault conditions, the residual sum of the sensors will not be zero, initiating an internally powered shunt trip of the circuit breaker.

Fusible Disconnect Switch: Fusible Disconnect switch shall be heavy duty safety switch in a surface mounted enclosure with provisions for padlocking in the "OFF" position. Number of poles, voltage rating, ampere rating, enclosure rating and fuse sizes shall be as shown on the plans.

Non-fusible Disconnect Switch: Non-fusible disconnect switch shall be a non-fusible, heavy duty safety switch in a surface mounted enclosure with provision for padlocking in the "OFF" position. Number of poles, voltage rating, ampere rating and enclosure rating shall be as shown on the plans.

Elevator Equipment Disconnect Switch: Elevator equipment disconnect switch shall be 3-pole, 600-volt, AC,100-ampere trip, molded case circuit breaker with shunt trip in a surface mounted NEMA-12 enclosure.

Overhead Crane Disconnect Switch: Overhead crane disconnect switch shall be 3-pole, 480-volt, AC,30-ampere trip, molded case circuit breaker in a surface mounted NEMA 12 enclosure.

Emergency Pump Shutoff Switch: Emergency pump shutoff switch shall be 4-pole, 600-volt, AC, 60-ampere, non-fusible, heavy duty safety switch in a NEMA-3R enclosure with provision for padlocking in the "OFF" position.

TRANSFORMER

Transformer: Transformer shall be indoor, dry type, energy efficient, NEMA Type TP-1 compliant transformer. Transformer shall have two 2 1/2 percent full capacity taps above and four 2 1/2 percent full capacity taps below normal primary voltage and copper windings. Transformer ratings and locations shall be as shown on the plans.

CONTROL PANELS

Declassification Fans Control Panel: Declassification fans control panel enclosure shall be single exterior hinged door, dust tight NEMA Type12 enclosure, containing an interior mounting panel and hinged exterior door. The door shall be maintained closed with door clamps. Security shall be provided by a hasp and staple for padlocking material. The enclosure shall be factory prewired in conformance with NEMA Class IIC wiring. All wires entering the enclosure shall terminate on terminal blocks. Control wiring shall be 7 strand No. 14 MTW except for hinge wiring, which shall be 19 strand No. 14 MTW. Panel shall be wired using red colored insulation conductors for general wiring and orange insulation with 3 continuous white stripes along its entire length for neutrals. Use of gray colored insulation conductors for wiring is prohibited. A wiring diagram encased between two heat-fused laminated plastic sheets shall be provided with brass mounting eyelets and attached to the inside of the enclosure. The declassification fans control panel shall include the following components: Main breaker, circuit breakers, control disconnect, starters, currents switches, control relay, terminal block, pushbuttons and pilot lights.

Main breaker, MB, shall be 3-pole, 240-volt, AC, molded case circuit breaker with 100-ampere frame, 30-ampere trip, and interrupting capacity of not less than 10 000 amperes (symmetrical) at 240 volts.

Circuit breakers, CB1, CB2 and CB3, shall be 3-pole, 240-volt, AC, molded case circuit breaker with 100-ampere frame, 15-ampere trip, and interrupting capacity of not less than 10 000 amperes (symmetrical) at 240 volts.

Control disconnect, CD, shall be single-pole, 120-volt, AC, molded case circuit breaker with 100-ampere frame, 15-ampere trip, and interrupting capacity of not less than 10 000 amperes (symmetrical) at 120 volts.

Starters, ST1, ST2 and ST3, shall be NEMA Size 00, NEMA rated, 3-pole, 600-volt, contactors with 120-volt coil, and non-adjustable overload relays. Overload relay shall be resettable by an externally operable pushbutton on the hinged door. Overload relay shall have three thermal overload elements and shall trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Starters shall be NEMA rated.

Current switches, CS1, CS2 and CS3, shall be self-powered, solid-state, AC, current sensing switch. Switch shall have a single-pole, normally open contact rated one-ampere at 240 volts, AC. Current sensing level shall be selectable between a low range of one to 15 amperes. Switch shall have a thru-hole of 14 mm diameter for sensing the AC current.

Control relay, CR, shall be a power relay with 120-volt AC coil and one single-pole, single-throw, 30-ampere, 300-volt, AC, normally open, 2 horsepower rated visible contacts. Coil burden shall be 10 VA.

Terminal block shall be 30-ampere, 300-volt, molded plastic with two or more mounting holes and two or more terminals in each cast block. The molded plastic shall have a high resistance to heat, moisture, mechanical shock, and electric potential and shall have a smooth even finish. Each block shall have a molded marking strip attached with screws. Terminal blocks shall have tubular, high pressure clamp connectors.

Declassification fans pushbutton stations shall be "start-stop" heavy duty oil-tight two-button station. The contact shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120 volts and 35 percent power factor. Pushbutton stations shown outside the declassification fans control panel shall be mounted in a NEMA type 4 enclosure.

Pilot Light, PL, shall be panel mounted, heavy duty, oil tight indicating light with 120 V, (ac), high visibility light emitting diode (LED) type lamp with green colored domed cap.

Exhaust Fan Control Panel: Exhaust fan control panel shall be a NEMA rated full voltage contactor with 120-volt coil, auxiliary control relay and double break silver contacts in a NEMA-1 enclosure. Auxiliary control relay have a continuous rated, 24 -volt, AC coil with one normally open contact rated at 30-ampere , 300-volt, AC. Number of poles, voltage rating, HP rating and NEMA sizes shall be as shown on the plans.

MISCELLANEOUS MATERIALS

Test Motor Controller (480-Volt): The 480-volt test motor controller shall be combination 3-pole, 480-volt, line voltage starter and circuit breaker in a NEMA-12 enclosure. Controller shall have one normally open auxiliary contacts and two 2-ampere, dual element, 600-volt fuses with 2-pole barrier type fuse base; 480-volt coil, double-break silver contacts and 3 manual reset, adjustable solid state electronic thermal overloads, set to trip between 115 and 125 percent of full load motor current. Reset button shall be externally operable. Controller shall be provided with a heavy duty oil-tight "start-stop" pushbutton. Controller shall be provided with a panel mounted voltmeter and ammeter complete with fuses and current transformers. Controller shall be provided with a heavy duty, oil tight indicating light with a high visibility light emitting diode (LED) type lamp with green colored domed cap. NEMA size and overload trip setting shall be as shown on the plans.

Test Motor Controller (240-Volt): The 240-volt test motor controller shall be combination 3-pole, 240-volt, line voltage starter and circuit breaker in a NEMA-12 enclosure. Controller shall have one normally open auxiliary contact and two 2-ampere, dual element, 300-volt fuses with 2-pole barrier type fuse base; 240-volt coil, double-break silver contacts and 3 manual reset, adjustable solid state electronic thermal overloads, set to trip between 115 and 125 percent of full load motor current. Reset button shall be externally operable. Controller shall be provided with a shall be heavy duty oil-tight "start-stop" pushbutton. Controller shall be provided with a panel mounted voltmeter and ammeter complete with fuses and current transformers. Controller shall be provided with a heavy duty, oil tight indicating light with a high visibility light emitting diode (LED) type lamp with green colored domed cap. NEMA size and overload trip setting shall be as shown on the plans.

Surge Protective Devices: Surge protective devices in various integrated facilities switchboards shall be similar to the surge protection device specified under "Service and Distribution" of these special provisions. Withstand current shall be as shown on the plans.

Power Monitoring Type 3: Power monitoring type 3 shall be a compact electronic power meter with the accuracy of ANSI C12.16 for Class 10 metering equipment. The meter shall monitor and display the function listed below. The meter shall be UL listed. The meter display shall mount in a standard DIN 3.78 inches x 3.78 inches square cutout or a standard ANSI round 4 inches cutout. The meter display shall be NEMA 1 rated and connected to the separate meter base separate via a standard Category 5 cable. The base shall be capable of being remote panel or DIN-rail mountable or mounting directly to the display. The meter display shall have a 8 digit numeric and 10 alphanumeric character, plus dedicated icons, reverse mode LCD with LED backlight display. All monitored parameters shall be viewable at the display with four button user interface or via network communications. All set points and recorded minimum and maximums shall be stored in non-volatile memory. The meter shall be supplied with three (3) current transformers sized as required. Potential transformers shall be self-included and fused for up to 600 volts. A solid-state relay KYZ pulse output shall be provided for use with a watt-hour pulse recorder or totalizer. The meter shall have the capability of communicate data over a compatible two-wire local area network (LAN) to central personal computer for storage and /or printout. The network shall also be capable of transmitting data in TIA-232 format via a translator module.

1. Current, per phase.
2. Current demand
3. Calculated neutral current.
4. Voltage, per phase (Line to line and line to neutral)
5. Frequency.
6. Real, reactive and apparent power, Total and per phase (kW, kvar, kVA).
7. Real, reactive and apparent power, Total and per phase (kW, kvar, kVA).

8. Real, reactive power demand.
9. Power factor, total and per phase.
10. Minimum/maximum readings, I,V, PF, F, THD, kW, kvar, kVA.
11. 128 kB for data logging.
12. Two digital input/ 2 digital output.
13. Four digital input/4 KYZ output.
14. Four analog output (4-20 mA).
15. Four analog output (0-1 mA).

Shunt Trip Pushbutton: Shunt trip pushbutton for the elevator disconnect shall be heavy duty oil-tight pushbutton with one normally open momentary contact. The contact shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120 volts and 35 percent power factor.

Alarm Test Pushbutton: Alarm test pushbutton for the sludge and oil testing system shall be heavy duty oil-tight pushbutton with one normally open momentary contact. The contact shall have an inductive pilot duty rating of 60 amperes (make), 6 amperes (break) and 10 amperes (continuous) at 120 volts and 35 percent power factor.

Alarm Light: Alarm light for the Wash/Fuel Building shall be a fluorescent, weatherproof light fixture for use with threaded conduit and suitable for wall mounting. Alarm light fixture shall have a guard and red globe. Lamp shall be 18-watt, 120-volt compact fluorescent with ballast and screw on type base.

Dual Level-2 Electric Vehicle Charging Station: Dual level-2 electric vehicle charging station shall be a free standing outdoor type charging station for electric vehicles. Input voltage shall be 240 V and shall require a supply of 2 dedicated 40 ampere, double pole circuit breakers. The standby power consumed shall be less than 10 watts (continuous). The station shall have 2 output ports, capable of providing maximum 30 A current at each port. Output connectors shall be SAEJ772TM connectors with 25 ft cable for each connector. Connector and cable assembly shall be field replaceable. The station shall comply with the following standards: UL 2231, UL2594, CEC 625, and SAE J1172. The unit shall operate from -30 to +130°F and up to 95% non-condensing operating humidity. Terminal block temperature rating shall be 212 °F. The station shall be equipped with TIA-485 communications port. Enclosure shall be rated NEMA 3R and manufactured from heavy duty aluminum with a powder-coat paint. All internal and external hardware shall be stainless steel.

Emergency Pump Shutoff Sign: Emergency pump shutoff sign shall be sheet steel, not less than 18-gage with a baked enamel coating and shall have red letters, 2 inches in height, on a white background.

Nameplates: Nameplates shall be laminated phenolic plastic with white core and black front and back. Nameplate inscription shall be in capitals letters etched through the outer layer of the nameplate material.

Warning Plates: Warning plates shall be laminated phenolic plastic with white core and red front and back. Warning plates inscription shall be in capital letters, etched through the outer layer of the nameplate material.

Device Labels: Device labels shall be industrial type, preprinted labels with adhesive backed white core and black front and back. Device labels shall resist fading, scratching, moisture, heat, chemicals, ultraviolet (UV) exposure and cleaning fluids. Device labels shall be K-Sun Labels, Dymo Letra Tag, or equal.

Declassification Fans Warning Signs: Declassification fans warning signs shall be sheet steel, not less than 18-gage with a baked enamel coating and shall have red letters, 2-inches in height, on a white background.

Plywood Backing Board: Plywood backing board for mounting electrical or telephone equipment shall be ¾-inch, APA plywood panels, C-D PLUGGED and touch-sanded, Exposure 1.

PART 3 - EXECUTION

INSTALLATION

Plywood Backing Board:

Plywood backing board shall be securely fastened to walls or other vertical framing.

Surface to be coated shall be cleaned of all dirt, excess materials, and filler by hand cleaning.

Exposed surfaces of plywood backing board shall be coated in conformance with the provisions in "Wood, Painted" specified under Section 12-9 "Painting," of these special provisions. The color shall match surrounding surfaces, or shall be as directed by the Engineer.

Coatings shall be applied in conformance with the manufacturer′s instructions. Each coat shall be applied to a uniform finish, free of skips, brush marks, laps or other imperfections.

Panelboard Installation:

Set cabinets plumb and symmetrical with building lines. Train interior wiring as specified under "Conductor and Cable Installation" in "Basic Materials and Methods" of these special provisions. Touch-up paint any marks, blemishes, or other finish damage suffered during installation. Replace cabinets, doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.

Mounting height shall be 5½ feet to the highest circuit breaker handle, measured above the finished floor.

Provide two ¾-inch empty conduit from flush panelboard enclosure to a point above furred ceiling for each 16 circuits or fraction thereof in each panelboard.

Where "Space" is indicated on the plans, branch connectors, mounting brackets, and other hardware shall be furnished and installed for future breaker.

A typewritten directory under transparent protective cover shall be provided and set in metal frame inside each cabinet door. Directory panel designation for each circuit breaker shall include complete information concerning equipment controlled, including room number or area designated on the plans.

Transformer Installation: Connect primary to minimum value taps during construction period and prior to initial building start-up. Make voltage readings and adjust tap connections to nominal voltage during final construction review and prior to building occupancy. Install conduit connections that will prevent transmission of the transformer vibrations to the conduit system. Transformers shall be bolted to floor when floor mounted and bolted to wall with support brackets when wall mounted. Pad mounted transformers (unit substation) shall be installed as shown on the plans.

Declassification Fans Control Panel Installation: The declassification fans control panel shall be surface mounted as the location shown on the plans. The following electrical components shall be mounted on the interior mounting panel of the declassification fans control panel Main breaker, MB; Circuit breakers, CB1, CB2, and CB3; Control disconnect, CD; Starters, ST1, ST2, and ST3; Current switches, CS1, CS2, and CS3; Terminal block, TB; and Control Relay, CR. Spacer shall be installed with the main breaker MB so that breaker is externally operable with the hinged door closed. The hinged door shall only be open when MB is in the "OFF" position. The pilot light and one set of pushbutton station shall be mounted on the exterior door of the declassification fans control panel: The other pushbutton stations shall be wall mounted as shown on the plans. A minimum of 6 inches of empty space shall be provided at the bottom of the control panel for bundling and terminating field conductors.

Equipment Identification:

Equipment shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts.

Nameplate inscriptions shall be read as follows:

1. Inscriptions for panelboards, transformers and integrated facilities switchboards shall include designation, voltage, amperes and phase of supply and shall read in the following example: PANEL BL, 120/208 V, 100 A, 3-PHASE, 4-wire.
2. Inscription for control panels or stations shall be the panel or station designation as shown on the plans and shall read in the following example: DECLASSIFATION FANS CONTROL PANEL.
3. Inscription for lighting control panels or lighting network panels shall be the panel designation and the panel number as shown on the plans and shall read in the following example: LIGHTING CONTROL PANEL LCP-125.
4. Pushbutton stations and timer switches shall be identified with nameplates adjacent to the unit. Inscription shall be the particular device the pushbutton or switch is controlling. For example the timer switch for radiant heaters shall have a nameplate adjacent to it that read "RADIANT HEATERS," pushbutton station for overhead roll up door shall read "OVERHEAD DOOR."
5. Starters, pushbuttons, controllers and disconnect switches shall be identified with nameplates attached to the unit. Inscription shall be the particular equipment the device is controlling. For example the non-fusible disconnect switch for overhead roll up door shall read "OVERHEAD DOOR."
6. Receptacle outlets fed from dedicated circuits shall be identified with nameplates adjacent to the outlet. Inscription shall be the particular device the circuit is feeding and as shown on the plans. For example the receptacle outlet for the drill press shall have a nameplate adjacent to it that read "DRILL PRESS."
7. Welding receptacles shall be identified with nameplates identifying the welder type, circuit number, panelboard number, circuit breaker size, number of poles and the voltage feeding the circuit for the welder. For example the welding receptacle for the GTAW welder shall have a nameplate adjacent to it that read "GTAW WELDER, CIRCUIT 5-7, PANEL 8BC, 60A/2 POLE, 480 V."
8. All components mounted inside the declassification fans control panel shall be identified with nameplates using the abbreviation used on the plans. For example MB for the main breaker. The panel, the operating handles of the circuit breakers and the pushbuttons shall have identification nameplate with inscription identifying their functions (DECLASSIFICATION FAN CONTROL PANEL, MAIN, NORTH FAN, SOUTH FAN, EAST FAN, START AND STOP).
9. Integrated facilities switchboards or other equipment containing conductors of two or more nominal voltages shall be identified with nameplates providing the information on the color identification of the grounded and ungrounded conductors. For example an IFS with 120/208 V, 120/240 V and 277/480 V systems shall be identified with a nameplate in the following example:

VOLTAGE 120/208 WYE	VOLTAGE 120/240 DELTA	VOLTAGE 277/480 WYE
PHASE A BLACK	PHASE A BLACK WITH ORANGE STRIPE	PHASE A BROWN
PHASE B RED	PHASE B ORANGE	PHASE B PURPLE
PHASE C BLUE	PHASE C BLUE WITH ORANGE STRIPE	PHASE C YELLOW
NEUTRAL WHITE	NEUTRAL ORANGE WITH 3 WHITE STRIPES	NEUTRAL GRAY

Warning Plates:

Warning plates shall be attached to designated equipment with self-tapping cadmium-plated screws or nickel-plated bolts.

Warning plate inscriptions shall be as shown on the plans.

Device Labels:

Receptacle outlets shall be provided with device labels. Device labels shall include the voltage, panelboard number and circuit number in the following example: 120 V, Circuit 8A25. GFCI protected receptacles shall include the inscription that reads 'GFCI PROTECTED" on the label.

Voice and data outlets shall be provided with device labels. Device labels for communication outlets shall include the information on the source of the cable. Label shall include the room number, IDF or MDF number and the designated jack number.

Electrical equipment mounted inside the attic space shall be provided with a device label that is mounted at the ceiling directly below the equipment. Device label shall be the equipment identification name. For example the exhaust fan motor starter shall read: EF MOTOR STARTER.

Emergency Pump Shutoff Sign: Emergency pump shutoff sign with the message "EMERGENCY PUMP SHUTOFF" shall be fastened to the wall at the emergency pump shutoff switch with at least 6 anchorage devices.

Declassification fans warning sign with the message as shown on the plans shall be fastened to the wall at locations as shown on the plans with at least six anchorage devices. Inscription shall be as follows:

OPEN DOOR LOUVERS AND TURN ON
DECLASSIFICATION FAN BEFORE
REPAIRING GASOLINE POWERED VEHICLES

12-16.07 LIGHTING

PART 1 – GENERAL

Scope: This work shall consist of furnishing, installing and connecting all lighting equipment and network lighting control system in accordance with the details shown on the plans and these special provisions.

Related Work:

Nameplates and device labels shall be as specified under "Electrical Equipment" in Section 12-16, "Electrical" of these special provisions.

Attention is directed to the requirements specified under "Integrated Facilities Switchboard" in Section 12-16, "Electrical" of these special provisions. Serial control cables, power monitoring software, power monitoring gateway and power monitoring switch are specified under this section of these special provisions. These items shall be part of the integrated facilities switchboard submittal.

SUBMITTALS

Manufacturer's descriptive information, photometric curves, catalog cuts, and installation instructions shall be submitted for approval. Any other data as requested by the Engineer shall also be submitted for approval. Wiring diagram for all the control panels, network riser diagrams for all the network lighting control system, component layout for the lighting network panels and control panels shall be submitted for approval.

Closeout Document Submittals:

Closeout documents shall be furnished for the following equipment prior to completion of the project:

Network Lighting Control System

Each closeout document shall contain the following information:

1. Parts list.
2. Operating instructions.
3. Maintenance instructions.
4. Wiring schematics.
5. Riser diagrams.

Each closeout document shall be submitted in the following manner:

1. One CD with PDF files.
2. Two individual 3-ring binders containing paper copies.

Incomplete or inadequate documentation shall be returned to the Contractor for correction and resubmittal. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

LEED SUBMITTALS

Submit under "LEED Requirement" in Section 5 of these special provisions.

SS Credit 8, Light Pollution Reduction: Submit the following:

Product data for interior luminaires, including complete photometric data.

Product data for exterior luminaires, posts, and mounting devices, including complete photometric data.

IEQ Credit 6.1, Controllability of Systems—Lighting: Submit product data for lighting control devices and control panels.

NETWORK LIGHTING CONTROL SYSTEM DESCRIPTION

The network lighting control system shall be an addressable sensor based control system consisting of components that are capable of turning light emitting diode, LED, lighting loads "on" and "off" as well as dimming LED lighting loads within a lighting control zone. The system includes lighting control devices such as occupancy sensors, photoelectric units, manual dimming switches, control panels with switching relays, power supply and dimming outputs and lighting network panels with hubs and main hubs.

Lighting control zone shall consist of lighting control devices daisy-chained with control cables to perform switching and dimming of LED fixtures within the control zone through a control panel. Low voltage power for the lighting control devices shall come from a locally located control panels.

Control panels shall be networked to the lighting network panels consisting of hubs and main hubs. Hubs shall be used to communicate with lighting control panels and to distribute low voltage power through the system. Main hub shall provide the required backbone network connectivity for the entire network lighting control system and shall provide connectivity with the local area network. Lighting control zones shall be capable of stand-alone default operation in case the network connectivity to the local area network is lost.

System shall be provided with a lighting network workstation installed with a web-based lighting network software management program that is capable of remote system control, status monitoring, and creating of lighting profiles. Individual lighting zones shall be programmed with lighting profiles through the web-based software. Software shall be capable of logging of system performance data and provide graphical reports for power consumed by the entire network lighting control system which can be exported in to excel format. It shall be capable of reporting and storing lighting system events and performance data.

QUALITY ASSURANCE

Commissioning: Comply with requirements under Section 5, "Department Commissioning," of these special provisions, and coordinate with Commissioning Agent to carry out commissioning of network lighting control system.

Regulatory Requirements: All the network lighting control system components that requires testing as specified on Certificate of Compliance Forms, "LTG-1C, (Page 4 of 4)," and "OLTG-1C, (Page 3 of 4)," under "Required Acceptance Tests" shall be certified as meeting the Acceptance Requirements for Code Compliance. In addition, a Certificate of Acceptance forms shall be submitted for each component to the State that certifies plans, specifications, installation certificates, operating and maintenance information meet the requirements of

"Section 10-103(a)," of Title 24 Part 1. The State must receive the properly filled out and signed forms by a Responsible Engineer before the building can receive final occupancy.

System Startup: Before system startup all the network lighting control system components must coordinate together to form an integrated network lighting control system. At system startup all lighting control devices shall be grouped together into a functional lighting control zones as shown on the plans. All functional lighting zones along with the lighting control device shall be programmed into the lighting network software by the network lighting control system manufacturer. The representative from the lighting network control system manufacturer shall be responsible for commissioning and programming the entire system at startup.

PART 2 - PRODUCTS

Lighting Fixture Lamps:

Lighting fixture lamps shall be type and size as shown on the plans.

Lighting Fixtures:

Lighting fixtures shall be as shown on the plans. Outdoor luminaires shall be listed and labeled "Fixture Suitable For Wet Locations."

Lighting Standard Poles:

Lighting standard poles for exterior light emitting diode luminaires shall be one piece construction, square straight steel structural tubing with nominal wall thickness of 11-gage and with a minimum yield strength of 50,000 psi. The height of the poles shall be as shown on the plans. The poles shall come complete with welded base plate, ASTM A-307 anchor bolts as required, bolt cover, oval reinforced gasketed handhole located 1'-6" above base with cover plate, pole cap and all necessary hardware. For number and location of additional handholes with cover plates, threaded coupling and pole heights see plans.

Poles shall be able to withstand stresses produced by steady state wind with velocity of 100 MPH. All exterior and interior pole metal surfaces shall be hot dip galvanized steel. Exterior and interior galvanized surfaces shall be coated with a corrosion powder coating. Poles shall be factory painted white. Paint or powder coating of the poles shall be in conformance with the provisions in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications. Poles shall be Holophane Type SSS; Beta Lighting Type PS; or equal.

Fused Splices: Fused splices shall be with standard midget, ferrule type, with "Non Time Delay" feature, and shall be 3-ampere, 277-volt, fuses.

Lighting Cables: Lighting cables shall be armored lighting control cable and lighting control cable.

Armored Lighting Control Cable, ALC: Armored lighting control cable shall be a steel wired armored Ethernet cable, Cat 5e, 4 pair, 24-AWG, UTP, extended frequency type cable complete with high density polyethylene insulation and tinned copper drain wire. Cable shall be in conformance with the requirements in TIA 568, "Commercial Building Telecommunication Cabling Standards." Cable shall be suitable for terminating with an 8P8C modular connector at each termination. Provide 8P8C modular connectors as required.

Lighting Control Cable, LC: Lighting control cable shall be an Ethernet cable, Cat 5e, 4 pair, 24-AWG, UTP, extended frequency type cable complete with high density polyethylene insulation and tinned copper drain wire. Cable shall be in conformance with the requirements in TIA 568, "Commercial Building Telecommunication Cabling Standards." Lighting cable shall be plenum rated and white in color. Cable shall be suitable for terminating with an 8P8C modular connector at each termination. Provide 8P8C modular connectors as required.

Lighting Control Devices:

Dimming Switch, Type 1: Dimming switch, Type 1 shall be a low voltage wall mounted raise/lower switches that can control 0 to 10 V(dc) dimmable LED drivers. Switch shall have two 8P8C modular

communication ports. Switch shall be able to communicate with control panels. Power supply for the switch shall be provided inside the control panels. Switch shall have soft click pushbutton control and single channel of control. Switch shall have single on/off, single dimming raise/lower pushbuttons and LED feedbacks. Switch shall be ivory in color and shall be installed in a wall mounted device box with single raised device cover.

Dimming Switch, Type 2: Dimming switch, Type 2 shall be a low voltage wall mounted raise/lower switches that can control 0 to 10 V(dc) dimmable LED drivers. Switch shall have two 8P8C modular communication ports. Switch shall be able to communicate with control panels. Power supply for the switch shall be provided inside the control panels. Switch shall have soft click pushbutton control and 2 channels of control. Switch shall have dual on/off, dual dimming raise/lower pushbuttons and LED feedbacks. Switch shall be ivory in color and shall be installed in a wall mounted device box with single raised device cover.

Wall switch occupancy sensor, Type 1: Wall switch occupancy sensor shall be a line voltage wall-mounted, dual technology (passive infrared and microphonics detection) sensor switch with time delay, integral photocell and two 8P8C modular communication ports. Switch shall be Title 24 compliant and shall be able to communicate with the control panels. The switch shall have one integrated Class 1 relay and 0-10 volts DC dimming output. Load rating shall be 1200 W at 277 volts, operate on 120/277 volts, ivory in color and be installed in a device box with single raised device cover. The switch shall be factory set in fully automatic (auto on/auto off) and capable of manual on/automatic off mode. The switch shall be able to detect motion up to 20 ft and have a field of view of not less than 170 degrees. The switch shall have no leakage to load in the "OFF" mode. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. The switch shall have a green LED indicator. The LED shall blink to indicate a potential wiring issue.

Wall switch occupancy sensor, Type 2: Wall switch occupancy sensor, Type 2 shall be a line voltage wall-mounted, dual technology (passive infrared and microphonics detection) sensor switch with time delay, integral photocell and two 8P8C modular communication ports. Switch shall be Title 24 compliant and shall be able to communicate with the control panels. The switch shall have two integrated Class 1 relays and two 0-10 volts DC dimming outputs. Primary load rating shall be 1200 W at 277 volts. Secondary relay shall be rated 13 amperes at 277 volts. The relays shall be capable of simultaneously controlling 2 different lighting loads or circuits. The second relay shall be independent allowing for two-circuit control. Switch shall operate on 120/277 volts, ivory in color and be installed in a device box with single raised device cover. The switch shall be factory set to automatically turn on load 1 when initial occupancy is detected, while holding load 2 until the pushbutton is pressed. The switch shall be able to detect motion up to 20 ft and have a field of view of not less than 170 degrees. The switch shall have no leakage to load in the "OFF" mode. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. The switch shall have a green LED indicator. The LED shall blink to indicate a potential wiring issue.

Ceiling mounted occupancy sensor, Type 1: Ceiling mounted occupancy sensor, Type 1 shall be a low voltage, dual technology (passive infrared and microphonics detection) sensor switch with 2 internal time delay, an integral photocell and two 8P8C modular communication ports. Switch shall have 2 channels of control. Switch shall be Title 24 compliant and shall be able to communicate with the control panels. Sensor shall be white in color. Power supply for the sensors shall be provided inside the control panels. The switch shall be capable of detecting 12 ft radial coverage when mounted at 9 feet above finished floor. The switch shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled. Switch shall have no leakage in the "OFF" mode. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes

Ceiling mounted occupancy sensor, Type 2: Ceiling mounted occupancy sensor, Type 2 shall be a low voltage, dual technology (passive infrared and microphonics detection) sensor switch with 2 internal time delay, integral photocell and two 8P8C modular communication ports. Switch shall have 2 channels of control. Switch shall be Title 24 compliant and shall be able to communicate with the control panels. Sensor shall be white in color. Power supply for the sensors shall be provided inside the control panels. The switch shall be capable of detecting 28 ft radial coverage when mounted at 9 feet above finished floor. The switch shall have LED indicator that remains active at all times in order to verify detection within the

area to be controlled. Switch shall have no leakage in the "OFF" mode. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes.

Ceiling mounted occupancy sensor, Type 3: Ceiling mounted occupancy sensor, Type 3 shall be a low voltage, dual technology (passive infrared and microphonics detection) sensor switch with time delay, integral photocell and two 8P8C modular communication ports. Switch shall be Title 24 compliant and shall be able to communicate with the control panels. Sensor shall be white in color. Power supply for the sensors shall be provided inside the control panels. The switch shall be capable of detecting 20 ft radial coverage when mounted at 45 feet above finished floor. The switch shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled. Switch shall have no leakage in the "OFF" mode. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes.

Photoelectric Unit, PEU: Photoelectric unit shall be a low voltage, ceiling mounted, combination on/off/dimming photocell unit suitable for daylight harvesting applications. Unit shall be capable of controlling dimming levels of any 0-10 V(dc) dimmable LED driver. Unit shall have two 8P8C modular communication ports. Unit shall have self calibrating set-points. The lights will remain off until the daylight level drops below the set-point. The unit shall have a 10 to 20 % hysteresis to prevent the system from cycling when the light level is very near the set-point. Switch shall be Title 24 compliant and shall be able to communicate with the control panels. Sensor shall be white in color and shall have a green LED indicator. Power supply for the sensors shall be provided inside the control panel. The time delay off setting shall be adjustable from 45 seconds to 25 minutes, initially set at 20 minutes.

Lighting Disconnect, Type 1: Lighting disconnect, Type 1 shall be one single pole specification grade switch rated at 277-volt, 20-ampere, mounted on a cover plate of the junction box.

Lighting Disconnect, Type 2: Lighting disconnect, Type 2 shall be a two single pole specification grade switches rated at 277-volt, 20-ampere, mounted on a cover plate of the junction box.

Digital Timer Switch: Digital timer switch shall be an electronic interval timer switch with a manually operated toggle switch or pushbutton. Switch shall be rated 1200-watt ballast at 120/277 volts. Time adjustments shall range from 5 minutes to 12 hours, initially set at 2 hours. Switch shall have an audible warning that beeps every 5 seconds at one minute prior to time out. Switch shall be ivory in color.

Timer Switch: Timer switch for workbench lights shall be a spring wound mechanical timer with a rotary dial. Contacts shall be rated 20 amperes at 277 volts. Time adjustments shall range from zero to two hours.

Lighting Network Workstation:

Lighting network workstation shall be a premanufactured tower style server with accessories. Workstation shall have all the software needed to run the network lighting control system. In addition the original DVD or CD copy to the of the software and manuals, inclusive of all licenses, shall be handed over to the engineer. The system workstation monitor and printer shall meet or exceed the following minimum requirements:

Processor: 3.00 GHz, minimum, quad core 64-bit processor;
Memory; 4 GB 1333 MHz ECC DDR3;
Hard Drive: 3.5 inch, SATA II, 7200 RPM, 2 TB;
Operating System; Microsoft windows Server 2008, NET 3.0 and 25 user CAL;
Graphics Card: PCI Express 512 MB;
Ethernet Connection: Internal gigabyte;
Modem: V.92 internal;
DVD Drive: 16X DVD ± RW Drive;
PCI Expansion Slots: Minimum six PCI/PCIe slots;
Power Supply: 930 W with hot plug redundant power;
Keyboard mouse: USB port and optical mouse;

Printer: Multifunction Laser with 128 MB memory;
Monitor: 21-inch Widescreen LCD, 5 ms response min 1000:1 contrast;
8-port Ethernet gigabit switch.

Lighting Network Software:

Lighting network software shall be an application that is routinely advertised and supplied for network lighting control system. The software shall be capable of auto-detecting all the downstream lighting control devices and control panels. All the lighting control devices shall be able to communicate their status to the software and be capable of being programmed through commands from the software home screen. A printable network inventory of the entire system shall be available from the software.

Lighting network software shall be capable of defining lighting control profiles which can be applied to the lighting control devices. All relays dimming and switching outputs shall be capable of being controlled through the software. All lighting control profiles shall be stored on the main hub and on the lighting network workstation. Lighting control profiles shall be capable of being scheduled based on occupancy, scheduled timed intervals and/or based on pre set working schedule hours. Software shall provide graphic tool for viewing all the programmed lighting control profiles. A printable report for all the lighting network profiles shall be available for printing.

The lighting network software shall include inbuilt encryption to protect the stored data and shall be accessed using user name and password only with at least three level of permissions. All lighting control devices firmware and software updates shall be available for free download through internet. The software has in-built daylight savings time adjustments and sunrise/sunset schedules based on location information using an internal astronomical clock.

The lighting network software shall monitor following status information for all the lighting control devices, whichever is applicable:

Current occupancy status,
Occupancy time-delay status,
Current photocell footcandle reading,
Current dimming levels,
Current relay switching status,
Manual override status,
Device temperature.

The lighting network software shall provide graphical screens in order to facilitate system energy performance. An energy score card shall be displayed that shows calculated energy savings in dollars and kwhr. Energy saving data shall be calculated for the system as a whole or individual zones. Reporting shall be provided in an Excel file format for all this data.

Power Monitoring Software:

Power monitoring software shall be an application that is routinely advertised and supplied for power monitoring network system. The software shall be compatible with all the power monitoring devices, power monitoring gateway and power monitoring switch that is provided. All power monitoring devices shall be able to communicate their data to the power monitoring software. The software shall be capable of monitoring and managing the lighting system power usage with the user only requiring a browser to access the system.

This system shall allow the user to directly connect to the web enabled equipment and to a software based system designed to aggregate data from multiple devices and provide a system level view of both real time information and advanced power and system analysis.

The software shall provide a real time, web based visualization system to allow the user to easily view the key operational characteristics of the system. The software shall include the following features:

1. The software shall have the ability to view the current value of all operational variables available from a device. The user shall be able to organize and view these attributes in easy to understand groupings for any device with more than 10 variables,
2. The software shall not require specific knowledge of a device to be able to display information from that device. Instead, the software shall have the ability to query the device for its operational capabilities and automatically set up web based pages to display the information, No custom screen development shall be required to display data from any device in the system.
3. The software shall automatically build a navigation tree of all connected devices so the user can easily find a device and display the data for that device.
4. The software shall provide a data warehouse based reporting option that allows the user to analyze long term (years) system performance and operational issues,
5. The reporting system shall support a variety of output formats including, but not limited to; interactive web pages, Excel files, csv files, pdf files, and XML files.
6. The reporting system shall provide, at a minimum the following standard reports:

    6.1 Capacity Summary – analyze actual circuit loading vs. design limits.
    6.2 Energy Summary – analyze energy consumption over time.
    6.3 Energy Cost Allocation – analyze energy costs over time.
    6.4 Power Quality – analyze power quality characteristics over time.
    6.5 Event Summary Report – analyze power event occurrences over time.

Control Panels:

Interior lighting control panels shall be the lighting control panels and the lighting control panel recessed.

Lighting Control Panel, LCP: Lighting control panel shall include 4 normally closed latching relays, printed circuit board, integrated power supply and heavy duty terminal blocks in a surface mounted NEMA Type 1 enclosure. Relays shall be rated to switch up to 30 A load (ballast) at 277 V(ac). Panel shall provide 0-10 V(dc) dimming output paired with each relay. Integrated power supply shall be able to provide power for the network lighting control system backbone and for the lighting control devices. Panel shall be able to communicate with the lighting network panel. Panel shall include four 8P8C modular communication ports. All lighting control devices within a single lighting zone shall be daisy chained using lighting cable or armored lighting cable directly into the lighting control panel. Each lighting control panel shall be capable of controlling up to two local lighting control zones.

Lighting Control Panel Recessed, LCPR: Lighting control panel recessed shall include 4 normally closed latching relays, printed circuit board, integrated power supply, heavy duty terminal blocks and lighting disconnect, type 1 inside a hinged flush-mounted, 20 inch wide NEMA Type 1 enclosure. The enclosure shall have dead front hinged cover, maximum depth of 6 inches and capable of mounting recessed inside a metal stud wall. Relays shall be rated to switch up to 30 A load (ballast) at 277 V(ac). Panel shall provide 0-10 V(dc) dimming output paired with each relay. Integrated power supply shall be able to provide power for the network lighting control system backbone and for the lighting control devices. Panel shall be able to communicate with the lighting network panel. Panel shall include four 8P8C modular communication ports. All lighting control devices within a single lighting zone shall be daisy chained using lighting cable or armored lighting cable directly into the lighting control panel recessed. Each lighting control panel recessed shall be capable of controlling up to two local lighting control zones. Lighting disconnect, Type 1 shall be one single pole specification grade switch rated at 277-volt, 20-ampere, mounted inside the enclosure to disconnect the power to the LCPR.

Building Exterior Lighting Control Panel, BELCP: Building exterior lighting control panel shall consist of 4 latching relays, printed circuit board, integrated power supply digital input/output interface kit and heavy duty terminal blocks in a surface mounted NEMA Type 12 enclosure. Relays shall be rated to switch up to 30 A load (ballast) at 277 V(ac). Panel shall provide 0-10 V(dc) dimming output paired with each relay. Integrated power supply shall be able to provide power for the network lighting control system backbone and for the lighting control devices. Digital input/output interface kit consists of an outdoor type, class 2, low voltage ambient light photoelectric sensor (PES), suitable for communicating with a normally low input interface device to detect the state of photoelectric sensor and communicate it to the building exterior lighting control panel. Panel shall be able to communicate with the lighting network panel and be capable of being controlled by astronomical time clock as part of main hub inside lighting network panel. Panel shall include four 8P8C

modular communication ports. Each building exterior lighting control panel shall be capable of controlling up to two exterior lighting control zones.

Exterior Lighting Control Panel, ELCP: Exterior lighting control panel shall be similar to the building exterior lighting control panel except that the exterior lighting control panel enclosure shall be NEMA Type 3R.

Canopy Lighting Control Panel, CLCP: Canopy lighting control panel shall be similar to the building exterior lighting control panel except that the canopy lighting control panel shall have an additional main hub. The main hub shall be as specified under "Lighting Network Panel," in these special provisions.

Lighting Network Panel, LNP: Lighting network panel shall include hubs and main hub mounted inside a compartment inside the integrated facilities switchboard. Each hub shall have 8 8P8C modular communication ports and operates on 120/277-volt. Each port shall have a green LED indicator. The hub shall be able to communicate with the network lighting control system and provide low voltage power available for the system. The number of hubs in each lighting network panel shall be as shown on the plans. A main hub shall be included inside the lighting network panel only at locations as shown on the plans. Main hub is similar to the hub except the main hub has internal astronomical time clock and only 4 8P8C modular ports. One of the ports is an Ethernet port and assigned an IP address. The other 3 ports are available for connection to any downstream hub. The main hub shall be capable of networking up to 400 lighting control devices.

Terminal Block:

Terminal block shall be 30-ampere, 600-volt, molded plastic with two or more mounting holes and two or more terminals in each cast block. The molded plastic shall have a high resistance to heat, moisture, mechanical shock, and electrical potential and shall have a smooth even finish. Each block shall have a molded marking strip attached with screws. Terminal blocks shall have tubular, high pressure clamp connectors.

Power Monitoring Gateway:

Power monitoring gateway shall be an industrial type router capable of delivering real time, WEB enabled monitoring of the electrical distribution and control equipment. The gateway shall be complete with a compact metal case and shall only required convection cooling. The gateway shall have two levels of authorized access to data via the user interface. One shall be for user level and permits viewing data only. The second one shall be for administrative level and permits configuration and changing settings, in addition to viewing data. The gateway shall be able to communicate to the power monitoring devices via ModBus RTU over TIA-485. The gateway operating temperature ratings shall be from 32 °F to 140 °F. Storage temperature shall be from -40 °F to 185 °F. The power supply input shall be 24 V(dc), ± 10 % with a 0.8 ampere current draw. The gateway shall conform to the following requirements:

Total number of supported devices: 96;
Maximum number of INCOM devices supported: 64;
Number of downstream communication ports: 3;
Number of USB port for configuration: 1;

Power Monitoring Switch:

Power monitoring switch shall be a 6-port industrial type Ethernet switch. Switch shall be capable of simultaneous, full duplex, high-speed communication on all ports. Switch shall require no software or additional hardware for configuration. Switch shall support standard copper 8P8C modular connectors. The unit's ambient temperature ratings shall be from -4 °F to 158 °F. Storage temperature shall be from -40 °F to 185 °F. The power supply input shall be 24 V(dc), ± 10 % with a maximum 7 W power consumption.

Serial Control Cable:

Serial control cable shall be as recommended by the power monitoring devices manufacturer.

Concrete:

Concrete shall be as specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions. The concrete shall be commercial quality Portland cement concrete containing not less than 564 pounds of cement per cubic yard.

FABRICATION

Component Mounting:

No equipment or device shall be mounted on the side or at the bottom of the control panels. A minimum of 6 inches of empty space shall be provided at the bottom of the panel for bundling and terminating field conductors.

All components mounted inside the control panel shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts. Nameplates shall be abbreviation used on the plans. For example PS for power supply.

The following electrical components shall be mounted on the interior back panel of the lighting control panel enclosure:

Terminal Block, TB
Latching relays,
Printed circuit board,
Power supply.

The following electrical components shall be mounted on the interior back panel of the lighting control panel recessed enclosure:

Terminal Block, TB
Latching relays,
Printed circuit board,
Power supply,
Lighting disconnect, Type 1.

The following electrical components shall be mounted on the interior back panel of the building exterior lighting control panel, canopy lighting control panel and exterior lighting control panel enclosure:

Terminal Block, TB
Latching relays,
Printed circuit board,
Power supply,
Digital Input/Output interface,
Main hub (Canopy lighting control panel only).

The photoelectric sensor, (PES), shall be mounted on the building exterior wall and on the exterior lighting control panel as shown on the plans.

The following electrical components shall be mounted on the interior back panel of the lighting network panel enclosure inside the integrated facilities switchboard:

Hubs,
Main Hubs.

Component Wiring:

The control panels shall be factory prewired in conformance with NEMA Class IIC wiring. All wires entering the enclosure shall terminate on terminal blocks. Power distribution type terminal blocks shall be installed as required for distributing power to various power devices. Dimming wiring shall be 7 strand

No. 14 MTW. Low voltage cables shall be physically separated from the un-grounded hot conductors using full height barriers inside the control panels.

The control panels shall be wired using colored insulation conductors for general wiring as specified elsewhere in these specifications and gray colored insulation conductors for neutrals of 277 V system. Use of gray colored insulation conductors for wiring un-grounded conductor is prohibited.

Wires and lighting cables shall be neatly trained and bundled, and wiring troughs shall be provided in the enclosure as necessary. Wiring shall be arranged so that any piece of apparatus may be removed without disconnecting any wires except the leads to that piece of apparatus.

A wiring diagram and relays switching and dimming sequence encased between 2 heat fused laminated plastic sheets shall be provided with brass mounting eyelets attached to the inside of the control stations.

Communication ports and dimming outputs inside the control panels shall be identified using device labels by the associated room number. For example, communication ports in LCP125 for room 125 shall be identified with 125.

PART 3 - EXECUTION

Lighting Fixtures:

Lighting fixtures shall be mounted securely in accordance with the manufacturer's recommendations. Mounting methods shall be suitable for the particular type of ceiling or support at each location.

The Contractor shall provide all supports, hangers, spacers, channels, fasteners and other hardware necessary to support the fixtures. Pendant mounted fixtures shall be securely supported with at least two wires to the building framing in addition to the standard mounting methods for seismic safety.

Fixtures shall be set at the mounting heights shown on the plans, except heights shown shall be adjusted to meet conditions.

Pole Mounted Luminaires:

In the cast iron embedded junction box in the raised foundation for luminaire, fused splice connector shall be installed in each ungrounded conductor between the line and the LED driver. The connector shall be readily accessible in the junction box and shall be insulated and made waterproof in accordance with the splice connector manufacturer's recommendations.

Concrete foundations shall be as shown on the plans. Anchor bolts or devices shall be accurately located and positioned to match the holes in the pole base plates. Pole and luminaire orientation shall be as indicated on the plans.

The poles for pole mounted type fixtures shall be mounted rigidly and securely on the foundations as recommended by the fixture and pole manufacturer.

Lighting Cable:

All lighting cables shall be installed and tested in conformance with manufacturer's recommendations and the following:

All lighting cables shall be extended continuous and unspliced between the lighting control devices, control panels and lighting network panels. Both ends of the cable shall be terminated using the 8P8C modular connectors for making terminations at the lighting control devices, control panels and lighting network panels.

Exposed armored lighting control cables shall be installed parallel and at right angles to the building lines. Cable runs shall be securely supported every 3 feet with open metal drive rings. Cable runs on walls in damp or wet locations shall be securely supported every 3 feet with open metal drive rings

with backboards to space cable off the wet surfaces. Horizontal cables runs on the walls shall not be made lower than the mounting heights of light fixture in rooms with exposed ceilings, as shown on the plans.

Lighting cables shall not be placed closer than 12 inches from a parallel hot water or steam pipe or 3 inches from such lines crossing perpendicular to the runs.

All lighting cables shall be secured to the building structures using specified fasteners, clamps and hangers.

Lighting control cables installed in spaces above suspended ceilings tiles shall be securely fastened using appropriate fasteners and shall not be permitted to be run on top of suspended ceiling tiles.

Lighting control cable runs above ceiling spaces shall be bundled together using fire rated tie wraps as required. Plastic tie wraps shall not be used.

Lighting cable terminations at control panel enclosures and lighting control device boxes shall be made using the approved cable grip connector fittings.

Provide plastic sleeves through full height walls to route lighting cables. All penetrations through full height walls shall be airtight.

Provide approved smoke and fire stop fitting through fire walls to route lighting control cables.

All vertical lighting cable runs to various wall mounted lighting devices shall be installed using conduits up to height of 12 feet in spaces with open ceilings and up to attic space in spaces with closed ceiling systems. Provide conduit bushings at conduit terminations.

Lighting Cable Identification: All lighting control cable runs between lighting control devices within a single lighting zone shall be identified with the associated room number at each terminations. All lighting cables homeruns between control panels and lighting network panels shall be identified at both ends of the cable. Each cable identifier shall be placed at an easily accessible location somewhere between 6 to 12 inches from each end of the cable. At minimum the cable identifier shall include the following information:

1. Control panel number where the cable originated from
2. LNP where the cable is terminated at
3. Hub inside the LNP
4. Hub port number

For example, cable identification for Gear Room 125 from the LCP125 to LNP-1A and terminated on hub HAA port 6 inside LNP-1A shall be identified as 125-1A-HAA-6.

Identification shall be made with one of the following:

Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.

Pre-printed, white, heat-shrinkable tubing.

Lighting Control Devices: Wall mounted lighting control devices shall be mounted at height of 3'-4" from the finished floor at locations shown on the plans. Ceiling mounted lighting control devices shall be mounted securely in accordance with the manufacturer's recommendations. Mounting methods shall be suitable for the particular type of ceiling or support at each location. Contractor shall provide all supports, hangers, spacers, channels, fasteners and all other necessary hardware to support the devices. Final location of the devices shall be per manufacturer's recommendations to provide best coverage for the application. Ceiling mounted devices in rooms with open ceiling shall be pendant mounted at fixture heights in those rooms. Ceiling mounted lighting control devices in rooms with the bridge crane shall not installed within the bridge crane's motion envelope.

Lighting Disconnect Switches: Lighting disconnect switches shall be mounted as shown on the plans.

Control Panels:

Unless otherwise noted on the plans, the lighting control panels shall be surface mounted at the locations as shown on plans.

Lighting control panel recessed shall be mounted flush with the wall at the locations as shown on plans.

Building exterior lighting control panels and canopy lighting control panel shall be surface mounted at the locations as shown on plans.

Exterior lighting control panel shall be mounted at the locations as shown on plans.

Lighting network panels shall be mounted inside the integrated facilities switchboards as shown on plans behind operable compartment doors.

Control panels and lighting network panels shall be identified with nameplates. Inscriptions for control panels shall include control panel identification as shown on the plans and shall read in the following example:

LIGHTING CONTROL PANEL
LCP-125

Hubs and main hubs shall be securely fastened to the back mounting panel inside the lighting network panels. Hubs and main hubs cab ne stacked vertically by using appropriated mounting methods. Lighting cables shall be neatly trained and bundled. Wiring troughs shall be provided in the enclosure.

Network Lighting Control System

The Contractor shall provide the services of a network lighting control system manufacturer's representative for a complete system startup, commissioning and network lighting software programming. The manufacturer representative shall be factory-trained and shall have a thorough knowledge of the software, hardware, and system programming. The manufacturer representative shall coordinate with the engineer to perform the following tasks:

Program the lighting profiles, user logins and access passwords into the network lighting software;

Program the switching relays and dimming outputs within the control panels;

Program the network lighting control system device tree;

Troubleshoot any communication issues between the lighting control devices and lighting network devices;

Program the lighting control devices set point and parameters;

Establishing communication link between the main hubs and Ethernet LAN or WAN;

Generate reports for lighting system events and performances data, and.

Develop graphical screens for energy usage and monitoring..

Power Monitoring System

The Contractor shall provide the services of a power monitoring system manufacturer's representative for a complete system startup, commissioning and power monitoring software programming. The manufacturer representative shall be factory-trained and shall have a thorough knowledge of the software, hardware, and

system programming. The manufacturer representative shall coordinate with the engineer to perform the following tasks:

Configure and load the power monitoring software on the lighting network workstation,;

Program the power monitoring type 1, 2 & 3 network addresses, power monitoring gateway, power monitoring switch;

Troubleshoot any communication issues between the power monitoring devices and gateway and switch;

Program the power monitoring software as specified;

Generate reports for power monitoring, and;

Develop graphical screens for energy usage and monitoring.

TESTING

Network Lighting Control System: The operational test for the network lighting control system shall be performed by the network lighting control system manufacturer's representative in the presence of the Engineer. Duration of the operational test shall be for at least 1 week period under real conditions at the site. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests. The Network Lighting Control System manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer recommendation.

Power Monitoring System: Test and operate the workstation and power monitoring software for at least 24 hour period under real conditions at the site. The operational test for the power monitoring software and devices shall be performed by the Power Monitoring System manufacturer's representative in the presence of the Engineer. Duration for the operational test shall be for at least 24 hour period under real conditions at the site. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests. The power monitoring system manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer recommendation.

SUPPORT

Network Lighting Control System:

The Contractor shall provide support services for network lighting control system of the facility for 1 year after the final acceptance of the contract. The services shall include a toll free telephone line connecting to a technical help desk for the network lighting control system manufacturer. Technical help desk shall provide over the phone support for troubleshooting any aspect of the network lighting control system free of cost to the State.

The support service for the network lighting control system shall include a 1 year service contract to maintain the software and all hardware system devices. The contract shall include a minimum of two site visits by the network lighting control system manufacturer's representative to perform system maintenance. The system maintenance shall include at minimum installation of software patches and upgrades to the system operating system, database maintenance and archiving of data, lighting profiles modifications, lighting control devices firmware upgrades and generating reports from the archived data.

Support services for the network lighting system after the first year will be handled by the State.

Power Monitoring System:

The Contractor shall provide support services for power monitoring system of the facility for 1 year after the final acceptance of the contract. The services shall include a toll free telephone line connecting to a technical help desk for the power monitoring system manufacturer. Technical help desk shall provide over the phone support for troubleshooting any aspect of the power monitoring system free of cost to the State.

The support service for the power monitoring shall include a 1 year service contract to maintain the software and all hardware system devices. The contract shall include a minimum of two site visits by the power monitoring system manufacturer's representative to perform system maintenance. The system maintenance shall include at minimum installation of software patches and upgrades to the system operating system, database maintenance and archiving of data, devices firmware upgrades and generating reports from the archived data.

Support services for the power monitoring system after the first year will be handled by the State.

DEMONSTRATION

Training: The Contractor shall provide four hours of on-site training on the use, operation, and, maintenance of each system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class. The training for the complete network lighting control system shall be performed by the network lighting control system manufacturer's representative. The training for the power monitoring system shall be performed by the power monitoring system manufacturer's representatives for their respective systems

Follow-up Training: Within 6 months of the operational tests, the Contractor shall provide an additional four hours on-site follow-up training for the use, operation and maintenance of the system for not more than 8 designated State employees. Exact date of the follow-up training shall be as directed by the Engineer.

WARRANTY

The manufacturer shall provide for all the light emitting diode luminaires a written warranty for the performance of the luminaires and against defects in materials and workmanship for the luminaires for 60 months after acceptance of the luminaires. Replacement luminaires must be provided promptly after receipt of failed luminaires at manufacturer expense. The State pays for shipping the failed luminaires to the manufacturer.

All network lighting control system components shall have a 5 year manufacturer warranty.

12-16.08 STANDBY GENERATOR

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing a standby generator in accordance with the details shown on the plans and these special provisions.

The standby generator shall be a factory assembled standby generator assembly and shall include other miscellaneous accessories, not mentioned, which are required for the complete installation and proper operation of the standby generator.

The standby generator assembly shall be supplied with warning sign, battery hydrometer with storage container, battery filler, distilled water, anchoring devices and vibration isolators that are required for the complete installation.

Attention is directed to "Service and Distribution" in these special provisions regarding the automatic transfer switch connected to the standby generator.

PERMIT REQUIREMENTS

The Contractor shall make all arrangements and obtain all permits and licenses required for the operation of the standby generator applicable to this project.

Generator exhaust shall conform to the rules for control of emissions adopted by the air quality control district in the air basin in which the standby generator is installed.

Full compensation project for any costs incurred by the Contractor to obtain the permits and licenses shall be considered as included in the contract lump sum price paid for building work, and no additional compensation will be allowed therefore.

SUBMITTAL

Product Data:

A list of all materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval. Manufacturer's descriptive data shall include catalog cuts, complete description, performance data and installation instructions.

Working Drawings:

Working drawings shall be submitted for approval. Working drawings shall show the shape, size, and method of attachment for each component used in the work. Control and wiring diagrams shall include rough-in dimensions, component layout, and conductor number identification.

Closeout Submittals:

Prior to the completion of the contract, one CD with PDF files and 2 identified copies of the operation and maintenance instructions with parts lists shall be delivered to the engineer at the jobsite. The instructions and parts list shall be in a bound manual form and shall be complete and adequate for all equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals and CDs at no additional expense to the State.

Quality Assurance:

The control panel and its components shall conform with the requirements in applicable NEMA ICS 1 standards.

PART 2 – PRODUCTS

Standby-Generator Assembly:

The standby generator assembly shall consist of a skid mounted, bio-diesel 5 fueled engine, generator, starting batteries, standby generator control panel, battery charger, weatherproof protective housing, top mounted exhaust system with silencer, base mounted diesel fuel tank, drip pan, warning sign, engine water jacket heater, fuel regulator vaporizer, generator disconnect, anchorage devices, and vibration isolators.

Engine:

The engine shall be 4-cycle, bio-diesel 5 fuel type, turbocharged, air-cooled type with not less than 824 cubic inches of piston displacement, liquid cooled, and designed for continuous operation. The engine shall deliver a minimum of 755 horsepower at 1800 RPM.

The engine's continuous duty rated output shall be ample to drive the generator and connected normal accessories at the rated speed and unity power factor at 100 percent of the rated load with an ambient temperature of 104°F at 2900 feet above sea level. The engine shall be cooled with a unit mounted radiator, fan with fan guard, water pump, and closed coolant recovery system providing visual diagnostic

means to determine if the system is operating with a normal engine coolant level. The intake air filter(s) with replaceable element must be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have replaceable oil filter(s) with internal bypass and replaceable element(s). Engine coolant and oil drain extensions, equipped with pipe plugs, must be provided outside the mounting base. The engine shall have a unit mounted, thermostatically controlled water jacket heater to aid in quick starting. The engine shall have sensing elements for low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, overspeed shutdown and overcrank shutdown.

The engine shall operate satisfactorily on commercial grade bio-diesel 5 fuel. The exposed surfaces of the engine shall be factory finished with one coat of primer and 2 coats of an industrial paint suitable for the intended use.

The engine shall be equipped with the following accessories:

Bio-diesel 5 Fuel Filter System: The bio-diesel 5 fuel filter system shall consist of a primary fuel filter capable of removing particles of 10 microns and larger, and a secondary filter capable of removing particles of 2microns and larger and with 98% efficiency. Each filter shall be a spin-on, replaceable unit, designed for bio-diesel 5 fuel filtration and water separation. Filters shall be located for easy service access.

Oil Filter System: The pressurized lubricating oil system shall have a full flow filter system, consisting of a strainer with openings not to exceed 0.025 inch in greatest dimension, and a separate, cleanable or replaceable filter capable of removing particles with a diameter of 25 microns and larger.

Air Filter System: The air intake shall be provided with a dry type air filter of adequate capacity to effectively remove dirt and abrasives from the combustion air. The air filter shall be dry type and 95% efficient and shall be designed to allow for easy removal and replacement of filter element. The filter shall be equipped with service indicators to indicate necessary replacement.

Engine Governor: Engine speed shall be controlled by an electronic type governor providing a 0.25 percent speed regulation from no load to full load and provide +/-0.25 percent steady state frequency regulation.

Engine Cooling: The engine shall be equipped with an engine driven radiator cooling system. The radiator shall be capable of cooling the engine while operating at 100 percent rated continuous load in 104°F maximum ambient temperature. Fan shall be push type.

Engine Jacket Heater: The engine shall be equipped with a 208-volt, 3000-watt engine jacket heater supplied and preinstalled by the standby generator manufacturer. The heater shall be thermostatically controlled to maintain engine coolant at the proper temperature to meet the requirement of NFPA 99 standard. The required electrical wiring shall be factory installed. The thermostat shall be adjustable between 85°F and 130°F. The controls shall turn off the preheater during start-up and normal engine operation. The wiring shall be factory installed.

Engine Starter: The engine shall be provided with a 24-volt heavy duty positive engagement solenoid shift motor.

Safety Controls:

The engine shall be provided with automatic controls that shut down engine operation when low lubricating oil pressure, high water temperature or overspeed conditions occur. The values at which the low lubricating oil pressure, high water temperature and overspeed controls operate to shut down engine operation, shall be as recommended by the engine manufacturer.

Upon failure of primary power, the engine shall automatically crank for 20 seconds or until it starts, whichever is shorter. If the engine fails to start within 20 seconds, further attempts to start shall be prevented by a manually reset lockout device. Overcranking fault condition shall be indicated by a pilot light on the control panel.

Exhaust System:

The exhaust system shall consist of a silencer and flexible connection.

The silencer shall be a critical type, sized to meet or exceed the engine requirements. The silencer shall be provided with a drain, flange connection and companion flanges.

The flexible connection shall be bellows type, not less than 12 inches in length and installed between the engine exhaust and the Schedule 40 galvanized steel exhaust pipe. The flexible connection shall be constructed of Type 321 stainless steel and shall be provided with flanged ends for connection to the engine and galvanized steel exhaust pipe.

Bio-diesel Fuel Tank: The engine shall be equipped with a double wall bio-diesel fuel tank of 60-gallon capacity. The fuel tank shall be base mounted, and shall be complete with fuel level indicator, flexible fuel lines, vent, and fill devices. In addition, fuel tank shall be factory equipped with mechanical type, non-metallic, float mechanism with externally operated electrical switch to control the biodiesel fuel dispenser. The contact rating shall be rated 10-ampere at 120 volt, AC. The float switch shall be factory set to keep the biodiesel fuel tank level between 35-50 gallons.

Starting Batteries: Storage batteries for engine starting and other requirements shall be heavy duty, lead-acid type. Total minimum battery capacity shall be 1250 cold cranking amperes below 32ºF. Batteries shall be mounted in corrosion resistant battery racks located within the skid base and shall be provided with battery cables of sufficient length to connect to the DC apparatus.

Generator:

The generator shall be a brushless type, single bearing, self-aligning, standby duty, synchronous type, with a drip-proof enclosure. The insulation shall be NEMA Class H or better.

The generator shall be rated at 500 kW, 625 kVA, 0.8 power factor, 277/480 volts, 3-phase, 4-wire, 60 Hz, and 1800 RPM. The generator shall have the following capabilities:

1. Steady state voltage regulation at full rated load shall be within plus or minus one percent.
2. Voltage regulation shall be within plus or minus 2 percent of rated steady state voltage from no load to full load.
3. Voltage recovery shall be within 2 percent of nominal rated voltage within 5 seconds, after the rated load is applied or removed in one-step.

Standby Generator Control Panel:

A completely wired and assembled standby generator control panel shall be mounted on the engine-generator unit. The panel and its components shall comply with NEMA ICS 1, "Industrial Controls and Systems." and shall be fully enclosed and vibration isolated. The controller shall supports remote communication thru a PC via network or modem configuration and shall supports Modbus protocol. The panel shall include the following switches and instruments exposed on the front of the control panel:

1. AC ammeter.
2. AC voltmeter.
3. Three-position combination ammeter-voltmeter-phase selector switch.
4. Frequency meter.
5. Manual reset generator exciter circuit breaker with thermal magnetic trips.
6. Battery charger DC ammeter
7. Manual "START-STOP" switch.
8. Indicating lights to show cause of emergency shutdown.
9. Emergency "STOP" switch.
10. Voltage adjust rheostat.
11. Engine oil pressure gage.
12. Engine running time meter.

13. Engine water temperature gage.
14. One SPDT contact for remote monitoring of all standby generator failures.
15. One SPDT contact for remote monitoring standby generator running status.
16. One SPDT low-level fuel contact for remote monitoring.

Equipment mounted in the control panel shall be arranged for easy service access. Equipment or devices to be mounted within the standby generator control panel shall include the following:

1. Hydrocarbon leak detection control panel with two input channels, two indicating lights for indicating fuel leak, and acknowledge pushbutton to reset indicating lights. The indicating lights shall be marked with identification tag as fuel tank and transition sump respectively.
2. Automatic voltage regulator.
3. Automatic starting controls.
4. Radio interference suppression
5. Transformers, relays and other equipment required for proper operation.
6. One SPDT low level fuel contact for remote monitoring.
7. One SPDT contact for remote monitoring of standby generator failures.
8. One SPDT contact for remote monitoring of standby generator running status.

Battery Charger:

The battery charger shall be of the three stage type rated for 120 –volt input and mounted inside the standby generator housing. The battery charger shall be provided with the following features:

1. Dual fusing for AC input and DC output.
2. Automatic DC voltage Regulation.
3. Automatic Load Regulation.
4. DC cranking circuit disconnect relay.
5. DC ammeter.
6. DC voltmeter.

Hydrocarbon Leak Detection sensors: Hydrocarbon leak detection sensor shall be suitable for integrating with leak detection control panel and detecting hydrocarbon leak inside the double wall of the biodiesel fuel tank as well as fuel line transition sump

Protective Housing: The protective housing shall be the manufacturer's weather enclosure with sound insulation. Protective housing shall have hinged and lockable side and end panels. The standby generator control panel shall be visible through one core end. The panels shall have louvers for proper airflow and intake and exhaust cooling. The standby generator shall be able to operate at rated load and temperature with the panels in place. The protective housing shall be 14-gage sheet steel. The enclosure shall be coated with electrostatically applied powder paint, baked and finished to manufacturer's specifications. Powder coat shall be selected from the manufacturer's standard color palette by the Engineer. The protective housing shall include a silencer mounting kit and a skid-end end cap.

Miscellaneous Accessories:

The standby-generator shall be provided with a drip pan, air exhaust ductwork, generator main power disconnect, warning sign, battery hydrometer with storage container, battery filler, distilled water, anchoring devices and vibration isolators

A drip pan fabricated of not less than 20-gage galvanized sheet steel with turned up edges rolled over wire, sized to catch all oil or grease which may drop from the engine, shall be provided under the engine-generator set.

A galvanized sheet metal duct shall be fabricated and installed between the radiator and the exhaust louvers. This radiator cooling air exhaust duct shall be installed with vibration isolators.

The generator main power disconnect shall be 600-volt, 3-pole, 800-ampere trip molded case, thermal-magnetic, circuit breaker and shall be mounted in a NEMA Type 1 enclosure on the side of the generator

housing. The adjustable magnetic trip shall be set for 4000 amperes. The interrupting capacity of the circuit breaker shall be 65,000 amperes at 480 volts AC.

A warning sign shall be mounted at a location on the standby generator set approved by the Engineer. The sign shall be sheet aluminum, not less than 18-gage with a baked enamel coating with rounded corner. Sign covering shall be engineer grade reflective sheeting. The sign shall have a red background and white upper case letters not less than 2 inches in height. The sign inscription shall read as follows:

DANGER
AUTOMATIC
MAY START AT ANY TIME

A commercial quality battery hydrometer with plastic type storage container, and a commercial quality one-gallon battery filler with filler hose and one gallon of distilled water, shall be furnished and installed adjacent to the battery location. The body of the battery filler shall be clearly marked "DISTILLED WATER" in letters not less than ½ inch in height.

PART 3 – EXECUTION

The leak detection sensors such as for the fuel tank and for the transition sump shall be installed and wired to the control panel. In addition, leak detection sensors shall be field tested for proper functioning by simulating hydrocarbon leak.

The standby generator assembly shall be mounted on a steel channel skid base with vibration isolators. Anchoring devices shall be as recommended by the standby generator manufacturer and shall be installed to fasten the standby generator securely to the concrete slab.

Vibration isolators shall be installed between the engine base and the concrete slab. The type and size of the isolators shall be as recommended by the standby generator manufacturer.

The warning sign shall be mounted on the standby generator in a location facing direction of foot traffic isolators shall be installed between the engine base and the concrete slab.

FABRICATION

The standby generator shall be factory assembled and tested prior to shipment.

TESTING

The standby generator system, including transfer switch, shall be tested at completion of installation and adjustments.

All necessary materials, test equipment and recording instruments, and labor required for the tests shall be furnished. The Contractor shall notify the Engineer not less than 5 working days in advance of testing. Testing shall be performed in the presence of the Engineer.

The standby generator shall be tested for compliance with the conditions shown on the plans and the requirements specified in these special provisions.

Tests shall utilize a resistive load bank supplied by the Contractor. All transient requirements shall be demonstrated by means of recording instruments. All engine safety shutdown devices shall be demonstrated.

A battery and starter test shall consist of 30 seconds of continuous cold cranking without engine start, followed immediately by a normal engine start without excessive starter laboring.

A 4-hour heat run shall be conducted at the specified rated voltage. The test result shall included the output voltage, amperage and voltage dip. The test shall comply with the following table:

4-HOUR CONTINUOUS TEST	
TIME	LOAD CAPACITY (% of rated Load)
1 to 30 minutes	25
31 to 60 minutes	50
61 to 90 minutes	75
91 to 240 minutes	100

DEMONSTRATION

The Contractor shall provide four hours of on-site training on the use, operation, and maintenance of the standby generator for not more than 8 designated State employees.

Training shall include hands-on training and giving course participants actual trouble-shooting and maintenance experience.

12-16.09 COMMUNICATION SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a complete and operational communication system in accordance with the details shown on the plans and these special provisions.

Related Work:

Basic materials, including cable identification and anchorage devices, shall be as specified under "Basic Materials and Methods," in Section 12-16 "Electrical," of these special provisions.

Nameplates and device plates shall be as specified in "Electrical Equipment" in Section 12-16, "Electrical," of these special provisions.

SYSTEM DESCRIPTION

The communication system shall include a voice system and data system and a radio communication system as shown on the plans and specified in these special provisions. The system shall include unshielded twisted pairs cable and terminations as shown on the plans and specified herein.

The systems shall include all materials, whether mentioned or not, but are necessary for the complete, operational and tested communication system.

SUBMITTALS

Product Data:

A list of all materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include catalog cuts with exact parts number (number of ports, type of cable, mounting methods and accessories) clearly identified, complete description, performance data and installation instructions for the materials and equipment specified herein.

Working Drawings:

Working drawings shall be submitted for approval. Working drawings shall include building floor plan with component layout and wiring layout, including conduit size and wire sizes. Working drawings shall show the shape, size, and method of attachment for each component used in the work.

Submit control and wiring diagrams that shall include rough-in dimensions, component layout and wire number identification.

Submit communication cable run sheets showing cross-connections between 66 blocks, patch panels all the way to each individual communication and radio outlets

QUALITY ASSURANCE

The sub-contractor or installer selected to provide the installation of the communication system shall be certified by the manufacturing company in all aspects of design, installation and testing products described herein and shall have a minimum of 5 years experience on similar structured cabling systems (SCS). Sub-contractor or installer shall possess a valid C-10 or C-7, "General Communications Cabling License," issued by the State of California, Department of Consumers Affairs, Sate Contractor's License Board. Evidence of the license is required as part of the submittal.

The subcontractor or installer selected must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize authorized manufacturer components.

CLOSEOUT SUBMITTAL

Closeout documents shall be furnished for the following equipment prior to completion of the project:

1. Communication Cables
2. 66 Blocks
3. Patch Panels
4. Communication Rack
5. Fiber Optic Cables
6. Uninterruptible Power Supply
7. Approved working drawings with as-built changes

Each closeout document shall contain the following information:

1. Parts list.
2. Operating instructions.
3. Maintenance instructions.
4. Wiring schematics.

Three copies of each closeout document shall be submitted in the following manner:

1. One CD with PDF files.
2. Two individual 3-ring binders containing paper copies.

Incomplete or inadequate documentation shall be returned to the Contractor for correction and resubmittal. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

PART 2 - PRODUCTS

COMMUNICATION CABLES

Data Cable, Voice Cable and Radio Cable:

Data cable, voice cable and radio cable shall be Category 6, 4 pair, 24-AWG, UTP cable with maximum outer jacket diameter of 0.22 inch. Cable shall be in conformance with the requirements in ANSI/TIA-568, "Commercial Building Telecommunication Cabling Standards." Data cable shall be colored blue. Voice cable shall be colored white or ivory. Radio cable shall be colored red. Data cable, voice cable and radio cable shall be as shown on the plans.

Speaker Cable and 50/100/200 Pair Cable:

Speaker cable shall be 2#18 AWG, tinned copper conductor type cable with PVC insulation and outer jacket.

The 50/100/200 pair cable shall be as shown on the plans.

Fiber Optic Cable:

Fiber optic cable shall be similar to the fiber optic cables as specified under "Closed Circuit Television System" in these special provisions. Number of strands for fiber optic cables shall be as shown on the plans. Single mode fiber optic cable shall be as shown on the plans.

Shielded-Twisted Pair Cable (50-Pair and 24-pair):

Shielded-twisted pair cable shall be 50 pairs or 24 pairs as shown on the plans.

PATCH CORDS

Patch Cords: Patch cords shall be as shown on the plans.

COMMUNICATION RACKS, CABLE MANAGERS AND 66 BLOCKS

Communication racks, cable managers, 66 Blocks and required accessories shall be as shown on the plans.

CABLE LADDERS AND WIRE MESH CABLE TRAY SYSTEM

Cable ladders, wire mesh cable tray system and required accessories shall be as shown on the plans.

FIBER PATCH PANELS, VOICE PATCH PANELS, DATA PATCH PANELS, AND UNSHIELDED TWISTED PAIR (UTP) PATCH PANELS

Fiber patch panels, voice patch panels, data patch panels, unshielded twisted pair (UTP) patch panels and required accessories shall be as shown on the plans.

COMMUNICATION OUTLET

Communication outlet box shall be 4-inch square box with faceplate. Boxes on stud walls shall have raised device covers.

Faceplate shall be stainless steel and shall accommodate modular type communication outlet jacks and include tear-resistant icons showing computer icon for data jacks and telephone icon for voice jacks.

COMMUNICATION JACK

Communication jacks shall be for voice, data or radio as shown on the plans. Communication jacks shall be modular 8P8C modular , for Category 6, 4 pair UTP cable and shall snap into Category 6 faceplates or termination boxes. Communication jack shall be UL approved. Configurations shall be as follows:

1. Voice outlets shall have two 8P8C modular jacks installed in the faceplate.
2. Data outlets shall have two 8P8C modular jacks installed in the faceplate.
3. Voice and data outlets shall have four 8P8C modular jacks installed in the faceplate. The upper 2 communication jacks shall be for voice and the lower 2 communication jacks shall be for data.
4. Radio outlets shall have two 8P8C modular jacks installed in the faceplate.

UNINTERRUPTIBLE POWER SUPPLY AND BATTERY STORAGE CABINET

Uninterruptible power supply (UPS) and battery storage cabinet shall contain UPS unit, input and output isolation circuit breakers, maintenance bypass transfer switch, and any other electrical/electronic equipment that is required but has not been mentioned herein. UPS input and output isolation circuit breakers shall be sized as shown on the plans. The circuit breaker shall be panel mounted type circuit breakers. Both circuit breakers operating handle shall be tied together so that both breakers shall be either in the ON or OFF position simultaneously. A legend plate with a legend ON and OFF shall be provided with the breakers operating handle. The unit shall be provided with a multifunction control console complete with LED status display with the following indicators: on line, on battery, replace battery and overload conditions. The unit shall also provided with audible alarms for the following conditions: battery on, low battery and overload condition. The UPS battery storage cabinet shall contain the storage batteries. The UPS battery cabinet shall have steel shelves for storing the UPS batteries. UPS batteries shall be valve regulated sealed lead acid and maintenance free type batteries. The UPS and battery storage cabinet shall meet or exceed the following specifications:

Design and Performance Specification	
Input voltage	120/208 V(ac)/ 60 Hz/3-phase, 4-wire plus ground
Input current distortion	4 % maximum at full load
Output voltage	120/208 V(ac)/ 60 Hz/3-phase, 4-wire plus ground
Output voltage regulation	+/- 1 %
Power rating	30 kVA / 24 kW
Battery time	9 minutes
Transfer time	8 milliseconds
Output total harmonic distortion (THD) at nominal voltage	1 % (maximum) for linear loads, less than 4 % for nonlinear loads
Total recharge time	3 hours (maximum)
Standards	Listed under UL 1778
Regulatory approvals	FCC Part 15, Class A UL 1778
Operating temperature	32° to 104°F,
Relative humidity	0-95 % non-condensing

MISCELLANEOUS MATERIALS

Communication Panel: Communication panel shall be a surface mounted NEMA Type 1 enclosure with a hinged door and shall be 24 inches wide by 24 inches high by 6 inches deep. Communication panel shall have flush lock on the door trim and with wooden backboard.

Speaker outlet box: Speaker outlet box shall be square baffle steel box suitable for the speaker that is provided. Speaker outlet box shall be provided with speaker mounting studs for attaching the speakers. Speaker outlet box shall be undercoated to prevent resonance.

PART 3 - EXECUTION

INSTALLATION

Communication Cables:

All communication cables shall be installed and tested in conformance with manufacturer's recommendations.

Data, voice and radio cables shall be extended continuous and unspliced between the associated patch panels and 66 blocks and communication jack. Cables shall be terminated on the 8P8C modular jacks provided in each outlet. Unless otherwise noted, each "data and voice" outlet shall have 4 runs with no splices. Cable 1 and 2 shall go to position 1 in the faceplate and shall be white and designated as "VOICE" cables. Cable 3 and 4 shall be blue and designated as "DATA" cables. Radio outlet shall have 2 runs with no splices. Radio cable shall be red.

Cable Identification: All cables at terminations shall be identified at all locations. All cables shall be terminated in alphanumeric sequence at all terminations. Identification shall be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Pre-printed, white, heat-shrinkable tubing.

The system shall be installed at locations as shown on the plans and by methods recommended by the manufacturer.

The Contractor shall provide all supports, fasteners and other hardware necessary to support the units.

TESTING

The operational test for the communication system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. All the copper communication cables shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. Telephone and data horizontal wiring pairs shall be tested from the communication outlet to the punchdown blocks and modular patch panels.

Category 6 cables shall be tested for conformance to the specifications of ANSI/TIA 568 Category 6. Fiber optic cables shall be tested as specified under "Closed Circuit Television System" in these special provisions.

Testing shall be done with TIA TSB-67 Level 2 test set. Test shall include length, mutual capacitance, characteristic impedance, attenuation, and near end and far end cross talk. Any cables not meeting the requirements of the standard shall be replaced by the Contractor at the Contractor's expense. Complete end to end test results must be submitted to the Engineer.

The UPS shall be shall be tested at completion of installation and adjustments. After the UPS system has been installed and the load connected, a qualified factory technician shall check the installations and perform initial on-site tests for compliance with the conditions specified in these special provisions.

All necessary materials, test equipment and recording instruments, and labor required for the UPS tests shall be furnished. During the UPS tests, all transient requirements shall be demonstrated by means of recording instruments. The Contractor shall notify the Engineer not less than 5 working days in advance of testing. Testing shall be performed in the presence of the Engineer.

The UPS system shall be tested at 100 percent of the UPS capacity utilizing a linear load bank with the utility power input being disconnected at the start of the test and no other input power to the UPS. The UPS shall automatically switch to the battery back-up without affecting loads and be able to maintain proper output voltage and frequency during the next 5 minutes. During the test, the following UPS conditions shall be indicated: Load on Ups and UPS alarm conditions.

The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing these operational tests.

12-16.10 FIRE ALARM AND DETECTION SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a complete and operational fire alarm and detection system in accordance with the details shown of the plans and these special provisions.

The system shall include all materials, whether mentioned or not, but are necessary for the complete and operational fire alarm and detection system.

SYSTEM DESCRIPTION

Design Requirements:

The fire alarm and detection system shall be a low voltage, direct current, zoned, closed circuit, electrically supervised, signaling line circuits and Class A addressable fire alarm and detection system. The system shall consist of fire alarm control panel, manual pull stations, smoke detectors, duct smoke detectors, heat detectors, end-of-line resistors, audio-visual devices, annunciator, multivoltage relay modules, addressable relay modules, fan relays control panel and all other necessary appurtenances.

Each addressable initiating device will annunciate its own unique identification number or "address" to the fire alarm control panel. When an individual device is activated in a specific zone, the fire alarm control panel shall communicate with the fan relay control panels and with addressable relay module to shut off all the heating, ventilating, air conditioning, exhaust and supply systems within that zone. The voltage rating and ampere rating of the relays shall be as required for the particular application.

Each and all items of the fire alarm and detection system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by UL or FM, and shall bear the "UL" or "FM" label. Control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing will not be acceptable. The alarm system components shall be listed by the California State Fire Marshal.

SUBMITTALS

Product Data:

Manufacturer's descriptive information and installation instructions shall be submitted for approval.

Installation instructions shall include brand name and catalog reference of equipment supplied, wiring diagrams, battery calculations, voltage drop calculations, riser diagrams and floor plans showing all devices and conduit and conductor sizes. A fire matrix for the sequence of operation shall be included in the submittals.

Working Drawings: Complete working drawings shall be submitted for approval. Working drawings shall include building floor plan with component layout and wiring layout, including conduit size and wire sizes. Working drawings shall show the shape, size, and method of attachment for each component used in the work. Submit control and wiring diagrams that shall include rough-in dimensions, component layout and wire number identification. Fire Sequence of Operation Matrix Table shall be submitted.

Closeout Submittals. Prior to the completion of the contract, one CD with PDF files and 2 identified copies of the operation and maintenance instructions with parts lists shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Approved working drawings from the Fire Marshall with as-built changes shall be included in the submittal. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Test Reports: Submit results of electrical continuity, insulation, and ground continuity tests performed on installed wiring.

State Fire Marshal Approval: Prior to the submittal of the working drawings, the Contractor shall have said drawings stamped "APPROVED" by the State Fire Marshal. Allow 12 weeks for State Fire Marshal review and approval. The Contractor shall resubmit working drawings to the State Fire Marshal as needed until approved. No additional payment will be made for resubmittals. Submittals shall be approved by the State Fire Marshal and Engineer prior to commencing work with the fire alarm system installation.

PART 2 - PRODUCTS

Fire Alarm System:

The system shall be wired, connected, and left in first-class operating condition. The system shall be electrically supervised, 4-wire Class A system, and shall use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, incoming and standby power supervision.

The system shall be an addressable fire alarm system complete with built-in or portable reprogramming capabilities so that all reprogramming or reconfiguration of the fire alarm system can be accomplished without removal of any solid-state devices. Hardware, software, and passwords used in programming the system and the I/O Map shall be submitted to the Engineer.

The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:

1. The appropriate initiating device circuit's red LED shall flash on the control panel and the annunciator until the alarm has been silenced at the control panel or the annunciator. Once silenced, this same LED shall latch on. A subsequent alarm received after silencing shall flash the subsequent zone alarm LED on the control panel.
2. A pulsing alarm tone shall occur within the control panel until silenced.
3. All alarm-indicating appliances shall sound in a Continuous Ringing Alarm pattern until silenced by the Alarm Silence Switch at the control panel or the annunciator.
4. All visual alarm lamps shall operate in a continuous pattern until extinguished by the Alarm Reset Switch.
5. Activate a supervised signal to notify specified notifying parties.

The alarm indicating appliances may be silenced by authorized personnel upon entering the locked control panel and operating the Alarm Silence Switch or by use of the key operated switch at the annunciator. A subsequent zone alarm shall reactivate the signals.

The system shall include the following electrical power requirements:

1. The control panel shall receive 120 V ac power via a dedicated standby circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 V ac power in a normal supervisory mode in accordance with NFPA 72. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 80 percent capacity in 12 hours.
3. The supervised standby battery power shall operate the entire system for 4 hours under normal conditions. At the end of 4 hours, the standby battery shall power the system under fire alarm conditions for 5 minutes.
4. All circuits requiring system-operating power shall be 24-Volt DC and shall be individually fused at the control panel.
5. Faults on ancillary circuits shall not interfere with the operation of the alarm and detection system.

Activation of Standpipe or Sprinkler Tamper Switch and Trouble Silence Switch:

1. The activation of any standpipe or sprinkler tamper switch shall activate a distinctive system supervisory audible signal and illuminate a "Sprinkler Supervisory Tamper" LED at the system control panel and the annunciator. There shall be no confusion between valve tamper activation and opens and grounds on fire alarm initiation circuit wiring.
2. Activating the Trouble Silence Switch shall silence the supervisory audible signal while maintaining the Sprinkler Supervisory Tamper LED indicating the tamper contact is still activated.
3. Restoring the valve to the normal position shall cause the audible signal and LED to pulse.
4. Activating the Trouble Silence Switch shall silence the supervisory audible signal and restore the system to normal.

Fire Alarm Control Panel:

Fire alarm control panel shall be surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt, AC, input power with separate terminals for all external wires and end-of-line resistors installed within the control panel. Panel shall be capable of communicating with addressable relay modules and the fan relay control panel. When a device is activated, the panel shall display the actual device and reference zone where the device is located and the associated zone number.

Each addressable device shall have a unique address. The manufacturer shall program each address to a system input zone and correlate to output operations as indicated. Non-functioning, non-addressed and non-programmed devices shall report trouble. Provide for site modification to the addressable programming. Provide for removal and replacement of devices without the necessity of readdressing any other devices.

Provide installation flexibility by ensuring that the physical sequence (placement) of the devices on the loop need not determine the device address. Installation tables shall be furnished by the Contractor to identify all device addresses.

The control panel shall conform to the following requirements:

Compatible with Simplex 4100, Notifier 640 or equivalent;
Minimum 12 reference zones and expandable to 16 zones;
Digital dialer communicator;
Audible trouble signal, silencing switch and trouble pilot light;
Solid state, modular construction;
Fan shut down relays;
24-hour standby batteries, battery charger with automatic transfer on loss of utility company power and retransfer upon restoration of utility power;
Indicating lights for normal power failure, battery power failure, audible alarm, and silencing switch;
Low battery reporting.

Manual Pull Station: Manual pull station shall be single-action, addressable, non-coded, closed circuit, pull down type pull station mounted on a standard electrical outlet box. The manual pull station actuating contact shall function continuously until reset. The pull station shall have provisions for fire drill and testing. Manual pull station shall be capable of being reset with the same key as for the fire alarm control panel. By using the key, authorized personnel can activate the manual pull station.

Smoke Detector: Smoke detector shall be ionization type addressable detector with dual chamber with sensitivity control and plug-in detector head. One chamber shall be for detection and the other for changes in ambient parameters.

The smoke detector shall have integral LED light to indicate operation of the smoke detector.

Duct Smoke Detector:

Duct smoke detector for the exhaust fan shall be as similar to the space smoke detector except it shall have the following additional features:

Sampling tube;
Uniform sensitivity between 500 feet to 3,000 feet per minute air velocity;
Remote mounted key activated test switch.

Duct smoke detector for the air conditioning units shall be similar and shall be the type approved by the air conditioning unit manufacturer.

Heat Detector: Heat detector for automatic detection of fire shall be of compact and rugged construction employing rate-of-rise and fixed temperature methods of detecting fires. The heat detectors shall be addressable and shall have twist-and-lock type plug-in detector head, and low profile.

Audio-visual Device: Audio-visual device shall be addressable, vibrating type horn with flashing light and adjustable volume control and shall conform to the following requirements.

Audible alarm shall provide:

1. A sound pressure level of at least 15 decibels (dB) above the average ambient sound level in the room or space, or 5 dB above the maximum sound level having a duration of 60 seconds, whichever is greater.
2. The minimum sound pressure level shall be 60 dBA.
3. The maximum shall be 110dBA at the minimum hearing distance.

Visual alarm shall have the following:

1. Visible alarm shall be provided in entrance, hallways, restrooms, and other common use areas as indicated on the plans.
2. No place in corridors or any rooms requiring visual alarm shall be more than 50 feet from the signal in the horizontal plane.
3. Visible alarm shall be placed 80 inches above the highest floor level or 6 inches below the ceiling, whichever is lower.
4. The Lamp shall be a xenon strobe type or equivalent.
5. The color shall be clear or nominal white (i.e., unfiltered or color filtered white light).
6. The maximum pulse duration shall be two-tenths of one second with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
7. The intensity shall be a minimum of 75 candela.
8. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.

Addressable Relay Module: Addressable relay module shall be an addressable relay that will provide the system it is associated with a dry contact output for equipment shutdown. Dry contact shall be rated for the control voltage and current being interrupted. Relay module shall be compatible with the fire alarm control panel. Addressable relay module shall be provided with a surface mounted back box.

Multivoltage Relay Module: Multivoltage relay module shall be an encapsulated multi-voltage relay module compatible with the fire alarm control panel. Contacts for multivoltage relay module connected directly to fans or motors or air conditioning units shall be double pole double throw (DPDT) with ampere and voltage ratings suitable for the unit that is being controlled. Contacts for multivoltage relay modules connected directly to control circuits shall be rated 10 A (minimum) and suitable for the control voltage for the unit that is being controlled. Multivoltage relay module shall be provided with a surface mounted back box.

Fan Relays Control Panel. Fan relays control panel shall be a control panel with multiple multivoltage relay modules enclosed in a surface mounted enclosure. Number of multivoltage relays shall match the quantity of fans and air conditioning units connected to that panel.

KNOX Box: KNOX box shall be the type approved by the Fire Marshall.

PART 3 - EXECUTION

INSTALLATION

The fire alarm system shall be installed in accordance with the manufacturer's recommendations. No modification of the recommended alarm system type, components type, or replacement shall be made without prior written approval from the Engineer.

Detectors shall not be installed until the cleanup of all trades is completed and final. (2010 NFPA 72 Section 17.7.1.11)

Fire alarm panel zoning: Fire alarm panel zoning shall be as follows:

Zone 1:	Building 1A-Lower Floor
Zone 2:	Building 1A-Upper Floor
Zone 3:	Building 1B- Bridge Paint (Grid Line E thru L)
Zone 4:	Building 1B-Bridge Maintenance Equipment (Grid Line L thru Q)
Zone 5:	Building 1B -Bridge Electrical (Grid Line Q thru S)
Zone 6:	Building 1B-Bridge Vehicle Maintenance 1 (Grid Line S thru V)
Zone 7 :	Building 1B-Bridge Vehicle Maintenance 2 (Grid Line V thru AA)
Zones 8 to 12:	Spares

Conduit and Conductors:

Fire alarm system wiring shall be installed in conduits conforming to the requirements of "Basic Materials and Methods" elsewhere in these special provisions. Conduit size shall be as recommended by the fire alarm system manufacturers except that conduits shall be not less than 1/2-inch diameter, trade size. Within the office areas and rooms with finished ceiling and furred wall, conduits shall be concealed in ceiling or walls. All other conduits shall be exposed conduit.

Conductors and cables for the fire alarm system shall be as recommended by the fire alarm system manufacturer.

No wiring other than that directly associated with fire alarm detection system shall be permitted in these conduits. Wiring splices shall be avoided to the extent possible and if needed, they shall be made only in junction boxes and shall be connected with crimp-type connectors. Wire nut-type connections are not acceptable.

All conduits entering or leaving the terminal cabinets and junction boxes shall be numbered in a logical and consecutive manner. A number shall be used only once.

All conductors shall be tagged, labeled, and color-coded. Color-coding shall be by wire insulation, not taping or banding. The numbering and color-coding shall be continuous for each circuit wire.

Wire shall be numbered at each connection, termination, and junction point. Each group of wires shall be tagged with its destination at each panel, terminal box, or junction box. Identification shall be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Pre-printed, white, heat-shrinkable tubing.

FIELD QUALITY CONTROL

Testing:

The operational test for the fire alarm system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

The completed fire alarm system shall be fully tested in accordance with NFPA 72 under the observation of the Engineer and subject to approval by the State Fire Marshal. The submitted and approved matrix for the sequence of operation shall be followed during the operational test. Submit test procedures before performing tests. Testing program shall include the following information, listings, and instructions:

1. Statement of procedure objective, scope of test, and list of equipment/system to be tested.
2. List of equipment required setting up and performing the tests.
3. List of prerequisite tests that need to be completed before the procedure can be performed.

4. Description of the required procedure setup, including diagrams illustrating test equipment connections and identifying test points, where applicable.
5. Step-by-step instructions for performing the procedure, identifying the points where data is to be recorded and the limits for acceptable data.
6. Provisions for recording pertinent test conditions and environment at time of test.
7. Instructions for recording data on data sheets and verifying that procedure steps have been completed.

Before requesting final approval of the installation, the installing contractor shall furnish a written statement to the State Fire Marshal to the effect that the system has been installed in accordance with approved plans and completely tested in accordance with manufacturer's specifications and appropriate NFPA requirements. (2010 NFPA 72 Section 10.18.1.3)

Upon completion of the installation of the fire alarm system, a satisfactory test of the system shall be made in the presence of the State Fire Marshal.

Monitoring:

The Contractor shall provide monitoring services for the facility for 1 year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

TRAINING

Training: The Contractor shall provide four hours of on-site training on the use, operation, and, maintenance of the system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.11 INTRUSION ALARM SYSTEM AND ACCESS CONTROL SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a complete and operational intrusion alarm system and access control system in accordance with the details shown on the plans and these special provisions. The systems shall also include a telephone entry system complying with the details as shown on the plans and these special provisions.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational intrusion alarm system.

Related Work:

Electromechanical locks, electrified door hinges, electrical power transfer hinges, electromagnetic locks, lock guards and panic devices shall be as specified under "Door Hardware" in Section 12-8, "Doors and Windows," of these special provisions.

Sliding gate operator system for sliding gates shall be as specified under "Security Metal Fence And Gates, And Pedestrian Gates" in Section 10-1, "General," of these Special Provisions.

Electromagnetic locks for swinging hinged gates shall be as specified under "Security Metal Fence And Gates, And Pedestrian Gates" in Section 10-1, "General," of these Special Provisions.

SYSTEM DESCRIPTION

Design Requirements:

The intrusion alarm system shall be compatible with the existing intrusion alarm control panel at SFOBB Tow Service Building located at the SFOBB Toll Plaza. The existing system is Bosch D9412GV2 with Bosch Wiegand proximity 26 bit card D8236. Therefore, prior to finalizing selection of components and devices, contractor shall make certain that the proposed system is fully compatible with the existing system in all respects. In addition, a mock up model of the proposed system shall be set up at the Contractors or equipment manufacturers preferred location for compatibility verification by the Engineer prior to making shop submittals.

The intrusion alarm system shall be a low voltage, direct current, zoned alarm system. Each zone shall be "supervised, Class A circuit." The end of line resistor shall be installed in the control panel.

The intrusion alarm system shall consist of a surface mounted intrusion alarm panel, magnetic contact switches, combination motion detector-microwave/passive infrared detectors, glass break discriminators, digital card readers, electromechanical locks, electrified door hinges, electrical power transfers, lock guards and digital keypad stations.

The intrusion alarm system shall self-test and report status of individual zones.

The intrusion alarm system shall provide an automatically rechargeable back-up power supply system, 24 hour minimum for building operation, in case of building power interruption.

Each and all items of the intrusion alarm system shall be listed as a product of a single alarm system manufacturer under the appropriate category by UL or FM, and shall bear the "UL" or "FM" label. Control equipment shall be listed under UL category AHJ as a single alarm unit for commercial use. Partial listing will not be acceptable.

The access control system shall consist of an access control workstation with an attached card reader, printer and monitor to run the access control program software, access control door controllers, electrified lock sets, electrified power transfer hinges, and 26 bit Wiegand compatible card readers able to read Bosch access card stock D8236.

The intrusion alarm, access control, and telephone entry system shall not be interconnected in any way. All systems shall be wired, connected and left in first class operating condition. All systems shall be electrically supervised, 4-wire, Class A system and shall use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, incoming and standby power supervision. All systems shall be an addressable system complete with built-in or portable reprogramming capabilities so that all reprogramming and reconfiguration of the system can be accomplished without removal of any solid state devices. Hardware, software and password used in programming the system and the I/O map shall be submitted to the Engineer.

SUBMITTALS

Product Data:

Manufacturer's descriptive information, working drawings and installation instructions shall be submitted for approval.

Working drawings shall include voltage drop and standby battery calculations, building floor plan with component layout, system riser diagram including wiring layout, interconnection between intrusion and access control system and conduits and conductor sizes. Working drawings shall show the shape, size and method of attachment for each component used in the work. Control and wiring diagrams shall include rough in dimensions, component layout and conductor number identification.

Installation instructions shall include manufacturer and catalog reference, and model number of equipment to be furnished, conduit and conductor sizes, wiring diagram, and floor plan showing locations of multiple switch contact monitor and devices.

Test Reports: Submit results of electrical continuity, insulation, and ground continuity tests performed on installed wiring.

Closeout Submittals: Prior to the completion of the contract, one CD with PDF files and 2 identified copies of the operation and maintenance instructions with parts lists shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Approved working drawings with as-built changes shall be included in the submittal. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

QUALITY ASSURANCE

Installer Qualification: The installer of the intrusion and access alarm system shall be licensed by the State Department of Consumer Affairs, Bureau of Collection and Investigative Services. License numbers and expiration dates shall be included on all correspondence.

Manufacturer qualification: The system manufacturer shall have not less than 5 years experience in products or systems similar to the size and complexity for this project and with a record of successful service performance.

PART 2 - PRODUCTS

Intrusion Alarm Control Panel:

The intrusion alarm control panel shall be a surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt, AC, input power with separate terminals for all external wires.

The intrusion alarm control panel shall meet the following requirements:

Compatible with existing Bosch D9412GV2 or equivalent;
Capable up to 246 individually identified points;
Addressable expandable modules;
Capable of controlling up to 8 doors;
Network Ethernet interface module;
Digital dialer communicator;
12-volt auxiliary power supply;
Rechargeable battery (24 hour minimum);
Battery charger;
Low battery reporting;
Silent alarm signaling;
System connected to RJ31X or RJ38X telephone jack or equivalent;
Line test every 24 hours
120-volt, AC, input
Front accessible control and indication digital keypad.

Magnetic Contact Switch:

Magnetic door switch for pedestrian door shall be a 2-section, self-lock mounting type switch, and shall be compatible with the material of the door on which it is installed. The switch shall be epoxied in the switch housing. Magnetic contact switches shall be the type capable of being concealed on the top of the door frame.

Magnetic contact switches for the overhead vehicle doors shall be 2-section, extra heavy-duty, floor mounting type switch with stainless steel armored cable.

Switch shall be housed in a non-magnetic case.

Glass Break Discriminator: Glass break discriminator shall be an acoustic glass break detector with advanced technology for sensing and reporting sound and shock wave activity. Detector shall respond to energy of breaking windows using piezo-electric crystal microphone. Sensor coverage pattern shall be directional, detecting breakage of uncovered glass in a 34-foot wide area at a distance of 11½ feet minimum. The sensor shall be housed in a fire retardant ABS housing.

Digital Keypad: The remote digital keypad shall be flush mounted on a sheet metal box. Each digital keypad shall have two separate SPDT outputs contact with selectable timings (10, 30, 35 seconds); multiple programmable codes, and 3 LED indicating lights for loop status, system status and shunt status. Each digital keypad shall operate on DC power and contacts shall be rated one ampere at minimum 12-volt DC. Each digital keypad shall be wired to the control panel to turn on or turn off the covered designated zones from each location. Digital keypad shall have 12-key with alarmed and ready lights and audible warning signal.

Combination Motion Detector-Microwave/Passive Infrared: Combination Motion Detector-Microwave/Passive Infrared detectors shall be low voltage, wall-mounted, wide angle microwave or passive infrared detectors with a detection pattern appropriate to cover areas indicated on the plans. Model must be specified on proposed installation layout. The detector shall have an LED indicating light.

Expansion Module: Expansion module shall be an addressable expansion module mounted inside a NEMA Type 1 enclosure. Module shall be compatible with the access control system and intrusion alarm system that is provided. Module shall include end-of line resistors required for the proper operation of the system.

The systems shall include the following electrical power requirements:

1. The control panels shall receive 120-volt AC power via dedicated standby circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120-volt AC power in a normal supervisory mode in accordance with NFPA 72. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 80 percent capacity in 12 hours.
3. The supervised standby battery power shall operate the entire system for 24 hours under normal conditions.
4. All circuits requiring system-operating power shall be 24-Volt DC and shall be individually fused at the control panel.
5. Faults on ancillary circuits shall not interfere with the operation of the alarm and detection system.

Access Control Panel:

The access control system shall utilize a 26 bit Wiegand compatible card readers able to read the existing Bosch access card stock D8236. The door controllers shall be surface mounted, self contained lockable enclosures. Control panel shall in a surface mounted, self-contained lockable panel and suitable for 120-volt, AC, input power with separate terminals for all external wires.

The access control panel shall meet the following requirements:

Capable of managing up to 128 door operators and 5,000 card holders;
Network Ethernet interface module
12-volt auxiliary power supply;
Rechargeable battery (24 hour minimum);
Battery charger;

Door Controller Enclosure:

The door controller and power supplies shall be mounted in a series of surface mounted enclosures without a keypad or faceplate. The controllers shall be suitable for 120-volt, AC, input power with separate terminals for all external wires. Controllers shall be provided with automatic standby battery powered

power supply. Back up batteries shall operate all doors and digital card readers managed by the door controller unit for up to 24 hours.

Access Credential Cards: Access credential cards shall be of credit card type plastic material and shall be compatible with the digital card readers and access system control panel. Entrance cards shall be compatible with the card reader that is provided and shall be compatible with the existing entrance cards readers at the SFOBB Tow Service Building located at the SFOBB Toll Plaza on Interstate 80. The existing entrance cards are Bosch Wiegand proximity 26 bit card D8236. Provide 200 entrance cards to the Engineer.

Access control work station, monitor and printer: System computer shall be a premanufactured tower style server with accessories. Computer shall have all the software needed to run the control terminal and the access control system. In addition the original DVD or CD copy to the of the access control system software and manuals, inclusive of all licenses, shall be handed over to the engineer. The system computer monitor and printer shall meet or exceed the minimum requirements:

Processor	2.66 GHz, minimum, Quad core or x86_64;
Memory	4 GB DDR2-800(ECC FBD);
Hard Drive	3.5 inch, SATA II, 7200 RPM, 750 GB;
Operating System	Microsoft windows Small Business Server 2003 Premium;
Graphics Card	PCI Express 512 MB;
Ethernet Connection	Internal gigabit ;
Modem	V.92 internal;
DVD Drive	16X DVD ± RW Drive;
PCI Expansion Slots	Minimum six PCI Expandable slots;
Power Supply	930 W with hot plug redundant power;
Keyboard mouse	USB port and optical mouse;
Printer	Multifunction Laser with 128 MB memory;
Monitor	19-inch Widescreen LCD, 5 ms response min 1000:1 contrast;
UPS	1500 VA, 120-volt, AC, 6 plug surge protection.

Software: Software shall be an application that is routinely advertised and supplied for access control and intrusion alarm monitoring by the access control panel manufacturer. The software shall be capable of programming and reading access assigned to Bosch Wiegand proximity 26 bit card D8236. The software shall include hour, day of week and day of month based and shall be capable of executing the following functions:

Alarm/disarm any specific zone;
Bypass/unbypass a point;
Activate/deactivate all relays;
Send a report to monitoring station and access control terminal;
Automatically adjust system clock for daylight savings time;
Turn an access authority level on/off
Hold any door open (unlocked and shunted) for an unlimited time;
Secure any or all doors closed (locked, no valid cards will allow entry;
Return a door to normal operation (locked valid cards will allow entry)
Turn recording access grant events on/off;
Turn recording access denied events on/off.

Telephone Entry Control Panel:

The telephone entry control system shall be as shown on the plans and shall be inclusive of all power supplies and related hardware and software required for the automatic functioning and integration of the telephone entry system with the intrusion and access control system.

PART 3 - EXECUTION

TELEPHONE ENTRY SYSTEM OPERATION

The telephone entry system at the north and west sides of the building shall be installed, wired, and integrated with the intrusion and access control system so that all three systems work in harmony with each other. Provide and install additional hardware, software, and cables that are not shown but are required for the complete functioning of the system as described herein.

When a visitor approaches the buildings designated entry, visitor shall scan thru the employees names entered into the telephone entry control panel and call the employee in question. Upon receipt of the telephone call from the telephone entry panel, the employee will receive the call, identify the visitor over the microphone and speaker system and then presses one of the designated number on the telephone receiver set. Upon pressing of the number, the access control panel shall grant access to the visitor via the door nearest to the telephone entry panel. In addition, access control panel shall record the entry for future reference.

Names of the employees and their telephone numbers will be provided to the Contractor for programming during system set up and testing. The Contractor shall request at least 7 days in advance of the date the names and numbers are needed.

INSTALLATION

The intrusion alarm system shall be installed in accordance with the manufacturer's recommendations.

The magnetic switch section without wires shall be recessed flush into the top edge of the door at the approximate center of the door, and the switch section with wires shall be recessed flush in the top section of the door frame. The two sections of the switch shall be mounted directly opposite each other to provide maximum sensitivity. The wiring from each magnetic switch shall be run to the control panel in the zone dedicated for the intrusion alarm circuit.

The magnetic switch section mounted on the bottom edge of the overhead door shall be without wires. The switch section with wire shall be mounted on the floor directly below the switch part without wires.

The glass break discriminator shall be mounted on the ceiling at locations shown on the plans.

Combination detector shall be mounted at not less than 7½ feet above finished floor at locations shown on the plans.

The end of line resistors shall be installed in the control panel.

Intrusion alarm zoning: Intrusion alarm panel zoning shall be as shown on the plans.

Conduit and Conductors:

All intrusion alarm system wiring shall be installed in conduit system conforming to the requirements under "Basic Materials and Methods" elsewhere in these special provisions. Conduit size shall be as recommended by the intrusion alarm manufacturer, except that conduits shall be not less than ½-inch diameter. Within the office areas and areas with finished ceiling and furred wall, conduits shall be concealed in ceiling or walls. All other conduit shall be exposed.

All conductors and cables for the intrusion alarm system wiring shall be as recommended by the intrusion alarm system manufacturer.

No common wires shall be connected to components across multiple Zones.

No wiring other than that directly associated with intrusion, access, or auxiliary functions shall be permitted in these conduits. Wiring splices shall be avoided to the extent possible and if needed, they shall be made

only in junction boxes and shall be connected with crimp-type connectors. Wire nut-type connections are not acceptable.

All conduits entering or leaving the terminal cabinets and junction boxes shall be identified in a logical and consecutive manner. A number shall be used only once.

All conductors shall be identified, tagged, labeled, and color-coded. Color-coding shall be by wire insulation, not taping or banding. The numbering and color-coding shall be continuous for each circuit wire.

Wire shall be identified at each connection, termination, and junction point. Each group of wires shall be tagged with its destination at each panel, terminal box, or junction box.

Conductor identification shall be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Pre-printed, white, heat-shrinkable tubing.

FIELD QUALITY CONTROL

Testing: The operational test for the intrusion alarm, access control, and telephone entry system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

Testing program shall include the following information, listings, and instructions:

1. Statement of procedure objective, scope of test, and list of equipment/system to be tested.
2. List of equipment required setting up and performing the tests.
3. List of prerequisite tests that need to be completed before the procedure can be performed.
4. Description of the required procedure setup, including diagrams illustrating test equipment connections and identifying test points, where applicable.
5. Step-by-step instructions for performing the procedure, identifying the points where data is to be recorded and the limits for acceptable data.
6. Provisions for recording pertinent test conditions and environment at time of test.
7. Instructions for recording data on data sheets and verifying that procedure steps have been completed.

Monitoring:

The Contractor shall provide monitoring services for the facility for 1 year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

TRAINING

Training: The Contractor shall provide four hours of on-site training on the use, operation, and maintenance of the system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

Follow-up Training: Within 2 months of the operational test, the Contractor shall provide an additional two hours on-site follow-up training for the use, operation and maintenance of the system for not more than 8 designated State employees. Exact date of the follow-up training shall be as directed by the Engineer.

12-16.12 CLOSED CIRCUIT TELEVISION SYSTEM

PART 1 - GENERAL

Closed circuit television (CCTV) system shall be Internet Protocol (IP) based, color type video surveillance system consisting of fixed and pan-tilt-zoom, indoor and outdoor dome cameras, camera enclosures, monitor, network switches, servers, fiber media converters, data cables, fiber optic cables, racks, client workstation, network video recorders and other equipment required by the CCTV manufacturer to install a complete system. The components shall be as shown on the plans.

SUBMITTALS

Manufacturer's descriptive information, catalog cuts, block diagram and installation instructions shall be submitted for approval. Block diagram shall include all cables and components of the system.

Installation instructions shall include manufacturer and catalog reference, model number of equipment to be furnished, conduit and conductor sizes, wiring diagram, and floor plan showing locations of the CCTV components including descriptive information, catalog cuts, and installation instructions.

Closeout Submittals. Prior to the completion of the contract, one CD with PDF files and 2 identified copies of the operation and maintenance instructions with parts list shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

PART 2 - PRODUCTS

INDOOR CEILING MOUNTED DOME CAMERA

The indoor ceiling mounted dome camera system shall be a complete network video surveillance system inside a dome camera.

The dome camera system shall meet or exceed the following specifications:

1. The camera shall include a 2.7 to 9 mm varifocal lens.
2. The camera shall deliver HD 720p resolution.
3. The camera shall offer a removable 32 GB micro SD/SDHC card.
4. The camera shall contain alarms that signal tampering movement.
5. The camera shall conform to the Open Network Video Interface Forum (ONVIF) standard.
6. The camera shall comply with the Power over Ethernet (IEEE 802.3) standard.
7. The camera shall support continuous recording, ring recording, and alarm/events/schedules recording system.
8. The camera shall use H.246 compression technology.

The camera system shall meet or exceed the following design and performance specifications:

Design and Performance Specification	
Power consumption	4.2 W (maximum)
Video sensor pixels	1280 X 800
Video sensitivity	1.0 lux
Video maximum frame rate	30 fps
Analog video out	2.5 mm jack for installation only
Alarm input	Short or DC 5V activation
Relay out	Input rating maximum 1 A, 24 V(ac/dc)
Audio input	Built-in microphone/Line in jack connector
Audio output	Line out of jack connector
Audio communication	Two-way full duplex
Audio Compression	G.711,L16 (live and recording)
Ethernet	10/100 Base T, auto sensing, half/full duplex, 8P8C modular
Unit configuration	PC surveillance software
Camera operating temperature	14 °F to 122 °F
Storage temperature	-4 °F to 158 °F

OUTDOOR FIXED DOME CAMERA

The outdoor fixed dome camera system shall be a complete network video surveillance system inside a dome camera with a high impact vandal resistant enclosure. The enclosure shall contain the camera and the varifocal lens. The camera that is mounted on the building exterior on the parapet wall shall comply with the Power-over Ethernet standard (IEEE 802.3). The camera that is mounted on the pole of lighting standards shall be provided with a local power supply mounted inside a NEMA 4X enclosure.

The dome camera system shall meet or exceed the following specifications:

1. The camera shall be a Day/Night CMOS camera with progressive scan.
2. The camera shall be designed to stream a 1080p high resolution video image in a true HD format (16:9).
3. The camera shall have local storage for flexible recording options.
4. The camera shall motorized automatic back focus.
5. The camera shall contain alarms that signal tampering movement.
6. The camera shall conform to the Open Network Video Interface Forum (ONVIF) standard.
7. In the night mode, the camera shall enhance low light viewing by switching the infrared filter out of the optical path and providing a monochrome image.
8. The camera shall be able to switch from color to monochrome mode automatically by sensing the illumination level.
9. The camera shall support continuous recording, ring recording, and alarm/events/schedules recording system.
10. The camera shall provide individually configurable streams in H.264 and M-JPEG, configurable frame rate and bandwidth.
11. The camera shall be provided with high-impact vandal resistant enclosure.
12. The camera shall be provided with a pendant for parapet mounting or pole mounting.

The camera system shall meet or exceed the following design and performance specifications:

Design and Performance Specification	
Input voltage	24 V(ac) for pole mounted units and Power-over-Ethernet (PoE)for wall mounted units
Power consumption	19.2 W IVA (24 V(ac)) and 15.4 W (PoE)
Video sensor pixels	1920 X 1080
Video sensitivity color/monochrome	0.5 lux/0.08 lux
Video resolution	720p, 4CIF/DI, VGA
HD resolution (H x V)	1080 p: 1920 x 1080 720 p: 1280 x 720
Data rate	99.6 Kbps to 10 Mbps
Overall IP delay	120 ms (Minimum), 240 ms (Maximum)
Relay out	1 output, 30 V(ac) or +40 V(dc), Maximum 0.5 continuous, 10 VA
Frame rate	25 and 30 frames/s
Camera operating temperature	-58 °F to 131 °F
Operating temperature (IVA)	-58 °F to 122 °F

OUTDOOR PTZ DOME CAMERA

The outdoor pan-tilt-zoom (PTZ) dome camera system shall be a complete network video surveillance system inside a dome camera with a high impact vandal resistant enclosure. The enclosure shall contain the camera and the varifocal lens. The PTZ dome shall be provided with a local power supply mounted inside NEMA 4X enclosure. Enclosure shall be attached to the back of the wall mounting arm. The unit shall be complete with a fiber optic media converter.

The dome camera system shall meet or exceed the following specifications:

1. The camera shall be camera shall have a CMOS sensor.
2. The camera shall be designed at1080p (HD) high resolution at 30 images per second (ips) and sensitivity to below 1.0 lux
3. The camera shall be capable 200x zoom (20x optical , 10x digital).
4. The camera shall be capable of high speed 360-degree continuous pan.
5. The camera shall have 99 user defined preset tour and autopan modes.
5. The camera shall contain alarms that signal tampering movement.
6. The camera shall conform to the Open Network Video Interface Forum (ONVIF) standard.
7. The camera shall support continuous recording, ring recording, and alarm/events/schedules recording system.
8. The camera shall provide quad streaming (three H.264 together with an M-JPEG stream) in full and reduced bandwidth modes.
9. The camera shall be mounted in a high impact, heavy duty vandal resistant housing.
10. The camera shall be provided with a pendant for parapet mounting or pole mounting.

The camera system shall meet or exceed the following design and performance specifications:

Design and Performance Specification	
Input voltage	21-30 V(ac)
Power consumption	55 W/ 60 VA (including heater)
Lens	20x optical zoom (4.7 to 94 mm)
Aspect ratio	HD 16:9
Iris	Automatic with manual override (F1.6 to F3.5 widest aperture)
Field of View	3degrees (tele) to 55 degrees (wide)
Number of pixels	Approximately 2 megapixels
Data rate	9.6 Kbps to 6 Mbps
Overall IP delay	240 ms
Input/output	2 Alarm inputs and 1 open -collector alarm output
Automatic gain control	Automatic/Manual (-3 to 28 dB, 21 steps)
Pan range/tilt angle	360 degrees continuous/ 18 degrees above horizon
Variable speed	0.1 degree/second-120 degree per second
Pre position speed	Pan: 360 degrees/second; Tilt: 100 degrees per second
Video and control connections	8P8C modular 100 Base TX Ethernet
Camera operating temperature	-49 °F to 131 °F

NETWORK SWITCH

The network switch shall be a line of fixed configuration, enterprise-class layer switch. Network switch shall include IEEE 802.3af and power over Ethernet (PoE) functionality in fast Ethernet and gigabit Ethernet configurations. Network switch shall be capable of 24 Ethernet, 10/100/1000 ports and 2 small form-factor pluggable (SFP) gigabit Ethernet port. The switch shall be capable of supporting 24 simultaneous full-powered PoE ports at 15.4 W. Network switch shall be capable of being mounted on a rack. The switch shall meet or exceed the following specifications:

Design and Performance Specification	
Input voltage	120 V(ac)
Power supply rating	540 W (maximum)
Maximum power supplied per port	15.4 W
Forwarding bandwidth	32 Gbps
Forwarding rate based on 64-byte packets	6.5 Mpps
Flash memory	32 MB
MAC Addresses	Configurable up to 12,000 MAC Addresses
Unicast routes	Configurable up to 11,000 unicast routes
Groups and multicast routes	Configurable up to 1000 IGMP groups and multicast routes
Configurable maximum transmission unit (MTU)	Up to 9000 bytes, with a maximum Ethernet frame size of 9018 bytes (Jumbo frames)for bridging on gigabit Ethernet ports
Operating temperature	32° to 113°F
Storage temperature	-50° to 158°F

NETWORK VIDEO RECORDER AND STORAGE

The network video recorder (NVR) and storage shall be a video recording and management server unit. The server unit shall be a 19-inch rack mounted unit with 8 TB storage capacity. The system shall meet or exceed the following specifications: The server unit shall meet or exceed the following specifications:

1. The system shall allow live, recording and playback for up to 64 camera channels per station with video image resolutions up to 1920 x 1080 (Full HD).
2. System shall be provided with a software that shall allow playback at a separate client workstation.
3. The system shall be pre-licensed for 24 cameras, expandable to 64 cameras.
4. The system shall be provided with expansion license for 12 additional cameras.
5. System shall support Redundant Array of Independent Disks (RAID) -5
6. The system shall contain a software for a full system recover.
7. The system shall be an embedded, all-in-one IP video recording and management system that provides "plug-and-play" iSCSI-based recording and management.
8. The system recording function shall include the following: record video, show and control live video from local and remote stations, playback recorded video from local and remote stations, trigger alarm recording or sending notifications, forward alarm video to remote stations and allow 2 different pre-alarm and post-alarm times or 2 different events.
9. The system shall offer different display modes to optimize display under the following conditions: Standard Definition (SD) Video on SD monitor; SD Video on Widescreen monitors and High definition (HD) video on widescreen monitors.
10. The system shall be capable of showing live video from different IP devices connected to different stations on one monitor.
11. The system shall allow playback of the stored video in the forward or reverse direction, frame by frame, and from beginning or end of the clip using standard VCR-like buttons.
12. The system shall provide a graphical representation of the recorded video using a timeline with different tracks for each recorded devices.
13. The system shall be capable of exporting video clips to a CD/DVD, network or USB drive.
14. The system shall provide embedded Internet Web browser access that allows 3 simultaneous remote PC's using any standard graphical browser to communicate with the system and display video via a network.
15. The browser shall use a secure connection using log-on and authorization levels during transmission..
16. The system shall have the following live surveillance requirements via Web Browser: Display live video images via Web Browser, display video as single screen sequences, display status of the inputs, control remote relays, and control compatible PTZ cameras.
17. The system shall allow playback via Web Browser.
18. The system shall allow remote access from another station.

The video recorder and storage shall meet or exceed the following design and performance specifications:

Design and Performance Specification	
Maximum recording rate	100 Mbit per second
Voltage input	120 V
Actual output wattage from power supply	260 W
Total BTUH/h	995 BTUH/h
System AC input VA requirement	310 VA
Power supply	720 W Redundant
USB Ports	2 USB 2.0 in rear
Network	Dual gigabit LAN
Recording rates per channel	NTSC:0,5-30IPS
Recording resolutions	Up to 2048 x 1536 pixels (3 Megapixels)
Supported video codecs/protocols	MPEG-4, H.264, M-JPEG, JPEG/MPEG via HTTP/TFTP/RTSP
Maximum number of configured remote stations	200
Maximum number of simultaneously connected remote stations	32
Electromagnetic compatibility	FCC Part 15, Class A
Operating temperature	Operating temperature
Storage temperature	-40° to 158°F
Operating relative humidity	8 to 90% (non-condensing)
Non-operating relative humidity	5 to 95% (non-condensing)

FIBER MEDIA CONVERTER

The fiber media converter shall include a fiber media converter module with a Small-Form Pluggable (SFP) modules at the camera end and a fiber media converter device with the matching SFP module as the head end device. The converters shall be designed to transmit 10/100/1000 Mbps Ethernet signals over fiber optic cable. The SFP modules shall provide the fast Ethernet optical interface connection. The unit at the camera end shall be complete with power supply mounted in a surface mounted weatherproof enclosure. The SFP modules shall be interchangeable modules for use with multimode fibers at wavelengths of 1310 nm / 1510 nm. The fiber media converter shall meet or exceed the following specifications:

1. Data interface: Ethernet
2. Data rate : 10/100/1000 Mbps, IEEE 802.3 Compliant, full duplex or half duplex electrical port, full duplex optical port
3. Operating temperature: -40° to 167°F

CCTV CLIENT WORK STATION

The CCTV client workstation shall be a minitower workstation with quad core processors. The workstation shall provide dual-monitor support. The workstation shall be Energy Star compliant. The workstation shall be complete with a USB standard keyboard and a USB optical scroll mouse. The workstation shall be provided with a 3 year, next business day on site service warranty. The workstation shall meet or exceed the following specifications:

Design and Performance Specification	
Input voltage	120 V(ac)
Processor	3.2 GHz, 1333 MHz memory, Quad core
Unbuffered RAM	4GB (2 x 2 GB) DDR3-1333 ECC
Operating system	MS Windows 7 ultimate edition, 64-bit
Rated input current	6A at 100 to 127 V
Operating line frequency	47 to 66 Hz
Heat dissipation	910 BTUH/h
Power consumption in sleep mode	< 4 W
Power supply	400 W, wide ranging, Active Power Factor correction, 90 % efficient
Operating temperature	40° to 95°F
Non-Operating temperature	140° to 140°F
Humidity	8 to 85%

MONITOR

The monitor shall be a liquid crystal display (LCD) monitor with 26 inches flat screen panel. The monitor shall meet or exceed the following specifications:

1. Resolution shall be up to 1920 x 1080 full HD.
2. Input voltage shall be 120 V(ac), 60 Hz, with internal power supply.
3. Connectors shall be provided for VGA, DVI, HDMI, CVBS and Audio.
4. Contrast Ratio shall be 4000:1.
5. Power consumption shall be 70 W Max.
6. The monitor shall provide the following features: picture-in-picture, front panel lockout and IR remote.
7. The monitor shall have anti-image retention mode.
8. Screen size shall be not less than 22.68 inches x 12.7 inches.
9. Brightness shall not be less than 37.8 cd/sqft (450 cd/m2)
10. Backlight LED type with life shall be not less than 50,000 hours.
11. Viewing angle (horizontal/vertical) shall be 178 degrees.
12. Response time shall 8 ms.
13. Speakers shall be integrated, 2 x 1.0 watt.
14. Indicators shall be LED (power on, standby, power off), on screen.
15. Operating humidity shall be 90 percent, non-condensing.
16. Operating temperature shall be 32ºF to 104ºF

CABLES

Video cable shall be Category 6, 4 pair, 24-AWG, UTP Ethernet cable. Cable shall be in conformance with the requirements in ANSI/TIA-568, "Commercial Building Telecommunication Cabling Standards." Video cable shall be colored yellow.

Fiber Optic cable shall be 2 strand multimode graded index fibers with 62.5 micron cores. Fibers shall comply with TIA-492AAAA-A, ICEA S-104-696 and TIA-568standards. The coating shall be mechanically strippable. Fiber optic cable shall be suitable for outside plant applications and recommended by the CCTV system manufacturer. Fiber optic cable shall meet or exceed the following specifications:

Fiber Characteristics Table	
Core	62.5 µm ± µm
Core Non-Circularity	< 6 per cent
Core/cladding Concentricity Error	< 3.0 µm
Numerical Aperture	0.275 ± 0.015
Cladding Diameter	125 µm ±1 µm
Cladding Non-circularity	≤2.0 per cent
Colored Fiber Coating Diameter	250 µm ±15 µm
Buffering Diameter	890 µm ±50 µm
Minimum Tensile Strength	100 000 psi
Fiber Minimum Bending Radius	0.75 in
Cable Minimum Bending Radius During Installation After Installation	 20 times cable diameter 10 times cable diameter
Operating Temperature Range	32 °F to 149 °F
Storage Temperature Range	-40 °F to 149 °F
Maximum Fiber Loss: At 1300 nm	 1.0 dB/ km (typical range 0.5 to 1.0 dB/km)
Bandwidth length product:	500 MHz*km at 1300 nm

CAMERA CONNECTION

The camera connection system shall meet or exceed the following specifications:

1. Quick, positive mechanical and electrical disconnect without the use of any tools to the dome drive unit
2. Removable terminal strips with screw-type terminals for use with a wide range of wire gage sizes
3. Quick-mount pole, parapet, or ceiling adapter
4. Built-in cable entry for easy connection.

POWER SUPPLY

Power supply shall be outdoor type, inside a NEMA 4X enclosure, 120 V(ac) input and 24 V(ac) output. The power supply shall be the type recommended by camera manufacturer.

PART 3 - EXECUTION

INSTALLATION

CCTV system shall be installed as shown on the plans. Cameras and monitors shall be adjusted for both day and night operations. The Contractor shall submit the installation and mounting details of the cameras. The system shall be installed at locations shown on the plans and by methods recommended by the manufacturer. The Contractor shall provide all supports, fasteners and other hardware necessary to support the units.

TRAINING

Training: The Contractor shall provide four hours of on-site training on the use, operation, and maintenance of the system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

Follow-up Training: Within 2 months of the final CCTV tests, the Contractor shall provide an additional two hours training on the use, operation and maintenance of the system for not more than 8 designated State employees. Exact date shall be as directed by the Engineer.

FIELD QUALITY CONTROL

Testing and Documentation: Prior to conducting any tests the Contractor shall provide the Engineer detailed test procedures for review and approval. Documentation of all test results shall be provided to the Engineer for review and approval. System Documentation shall incorporate test results for ongoing maintenance and performance measurements.

Data Cable Tests:

Category 6 cables shall be tested for conformance to the specifications of TIA 568 Category 6. Testing shall be done with a TIA 1152 Level 3 test set. Test shall be include length, mutual capacitance, characteristic impedance, attenuation, and near-end and far end cross talk. Any pairs not meeting the requirements of the standard shall be brought into compliance by the Contractor, at the Contractor's expense. Complete, end to end test results must be submitted to the Engineer.

Fiber Optic Cable Tests:

All fiber testing shall be performed on all fibers in the completed end to end system. Testing shall consist of a bidirectional end to end optical time domain reflectometer (OTDR) trace performed per TIA 455-61 or a bidirectional end to end power meter test performed per TIA 455-53A. The system loss measurements shall be provided at 1310 nm. Testing of fiber optic cables shall include the following:

1. Testing at the factory
2. Testing after delivery to the project site but prior to installation
3. Testing after installation but prior to connection to any other portion of the system.

The Contractor shall test all fiber optic cables prior to the installation of the cable. Attenuation deviations from the shipping records of greater than five percent shall be brought to the attention of the Engineer. The cable shall not be installed until completion of this test sequence and the Engineer provides written approval.

After the fiber optic cable has been pulled, but before breakout and termination, all fibers shall be tested with an OTDR for attenuation. Fiber optic cables shall be tested at 1310 nm.

CCTV Control Location Tests:

In the presence of the Engineer, the Contractor, after installation of the CCTV, shall verify the correct operation of the camera and pan and tilt drive units. These tests shall include:

1. Viewing video images as the lens focal lengths and apertures of the lens is varied from the camera control, master and remote locations. The Contractor shall verify that the camera is focused after each change.
2. Verifying the correct operation of the auto iris, power zoom and imager protection features from the multiprocessor camera control, master and remote locations.
3. Verifying the correct operation of the pan and tilt unit from the multiprocessor camera control, master and remote locations.

The Contractor shall have a representative present during all phases of testing, who is capable of troubleshooting Contractor installed equipment. The representative shall troubleshoot Contractor installed equipment as the need arises. All of the work described herein shall be considered paid as part of the CCTV installation. Difference.

Final CCTV Test:

In the presence of the Engineer, the Contractor shall conduct a final test of the CCTV system to verify the system is complete and fully operational. The Contractor shall conduct end to end performance tests on the CCTV system. These tests shall confirm the functional operation of all elements of the system and shall include measurements of the system performance.

The pan and tilt shall be functionally tested over 350 degrees in the horizontal plane and 90 degrees in the vertical plane. Functional testing shall also confirm specification compliance for the lens operation, the auto and manual iris control, and the camera receiver and transmitter.

12-16.13 ELECTRICAL EQUIPMENT FOR FUEL DISPENSING AND MONITORING SYSTEM

PART 1 - GENERAL

SUMMARY

This work shall consist of furnishing and installing all labor, materials, tools, equipment, and any other incidentals materials that may be necessary to install electrical equipment such as hydrocarbon leak detection sensors, tank level sensors, fuel control terminal, vehicle identification tag interface board, vehicle information tag transmitter, intrinsically safe barriers, system software, and tank level and leak detection control panel for fuel dispensing and monitoring system at the fuel island in accordance with the details shown on the plans, equipment manufacturer recommendations, and these special provisions.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational fuel dispensing and monitoring system.

Related Work Fuel dispensing equipment shall be as specified under "Fuel Dispensing Equipment" of these special provisions.

DESIGN REQUIREMENTS

State of California, Department of Transportation utilizes the following equipments for statewide fuel inventory control and for dispensing fuel:

EJ Ward Central Fuel Dispensing and Inventory Control System located in Sacramento, California.

Voyager Credit Card System for dispensing fuel statewide from State as well as private venders.

Veeder-Root Tank Level Monitoring and Leak Detection System for interfacing with Central Inventory Control System.

Prior to finalizing selection of various system components and devices, the Contractor shall make certain that the proposed system is fully compatible and completely integrable with the existing system in all respect. A mock up model of the proposed system shall be set up at the Contractor's preferred location for compatibility verification by the Engineer prior to making shop submittals.

QUALIFICATION

Contractor performing installation, wiring, and system start up/commissioning work of the fuel dispensing and monitoring system shall be trained and certified by the proposed equipments manufacturer as well as by EJ Ward, Incorporated, telephone (210-824-7383).

Installation work of installing tank level sensors, leak detection sensors, tank level and leak detection panel, communication module, fuel control terminal, and other devices be performed by an qualified individual who is fully trained to install all components per manufacturer recommendations and to troubleshoot system software for the complete automatic functioning of the fuel dispensing and remote central inventory control system.

SUBMITTALS

Catalog cuts of all materials to be installed and installation instructions shall be submitted for approval.

Closeout Submittals. Prior to the completion of the contract, one CD with PDF files and 2 identified copies of the operation and maintenance manual shall be delivered to the Engineer at the jobsite. The manual shall

include instructions and parts lists in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

PART 2 - PRODUCTS

The fuel dispensing and monitoring system electrical equipment shall include the following:

Fuel Control Terminal
Communication Module
Vehicle Information Transmitters
Pulsers
Intrinsically Safe Barriers
Tank Level Sensors
Leak Detection Sensors
Leak Detection and Tank Level Monitoring Panel
System Software
Cables and Connectors
Alarm Light

Fuel Control Terminal FCT):

The fuel control terminal shall be a microprocessor based, stand-alone-type fuel dispensing terminal designed to interface with various electromechanical fuel dispensers and solenoid valves and shall communicate with the Central System located in Sacramento. The FCT shall consist of the following hardware:

1. Suitable for 120-volt input with built-in power conditioner equipment
2. NEMA 4 enclosure with locking type door, consisting of three parts: cabinet, island conduit receptacle and the island conduit receptacle base plate
3. Main processor board (MPB) with appropriate modules
4. 2GB of RAM and 4 GB of hard drive with upgradable memory
5. Capable of handling up to 1M transactions and 999,999 employees and vehicles
6. Control up to 8 independent hoses
7. Configurable authorization inclusive of server based remote authorization and monitoring
8. Modules to receive data from each fuel dispenser the amount of fuel dispensed and total fuel dispensed per day
9. Auxiliary power transformer
10. Power supply
11. Externally operable backlit type LCD display and alphanumeric keyboard
12. Pumps input totalizer
13. Real time clock
14. Magnetic credit card reader slot
15. Front panel interface board
16. Minimum of six-hose dispenser interface board
17. Communication module
18. Modem
19. Front panel speaker (beeper)
20. Necessary circuit breakers and electromechanical type contactors and relays for dispensers and solenoid valves control
21. Tanks monitoring
22. System software
23. Power ON indicating light

Communication Module:

The communication module shall be part of the fuel control terminal panel and shall communicate all pertinent data such as fuel storage and fuel usage with the fuel control terminal for transmission to the central monitoring and inventory control system in Sacramento, California.

Vehicle Information Transmitter (VIT):

Transmitter for each dispenser hose shall be capable of interfacing with VIT and relay the vehicle information to FCT.

Pulser:

Pulser for each dispenser shall be capable of gathering and transmitting the fuel usage to the FCT.

Intrinsically Safe Barrier:

Intrinsically safe barriers shall be suitable for installation in appropriate environment and for transmitting vehicle related information.

Tank Level Sensors:

Tank level sensors shall be designed for sensing level of hydrocarbon inside closed fuel storage tanks and must be compatible with the leak detection and tank level monitoring panel.

Leak Detection Sensors:

Leak detection sensors shall be designed for sensing presence of hydrocarbon either in the liquid or in vapor state and must be compatible with the leak detection and tank level monitoring panel..

Leak Detection and Tank Level Monitoring Panel:

Leak detection and tank level monitoring panel shall be microprocessor based control panel with printer, backlit LCD display and alphanumeric keyboard, and be suitable for interfacing with hydrocarbon leak detection sensors as well as tank level monitoring sensors. The control panel shall have the following:

1. Suitable for 120-volt input
2. Report upon demand volume of each fuel tank to the central monitoring system
3. Printer to print volume of each fuel storage tank connected to it at anytime
4. Minimum of 8 input channels for leak detection
5. Minimum of 4 input channels for tank level sensing
6. Leak indicating light corresponding for each tank
7. Beeper with reset button to indicate trouble
8. Power on indicating light
9. Auxiliary output for alarm devices

System Software:

System software shall be as required for the automatic dispensing of various types of fuel and to communicate to and from the central monitoring system for validating credit cards and other pertinent information in conjunction with dispensing fuel and fuel inventory control.

Cables and Connectors:

Type of cables and connectors shall be as recommended by the manufacturer of the fuel control terminal system.

Alarm Light:

Alarm light shall be weathertight light with 120-volt LED lamp, cast iron back mounting box with external mounting hubs, red globe and guard.

PART 3 - EXECUTION

Fuel dispensing system shall be installed as shown on the plans and as recommended by the manufacturer of the fuel control terminal system. During installation, the contractor shall make arrangement with the EJ Ward Incorporated representative for consultation and assistance. In addition to the manufacturer representative of the proposed fuel dispensing system being installed, EJ Ward, Incorporated representative shall be present at the site for performing system programming and system set up and commissioning of the fuel dispensing system and to make certain the fuel control terminal system communicate with the central monitoring and reporting system in Sacramento, California.

System Operation: While refueling State vehicles, the fuel dispensing system shall follow the following sequence:

1. Swipe the voyager credit card
2. Prompt on the screen to ask to enter odometer reading of the vehicle
3. Prompt on the screen to ask to enter unique PIN code assigned to the vehicle being refueled
4. After verification, allow dispensing of the fuel
5. Record vehicle ID and amount of fuel dispensed

TRAINING

The manufacturer representative of the fuel dispensing system being installed along with the EJ Ward, Incorporated representative shall provide training to four state personnel in the operation and maintenance of the fuel dispensing terminal system.

12-16.14 PHOTOVOLTAIC SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of designing, furnishing and installing a fully operational photovoltaic (PV) system in accordance with the details shown on the plans and these special provisions.

The PV system shall be a utility interactive grid-tie PV electric generating system including a monitoring system that is furnished and installed and is fully operational, and centrally monitored.

The Contractor shall be responsible for providing and installing the complete PV system as shown on the plans and including the following:

1. Based upon type of roofing system, corrosion resistant self ballasting structural support racking system for mounting PV array.
2. Suitable dead weight system for self ballasting PV array racking system.
3. Fasteners.
4. Roof seating details.
5. Support system for electrical conduits and components.

Plans are diagrammatic and are intended to establish basic dimension of units.

The Contractor shall notify the Engineer when the PV system is delivered to the jobsite.

UTILITY REBATE

A rebate application has been submitted to the electric utility company by the State of California Department of Transportation (Caltrans). Caltrans shall receive the rebate once the installation of the PV system is approved by the local electrical utility company.

The Contractor shall meet the following requirements of the rebate:

1. Installed system, including all components, must meet or exceed the local electrical utility company interconnection requirements for self-generating equipment. The local electrical utility companies for each structure are listed in the following table.

Structure	Local Power Company
Building 1B	PG&E

2. Installed system components shall comply with the requirements of IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems.

After the installation work has been completed, the Contractor shall contact and arrange with the local electrical utility company representative to inspect and approve that the PV system complies with the rebate requirements.

The Contractor shall notify the Engineer at least 2 days prior to the inspection date.

DEFINITIONS

Array: A mechanically-integrated assembly of modules, together with support structure and foundation, thermal control, and other components, if used, to form a DC power-producing unit.

CSI: Stands for California Solar Initiative.

CEC-AC rating: Rating as defined by the CSI.

Insolation: Sunlight, direct or diffuse. The integrated intensity of sunlight reaching a given area, usually expressed in watts per square meter per day. This measurement may be used to express the average amount of solar energy falling on different regions of the country.

PV Module: A number of solar cells connected together electrically and sealed inside a weatherproof package with a clear face.

NRTL: Stands for Nationally Recognized Testing Laboratory.

Photovoltaic (PV): Pertaining to the direct conversion of light into electricity.

PTC (PVUSA Test Conditions): Test conditions applied to PV modules intended to represent wattage during operation. Irradiance of 94.92 watts/ft^2, 68 °F ambient temperature, 3.28-feet/second wind speed, and an air mass of 1.5.

String: A number of modules interconnected electrically in series to produce the operating voltage required by the load.

Standard Test Conditions (STC): Test conditions applied to PV modules. Irradiance of 92.94 watts/ft2, cell temperature of 77 °F ambient temperature, and an air mass of 1.5.

Utility-Interactive Inverter: An inverter that can function only when electrically connected to the utility grid, and uses the voltage and frequency on the utility line as a control parameter to ensure that the photovoltaic array's DC output is converted to AC power fully synchronized with the utility power.

SYSTEM DESCRIPTION

Performance Requirements:

The PV system shall be designed for life expectancy of 25 years. The PV system shall be sized to meet or exceed alternating current (AC) energy generation requirements as shown on the plans. Available roof areas for mounting PV modules are shown on the plans.

PV module manufacturer shall warrant that selected PV modules shall produce no less than 80 percent of the maximum rated power during the first 20 years of their service.

SUBMITTALS

Pre-Construction Submittals:

Pre-Construction submittals for the PV system shall be submitted for approval prior to the start of construction. Pre-Construction submittals shall include the following:

1. PV module and conduit layout plan.
2. PV manufacturer qualifications.
3. PV Installer qualifications.
4. Manufacturer's installation instructions.
5. Bill of Materials (BOM) including manufacturer and part number.
6. Cut sheets of each item listed on the BOM and Test Certification data.
7. Working drawings and design calculations.
8. Product data.
9. Monitoring system installer's qualification.
10. Warranty for the monitoring system.
11. A cost proposal to the Department for maintaining the monitoring system after acceptance of contract. The proposal shall include maintenance and services that will be provided.

PV Module and Conduit Layout Plan:

PV module and conduit layout plan shall show the following:

1. The layout of the PV modules on the roof.
2. The layout of conduits on the roof.
3. All areas of the roof or walls that will be disturbed during the installation of the PV modules.

The area of roof disturbed by the installation of the PV modules must not exceed area in square feet as shown on the plans.

Working Drawings:

Working drawings, PV mounting system structural calculations, and PV electrical system electrical calculations shall be submitted for approval.

Working drawings shall show fabrication, installation, and finish for the PV system and shall consist of the following:

1. Fully dimensioned plans and elevations showing all major components of the PV system.
2. Installation details of PV mounting system, including mounting rack support.
3. Wiring diagrams including conductor identification (origin and destination) of all power and control conductors.
4. Rough-in requirements.
5. System grounding locations.

Product Data:

A list of materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval prior to procurement. Any other data as requested by the Engineer shall also be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data, results of PV system performance estimate, and installation instructions for the materials and equipment specified herein.

Monitoring system equipment product data shall include layout, wiring diagrams, power supply, capacities, sizes, performances, sub-array monitoring, and communication equipment.

Manufacturer's descriptive data shall be submitted for the following:

PV modules
Utility interactive inverter cabinet
Utility interactive inverter with DC/AC disconnect switches
Circuit combiner boxes
PV Power DC Disconnect Switch
DC/AC surge protection systems
Factory finishes
Hardware
Sealants
Grounding accessories
PV racking systems
Control interface
All monitoring equipment including remote monitoring/communication devices
Communication cables
Data Acquisition Server System
Sub-array monitoring
Utility AC disconnect switch

Closeout Submittals:

Closeout documents shall contain the following sections:

1. Operating instructions for the complete PV system.
2. Maintenance instructions for the complete PV system.
3. Operational manuals for each system listed on the BOM.
4. Specified product warranty information.
5. As-built drawings.
6. At the conclusion of all PV installation work and testing, a certificate of compliance shall be submitted stating that the work has been performed in compliance with the CSI and these special provisions.

Three copies of each closeout document shall be submitted in the following manner:

1. CD with PDF files
2. Two individual 3-ring binder containing paper copies.

Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

QUALITY ASSURANCE

Regulatory Requirements:

The PV system shall meet the requirements of the California Solar Initiative Program Handbook (CSI Handbook). Copies of the handbook can be found at the following website:

http://www.gosolarcalifornia.ca.gov/documents/CSI_HANDBOOK.PDF

If there is a conflict or overlap of requirements between the CSI Handbook, project plans, or these specifications, the most stringent requirements shall be applied.

PV Installer Qualifications:

The PV installer shall be a registered installer listed on the CSI database found at the following website:

http://www.gosolarcalifornia.ca.gov/retailers/search-new.php

The PV installer shall have experience in designing and installing at least one commercial PV system of 30 kW or greater.

The manufacturer providing components for the PV system shall have a minimum of 5 years successful experience, manufacturing and providing components for PV systems similar to those specified herein.

The manufacturer's limited warranty for the PV module shall be a minimum of 25 years s components.

The first paragraph of Section 2.4, "Warranty Requirements," of the CSI Handbook is amended to read:

Currently, all solar energy systems must have a minimum 10 year manufacturer warranty provided in combination by the manufacturer and Solar Contractor to protect the purchaser against defective workmanship, system or component breakdown, or degradation in electrical output of more than 15 percent from their originally rated electrical output during the 10 year period. The warranty must cover the solar generating system only, including the PV module (panel) inverters, solar collectors, tracking mechanisms, heat exchangers, pumps, heat driven cooling systems associated with the solar energy system.

The PV modules (panels) must have a minimum 25 year manufacturer warranty.

PART 2 - PRODUCTS

All PV system components shall be factory assembled and tested.

PV system components shall be sized to the system capacity and voltage requirements as shown on the plans, and be designed to provide maximum power point tracking for voltage and current range expected from the PV array for temperatures and solar insolation conditions expected for project site conditions.

PV Modules: PV modules shall conform to the requirements shown on the plans.

Utility Interactive Inverter Cabinet: Utility interactive inverter cabinet shall conform to the requirements shown on the plans.

Circuit Combiner Box: Circuit combiner box shall conform to the requirements shown on the plans.

Utility interactive inverter with DC/AC Disconnect Switches and Utility AC disconnect switch: Utility interactive inverter with DC/AC disconnect switches and Utility AC disconnect switch shall conform to the requirements shown on the plans.

PV Power DC Disconnect Switch shall conform to the requirements shown on the plans.

PV Service AC disconnect Switch shall conform to the requirements shown on the plans.

Data acquisition server system shall conform to the requirements as shown on the plans.

PV Module Mounting System:

PV module mounting system shall meet seismic and wind code requirements of the CBC 2010.

PV module mounting system shall be Unirac, DPW Solar, Sollega or approved equal.

Communication Cables:

TIA-485 cable shall be a shielded, one twisted pair, 22 AWG with ground conductor, low loss, plenum rated, extended frequency data cable.

Category 6 cables shall be 4 pair, 24 AWG, unshielded twisted pair (UTP), low loss, CMP Rated (plenum rated), and shall conform to TIA-568 Commercial Telecommunications Buildings Standards, Horizontal Cable Section. Pairs coloring shall be according to TIA-568 standards. Cable shall come with male 8P8C modular connectors at each end.

Control Interface:

Control interface may be located inside the utility interactive inverter cabinet, or in a separate outside cabinet. The separate cabinet shall be a NEMA 3R enclosure, with an exterior door that is lockable with a padlock.

Interface shall have isolated DC voltage and current sensors for gathering inverter and sub-array combiner data. The interface shall be able to monitor inverter status and fault codes.

Interface shall have a keypad, LCD display and be able to display PV system information.

Accessories: All accessories necessary for the complete installation of the PV system components, shall be furnished and installed as required to have a complete and operational PV system.

PART 3 - EXECUTION

EXAMINATION

The Contractor shall verify that items provided under other portions of these special provisions are properly sized and located. Examine supporting members to ensure surfaces are at proper elevation and PV modules are free from dirt or other deleterious matter.

INSTALLATION

PV Module Mounting System:

Install PV modules array on roofs as shown on plans, in accordance with the provisions of the approved working drawings, and as described herein.

1. PV modules mounting rack shall be designed to withstand loading as shown on the plans and in conformance with the 2010 California Building Code.
2. Module racking systems shall be designed to accept framed PV modules.
3. Metal framed PV modules shall be grounded as shown on the plans and in conformance with the 2010 California Electrical Code, Article 690.

The Contractor shall notify the Engineer at least 2 days prior to installing the PV modules.

Provide and install junction boxes as required. All roof mounted junction boxes to be of NEMA-3 type junction boxes sized for the number of conductors inside it. Roof mounted junction boxes to be supported on roof supports as shown on the plans. There shall be minimum of two roof support per junction box.

Utility Interactive Inverter Cabinet Mounting: Utility interactive inverter cabinet shall be installed on the concrete slab as recommended by the manufacturer and as shown on the plans.

TESTING AND APPROVALS

State Fire Marshal Approval: The complete PV system shall be reviewed, approved, and accepted by the State Fire Marshal, after installation of the system has been completed.

Grid-Tie PV System Report: Attention is directed to "Supplemental Project Information" of these special provisions regarding Grid-Tie PV System Report form. Information shall be recorded by the Contractor on the Grid-Tie PV System Report form in the presence of the Engineer. Final completed form shall be submitted to the Engineer.

Functional Testing:

After installation is completed, functional testing shall be performed in the presence of the Engineer to demonstrate that the entire PV system is functioning properly.

Functional testing of the PV system shall not be performed until:

1. All of the Engineer's punch list items have been corrected
2. The local electrical utility company representative has approved the completed PV system
3. Obtaining State Fire Marshal approval

The functional test shall consist of operating the entire PV system for 5 consecutive days. In the event any of the system fails to perform satisfactorily, the entire test shall be repeated after the deficiency has been corrected.

Functional testing shall be performed in accordance with Section 86-2.14B, "Field Testing" and Section 86.2.14C, "Functional Testing," of the Standard Specifications.

The Contractor shall be responsible for the compatibility and adjustment of all operating functions of the PV system, in accordance with manufacturer's instructions and these special provisions.

The Contractor shall make necessary repairs, replacements, adjustments and retests at the Contractor's expense.

CLEANING

The Contractor shall clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials, and other unsightly marks

The Contractor shall clean metal surfaces exercising care to avoid damage.

The Contractor shall clean energy generating surfaces of the PV modules to ensure no obstructions block sunlight.

AMENDMENTS TO THE STANDARD SPECIFICATIONS

DATED MAY 2006

AMENDMENTS ISSUE DATE: 10-19-12

SECTION 0 GLOBAL REVISIONS

(Issued 01-20-12)

Global revisions are changes to contract documents not specific to a section of the Standard Specifications. In each contract document at each occurrence, interpret the following terms as shown:

Term	Interpretation	Conditions
AC	HMA	1. Where AC means asphalt concrete 2. Except where existing AC is described
Asphalt concrete	Hot mix asphalt	Except where existing asphalt concrete is described
Class 1 concrete	Concrete containing not less than 675 pounds of cementitious material per cubic yard	--
Class 2 concrete	Concrete containing not less than 590 pounds of cementitious material per cubic yard	--
Class 3 concrete	Concrete containing not less than 505 pounds of cementitious material per cubic yard	--
Class 4 concrete	Concrete containing not less than 420 pounds of cementitious material per cubic yard	--
Clause providing an option to use either a class concrete or minor concrete	Use minor concrete	--
Clause referring to a delay as a right-of-way delay	Delay under Section 8-1.09, "Delays"	--
Contact joint	Construction joint	--
Controlling operation	Controlling activity	--
Engineer's Estimate	Verified Bid Item List	--
Engineering fabrics	Geosynthetics	--
Notice to Contractors	Notice to Bidders	--
Partial payments	Progress payments	Except in Section 9-1.07D, "Mobilization"
PCC pavement	Concrete pavement	Except where existing PCC pavement is described
Portland cement concrete pavement	Concrete pavement	Except where existing portland cement concrete pavement is described
Project information	Supplemental project information	Except in "Contract Project Information Signs"
Reference to a working day or non–working day under Section 8-1.06, "Time of Completion"	Working day as defined in Section 1-4.02, "Glossary"	--
Section 9-1.015	Section 9-1.01C	--
Section 86, "Signal, Lighting and Electrical Systems"	Section 86, "Electrical Systems"	--
Section 86-2.08, "Conductors"	Section 86-2.08, "Conductors and Cables"	--
Section 86-5.01A(5), "Installation Details"	Section 86-5.01A(4),	--

	"Installation Details"	
Section 86-6.05, "Sign Lighting Fixtures—Mercury"	Section 86-6.05, "Induction Sign Lighting Fixtures"	--
Time extension due to an unanticipated event not caused by either party or an issue involving a third party under Section 8-1.07, "Liquidated Damages"	Non–working day	--
Time extension due to an act of the Engineer or of the Department not contemplated by the contract	Time adjustment under Section 8-1.09B, "Time Adjustments"	--
Weakened plane joint	Contraction joint	--

^^

SECTION 1 DEFINITIONS AND TERMS
(Issued 06-20-12)

Replace Section 1 with:
SECTION 1 GENERAL
1-1 GENERAL

1-1.01 GENERAL

Section 1 includes general rules of interpretation.

The Department is gradually standardizing the style and language of the specifications. The new style and language includes:

1. Use of:

    1.1. Imperative mood
    1.2. Introductory modifiers
    1.3. Conditional clauses

2. Elimination of:

    2.1. Language variations
    2.2. Definitions for industry-standard terms
    2.3. Redundant specifications
    2.4. Needless cross-references

The use of this new style does not change the meaning of a specification not yet using this style.

Sections 1 through 9 include general specifications applicable to every contract unless specified as applicable under certain conditions.

Sections 10 through 15 include specifications for general construction applicable to every contract unless specified as applicable under certain conditions.

The specifications are written to the Bidder before award and the Contractor after. Before award, interpret sentences written in the imperative mood as starting with "The Bidder must" and interpret "you" as "the Bidder" and "your" as "the Bidder's." After award, interpret sentences written in the imperative mood as starting with "The Contractor must" and interpret "you" as "the Contractor" and "your" as "the Contractor's."

Omission of "a," "an," and "the" is intentional. These articles have been omitted in some specifications for streamlining purposes.

Unless an object or activity is specified to be less than the total, the quantity or amount is all of the object or activity.

A plural term includes the singular.

All items in a list apply unless the items are specified as choices.

Headings are included for the purposes of organization and referencing. Inclusion of a heading with no related content, "Reserved," or "Not Used" does not indicate that no specification exists for that subject; applicable specifications may be covered in a general or referenced specification.

1-2 REFERENCES

1-2.01 REFERENCES

Where Standard Specifications refer to the special provisions to describe the work, interpret the reference as a reference to the Bid Item List, the special provisions, or both.

Interpret a reference to a section of the Standard Specifications as a reference to the Standard Specifications as revised by any amendment, special provision, or both.

A reference within parentheses to a law or regulation is included in the contract for convenience only and is not a comprehensive listing of related laws and regulations. Lack of a reference does not indicate no related laws or regulations exist.

Where the version of a referenced document is not specified, use the current version in effect on the date of Notice to Bidders.

A reference to a subsection includes the section's general specifications of which the subsection is a part.

A code not specified as a Federal code is a California code.

1-3 ABBREVIATIONS AND MEASUREMENT UNITS

1-3.01 ABBREVIATIONS

Abbreviations

Abbreviation	Meaning
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMA	archaeological monitoring area
ANSI	American National Standards Institute
APHA	American Public Health Association
API	American Petroleum Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American Wire Gage
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
CIH	Certified Industrial Hygienist
DBE	Disadvantaged Business Enterprise
DVBE	Disabled Veteran Business Enterprise
EIA	Electronic Industries Alliance
ESA	environmentally sensitive area
ETL	Electrical Testing Laboratories
(F)	final pay item
FHWA	Federal Highway Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NEC	National Electrical Code
NETA	National Electrical Testing Association, Inc.
NEMA	National Electrical Manufacturers Association
PLAC	permit, license, agreement, certification, or any combination of these
RFI	request for information
SSPC	The Society for Protective Coatings
TIA	time impact analysis
UL	Underwriters' Laboratories Inc.

1-3.02 MEASUREMENT UNITS

Measurement Units

Symbols as used in the specifications	Symbols as used in the Bid Item List	Meaning
A	—	amperes
	ACRE	acre
	CF	cubic foot
	CY	cubic yard
--	EA	each
g	--	gram
ksi	--	kips per square inch
	GAL	gallon
h	H	hour
	LB	pound
--	LS	lump sum
	LF	linear foot
	LNMI	lane mile
	MFBM	thousand foot board measure
	MI	mile
	MSYD	thousand station yard
Ω	--	ohm
pcf	--	pounds per cubic foot
s	--	second
	STA	100 feet
	SQFT	square foot
	SQYD	square yard
	TAB	tablet
ton	TON	2,000 pounds
V	--	volt
W	--	watt
--	WDAY	working day

1-4 DEFINITIONS

1-4.01 GENERAL

Interpret terms as defined in the contract documents. A construction-industry term not defined in the contract documents has the meaning defined in Means Illustrated Construction Dictionary, Condensed Version, Second Edition.

1-4.02 GLOSSARY

aerially deposited lead: Lead primarily from vehicle emissions deposited within unpaved areas or formerly unpaved areas.

archaeological monitoring area: Area within, near, or straddling the project limits where access is allowed, but work is subject to archaeological monitoring.

archaeological resources: Remains of past human activity, including historic and prehistoric material (e.g., tools and tool fragments, hearth and food remains, structural remains, and human remains).

acceptance: Formal written acceptance by the Director of an entire contract that has been completed in all respects in accordance with the plans and specifications and any modifications to them previously approved.

base: Layer of specified material of planned thickness placed immediately below the pavement or surfacing.

basement material: Material in excavation or embankments underlying the lowest layer of subbase, base, pavement, surfacing, or other specified layer to be placed.

bid item: Specific work unit for which the bidder provides a price.

Bid Item List: List of bid items and the associated quantities.

Bid Item List, verified: Bid Item List with verified prices. The Contract Proposal of Low Bidder at the Department's Web site is the verified Bid Item List.

bridge: Structure, with a bridge number, that carries a utility facility, or railroad, highway, pedestrian or other traffic, over a water course or over or under or around any obstruction.

building-construction contract: Contract that has "building construction" on the cover of the Notice to Bidders and Special Provisions.

business day: Day on the calendar except Saturday or holiday.

California Manual on Uniform Traffic Control Devices: The California Manual on Uniform Traffic Control Devices for Streets and Highways (California MUTCD) is issued by the Department of Transportation and is the Federal Highway Administration's MUTCD 2003 Edition, as amended for use in California.

Certified Industrial Hygienist: Industrial hygienist certified in comprehensive practice by the American Board of Industrial Hygiene.

conduit: Pipe or tube in which smaller pipes, tubes, or electrical conductors are inserted or are to be inserted.

contract: Written and executed contract between the Department and the Contractor.

contract bonds: Security for the payment of workers and suppliers furnishing materials, labor, and services and for guaranteeing the Contractor's work performance.

contract item: Bid item.

Contractor: Person or business or its legal representative entering into a contract with the Department for performance of the work.

culvert: Structure, other than a bridge, that provides an opening under a roadway for drainage or other purposes.

day: 24 consecutive hours running from midnight to midnight; calendar day.

deduction: Amount of money permanently taken from progress payment and final payment. Deductions are not retentions under Pub Cont Code § 7107.

Department: Department of Transportation as defined in St & Hwy Code § 20 and authorized in St & Hwy Code § 90; its authorized representatives.

detour: Temporary route for traffic around a closed road part. A passageway through a job site is not a detour.

Director: Department's Director.

Disabled Veteran Business Enterprise: Business certified as a DVBE by the Office of Small Business and DVBE Services, Department of General Services.

Disadvantaged Business Enterprise: Disadvantaged Business Enterprise as defined in 49 CFR 26.5.

divided highway: Highway with separated traveled ways for traffic, generally in opposite directions.

Engineer: Department's Chief Engineer acting either directly or through properly authorized agents; the agents acting within the scope of the particular duties delegated to them.

environmentally sensitive area: Area within, near, or straddling the project limits where access is prohibited or limited to protect environmental resources.

Federal-aid contract: Contract that has a Federal-aid project number on the cover of the Notice to Bidders and Special Provisions.

fixed costs: Labor, material, or equipment cost directly incurred by the Contractor as a result of performing or supplying a particular bid item that remains constant regardless of the item's quantity.

frontage road: Local street or road auxiliary to and located generally on the side of an arterial highway for service to abutting property and adjacent areas and for control of access.

grading plane: Basement material surface on which the lowest layer of subbase, base, pavement, surfacing, or other specified layer is placed.

highway: Whole right of way or area that is reserved for and secured for use in constructing the roadway and its appurtenances.

holiday:

1. Every Sunday
2. January 1st, New Year's Day
3. 3rd Monday in January, Birthday of Martin Luther King, Jr.
4. February 12th, Lincoln's Birthday
5. 3rd Monday in February, Washington's Birthday
6. March 31st, Cesar Chavez Day
7. Last Monday in May, Memorial Day
8. July 4th, Independence Day
9. 1st Monday in September, Labor Day
10. 2nd Monday in October, Columbus Day
11. November 11th, Veterans Day
12. 4th Thursday in November, Thanksgiving Day

13. Day after Thanksgiving Day
14. December 25th, Christmas Day

If January 1st, February 12th, March 31st, July 4th, November 11th, or December 25th falls on a Sunday, the Monday following is a holiday. If November 11th falls on a Saturday, the preceding Friday is a holiday. Interpret "legal holiday" as "holiday."

idle equipment: Equipment:

1. On the job site at the start of a delay
2. Idled because of the delay
3. Not operated during the delay

informal-bid contract: Contract that has "Informal Bid Authorized by Pub Cont Code §10122" on the cover of the Notice to Bidders and Special Provisions.

Information Handout: Supplemental project information furnished to bidders as a handout.

laboratory: Laboratory authorized by the Department to test materials.

liquidated damages: Amount prescribed in the specifications, pursuant to the authority of Pub Cont Code § 10226, to be paid to the State or to be deducted for each day's delay in completing the whole or any specified portion of the work beyond the time allowed in the specifications.

listed species: Any species listed as threatened or endangered under (1) Federal Endangered Species Act of 1973, 16 USC §1531 et seq., (2) California Endangered Species Act, Fish & Game Code §§ 2050–2115.5, (3) or both.

material shortage: Shortage of raw or produced material that is area-wide and caused by an unusual market condition, except if any of the following occurs:

1. Shortage relates to a produced, nonstandard material
2. Supplier's and the Contractor's priority for filling an order differs
3. Event outside the U.S. for a material produced outside the U.S.

median: Portion of a divided highway separating the traveled ways for traffic in opposite directions including inside shoulders.

mobilization: Preparatory work that must be performed or costs incurred before starting work on the various items on the job site (Pub Cont Code § 10104).

Notice to Bidders: Document that provides a general work description, bidder and bid specifications, and the time and location the Department receives bids.

paleontological resources: Fossils and the deposits they are found in. Fossils are evidence of ancient life preserved in sediments and rock. Examples of paleontological resources are remains of (1) animals, (2) animal tracks, (3) plants, and (4) other organisms. Archaeological resources are not paleontological and fossils found within an archaeological resource are generally considered archaeological resources, not paleontological resources.

pavement: Uppermost layer of material placed on the traveled way or shoulders. This term is used interchangeably with surfacing.

permitted biological activities: Monitoring, surveying, or other practices that require a take permit and project specific permission from U.S. Fish and Wildlife Service or NOAA Fisheries or a take permit or Memorandum of Understanding with Department of Fish and Game.

plans: Official project plans and Standard Plans, profiles, typical cross sections, working drawings and supplemental drawings, or reproductions thereof, approved by the Engineer, which show the location, character, dimensions and details of the work to be performed. These documents are to be considered as a part of the plans.

In the above definition, the following terms are defined as follows:

Standard Plans: Standard Plans issued by the Department.

project plans: Specific details and dimensions peculiar to the work supplemented by the Standard Plans insofar as the same may apply.

protective radius: Minimum distance between construction activities and regulated species.

regulated species: Any species protected by one or any combination of the following:

1. Federal Endangered Species Act of 1973, 16 USC §1531 et seq.
2. California Endangered Species Act, Fish & Game Code §§2050–2115.5
3. Fish & Game Code §§1600–1616
4. National Environmental Policy Act, 42 USC §4321 et seq.
5. California Environmental Quality Act, Pub Res Code § 21000 et.seq.

6. Other law or regulation that governs activities that affect species or their habitats.

roadbed: Area between the intersection of the upper surface of the roadway and the side slopes or curb lines. The roadbed rises in elevation as each increment or layer of subbase, base, surfacing or pavement is placed. Where the medians are so wide as to include areas of undisturbed land, a divided highway is considered as including 2 separate roadbeds.

roadway: Highway portion included between the outside lines of sidewalks, or curbs, slopes, ditches, channels, waterways, and including all the appertaining structures, and other features necessary to proper drainage and protection.

routine biological activities: Biological monitoring, surveying, or other activity that does not require a take permit from the U.S. Fish and Wildlife Service or NOAA Fisheries or a take permit or Memorandum of Understanding with Department of Fish and Game.

service-approved biologist: Biologist whose activities must be approved by a state or federal agency as provided in PLACs.

shoulder: Roadway portion contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

small tool: Tool or piece of equipment not listed in Labor Surcharge and Equipment Rental Rates that has a replacement value of $500 or less.

special provisions: Specific clauses setting forth conditions or requirements peculiar to the work and supplementary to these Standard Specifications. The Department's publication titled "Labor Surcharge And Equipment Rental Rates" is part of the special provisions.

specifications: Directions, provisions, and requirements contained in these Standard Specifications, Amendments to the Standard Specifications, and the special provisions. Where the term "these specifications" or "these Standard Specifications" is used in this book, it means the provisions set forth in this book.

State: State of California, including its agencies, departments, or divisions, whose conduct or action is related to the work.

Structure Design: Offices of Structure Design of the Department.

subbase: Layer of specified material of planned thickness between a base and the basement material.

subgrade: Roadbed portion on which pavement, surfacing, base, subbase, or a layer of any other material is placed.

substructure: Bridge portions below the bridge seats, tops of piers, haunches of rigid frames, or below the spring lines of arches. Backwalls and parapets of abutments and wingwalls of bridges are portions of the substructure.

superstructure: Bridge portion except the bridge substructure.

supplemental project information: Information relevant to the project, specified as supplemental project information, and made available to bidders.

surfacing: Uppermost layer of material placed on the traveled way, or shoulders. This term is used interchangeably with pavement.

take: Legal definition regarding harm to listed species as defined in 16 USC §1532 and Fish & Game Code § 86.

take permit: Permit granted by the US Fish and Wildlife Service or by the NOAA Fisheries that allows take of federal listed species under 16 USC §1539 or by the Department of Fish & Game that allows take of state listed species under to Fish & Game Code § 2081.

traffic lane: Portion of a traveled way for the movement of a single line of vehicles.

traveled way: Portion of the roadway for the movement of vehicles, exclusive of shoulders.

total bid: Sum of the item totals as verified by the Department; original contract price.

withhold: Money temporarily or permanently taken from progress payment. Withholds are not retentions under Pub Cont Code § 7107.

work: All the work specified, indicated, shown or contemplated in the contract to construct the improvement, including all alterations, amendments, or extensions to it made by contract change order or other written orders of the Engineer.

working day: Time measure unit for work progress. A working day is any day except:

1. Saturdays and holidays
2. A day when you cannot perform work on the controlling activity for at least 50 percent of the day with at least 50 percent of the normal labor and equipment due to any of the following:

    2.1. Adverse weather-related conditions that cause you to dismiss the crew

2.2. Maintaining traffic under the contract
2.3. The Engineer's direction to suspend the controlling activities for reasons unrelated to your performance
2.4. An unanticipated event not caused by either party such as:

2.4.1. Act of God (Pub Cont Code § 7105)
2.4.2. Act of a public enemy
2.4.3. Epidemic
2.4.4. Fire
2.4.5. Flood
2.4.6. Governor-declared state of emergency
2.4.7. Landslide
2.4.8. Quarantine restriction

2.5. An issue involving a third-party, including:

2.5.1. Industry or area-wide labor strike
2.5.2. Material shortage
2.5.3. Freight embargo
2.5.4. Jurisdictional requirement of a law enforcement agency
2.5.5. Workforce labor dispute of a utility or non-highway facility owner resulting in a utility or non-highway facility reconstruction not described and not solely for the Contractor's convenience

1-5 DISTRICTS

District Composition and Office Addresses

District	Counties	Location Address	Mailing Address
1	Del Norte (DN), Humboldt (Hum), Lake (Lak), Mendocino (Men)	1656 UNION ST EUREKA, CA	PO BOX 3700 EUREKA CA 95502
2	Lassen (Las), Modoc (Mod), Plumas (Plu), Shasta (Sha), Siskiyou (Sis), Tehama (Teh), Trinity (Tri)	1657 RIVERSIDE DR REDDING, CA	PO BOX 496073 REDDING CA 96049-6073
3	Butte (But), Colusa (Col), El Dorado (ED), Glenn (Gle), Nevada (Nev), Placer (Pla), Sacramento (Sac), Sierra (Sie), Sutter (Sut), Yolo (Yol), Yuba (Yub)	703 B ST MARYSVILLE, CA	703 B ST MARYSVILLE CA 95901
4	Alameda (Ala), Contra Costa (CC), Marin (Mrn), Napa (Nap), San Francisco (SF), San Mateo (SM), Santa Clara (SCl), Solano (Sol), Sonoma (Son)	111 GRAND AVE OAKLAND, CA	PO BOX 23660 OAKLAND CA 94623-0660
5	Monterey (Mon), San Benito (SBt), San Luis Obispo (SLO), Santa Barbara (SB), Santa Cruz (SCr)	50 HIGUERA ST SAN LUIS OBISPO, CA	50 HIGUERA ST SAN LUIS OBISPO CA 93401-5415
6	Fresno (Fre), Kern (Ker), Kings (Kin), Madera (Mad), Tulare (Tul)	1352 W. OLIVE AVE FRESNO, CA	PO BOX 12616 FRESNO CA 93728-2616
7	Los Angeles (LA), Ventura (Ven)	100 S. MAIN ST LOS ANGELES	100 S MAIN ST LOS ANGELES CA 90012
8	Riverside (Riv), San Bernardino (SBd)	464 W 4TH ST SAN BERNARDINO, CA	464 W 4TH ST SAN BERNARDINO CA 92401-1400
9	Inyo (Iny), Mono (Mno)	500 S MAIN ST BISHOP, CA	500 S MAIN ST BISHOP CA 93514-3423
10	Alpine (Alp), Amador (Ama), Calaveras (Cal), Mariposa (Mpa), Merced (Mer), San Joaquin (SJ), Stanislaus (Sta), Tuolumne (Tuo)	1976 E CHARTER WAY STOCKTON, CA	PO BOX 2048 STOCKTON CA 95201
11	Imperial (Imp), San Diego (SD)	4050 TAYLOR ST SAN DIEGO, CA	4050 TAYLOR ST SAN DIEGO CA 92110-2737
12	Orange (Ora)	3347 MICHELSON DR STE 100 IRVINE, CA	3347 MICHELSON DR STE 100 IRVINE CA 92612-0661

A project with work in District 1, 2, or 3 is a North Region project. For Districts 1, 2, and 3, interpret each reference to the district office as the North Region office. The North Region office address is the District 3 address.

1-6 WEB SITES, ADDRESSES, AND TELEPHONE NUMBERS

Web Sites, Addresses, and Telephone Numbers

Agency, Department Unit, or Reference	Web Site	Address	Telephone No.
Bidders' Exchange	www.dot.ca.gov/hq/esc/oe/bidex	MSC 26 BIDDERS' EXCHANGE DEPARTMENT OF TRANSPORTATION 1727 30TH ST SACRAMENTO CA 95816-7005	(916) 227-6259
Department	www.dot.ca.gov		
Department of General Services, Office of Small Business and DVBE Services	www.pd.dgs.ca.gov/smbus/default.htm	OFFICE OF SMALL BUSINESS AND DVBE SERVICES DEPARTMENT OF GENERAL SERVICES 707 3RD ST WEST SACRAMENTO CA 95605-2811	(800) 559-5529 (916) 375-4940
Department of Industrial Relations	www.dir.ca.gov		
Department of Industrial Relations, Division of Apprenticeship Standards		455 GOLDEN GATE AVENUE SAN FRANCISCO, CA 94102	
Division of Accounting, Office of External Accounts Payable	http://www.dot.ca.gov/hq/asc/oap/payments/contact.htm#conpets1	MAJOR CONSTRUCTION PAYMENT AND INFORMATION UNIT OFFICE OF EXTERNAL ACCOUNTS PAYABLE DIVISION OF ACCOUNTING DEPARTMENT OF TRANSPORTATION P.O. BOX 168043 SACRAMENTO, CA 95816-8043	(916) 227-9013
Office Engineer		MSC 43 OFFICE ENGINEER DEPARTMENT OF TRANSPORTATION 1727 30TH ST SACRAMENTO CA 95816-7005	
Office Engineer–All Projects Currently Advertised	http://www.dot.ca.gov/hq/esc/oe/weekly_ads/all_advertised.php		
Offices of Structure Design, Documents Unit		MSC 9-4/4I DOCUMENTS UNIT OFFICES OF STRUCTURE DESIGN DEPARTMENT OF TRANSPORTATION 1801 30TH ST SACRAMENTO CA 95816-7006	(916) 227-0716
Publication Distribution Unit		PUBLICATION UNIT DEPARTMENT OF TRANSPORTATION 1900 ROYAL OAKS DRIVE SACRAMENTO CA 95815-3800	

Transportation Laboratory		MATERIALS AND ENGINEERING TESTING SERVICES AND GEOTECHNICAL SERVICES DEPARTMENT OF TRANSPORTATION 5900 FOLSOM BLVD SACRAMENTO CA 95819-4612	(916) 227-7000
Department's Pre-Qualified Products List	http://www.dot.ca.gov/hq/esc/approved_products_list		

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SECTION 2 PROPOSAL REQUIREMENTS AND CONDITIONS
(Issued 01-20-12)

Replace Section 2 with:

SECTION 2 BIDDING

2-1.01 GENERAL

Section 2, "Bidding," includes specifications related to bid eligibility and the bidding process.

2-1.02 BID INELIGIBILITY

A firm that has provided architectural or engineering services to the Department for this contract before bid submittal for this contract is prohibited from any of the following:

1. Submit a bid
2. Subcontract for a part of the work
3. Supply materials

2-1.03 BID DOCUMENTS

2-1.03A General

Standard Specifications and Standard Plans may be viewed at the Department's Web site and may be purchased at the Publication Distribution Unit.

Special provisions, Amendments to the Standard Specifications, and project plans may be viewed at the Bidders' Exchange. To obtain bid books, submit a request to the Bidders' Exchange. For an informal-bid contract, you may also obtain special provisions, Amendments to the Standard Specifications, and project plans at the Bidders' Exchange.

2-1.03B Supplemental Project Information

Logs of test borings attached to the project plans are supplemental project information. The Department makes other supplemental information available as specified in the special provisions.

If an Information Handout or cross sections are available:

1. You may view them at the Office Engineer–All Projects Currently Advertised Web site
2. For an informal-bid contract, you may obtain them at the Bidders' Exchange street address

If rock cores are available for inspection, you may view them by sending a request to Coreroom@dot.ca.gov.

If other supplemental project information is available for inspection, you may view it by phoning in a request. Make your request at least 7 days before viewing. Include in your request:

1. District-County-Route
2. Contract number
3. Viewing date
4. Contact information, including telephone number.

For rock cores, also include the bridge number in your request.
If bridge as-built drawings are available:

1. For a project in District 1 through 6 or 10, you may request them from the Office of Structure Maintenance and Investigations, fax (916) 227-8357
2. For a project in District 7, 8, 9, 11, or 12, you may request them from the Office of Structure Maintenance and Investigations, fax (916) 227-8357, and they are available at the Office of Structure Maintenance and Investigations, Los Angeles, CA, telephone (213) 897-0877

As-built drawings may not show existing dimensions and conditions. Where new construction dimensions are dependent on existing bridge dimensions, verify the field dimensions and adjust dimensions of the work to fit existing conditions.

2-1.04–2-1.10 RESERVED

2-1.11 JOB SITE AND DOCUMENT EXAMINATION

Examine the job site and bid documents.
Bid submission is your acknowledgment that you have examined the job site and bid documents and are satisfied with:

1. General and local conditions to be encountered
2. Character, quality, and scope of work to be performed
3. Quantities of materials to be furnished
4. Character, quality, and quantity of surface and subsurface materials or obstacles
5. Requirements of the contract

2-1.12 BID DOCUMENT COMPLETION

2-1.12A General

Complete forms in the Bid book.
Except for the bid item number and the percentage of each item subcontracted, do not fax submittals.

2-1.12B Bid Item List and Bid Comparison

Submit a bid based on the work item quantities the Department shows in the Bid Item List.
For a lump sum based bid, the Department compares bids based on the total price.
For a unit price based bid, the Department compares bids based on the sum of the item totals.
For a cost plus time based bid, the Department compares bids based on the sum of the item totals and the total bid for time. If your bid for time exceeds the number of working days described in the Notice to Bidders, your bid is nonresponsive.

2-1.12C Subcontractor List

In the Subcontractor List, list each subcontractor to perform work in an amount in excess of 1/2 of 1 percent of the total bid or $10,000, whichever is greater (Pub Cont Code § 4100 et seq.)
The Subcontractor List must show the name, address, and work portions to be performed by each subcontractor listed. Show work portion by bid item number, description, and percentage of each bid item subcontracted.
On the Subcontractor List you may either submit each subcontracted bid item number and corresponding percentage with your bid or fax these numbers and percentages to (916) 227-6282 within 24 hours after bid opening. Failure to do so results in a nonresponsive bid.

2-1.13 BIDDER'S SECURITY

Submit your bid with one of the following forms of bidder's security equal to at least 10 percent of the bid:

1. Cash
2. Cashier's check
3. Certified check
4. Bidder's bond signed by a surety insurer who is licensed in California

Make checks and bonds payable to the Department of Transportation.

If using a bidder's bond, you may use the form in the Bid book. If you do not use the form in the Bid book, use a form containing the same information.

2-1.14 BID SUBMITTAL

Submit your bid:

1. Under sealed cover
2. Marked as a bid
3. Identifying the contract number and the bid opening date

If an agent other than the authorized corporation officer or a partnership member signs the bid, file a Power of Attorney with the Department either before opening bids or with the bid. Otherwise, the bid may be nonresponsive.

2-1.15 BID WITHDRAWAL

An authorized agent may withdraw a bid before the bid opening date and time by submitting a written bid withdrawal request at the location where the bid was submitted. Withdrawing a bid does not prevent you from submitting a new bid.

After the bid opening time, you cannot withdraw a bid.

2-1.16 BID OPENING

The Department publicly opens and reads bids at the time and place described in the Notice to Bidders.

2-1.17 BID REJECTION

The Department may reject:

1. All bids
2. A nonresponsive bid

2-1.18 BID RELIEF

The Department may grant bid relief under Pub Cont Code § 5100 et seq. Submit any request for bid relief to the Office Engineer. For Relief of Bid Request form, go to:

http://www.dot.ca.gov/hq/esc/oe/contractor_info/relief.pdf

2-1.19 SUBMITTAL FAILURE HISTORY

The Department considers a bidder's past failure to submit documents required after bid opening in determining a bidder's responsibility.

2-1.20 BID RIGGING

Section 2-1.20, "Bid Rigging," applies to a Federal-aid contract.

The U.S. Department of Transportation (DOT) provides a toll-free hotline to report bid rigging activities. Use the hotline to report bid rigging, bidder collusion, and other fraudulent activities. The hotline number is (800) 424-9071. The service is available Monday through Friday between 11:00 a.m. and 8:00 p.m. and is confidential and anonymous. The hotline is part of the DOT's effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General.

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SECTION 3 AWARD AND EXECUTION OF CONTRACT

(Issued 10-19-12)

Replace Section 3 with:

SECTION 3 CONTRACT AWARD AND EXECUTION

3-1.01 SCOPE

Section 3, "Contract Award and Execution," includes specifications related to contract award and execution.

3-1.02 CONTRACT AWARD

Submit any bid protest to the Office Engineer.

If the Department awards the contract, the award is made to the lowest responsible bidder within the number of days shown in the following table:

Contract Award Period

Days (after bid opening)	Project Estimated Cost shown in the Notice to Bidders
30	< $200 million
60	≥ $200 million

The Department may extend the specified award period if the bidder agrees.

You may request to extend the award period by faxing a request to (916) 227-6282 before 4:00 p.m. on the last day of the award period. If you do not make this request, after the specified award period:

1. Your bid becomes invalid
2. You are not eligible for the award of the contract

3-1.03 CONTRACT BONDS (PUB CONT CODE §§ 10221 AND 10222)

The successful bidder must furnish:

1. Payment bond to secure the claim payments of laborers, workers, mechanics, or materialmen providing goods, labor, or services under the contract. This bond must be equal to at least 100 percent of the total bid.
2. Performance bond to guarantee the faithful performance of the contract. This bond must be equal to at least 50 percent of the total bid.

The Department furnishes the successful bidder with the bond forms.

3-1.04 CONTRACTOR LICENSE

For a Federal-aid contract, the Bidder must be properly licensed (Pub Cont Code § 10164) from contract award through contract acceptance.

For a non-Federal-aid contract:

1. The Bidder must be properly licensed from bid opening through contract acceptance (Bus & Prof Code § 7028.15)
2. Joint venture bidders must obtain a joint venture license before contract award (Bus & Prof Code § 7029.1)

3-1.05 INSURANCE POLICIES

The successful bidder must submit:

1. Copy of its commercial general liability policy and its excess policy or binder until such time as a policy is available, including the declarations page, applicable endorsements, riders, and other modifications in effect at the time of contract execution. Standard ISO form No. CG 0001 or similar exclusions are allowed if not inconsistent with Section 7-1.12, "Indemnification and Insurance." Allowance of additional exclusions is at the discretion of the Department.
2. Certificate of insurance showing all other required coverages. Certificates of insurance, as evidence of required insurance for the auto liability and any other required policy, shall set forth deductible amounts applicable to each policy and all exclusions that are added by endorsement to each policy. The evidence of insurance shall provide that no cancellation, lapse, or reduction of coverage will occur without 10 days prior written notice to the Department.

3. A declaration under the penalty of perjury by a CPA certifying the accountant has applied GAAP guidelines confirming the successful bidder has sufficient funds and resources to cover any self-insured retentions if the self-insured retention is over $50,000.

If the successful bidder uses any form of self-insurance for workers compensation in lieu of an insurance policy, it shall submit a certificate of consent to self-insure under Labor Code § 3700.

3-1.06 FORM FHWA-1273

For a federal-aid contract, form FHWA-1273 is included with the Contract form in the documents sent to the successful bidder for execution. Comply with its provisions. Interpret the training and promotion section as specified in section 7-1.50A.

3-1.07–3-1.08 RESERVED

3-1.09 CONTRACT EXECUTION

The successful bidder must sign the contract and return it, including the attached form FHWA-1273, to the Office Engineer along with:

1. Contract bonds
2. Documents identified in Section 3-1.05, "Insurance Policies"

For an informal-bid contract, the Office Engineer must receive these documents before the 5th business day after the bidder receives the contract. For all other contracts, the Office Engineer must receive these documents before the 10th business day after the bidder receives the contract.

The bidder's security may be forfeited for failure to execute the contract within the time specified (Pub Cont Code §§ 10181, 10182, and 10183).

The following is a copy of the Contract form:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
CONTRACT
DES-OE-0103A (REV 03/2010)

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
CONTRACT NO. _____

This contract is entered into between the State of California's Department of Transportation and the Contractor named below:

_____
CONTRACTOR'S NAME

The parties agree to comply with the terms of the following exhibits that are by this reference made a part of this contract.

Exhibit A - Bid book dated _____

Exhibit B - Notice to Bidders and Special Provisions dated _____

Exhibit C - Project Plans approved _____

Exhibit D - Standard Specifications dated _____

Exhibit E - Standard Plans dated _____

Exhibit F - Addenda

Exhibits A, B, C, and F are those exhibits identified with the same contract number as this contract.

This contract has been executed by the following parties:

CONTRACTOR

CONTRACTOR'S NAME *(if other than an individual, state whether a corporation, partnership, etc.)*

BY *(Authorized Signature)*	DATE SIGNED *(Do not type)*
PRINTED NAME AND TITLE OF PERSON SIGNING	
FEDERAL EMPLOYER IDENTIFICATION NUMBER	LICENSE NUMBER

DEPARTMENT OF TRANSPORTATION

BY *(Authorized Signature)*	DATE SIGNED *(Do not type)*
PRINTED NAME AND TITLE OF PERSON SIGNING	

This contract has been certified as complying with the State Contract Act:

BY *(Authorized Signature)*	DATE SIGNED *(Do not type)*
PRINTED NAME AND TITLE OF PERSON SIGNING	

ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.

3-1.10 BIDDERS' SECURITIES

The Department keeps the securities of the 1st, 2nd, and 3rd low bidders until the contract has been executed. The other bidders' securities, other than bidders' bonds, are returned upon determination of the 1st, 2nd, and 3rd low bidders, and their bidders' bonds are of no further effect (Pub Cont Code § 10184).

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SECTION 4 SCOPE OF WORK

(Issued 06-05-09)

Add to Section 4-1.01:

Nothing in the specifications voids the Contractor's public safety responsibilities.

Add:

4-1.015 PROJECT DESCRIPTION

Construct the work described in the special provisions and on project plans and by the bid items. The special provisions, project plans, and bid item descriptions set forth the specifications that apply.

Replace Section 4-1.03 with:

4-1.03 CHANGES

4-1.03A General

The Department may make changes within the scope of work and add extra work. The Engineer describes the changes and extra work, the payment basis, and any time adjustment in a Contract Change Order.

A Contract Change Order is approved when the Department signs the Contract Change Order.

Submit detailed cost data for a payment adjustment for:

1. Request for a payment adjustment for a bid item
2. Payment adjustment resulting from a change of more than 25 percent in the bid item's quantity if requested

If ordered, start the work before receipt of an approved Contract Change Order.

You may protest a Contract Change Order.

4-1.03B Increased or Decreased Quantities

The Department adjusts payment for changed quantities and eliminated items under Section 9-1.05, "Changed Quantity Payment Adjustments."

4-1.03C Changes in Character of Work

The Department adjusts payment for an item if:

1. An ordered plan or specification change materially changes the character of a work item from that on which the bid price was based
2. The unit cost of the changed item differs when compared to the unit cost of that item under the original plans and specifications
3. No approved Contract Change Order addresses the payment

The Department adjusts the payment under Section 9-1.06, "Work-Character Changes."

4-1.03D Extra Work

The Department classes new and unforeseen work as extra work if the Engineer determines that the work is not covered by any of the various items for which there is a bid price or by combinations of those items. If portions of this work are covered by some of the various items for which there is a bid price or combinations of those items, the

remaining portion of the work will be classed as extra work. Extra work also includes work specifically designated as extra work in the plans or specifications.

Add:

4-1.035 VALUE ENGINEERING

4-1.035A General

Reserved

4-1.035B Value Engineering Change Proposal

You may submit a VECP to reduce any of the following:

1. Total cost of construction
2. Construction activity duration
3. Traffic congestion

Before preparing a VECP, meet with the Engineer to discuss:

1. Proposal concept
2. Permit issues
3. Impact on other projects
4. Project impacts, including traffic, schedule, and later stages
5. Peer reviews
6. Overall proposal merits
7. Review times required by the Department and other agencies

The VECP must not impair the project's essential functions or characteristics, such as:

1. Service life
2. Operation economy
3. Maintenance ease
4. Desired appearance
5. Design and safety

The VECP must include:

1. Description of the contract specifications and drawing details for performing the work and the proposed changes.
2. Itemization of contract specifications and drawing details that would be changed.
3. Detailed cost estimate for performing the work under the existing contract and under the proposed change. Determine the estimates under Section 9-1.03, "Force Account Payment."
4. Deadline for the Engineer to decide on the changes.
5. Bid items affected and resulting quantity changes.

The Department is not required to consider a VECP. If a VECP is similar to a change in the plans or specifications being considered by the Department at the time the proposal is submitted or if the proposal is based on or similar to drawings or specifications adopted by the Department before Contract award, the Department does not accept the VECP and may make these changes without VECP payments.

Until the Department approves a change order incorporating the VECP or parts of it, continue to perform the work under the contract. If the Department does not approve a change order before the deadline stated in the VECP or other date you subsequently stated in writing, the VECP is rejected. The Department does not adjust time or payment for a rejected VECP.

The Department decides whether to accept a VECP and the estimated net construction-cost savings from adopting the VECP or parts of it.

The Department may require you to accept a share of the investigation cost as a condition of reviewing a VECP. After written acceptance, the Department considers the VECP and deducts the agreed cost.

If the Department accepts the VECP or parts of it, the Department issues a change order that:

1. Incorporates changes in the contract necessary to implement the VECP or the parts adopted
2. Includes the Department's acceptance conditions
3. States the estimated net construction-cost savings resulting from the VECP
4. Obligates the Department to pay you 50 percent of the estimated net savings

In determining the estimated net construction-cost savings, the Department excludes your VECP preparation cost and the Department's VECP investigation cost, including parts paid by you.

If a VECP providing for a reduction in working days is accepted by the Department, 50 percent of the reduction is deducted from contract time.

If a VECP providing for a reduction in traffic congestion or avoiding traffic congestion is accepted by the Department, the Department pays 60 percent of the estimated net savings in construction costs attributable to the VECP. Submit detailed traffic handling comparisons between the existing contract and the proposed change, including estimates of the traffic volumes and congestion.

The Department may apply an accepted VECP for general use on other contracts.

If an accepted VECP is adopted for general use, the Department pays only the contractor who first submitted the VECP and only to the contracts awarded to that contractor before the submission of the accepted VECP.

If the Department does not adopt a general-use VECP, an identical or similar submitted proposal is eligible for acceptance.

4-1.035C Value Analysis Workshop

Section 4-1.035C, "Value Analysis Workshop," applies to a non-building-work contract with a total bid of over $5 million.

You may request a value analysis workshop by submitting a request after contract approval.

The Department offers a value analysis workshop to:

1. Identify value enhancing opportunities
2. Consider changes to the contract that will reduce the total cost of construction, construction activity duration, or traffic congestion without impairing the essential functions specified for a VECP in Section 4-1.035B, "Value Engineering Change Proposal."

If the request is authorized, you and the Engineer:

1. Schedule a value analysis workshop
2. Select a facilitator and workshop site
3. Agree to other workshop administrative details

The workshop must be conducted under the methods described in the Department's Value Analysis Team Guide available at:

http://www.dot.ca.gov/hq/oppd/value/

The facilitator must be a certified value specialist as recognized by the Society of American Value Engineers.

The Department reimburses you for 1/2 of the workshop cost. The workshop cost is the sum of the workshop-facilitator cost and the workshop-site cost. The Department determines the workshop cost based on the facilitator and workshop-site invoice prices minus any available or offered discounts. The Department does not pay you for any other associated costs.

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SECTION 5 CONTROL OF WORK
(Issued 06-01-11)

Add:

5-1.005 GENERAL

Failure to comply with any specification part is a waiver of your right to an adjustment of time and payment related to that part.

After contract approval, submit documents and direct questions to the Engineer. Orders, approvals, authorizations, and requests to the Contractor are by the Engineer.

The Engineer furnishes the following in writing:

1. Approvals
2. Authorizations
3. Certifications
4. Decisions
5. Notifications
6. Orders
7. Responses

The Contractor must furnish the following in writing:

1. Assignments
2. Notifications
3. Proposals
4. Reports
5. Requests, including RFIs, sequentially numbered
6. Subcontracts
7. Test results

The Department rejects a form if it has any error or any omission.

Convert foreign language documents to English.

Use contract administration forms available at the Department's Web site.

If the last day for submitting a document falls on a Saturday or holiday, it may be submitted on the next business day with the same effect as if it had been submitted on the day specified.

Add to 5-1.01:

Failure to enforce a contract provision does not waive enforcement of any contract provision.

Add:

5-1.011 PROTESTS

You may protest an Engineer's decision by submitting an RFI under Section 5-1.145, "Requests for Information."

Add:

5-1.012 PARTNERING

5-1.012A General

The Department strives to work cooperatively with all contractors; partnering is our way of doing business. The Department encourages project partnering among the project team, made up of significant contributors from the Department and the Contractor, and their invited stakeholders.

For a project with a total bid greater than $1 million, professionally facilitated project partnering is encouraged.

For a project with a total bid greater than $10 million, professionally facilitated project partnering is required.

In implementing project partnering, you and the Engineer manage the contract by:

1. Using early and regular communication with involved parties
2. Establishing and maintaining a relationship of shared trust, equity, and commitment
3. Identifying, quantifying, and supporting attainment of mutual goals
4. Developing strategies for using risk management concepts

5. Implementing timely communication and decision making
6. Resolving potential problems at the lowest possible level to avoid negative impacts
7. Holding periodic partnering meetings and workshops as appropriate to maintain partnering relationships and benefits throughout the life of the project
8. Establishing periodic joint evaluations of the partnering process and attainment of mutual goals

Partnering does not void any contract part.

The Department's "Field Guide to Partnering on Caltrans Construction Projects" current at the time of bid is available to the project team as reference. This guide provides structure, context, and clarity to the partnering process requirements. This guide is available at the Department's Partnering Program website:

http://www.dot.ca.gov/hq/construc/partnering.html

In implementing project partnering, the project team must:

1. Create a partnering charter that includes:

    1.1. Mutual goals, including core project goals and may also include project-specific goals and mutually supported individual goals.
    1.2. Partnering maintenance and close-out plan.
    1.3. Dispute resolution plan that includes a dispute resolution ladder and may also include use of facilitated dispute resolution sessions.
    1.4. Team commitment statement and signatures.

2. Participate in monthly partnering evaluation surveys to measure progress on mutual goals and may also measure short-term key issues as they arise.
3. Evaluate the partnering facilitator on Forms CEM-5501 and CEM-5502. The Engineer provides the evaluation forms to the project team and collects the results. The Department makes evaluation results available upon request. Facilitator evaluations must be completed:

    3.1. At the end of the initial partnering workshop on Form CEM-5501.
    3.2. At the end of the project close-out partnering workshop on Form CEM-5502.

4. Conduct a project close-out partnering workshop.
5. Document lessons learned before contract acceptance.

5-1.012B Partnering Facilitator, Workshops, and Monthly Evaluation Surveys

The Engineer sends you a written invitation to enter into a partnering relationship after contract approval. Respond within 15 days to accept the invitation and request the initial and additional partnering workshops. After the Engineer receives the request, you and the Engineer cooperatively:

1. Select a partnering facilitator that offers the service of a monthly partnering evaluation survey with a 5-point rating and agrees to follow the Department's "Partnering Facilitator Standards and Expectations" available at the Department's Partnering Program website
2. Schedule initial partnering workshop
3. Determine initial workshop site and duration
4. Agree to other workshop administrative details

Additional partnering workshops and sessions are encouraged throughout the life of the project as determined necessary by you and the Engineer, recommended quarterly.

5-1.012C Training in Partnering Skills Development

For a project with a total bid of $25 million or greater, training in partnering skills development is required.

For a project with a total bid between $10 million and $25 million, training in partnering skills is optional.

You and the Engineer cooperatively schedule the training session and select a professional trainer, training site, and 1 to 4 topics from the following list to be covered in the training:

1. Active Listening
2. Building Teams
3. Change Management
4. Communication
5. Conflict Resolution
6. Cultural Diversity
7. Dealing with Difficult People
8. Decision Making
9. Effective Escalation Ladders
10. Emotional Intelligence
11. Empathy
12. Ethics
13. Facilitation Skills
14. Leadership
15. Partnering Process and Concepts
16. Project Management
17. Project Organization
18. Problem Solving
19. Running Effective Meetings
20. Time Management
21. Win-Win Negotiation

Before the initial partnering workshop, the trainer conducts a 1-day training session in partnering skills development for the Contractor's and the Engineer's representatives. This training session must be a separate session from the initial partnering workshop and must be conducted locally. The training session must be consistent with the partnering principles under the Department's "Field Guide to Partnering on Caltrans Construction Projects."

Send at least 2 representatives to the training session. One of these must be your assigned representative as specified in Section 5-1.06, "Superintendence," of the Standard Specifications.

5-1.012D Payment

The Department pays you for:

1. 1/2 of partnering workshops and sessions based on facilitator and workshop site cost
2. 1/2 of monthly partnering evaluation survey service cost
3. Partnering skills development trainer and training site cost

The Department determines the costs based on invoice prices minus any available or offered discounts. The Department does not pay markups on these costs.

The Department does not pay for wages, travel expenses, or other costs associated with the partnering workshops and sessions, monthly partnering evaluation surveys, and training in partnering skills development.

Add:

5-1.015 RECORDS

5-1.015A General

Reserved

5-1.015B Record Retention

Retain project records from bid preparation through:

1. Final payment
2. Resolution of claims, if any

For at least 3 years after the later of these, retain cost records, including records of:

1. Bid preparation
2. Overhead
3. Payrolls

4. Payments to suppliers and subcontractors
5. Cost accounting

Maintain the records in an organized way in the original format, electronic and hard copy, conducive to professional review and audit.

5-1.015C Record Inspection, Copying, and Auditing

Make your records available for inspection, copying, and auditing by State representatives for the same time frame specified under Section 5-1.015B, "Record Retention." The records of subcontractors and suppliers must be made available for inspection, copying, and auditing by State representatives for the same period. Before contract acceptance, the State representative notifies the Contractor, subcontractor, or supplier 5 business days before inspection, copying, or auditing.

If an audit is to start more than 30 days after contract acceptance, the State representative notifies the Contractor, subcontractor, or supplier when the audit is to start.

5-1.015D Cost Accounting Records

Maintain cost accounting records for the project distinguishing between the following work cost categories:

1. Work performed based on bid item prices
2. Work performed by change order other than extra work. Distinguish this work by:

    2.1. Bid item prices
    2.2. Force account
    2.3. Agreed price

3. Extra work. Distinguish extra work by:

    3.1. Bid item prices
    3.2. Force account
    3.3. Agreed price
    3.4. Specialist billing

4. Work performed under potential claim records
5. Overhead
6. Subcontractors, suppliers, owner-operators, and professional services

Cost accounting records must include:

1. Final cost code lists and definitions
2. Itemization of the materials used and corresponding vendor's invoice copies
3. Direct cost of labor
4. Equipment rental charges
5. Workers' certified payrolls
6. Equipment:

    6.1. Size
    6.2. Type
    6.3. Identification number
    6.4. Hours operated

5-1.015E Extra Work Bills

Maintain separate records for costs of work performed by change order.

Within 7 days after performing the work, submit extra work bills using the Department's Internet extra work billing system.

The Contractor submitting and the Engineer approving an extra work bill using the Internet force account work billing system is the same as each party signing the bill.

The Department provides billing system:

1. Training within 30 days of your written request
2. Accounts and user identification to your assigned representatives after a representative has received training

Each representative must maintain a unique password.

Replace Section 5-1.04 with:

5-1.04 CONTRACT COMPONENTS

A component in one contract part applies as if appearing in each. The parts are complementary and describe and provide for a complete work.

If a discrepancy exists:

1. The governing ranking of contract parts in descending order is:

    1.1. Special provisions
    1.2. Project plans
    1.3. Revised Standard Plans
    1.4. Standard Plans
    1.5. Amendments to the Standard Specifications
    1.6. Standard Specifications
    1.7. Supplemental project information

2. Written numbers and notes on a drawing govern over graphics
3. A detail drawing governs over a general drawing
4. A detail specification governs over a general specification
5. A specification in a section governs over a specification referenced by that section

If a discrepancy is found or confusion arises, request correction or clarification.

Add:

5-1.055 SUBCONTRACTING

5-1.055A General

No subcontract releases you from the contract or relieves you of your responsibility for a subcontractor's work.

If you violate Pub Cont Code § 4100 et seq., the Department may exercise the remedies provided under Pub Cont Code § 4110. The Department may refer the violation to the Contractors State License Board as provided under Pub Cont Code § 4111.

Except for a building-construction non-federal-aid contract, perform work equaling at least 30 percent of the value of the original total bid with your employees and with equipment owned or rented by you, with or without operators.

Each subcontract must comply with the contract.

The Department encourages you to include a dispute resolution process in each subcontract.

Each subcontractor must have an active and valid State contractor's license with a classification appropriate for the work to be performed (Bus & Prof Code, § 7000 et seq.).

Submit copies of subcontracts upon request.

Before subcontracted work starts, submit a Subcontracting Request form.

Do not use a debarred contractor; a current list of debarred contractors is available at the Department of Industrial Relations' Web site.

Upon request, immediately remove and not again use a subcontractor who fails to prosecute the work satisfactorily.

Replace Section 5-1.07 with:

5-1.07 LINES AND GRADES

The Engineer places stakes and marks under Chapter 12, "Construction Surveys," of the Department's Surveys Manual.

Submit your request for Department-furnished stakes:

1. On a Request for Construction Stakes form. Ensure:

    1.1. Requested staking area is ready for stakes
    1.2. You use the stakes in a reasonable time

2. A reasonable time before starting an activity using the stakes

Establish priorities for stakes and note priorities on the request.

Preserve stakes and marks placed by the Engineer. If the stakes or marks are destroyed, the Engineer replaces them at the Engineer's earliest convenience and deducts the cost.

Replace Section 5-1.10 with:

5-1.10 EQUIPMENT

Clearly stencil or stamp at a clearly visible location on each piece of equipment except hand tools an identifying number and:

1. On compacting equipment, its make, model number, and empty gross weight that is either the producer's rated weight or the scale weight
2. On meters and on the load-receiving element and indicators of each scale, the make, model, serial number, and producer's rated capacity

Submit a list:

1. Describing each piece of equipment
2. Showing its identifying number

Upon request, submit producer's information that designates portable vehicle scale capacities.

For proportioning materials, use measuring devices, material plant controllers, and undersupports complying with Section 9-1.01B, "Weighing Equipment and Procedures."

Measuring devices must be tested and approved under California Test 109 in the Department's presence by any of the following:

1. County Sealer of Weights and Measures
2. Scale Service Agency
3. Division of Measurement Standards Official

The indicator over-travel must be at least 1/3 of the loading travel. The indicators must be enclosed against moisture and dust.

Group measuring system dials such that the smallest increment for each indicator can be read from the location at which proportioning is controlled.

Replace Section 5-1.116 with:

5-1.116 DIFFERING SITE CONDITIONS (23 CFR 635.109)

5-1.116A Contractor's Notification

Promptly notify the Engineer if you find either of the following:

1. Physical conditions differing materially from either of the following:

    1.1. Contract documents
    1.2. Job site examination

2. Physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract

Include details explaining the information you relied on and the material differences you discovered.

If you fail to notify the Engineer promptly, you waive the differing site condition claim for the period between your discovery of the differing site condition and your notification to the Engineer.

If you disturb the site after discovery and before the Engineer's investigation, you waive the differing site condition claim.

5-1.116B Engineer's Investigation and Decision

Upon your notification, the Engineer investigates job site conditions and:

1. Notifies you whether to resume affected work
2. Decides whether the condition differs materially and is cause for an adjustment of time, payment, or both

You may protest the Engineer's decision.

Replace Section 5-1.14 with:

5-1.14 COST REDUCTION INCENTIVE

Comply with Section 4-1.035B, "Value Engineering Change Proposal."

Add:

5-1.145 REQUESTS FOR INFORMATION

Submit an RFI upon recognition of any event or question of fact arising under the Contract.

The Engineer responds to the RFI within 5 days. Proceed with the work unless otherwise ordered. You may protest the Engineer's response by:

1. Submitting an Initial Potential Claim Record within 5 days after receipt of the Engineer's response
2. Complying with Section 5-1.146, "Potential Claims and Dispute Resolution"

Add:

5-1.146 POTENTIAL CLAIMS AND DISPUTE RESOLUTION

5-1.146A General

Minimize and mitigate impacts of potentially claimed work or event.

For each potential claim, assign an identification number determined by chronological sequencing and the 1st date of the potential claim.

Use the identification number for each potential claim on the:

1. Initial Potential Claim Record
2. Supplemental Potential Claim Record
3. Full and Final Potential Claim Record

Failure to comply with this procedure is:

1. Waiver of the potential claim and a waiver of the right to a corresponding claim for the disputed work in the administrative claim procedure
2. Bar to arbitration (Pub Cont Code § 10240.2)

5-1.146B Initial Potential Claim Record

Submit an Initial Potential Claim Record within 5 days of the Engineer's response to the RFI or within 5 days from the date when a dispute arises due to an act or failure to act by the Engineer. The Initial Potential Claim Record establishes the claim nature and circumstances. The claim nature and circumstances must remain consistent.

The Engineer responds within 5 days of the date of the Initial Potential Claim Record. Proceed with the potentially claimed work unless ordered.

Within 20 days of a request, provide access to the project records determined necessary by the Engineer to evaluate the potential claim.

5-1.146C Supplemental Potential Claim Record

Within 15 days of submitting the Initial Potential Claim Record, submit a Supplemental Potential Claim Record including:

1. Complete nature and circumstances causing the potential claim or event
2. Contract specifications supporting the basis of a claim
3. Estimated claim cost and an itemized breakdown of individual costs stating how the estimate was determined
4. TIA

The Engineer evaluates the Supplemental Potential Claim Record and furnishes you a response within 20 days of submittal. If the estimated cost or effect on the scheduled completion date changes, update the Supplemental Potential Claim Record information as soon as the change is recognized and submit this information.

5-1.146D Full and Final Potential Claim Record

Notify the Engineer within 10 days of the completion date of the potentially claimed work. The Engineer approves this completion date or notifies you of a revised date.

Within 30 days of the completion of the potentially claimed work, submit a Full and Final Potential Claim Record including:

1. A detailed factual account of the events causing the potential claim, including:

    1.1. Necessary dates
    1.2. Locations
    1.3. Work items affected by the potential claim

2. The Contract documents supporting the potential claim and a statement of the reasons these parts support entitlement
3. If a payment adjustment is requested, an itemized cost breakdown. Segregate costs into the following categories:

    3.1. Labor, including:

        3.1.1. Individuals
        3.1.2. Classifications
        3.1.3. Regular and overtime hours worked
        3.1.4. Dates worked

    3.2. Materials, including:

        3.2.1. Invoices
        3.2.2. Purchase orders
        3.2.3. Location of materials either stored or incorporated into the work
        3.2.4. Dates materials were transported to the job site or incorporated into the work

    3.3. Equipment, including:

        3.3.1. Detailed descriptions, including make, model, and serial number
        3.3.2. Hours of use
        3.3.3. Dates of use
        3.3.4. Equipment rates at the rental rate listed in Labor Surcharge and Equipment Rental Rates in effect when the affected work related to the claim was performed

4. If a time adjustment is requested:

    4.1. Dates for the requested time.
    4.2. Reasons for a time adjustment.
    4.3. Contract documentation supporting the requested time adjustment.

4.4. TIA. The TIA must demonstrate entitlement to a time adjustment.

5. Identification and copies of your documents and copies of communications supporting the potential claim, including certified payrolls, bills, cancelled checks, job cost reports, payment records, and rental agreements
6. Relevant information, references, and arguments that support the potential claim

The Department does not consider a Full and Final Potential Claim Record that does not have the same nature, circumstances, and basis of claim as those specified on the Initial Potential Claim Record and Supplemental Potential Claim Record.

The Engineer evaluates the information presented in the Full and Final Potential Claim Record and furnishes you a response within 30 days of its receipt unless the Full and Final Potential Claim Record is submitted after Contract acceptance; in which case, a response may not be furnished. The Engineer's receipt of the Full and Final Potential Claim Record must be evidenced by postal return receipt or the Engineer's written receipt if delivered by hand.

5-1.146E Dispute Resolution

Comply with Section 5-1.15, "Dispute Resolution."

Add:

5-1.15 DISPUTE RESOLUTION

5-1.15A General

Section 5-1.15, "Dispute Resolution," applies to a contract with 100 or more working days.

The dispute resolution process is not a substitute for the submitting an RFI or a potential claim record.

5-1.15B Dispute Resolution Advisor

Section 5-1.15B, "Dispute Resolution Advisor," applies to a contract with a total bid from $3 million to $10 million.

A dispute resolution advisor, hereinafter referred to as "DRA," is chosen by the Department and the Contractor to assist in the resolution of disputes.

The DRA shall be established by the Department and the Contractor within 30 days of contract approval.

The Department and the Contractor shall each propose 3 potential DRA candidates. Each potential candidate shall provide the Department and the Contractor with their disclosure statement. The disclosure statement shall include a resume of the potential candidate's experience and a declaration statement describing past, present, anticipated, and planned relationships with all parties involved in this contract.

The Department and the Contractor shall select one of the 6 nominees to be the DRA. If the Department and the Contractor cannot agree on one candidate, the Department and the Contractor shall each choose one of the 3 nominated by the other. The final selection of the DRA will be decided by a coin toss between the two candidates.

The Department and the Contractor shall complete and adhere to the Dispute Resolution Advisor Agreement. No DRA meeting shall take place until the Dispute Resolution Advisor Agreement has been signed by all parties, unless all parties agree to sign it at the first meeting.

If DRA needs outside technical services, technical services shall be preapproved by both the Department and the Contractor.

DRA recommendations are nonbinding.

The Contractor shall not use the DRA for disputes between subcontractors or suppliers that have no grounds for a lawsuit against the Department.

DRA replacement is selected in the same manner as the original selection. The appointment of a replacement DRA will begin promptly upon determination of the need for replacement. The Dispute Resolution Advisor Agreement shall be amended to reflect the change of the DRA.

Failure of the Contractor to participate in selecting DRA will result in the withhold of 25 percent of the estimated value of all work performed during each estimate period that the Contractor fails to comply. DRA withholds will be released for payment on the next monthly progress payment following the date that the Contractor has provided assistance in choosing the DRA and no interest will be due the Contractor.

The State and the Contractor shall bear the costs and expenses of the DRA equally.

The DRA shall be compensated at an agreed rate of $1,500 per day for time spent per meeting either at the start of the project or for a dispute. A member serving on more than one State DRA or Dispute Resolution Board, regardless the number of meetings per day shall not be paid more than the agreed rate per day. The agreed rate shall

be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel, and incidentals for each day or portion thereof that the DRA is at an authorized DRA meeting.

No additional compensation will be made for time spent by the DRA to review and research activities outside the official DRA meetings unless that time, such as time spent evaluating and preparing recommendations on specific issues presented to the DRA, has been specifically agreed to in advance by the State and Contractor. Time away from the project that has been specifically agreed to in advance by the Department and the Contractor will be compensated at an agreed rate of $150 per hour. The agreed amount of $150 per hour shall include all incidentals including expenses for telephone, fax, and computer services.

The State will provide conference facilities for DRA meetings at no cost to the Contractor.

The Contractor shall make direct payments to the DRA for participation in authorized meetings and approved hourly rate charges from invoices submitted.

The State will reimburse the Contractor for the State's share of the costs.

There will be no markups applied to expenses associated with the DRA, either by the DRA or by the Contractor when requesting payment of the State's share of DRA expenses. Regardless of the DRA recommendation, neither party will be entitled to reimbursement of DRA costs from the other party.

The Contractor shall submit extra work bills and include invoices with original supporting documents for reimbursement of the State's share.

The cost of technical services will be borne equally by the State and Contractor. There will be no markups for these costs.

A copy of the "Dispute Resolution Advisor Agreement" to be executed by the Contractor, State and the DRA is as follows:

Form CEM 6206 Rev (04-06-07)

DISPUTE RESOLUTION ADVISOR AGREEMENT

_____
(Contract Identification)

Contract No. _____

THIS DISPUTE RESOLUTION ADVISOR AGREEMENT, hereinafter called "AGREEMENT", made and entered into this _____ day of _____, _____, between the State of California, acting through the California Department of Transportation and the Director of Transportation, hereinafter called the "STATE," _____ hereinafter called the "CONTRACTOR," and _____, the Dispute Resolution Advisor, hereinafter called the "DRA."

WITNESSETH, that

WHEREAS, the STATE and the CONTRACTOR, hereinafter called the "parties," are now engaged in the construction on the State Highway project referenced above; and

WHEREAS, the Standard Specifications for the above referenced contract provides for the establishment and operation of the DRA to assist in resolving disputes; and

WHEREAS, the DRA is composed of one person, chosen by the CONTRACTOR and the STATE;

NOW THEREFORE, in consideration of the terms, conditions, covenants, and performance contained herein, or attached and incorporated and made a part hereof, the STATE, the CONTRACTOR, and the DRA hereto agree as follows:

SECTION I DESCRIPTION OF WORK

To assist in the timely resolution of disputes between the parties, the contract provides for the establishment and the operation of the DRA. The DRA is to fairly and impartially consider disputes placed before it and provide recommendations for resolution of these disputes to the parties. The DRA shall provide recommendations based on the facts related to the dispute, the contract and applicable laws and regulations. The DRA shall perform the services necessary to participate in the DRA's actions as designated in Section III, Scope of Work.

SECTION II DRA QUALIFICATIONS

The DRA shall be knowledgeable in the type of construction and contract documents anticipated by the contract and shall have completed training through the Dispute Review Board Foundation. In addition, it is desirable for the DRA to have served on several State Dispute Resolution Boards (DRB).

No DRA shall have prior direct involvement in this contract. No DRA shall have a financial interest in this contract or parties thereto, including but not limited to the CONTRACTOR, subcontractors, suppliers, consultants, and legal and business services, within a period 6 months prior to award and during this contract. Exceptions to above are compensation for services on this or other DRAs and DRBs or retirement payments or pensions received from a party that are not tied to, dependent on or affected by the net worth of the party.

The DRA shall fully disclose all direct or indirect professional or personal relationships with all key members of the contract.

SECTION III SCOPE OF WORK

The Scope of Work of the DRA includes, but is not limited to, the following:

A. PROCEDURES

The DRA shall meet with the parties at the start of the project to establish procedures that will govern the conduct of its business and reporting procedures in conformance with the requirements of the contract and the terms of this AGREEMENT. The DRA established procedures shall only be implemented upon approval by the parties. Subsequent meetings shall be held only to hear disputes between the parties.

The DRA shall not meet with, or discuss contract issues with individual parties.

The State shall provide the DRA with the contract and all written correspondence regarding the dispute between the parties and, if available, the Contractor's supplemental potential claim record, and the Engineer's response to the supplemental potential claim record.

The parties shall not call the DRA who served on this contract as a witness in arbitration proceedings, which may arise from this contract.

The DRA shall have no claim against the STATE or the CONTRACTOR, or both, from claimed harm arising out of the parties' evaluations of the DRA's opinions.

B. DISPUTE MEETING

The term "dispute meeting" as used in this subsection shall refer to both the informal and traditional dispute meeting processes, unless otherwise noted.

If the CONTRACTOR requests a dispute meeting with the DRA, the Contractor must simultaneously notify the STATE. Upon being notified of the need for a dispute meeting, the DRA shall review and consider the dispute. The DRA shall determine the time and location of the dispute meeting with due consideration for the needs and preferences of the parties, while recognizing the importance of a speedy resolution to the dispute.

Dispute meetings shall be conducted at any location that would be convenient and provide required facilities and access to necessary documentation.

Only the STATE's Area Construction Engineer, Resident Engineer, and Structure Representative and the CONTRACTOR's or subcontractor's, Superintendent or Project Manager may present information at a dispute meeting. There shall be no participation of persons who are not directly involved in the contract or who do not have direct knowledge of the dispute. The exception to this is technical services, as described below:

> The DRA, with approval of the parties, may obtain technical services necessary to adequately review the disputes presented, including audit, geotechnical, schedule analysis and other services. The parties' technical staff may supply those services as appropriate. The cost of technical services, as agreed to by the parties, shall be borne equally by the two parties as specified in an approved contract change order. The CONTRACTOR shall not be entitled to markups for the payments made for these services.

At the dispute meeting the DRA may ask questions, seek clarification, and request further clarification of data presented by either of the parties as may be necessary to assist in making a fully informed recommendation. However, the DRA shall refrain from expressing opinions on the merits of statements on matters under dispute during the parties' presentations. Each party will be given ample time to fully present its position, make rebuttals, provide relevant documents, and respond to DRA questions and requests.

There shall be no testimony under oath or cross-examination, during DRA dispute meetings. There shall be no reporting of the procedures by a shorthand reporter or by electronic means. Documents and verbal statements shall be received by the DRA in conformance with the rules and regulations established at the first meeting between the DRA and parties. These established rules and regulations need not comply with prescribed legal laws of evidence.

Failure to attend a dispute meeting by either of the parties shall be conclusively considered by the DRA as indication that the non-attending party considers all written documents and correspondence submitted as their entire and complete argument. The claimant shall discuss the dispute, followed by the other party. Each party shall then be allowed one or more rebuttals at the meeting until all aspects of the dispute are thoroughly covered.

1. TRADITIONAL DISPUTE MEETING:

The following procedure shall be used for the traditional dispute meeting:

a. Within 5 days after receiving the STATE's written response to the CONTRACTOR's supplemental potential claim record, the CONTRACTOR shall refer the dispute to the DRA, if the CONTRACTOR wishes to further pursue the dispute. The CONTRACTOR shall make the referral in writing to the DRA, simultaneously copied to the STATE. The written dispute referral shall describe the disputed matter in individual discrete segments, so that it will be clear to both parties and the DRA what discrete elements of the dispute have been resolved, and which remain unresolved, and shall include an estimate of the cost of the affected work and impacts, if any, on project completion.

b. The parties shall each be afforded an opportunity to be present and to be heard by the DRA, and to offer evidence. Either party furnishing written evidence or documentation to the DRA must furnish copies of such information to the other party a minimum of 10 days prior to the date the DRA is scheduled to convene the meeting for the dispute. Either party shall produce such additional evidence as the DRA may deem necessary to reach an understanding and a determination of the dispute. The party furnishing additional evidence shall furnish copies of such additional evidence to the other party

at the same time the evidence is provided to the DRA. The DRA shall not consider evidence not furnished in conformance with the terms specified herein.

c. Upon receipt by the DRA of a written referral of a dispute, the DRA shall convene to review and consider the dispute. The dispute meeting shall be held no later than 25 days after receipt of the written referral unless otherwise agreed to by all parties.
d. The DRA shall furnish a written report to both parties. The DRA may request clarifying information of either party within 5 days after the DRA dispute meeting. Requested information shall be submitted to the DRA within 5 days of the DRA request. The DRA shall complete its report and submit it to the parties within 10 days of the DRA dispute meeting, except that time extensions may be granted at the request of the DRA with the written concurrence of both parties. The report shall summarize the facts considered, the contract language, law or regulation viewed by the DRA as pertinent to the dispute, and the DRA's interpretation and philosophy in arriving at its conclusions and recommendations and, if appropriate, recommends guidelines for determining compensation. The DRA's written opinion shall stand on its own, without attachments or appendices.
e. Within 10 days after receiving the DRA's report, both parties shall respond to the DRA in writing signifying that the dispute is either resolved or remains unresolved. Failure to provide the written response within the time specified, or a written rejection of the DRA's recommendation or response to a request for reconsideration presented in the report by either party, shall conclusively indicate that the party(s) failing to respond accepts the DRA recommendation. Immediately after responses have been received from both parties, the DRA shall provide copies of both responses to the parties simultaneously. Either party may request clarification of elements of the DRA's report from the DRA prior to responding to the report. The DRA shall consider any clarification request only if submitted within 5 days of receipt of the DRA's report, and if submitted simultaneously in writing to both the DRA and the other party. Each party may submit only one request for clarification for any individual DRA report. The DRA shall respond, in writing, to requests for clarification within 5 days of receipt of such requests.
f. Either party may seek a reconsideration of the DRA's recommendation. The DRA shall only grant reconsideration based upon submission of new evidence and if the request is submitted within the 10 day time limit specified for response to the DRA's written report. Each party may submit only one request for reconsideration regarding an individual DRA recommendation.
g. If the parties are able to settle their dispute with the aid of the DRA's report, the STATE and CONTRACTOR shall promptly accept and implement the settlement of the parties. If the parties cannot agree on compensation within 30 days of the acceptance by both parties of the settlement, either party may request the DRA to make a recommendation regarding compensation.

2. INFORMAL DISPUTE MEETING

An informal dispute meeting shall be convened, only if, the parties and the DRA agree that this dispute resolution process is appropriate to settle the dispute.
The following procedure shall be used for the informal dispute meeting:

a. The parties shall furnish the DRA with one copy of pertinent documents requested by the DRA that are or may become necessary for the DRA to perform its function. The party furnishing documents shall furnish such documents to the other party at the same time the document is provided to the DRA.
b. After the dispute meeting has concluded, the DRA shall deliberate in private the same day, until a response to the parties is reached or as otherwise agreed to by the parties.
c. The DRA then verbally delivers its recommendation with findings to the parties.
d. After the recommendation is presented, the parties may ask for clarifications.
e. Occasionally the DRA, on complex issues, may be unable to formulate a recommendation based on the information given at a dispute meeting. However, the DRA may provide the parties with advice on strengths and weaknesses of their prospective positions, in the hope of the parties reaching settlement.
f. If the parties are able to settle their dispute with the aid of the DRA's opinion, the STATE and CONTRACTOR shall promptly accept and implement the settlement of the parties.
g. The DRA will not be bound by its oral recommendation in the event that a dispute is later heard by the DRA in a traditional dispute meeting.

Unless the dispute is settled, use of the informal dispute meeting does not relieve the parties of their responsibilities under Section 5-1.15B, "Dispute Resolution Advisor," of the Standard Specifications or Subsection, "Traditional Dispute Meeting," of this AGREEMENT. There will be no extension of time allowed for the process to permit the use of the informal dispute meeting, unless otherwise agreed to by the parties.

SECTION IV TIME FOR BEGINNING AND COMPLETION

Once established, the DRA shall be in operation until the day the Director accepts the contract. The DRA shall not begin work under the terms of this AGREEMENT until authorized in writing by the STATE or as agreed to by the parties.

SECTION V PAYMENT

The DRA shall be compensated at an agreed rate of $1,500 per day for time spent per meeting, either at the start of the project or for a dispute. A member serving on more than one State DRA or DRB, regardless the number of meetings per day, shall not be paid more than the agreed rate per day. The agreed rate shall be considered full compensation for onsite time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof that the DRA is at an authorized DRA meeting. No additional compensation will be made for time spent by the DRA to review and research activities outside the official DRA meetings unless that time, (such as time spent evaluating and preparing recommendations on specific issues presented to the DRA), has been specifically agreed to in advance by the parties. Time away from the project, which has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of $150 per hour. The agreed amount of $150 per hour shall include all incidentals including expenses for telephone, fax, and computer services. The State will provide administrative services such as conference facilities to the DRA.

A. PAYMENT PROCESSING

The CONTRACTOR shall make direct payments to the DRA for their participation in authorized meetings and approved hourly rate charges, from invoices submitted by the DRA, and technical services.

The DRA may submit invoices to the CONTRACTOR for partial payment for work performed and services rendered for their participation in authorized meetings not more often than once per month during the progress of the work. The invoices shall be in a format approved by the parties and accompanied by a general description of activities performed during that billing period. Payment for hourly fees, at the agreed rate, shall not be paid to the DRA until the amount and extent of those fees are approved by the STATE and CONTRACTOR.

B. INSPECTION OF COSTS RECORDS

The DRA and the CONTRACTOR shall keep available for inspection by representatives of the STATE and the United States, for a period of 3 years after final payment, the cost records and accounts pertaining to this AGREEMENT. If any litigation, claim, or audit arising out of, in connection with, or related to this contract is initiated before the expiration of the 3-year period, the cost records and accounts shall be retained until such litigation, claim, or audit involving the records is completed.

SECTION VI ASSIGNMENT OF TASKS OF WORK

The DRA shall not assign the work of this AGREEMENT.

SECTION VII TERMINATION OF DRA

The DRA may resign after providing not less than 15 days written notice of the resignation to the STATE and CONTRACTOR. The DRA may be terminated, by either party, for failing to fully comply at all times with all required employment or financial disclosure conditions of DRA membership in conformance with the terms of the contract and this AGREEMENT. Each party shall document the need for replacement and substantiate the replacement request in writing to the other party and the DRA.

SECTION VIII LEGAL RELATIONS

The parties hereto mutually understand and agree that the DRA in the performance of duties is acting in the capacity of an independent agent and not as an employee of either party.

No party to this AGREEMENT shall bear a greater responsibility for damages or personal injury than is normally provided by Federal or State of California Law.

Notwithstanding the provisions of this contract that require the CONTRACTOR to indemnify and hold harmless the STATE, the parties shall jointly indemnify and hold harmless the DRA from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRA.

SECTION IX CONFIDENTIALITY

The parties hereto mutually understand and agree that all documents and records provided by the parties in reference to issues brought before the DRA, which documents and records are marked "Confidential - for use by the DRA only," shall be kept in confidence and used only for the purpose of resolution of subject disputes, and for assisting in development of DRA findings and recommendations; that such documents and records will not be utilized or revealed to others, except to officials of the parties who are authorized to act on the subject disputes, for any purposes, during the life of this AGREEMENT. Upon termination of this AGREEMENT, said confidential documents and records, and all copies thereof, shall be returned to the parties who furnished them to the DRA. However, the parties understand that such documents may be subsequently discoverable and admissible in court or arbitration proceedings unless a protective order has been obtained by the party seeking further confidentiality.

SECTION X DISPUTES

Disputes between the parties arising out of the work or other terms of this AGREEMENT that cannot be resolved by negotiation and mutual concurrence between the parties or through the administrative process provided in the contract shall be resolved by arbitration as provided in Section 9-1.10, "Arbitration," of the Standard Specifications. Disputes between the DRA and the parties that cannot be resolved by negotiation and mutual concurrence shall be resolved in the appropriate forum.

SECTION XI VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION

In the event that any party, including the DRA, deems it necessary to institute arbitration proceedings to enforce any right or obligation under this AGREEMENT, the parties hereto agree that such action shall be initiated in the Office of Administrative Hearings of the State of California. The parties hereto agree that all questions shall be resolved by arbitration by application of California law and that the parties to such arbitration shall have the right of appeal from such decisions to the Superior Court in conformance with the laws of the State of California. Venue for the arbitration shall be Sacramento or any other location as agreed to by the parties.

SECTION XII FEDERAL REVIEW AND REQUIREMENTS

On Federal-Aid contracts, the Federal Highway Administration shall have the right to review the work of the DRA in progress, except for private meetings or deliberations of the DRA.

Other Federal requirements in this agreement shall only apply to Federal-Aid contracts.

SECTION XIII CERTIFICATION OF CONTRACTOR, DRA, AND STATE

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT as of the day and year first above written.

DRA

By: _____

Title: _____

CONTRACTOR

By: _____

Title: _____

CALIFORNIA DEPARTMENT
OF TRANSPORTATION

By: _____

Title: _____

5-1.15C Dispute Resolution Board

Section 5-1.15C, "Dispute Resolution Board," applies to a contract with a total bid of over $10 million.

The Dispute Resolution Board, hereinafter referred to as "DRB," is a three member board established by the Department and Contractor to assist in the resolution of disputes.

The DRB shall be established by the Department and the Contractor within 45 days after contract approval.

The DRB shall consist of one member selected by the Department and approved by the Contractor, one member selected by the Contractor and approved by the Department, and a third member selected by the first 2 members and approved by both the Department and the Contractor.

The Department and Contractor shall provide the other written notification for approval of the name of their DRB nominee along with the nominee's disclosure statement.

Disclosure statements shall include a resume of the nominee's experience and a declaration statement describing past, present, anticipated, and planned relationships with all parties involved in this contract. Objections to nominees shall be based on a specific breach or violation of nominee responsibilities or on nominee qualifications. The Department or the Contractor may, on a one-time basis, object to the other's nominee without specifying a reason and this person shall not be selected for the DRB. Another person shall then be nominated within 15 days.

The 2 DRB members shall proceed with the selection of the third DRB member immediately after receiving written notification from the Department of their selection. The 2 DRB members shall provide their recommendation simultaneously to the parties within 15 days. The third member shall provide disclosure statement to the first 2 DRB members, to the Department, and the Contractor. The professional experience of the third DRB member shall complement that of the first 2 DRB members. The third DRB member shall be subject to mutual approval of the Department and the Contractor. If the 2 DRB members cannot agree on the third nominee, they shall submit a list of nominees to the Department and the Contractor for final selection and approval.

If the Department and the Contractor cannot agree on the third DRB member, or if the first 2 DRB members are unable to agree upon a recommendation, the Department and the Contractor shall select 6 names from the current list of arbitrators certified by the Public Works Contract Arbitration Committee created by Article 7.2 of the State Contract Act. The 2 DRB members shall then select one of the 6 names by a blind draw.

The 3 DRB members shall appoint one member as a chairperson to provide leadership for the DRB's activities. The chairperson shall be approved by the Department and the Contractor. In the event of an impasse, the third DRB member shall become the chairperson.

The Department and Contractor shall complete and adhere to the Dispute Resolution Board Agreement. No DRB meeting shall take place until the Dispute Resolution Board Agreement has been signed by all parties, unless all parties agree to sign it at the first meeting.

If the DRB needs outside technical services, technical services shall be preapproved by both the Department and the Contractor.

DRB recommendations are nonbinding.

The Contractor shall not use the DRB for disputes between the subcontractors or suppliers that have no grounds for a lawsuit against the Department.

DRB member replacements are selected in the same manner as the original selection. The appointment of a replacement DRB member will begin promptly upon determination of the need for replacement. The Dispute Resolution Board Agreement shall be amended to reflect the change in the DRB.

Failure of the Contractor to participate in establishing the DRB will result in the withholding of 25 percent of the estimated value of all work performed during each estimate period that the Contractor fails to comply. DRB withholds will be released for payment on the next monthly progress payment following the date that the Contractor has provided assistance in establishing the DRB and no interest will be due the Contractor.

The Department and the Contractor shall bear the costs and expenses of the DRB equally.

Each DRB member shall be compensated at an agreed rate of $1,500 per day for time spent per meeting either at the start of the project, for scheduled progress, or dispute meetings. A member serving on more than one Department DRB or Dispute Resolution Advisor (DRA), regardless of the number of meetings per day shall not be paid more than the agreed rate per day. The agreed rate shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel, and incidentals for each day or portion thereof that the DRB member is at an authorized DRB meeting.

No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time, such as time spent evaluating and preparing recommendations on specific issues presented to the DRB, has been specifically agreed to in advance by the Department and Contractor. Time away from the project, which has been specifically agreed to in advance by the Department and Contractor, will be compensated at an agreed rate of $150 per hour. The agreed amount of $150 per hour shall include all incidentals including expenses for telephone, fax, and computer services.

The Department will provide conference facilities for DRB meetings at no cost to the Contractor.

The Contractor shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member.

The Department will reimburse the Contractor for the Department's share of the costs.

There will be no markups applied to expenses connected with the DRB, either by the DRB members or by the Contractor when requesting payment of the Department's share of DRB expenses. Regardless of the DRB recommendation, neither party shall be entitled to reimbursement of DRB costs from the other party.

The Contractor shall submit extra work bills and include evidence of every payment to each DRB member in the form of a cancelled check or bank statement within 30 days of payment.

The cost of technical services requested by the DRB will be borne equally by the State and Contractor. There will be no markups for these costs.

A copy of the "Dispute Resolution Board Agreement" to be executed by the Department, Contractor, and the 3 DRB members after approval of the contract follows:

Form CEM 6202 Rev (10/22/2008)

DISPUTE RESOLUTION BOARD AGREEMENT

_____
(Contract Identification)

Contract No. _____

THIS DISPUTE RESOLUTION BOARD AGREEMENT, hereinafter called "AGREEMENT", made and entered into this _____ day of _____, _____, between the State of California, acting through the California Department of Transportation and the Director of Transportation, hereinafter called the "STATE," _____ _____ hereinafter called the "CONTRACTOR," and the Dispute Resolution Board, hereinafter called the "DRB" consisting of the following members:

_____ ,
(DRB Member)

_____ ,
(DRB Member)

and _____
(DRB Chairperson)

WITNESSETH, that

WHEREAS, the STATE and the CONTRACTOR, hereinafter called the "parties," are now engaged in the construction on the State Highway project referenced above; and

WHEREAS, the Standard Specifications for the above referenced contract provides for the establishment and operation of the DRB to assist in resolving disputes; and

WHEREAS, the DRB is composed of three members, one selected by the STATE, one selected by the CONTRACTOR, and the third member selected by the other two members and approved by the parties; and

NOW THEREFORE, in consideration of the terms, conditions, covenants, and performance contained herein, or attached and incorporated and made a part hereof, the STATE, the CONTRACTOR, and the DRB members hereto agree as follows:

SECTION I DESCRIPTION OF WORK

To assist in the timely resolution of disputes between the parties, the contract provides for the establishment and the operation of the DRB. The DRB is to fairly and impartially consider disputes placed before it and provide recommendations for resolution of these disputes to the parties. The DRB shall provide recommendations based on the facts related to the dispute, the contract and applicable laws and regulations. The DRB shall perform the services necessary to participate in the DRB's actions as designated in Section III, Scope of Work.

SECTION II DRB QUALIFICATIONS

DRB members shall be knowledgeable in the type of construction and contract documents anticipated by the contract and shall have completed training through the Dispute Review Board Foundation.

No DRB member shall have prior direct involvement in this contract. No DRB member shall have a financial interest in this contract or parties thereto, including but not limited to the CONTRACTOR, subcontractors, suppliers, consultants, and legal and business services, within a period 6 months prior to award and during this contract. Exceptions to above are compensation for services on this or other DRBs and DRAs or retirement payments or pensions received from a party that are not tied to, dependent on or affected by the net worth of the party.

DRB members shall fully disclose all direct or indirect professional or personal relationships with all key members of the contract.

SECTION III SCOPE OF WORK

The scope of work of the DRB includes, but is not limited to, the following:

A. PROCEDURES

The DRB shall establish procedures that will govern the conduct of its business and reporting procedures in conformance with the requirements of the contract and the terms of this AGREEMENT. The DRB established procedures shall only be implemented upon approval of the parties.

The DRB Chairperson shall schedule progress and dispute meetings and any other DRB activities.

The parties shall not call on any of the DRB members, who served on this contract, as a witness in arbitration proceedings, which may arise from this contract.

DRB members shall have no claim against the STATE or the CONTRACTOR, or both, from claimed harm arising out of the parties' evaluations of the DRB's opinions.

During progress or dispute meetings, DRB members shall refrain from expressing opinions on the merits of statements on matters under dispute or potential dispute. Opinions of DRB members expressed in private sessions shall be kept strictly confidential. Individual DRB members shall not meet with, or discuss contract issues with individual parties. Discussions regarding the project between the DRB members and the parties shall be in the presence of all three members and both parties. Individual DRB members shall not undertake independent investigations of any kind pertaining to disputes or potential disputes, except with the knowledge of both parties and as expressly directed by the DRB Chairperson.

B. PROGRESS MEETINGS

DRB members shall visit the project site and meet with representatives of the parties to keep abreast of construction activities and to develop familiarity with the work in progress. Scheduled progress meetings shall be held at or near the project site. The DRB shall meet at least once at the start of the project, and at least once every 4 months thereafter. The frequency, exact time, and duration of additional site visits and progress meetings shall be as recommended by the DRB and approved by the parties consistent with the construction activities or matters under consideration and dispute. Scheduled progress meetings may be waived, if the parties are in agreement, when the only work remaining is plant establishment work. Each meeting shall consist of a round table discussion and a field inspection of the work being performed on the contract, if necessary. Each meeting shall be attended by representatives of both parties. The agenda shall generally be as follows:

1. Meeting opened by the DRB Chairperson.
2. Remarks by the STATE's representative.
3. A description by the CONTRACTOR's representative of work accomplished since the last meeting; the current schedule status of the work; and a forecast for the coming period.
4. An outline by the STATE's representative of the status of the work as the STATE views it.
5. An outline by the CONTRACTOR's representative of potential problems and a description of proposed solutions.
6. A brief description by the CONTRACTOR's and the STATE's representative of potential claims and disputes that have surfaced since the last meeting.
7. A summary by the STATE's representative, the CONTRACTOR's representative, or the DRB of the status of past potential claims and disputes.

The STATE's representative will prepare minutes of all progress meetings and circulate them for revision and approval by all concerned within 10 days of the meeting.

C. DISPUTE MEETING

The term "dispute meeting" as used in this subsection shall refer to both the informal and traditional dispute meeting processes, unless otherwise noted.

Either the STATE or the CONTRACTOR may request a dispute meeting with the DRB. The requesting party shall simultaneously notify the other party of each dispute meeting request. Upon being notified of the need for a dispute meeting, the DRB shall review and consider the dispute. The DRB shall determine the time and location of the dispute meeting with due consideration for the needs and preferences of the parties, while recognizing the importance of a speedy resolution to the dispute.

Dispute meetings shall be conducted at any location that would be convenient and provide required facilities and access to necessary documentation.

No DRB dispute meeting shall take place later than 30 days prior to acceptance of the contract.

Only the STATE's Area Construction Engineer, Resident Engineer, and Structure Representative and the CONTRACTOR's or subcontractor's, Superintendent or Project Manager may present information at a dispute meeting. There shall be no participation of persons who are not directly involved in the contract or who do not have direct knowledge of the dispute. The exception to this is technical services, as described below:

> The DRB, with approval of the parties, may obtain technical services necessary to adequately review the disputes presented, including audit, geotechnical, schedule analysis and other services. The parties' technical staff may supply those services as appropriate. The cost of technical services, as agreed to by the parties, shall be borne equally by the two parties as specified in an approved contract change order. The CONTRACTOR shall not be entitled to markups for the payments made for these services.

At the dispute meeting the DRB may ask questions, seek clarification, and request further clarification of data presented by either of the parties as may be necessary to assist in making a fully informed recommendation. However, the DRB shall refrain from expressing opinions on the merits of statements on matters under dispute during the parties' presentations. The claimant shall discuss the dispute, followed by the other party. Each party shall then be allowed one or more rebuttals at the meeting until all aspects of the dispute are thoroughly covered. Each party will be given ample time to fully present its position, make rebuttals, provide relevant documents, and respond to DRB questions and requests.

There shall be no testimony under oath or cross-examination, during DRB dispute meetings. There shall be no reporting of the procedures by a shorthand reporter or by electronic means. Documents and verbal statements shall be received by the DRB in conformance with the procedures established at the first meeting between the DRB and the parties. These established procedures need not comply with prescribed legal laws of evidence.

Failure to attend a dispute meeting by either of the parties shall be conclusively considered by the DRB as indication that the non-attending party considers all written documents and correspondence submitted as their entire and complete argument.

After dispute meetings are concluded, the DRB shall meet in private and reach a conclusion supported by two or more members. Private sessions of the DRB may be held at a location other than the job site or by electronic conferencing as deemed appropriate, in order to expedite the process.

The DRB shall make every effort to reach a unanimous decision.

1. TRADITIONAL DISPUTE MEETING:

The following procedure shall be used for the traditional dispute meeting:

a. Within 21 days after receiving the STATE's written response to the CONTRACTOR's supplemental potential claim record, the CONTRACTOR shall refer the dispute to the DRB if the CONTRACTOR wishes to further pursue the dispute. The CONTRACTOR shall make the referral in writing to the DRB, simultaneously copied to the STATE. The written dispute referral shall describe the disputed matter in individual discrete segments, so that it will be clear to both parties and the DRB what discrete elements of the dispute have been resolved, and which remain unresolved, and shall include an estimate of the cost of the affected work and impacts, if any, on project completion.

b. The parties shall each be afforded an opportunity to be present and to be heard by the DRB, and to offer evidence. Either party furnishing written evidence or documentation to the DRB must furnish copies of such information to the other party a minimum of 15 days prior to the date the DRB is scheduled to convene the meeting for the dispute. Either party shall produce such additional evidence as the DRB may deem necessary to reach an understanding and a determination of the dispute. The party furnishing additional evidence shall furnish copies of such additional evidence to the other party at the same time the evidence is provided to the DRB. The DRB shall not consider evidence not furnished in conformance with the terms specified herein.

c. Upon receipt by the DRB of a written referral of a dispute, the DRB shall convene to review and consider the dispute. The dispute meeting shall be held no earlier than 30 days and no later than 60 days after receipt of the written referral unless otherwise agreed to by all parties.

d. The DRB may request clarifying information of either party within 10 days after the dispute meeting. Requested information shall be submitted to the DRB within 10 days of the DRB request.

e. The DRB shall furnish a written report to the parties with its conclusion(s) and recommendation(s). The DRB shall complete its report, including minority opinion, if any, and submit it to the parties within 30 days of the dispute meeting, except that time extensions may be granted at the request of the DRB with the written concurrence of the parties. The report shall summarize the facts considered, the contract language, law or regulation viewed by the DRB as pertinent to the dispute, and the DRB's interpretation and reasoning in arriving at its conclusion(s) and recommendation(s) and, if appropriate, recommends

guidelines for determining compensation. The DRB's written opinion shall stand on its own, without attachments or appendices. The DRB Chairperson shall furnish a copy of the written recommendation report to the DRB Coordinator, Division of Construction, MS 44, P.O. Box 942874, Sacramento, CA 94274.

f. Within 30 days after receiving the DRB's report, the parties shall respond to the DRB in writing signifying that the dispute is either resolved or remains unresolved. Failure to provide the written response within the time specified, or a written rejection of the DRB's recommendation or a written response requesting the DRB reconsider their recommendation, shall conclusively indicate that the party(s) failing to respond accepts the DRB recommendation. Immediately after responses have been received from both parties, the DRB shall provide copies of both responses to the parties simultaneously. Either party may request clarification of elements of the DRB's report from the DRB prior to responding to the report. The DRB shall consider any clarification request only if submitted within 10 days of receipt of the DRB's report, and if submitted simultaneously in writing to both the DRB and the other party. Each party may submit only one request for clarification for any individual DRB report. The DRB shall respond, in writing, to requests for clarification within 10 days of receipt of such requests.
g. Either party may seek a reconsideration of the DRB's recommendation. The DRB shall only grant reconsideration based upon submission of new evidence and if the request is submitted within the 30 day time limit specified for response to the DRB's written report. Each party may submit only one request for reconsideration regarding an individual DRB recommendation.
h. If the parties are able to settle their dispute with the aid of the DRB's report, the STATE and the CONTRACTOR shall promptly accept and implement the settlement of the parties. If the parties cannot agree on compensation within 60 days of the acceptance by both parties of the settlement, either party may request the DRB to make a recommendation regarding compensation.

2. INFORMAL DISPUTE MEETING

An informal dispute meeting shall be convened, only if, the parties and the DRB agree that this dispute resolution process is appropriate to settle the dispute.

The following procedure shall be used for the informal dispute meeting:

a. The parties shall furnish the DRB with one copy of pertinent documents requested by the DRB that are or may become necessary for the DRB to perform its function. The party furnishing documents shall furnish such documents to the other party at the same time the document is provided to the DRB.
b. After the dispute meeting has concluded, the DRB members shall deliberate in private the same day until a response to the parties is reached or as otherwise agreed to by the parties.
c. The DRB then verbally delivers its recommendation with findings, including minority opinion, if any, to the parties.
d. After the recommendation is presented, the parties may ask for clarifications.
e. Occasionally the DRB may be unable to formulate a recommendation based on the information given at a dispute meeting. However, the DRB may provide the parties with advice on strengths and weaknesses of their prospective positions, in the hope of the parties reaching settlement.
f. If the parties are able to settle their dispute with the aid of the DRB's opinion, the STATE and the CONTRACTOR shall promptly accept and implement the settlement of the parties.
g. The DRB will not be bound by its verbal recommendation in the event that a dispute is later heard by the DRB in a traditional dispute meeting.

Unless the dispute is settled, use of the informal dispute meeting does not relieve the parties of their responsibilities under Section 5-1.15C, "Dispute Resolution Board," of the Standard Specifications or subsection, "Traditional Dispute Meeting," of this AGREEMENT. There will be no extension of time allowed for the process to permit the use of the informal dispute meeting, unless otherwise agreed to by the parties.

SECTION IV TIME FOR BEGINNING AND COMPLETION

DRB members shall not begin work under the terms of this AGREEMENT, until authorized in writing by the STATE or as agreed to by the parties. Once established, the DRB shall be in operation until the Director accepts the contract. If the contract is terminated in accordance with Section 8-1.08, "Termination of Control," of the Standard Specifications, the DRB will be dissolved.

SECTION V PAYMENT

Each DRB member shall be compensated at an agreed rate of $1,500 per day for time spent per meeting, either at start of project, or a scheduled progress or a dispute meeting. A member serving on more than one State DRB or DRA, regardless of the number of meetings per day, shall not be paid more than the agreed rate per day. The agreed rate shall be considered full compensation for on site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB member to review and research activities outside the official DRB meetings unless that time, such as time spent evaluating and preparing recommendations on specific issues presented to the DRB, has been specifically agreed to in advance by the parties. Time away from the project, which has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of $150 per hour. The agreed amount of $150 per hour shall include all incidentals including expenses for telephone, fax, and computer services. The State will provide administrative services such as conference facilities to the DRB.

A. PAYMENT PROCESSING

The CONTRACTOR shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges, from invoices submitted by each DRB member, and technical services.

DRB members may submit invoices to the CONTRACTOR for partial payment for work performed and services rendered for their participation in authorized meetings not more often than once per month during the progress of the work. The invoices shall be in a format approved by the parties and accompanied by a general description of activities performed during that billing period. Payment for hourly fees, at the agreed rate, shall not be paid to a DRB member until the amount and extent of those fees are approved by the STATE and the CONTRACTOR.

B. INSPECTION OF COSTS RECORDS

DRB members and the CONTRACTOR shall keep available for inspection by representatives of the STATE and the United States federal government, for a period of 3 years after final payment, the cost records and accounts pertaining to this AGREEMENT. If any litigation, claim, or audit arising out of, in connection with, or related to this contract is initiated before the expiration of the 3-year period, the cost records and accounts shall be retained until such litigation, claim, or audit involving the records is completed.

SECTION VI ASSIGNMENT OF TASKS OF WORK

DRB members shall not assign the work of this AGREEMENT.

SECTION VII TERMINATION OF A DRB MEMBER

DRB members may resign after providing not less than 15 days written notice of their resignation to the STATE and the CONTRACTOR. A DRB member may be terminated, by either party, for failing to comply at all times with all required employment or financial disclosure conditions of DRB membership in conformance with the terms of the contract and this AGREEMENT.

Service of a DRB member may be terminated at any time with not less than 15 days notice as follows:

A. The State may terminate service of the State appointed member.
B. The Contractor may terminate service of the Contractor appointed member.
C. Upon the written recommendation of the State and Contractor appointed members for the removal of the third member.
D. Upon resignation of a member.

When a member of the DRB is replaced, the replacement member shall be appointed in the same manner as the replaced member was appointed. The appointment of a replacement DRB member will begin promptly upon determination of the need for replacement and shall be completed within 15 days. Changes in either of the DRB members chosen by the 2 parties will not require re-selection of the third member, unless both parties agree to such re-selection in writing. The Dispute Resolution Board Agreement shall be amended to reflect the change of a DRB member.

Each party shall document the need for replacement and substantiate the replacement request in writing to the other party and DRB members.

SECTION VIII LEGAL RELATIONS

The parties hereto mutually understand and agree that each DRB member in the performance of duties is acting in the capacity of an independent agent and not as an employee of either party.

No party to this AGREEMENT shall bear a greater responsibility for damages or personal injury than is normally provided by Federal or State of California Law.

Notwithstanding the provisions of this contract that require the CONTRACTOR to indemnify and hold harmless the STATE, the parties shall jointly indemnify and hold harmless the DRB members from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRB.

SECTION IX CONFIDENTIALITY

The parties hereto mutually understand and agree that all documents and records provided by the parties in reference to issues brought before the DRB, which documents and records are marked "Confidential - for use by the DRB only," shall be kept in confidence and used only for the purpose of resolution of subject disputes, and for assisting in development of DRB findings and recommendations; that such documents and records will not be utilized or revealed to others, except to officials of the parties who are authorized to act on the subject disputes, for any purposes, during the life of this AGREEMENT. Upon termination of this AGREEMENT, said confidential documents and records, and all copies thereof, shall be returned to the parties who furnished them to the DRB. However, the parties understand that such documents may be subsequently discoverable and admissible in court or arbitration proceedings unless a protective order has been obtained by the party seeking further confidentiality.

SECTION X DISPUTES

Disputes between the parties arising out of the work or other terms of this AGREEMENT, which cannot be resolved by negotiation and mutual concurrence between the parties, or through the administrative process provided in the contract, shall be resolved by arbitration as provided in Section 9-1.10, "Arbitration," of the Standard Specifications. Disputes between the DRB and either party, which cannot be resolved by negotiation and mutual concurrence, shall be resolved in the appropriate forum.

SECTION XI VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION

In the event that any party deems it necessary to institute arbitration proceedings to enforce any right or obligation under this AGREEMENT, the parties hereto agree that such action shall be initiated in the Office of Administrative Hearings of the State of California. The parties hereto agree that all questions shall be resolved by arbitration by application of California law and that the parties to such arbitration shall have the right of appeal from such decisions to the Superior Court in conformance with the laws of the State of California. Venue for the arbitration shall be Sacramento or any other location as agreed to by the parties.

SECTION XII FEDERAL REVIEW AND REQUIREMENTS

On Federal-Aid contracts, the Federal Highway Administration shall have the right to review the work of the DRB in progress, except for private meetings or deliberations of the DRB that do not become part of the project records.

Other Federal requirements in this agreement shall only apply to Federal-Aid contracts.

SECTION XIII CERTIFICATION OF CONTRACTOR, DRB, AND STATE

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT as of the day and year first above written.

DRB MEMBER

By: _____

Title: _____

DRB MEMBER

By: _____

Title :_____

DRB CHAIRPERSON

By :_____

Title :_____

CONTRACTOR

CALIFORNIA DEPARTMENT
OF TRANSPORTATION

By: _____

By: _____

Title: _____

Title: _____

Add:

5-1.16–5-17 (BLANK)

Add:

5-1.18 PROPERTY AND FACILITY PRESERVATION

5-1.18A General

Preserve property and facilities, including:

1. Adjacent property
2. Department's instrumentation
3. ESAs
4. Lands administered by other agencies
5. Railroads and railroad equipment
6. Roadside vegetation not to be removed
7. Utilities
8. Waterways

Immediately report damage to the Engineer.

If you cause damage, you are responsible.

Install sheet piling, cribbing, bulkheads, shores, or other supports necessary to support existing facilities or support material carrying the facilities.

Dispose of temporary facilities when they are no longer needed.

If you damage plants not to be removed:

1. Dispose of them outside the right of way unless the Engineer allows you to reduce them to chips and spread the chips within the highway at locations designated by the Engineer
2. Replace them

Replace plants with plants of the same species.

Replace trees with 24-inch-box trees.

Replace shrubs with No. 15 container shrubs.

Replace ground cover plants with plants from flats. Replace Carpobrutus ground cover plants with plants from cuttings. Plant ground cover plants 1 foot on center.

If a plant establishment period is specified, replace plants before the start of the plant establishment period; otherwise, replace plants at least 30 days before Contract acceptance.

Water each plant immediately after planting and saturate the backfill soil around and below the roots or ball of earth around the roots of each plant. Water as necessary to maintain plants in a healthy condition until Contract acceptance.

The Department may make a temporary repair to restore service to a damaged facility.

If working on or adjacent to railroad property, do not interfere with railroad operations.

For an excavation on or affecting railroad property, submit work plans showing the system to be used to protect railroad facilities. Allow 65 days for the Engineer's review of the plans. Do not perform work based on the plans until the Engineer notifies you they are accepted.

5-1.18B Nonhighway Facilities (Including Utilities)

The Department may rearrange a nonhighway facility during the Contract. Rearrangement of a nonhighway facility includes installation, relocation, alteration, or removal of the facility.The Department may authorize facility owners and their agents to enter the highway to perform rearrangement work for their facilities or to make connections or repairs to their property. Coordinate activities to avoid delays.

Notify the Engineer at least 3 business days before you contact the regional notification center under Govt Code § 4216 et seq. Failure to contact the notification center prohibits excavation.

Before starting work that could damage or interfere with underground infrastructure, locate the infrastructure described in the Contract, including laterals and other appurtenances, and determine the presence of other underground infrastructure inferred from visible facilities such as buildings, meters, or junction boxes.

Notify the Engineer if the infrastructure described in the Contract cannot be found. If after giving the notice, you find the infrastructure in a substantially different location than described, finding the infrastructure is paid for as extra work as specified in Section 4-1.03D, "Extra Work."

Underground infrastructure described in the Contract may be in different locations than described, and additional infrastructure may exist.

Upon discovering an underground main or trunk line not described in the Contract, immediately notify the Engineer and the infrastructure owner. The Engineer orders the locating and protecting of the infrastructure. The locating and protecting is paid for as extra work as specified in Section 4-1.03D, "Extra Work." If ordered, repair infrastructure damage. If the damage is not due to your negligence, the repair is paid for as extra work as specified in Section 4-1.03D, "Extra Work."

If necessary underground infrastructure rearrangement is not described in the Contract, the Engineer may order you to perform the work. The rearrangement is paid for as extra work as specified in Section 4-1.03D, "Extra Work."

If you want infrastructure rearrangement different from that described in the Contract:

1. Notify the Engineer
2. Make an arrangement with the infrastructure owner
3. Obtain authorization for the rearrangement
4. The Department does not adjust time or payment for rearrangement different from the Contract
5. Pay the infrastructure owner any additional cost

Immediately notify the Engineer of a delay due to the presence of main line underground infrastructure not described in the Contract or in a substantially different location or due to rearrangement different from the Contract. The Department pays for one of these delays in the same manner as specified for a right of way delay in Section 8-1.09, "Right of Way Delays."

^^

SECTION 6 CONTROL OF MATERIALS
(Issued 05-01-09)

Replace Section 6-1.05 with:

6-1.05 SPECIFIC BRAND OR TRADE NAME AND SUBSTITUTION

A reference to a specific brand or trade name establishes a quality standard and is not intended to limit competition. You may use a product that is equal to or better than the specified brand or trade name if approved.

Submit a substitution request within a time period that:

1. Follows Contract award
2. Allows 30 days for review
3. Causes no delay

Include substantiating data with the substitution request that proves the substitution:

1. Is of equal or better quality and suitability
2. Causes no delay in product delivery and installation

Add:

6-1.075 GUARANTEE

Guarantee the work remains free from substantial defects for 1 year after contract acceptance except for work parts for which you were relieved of maintenance and protection. Guarantee each of these relieved work parts for 1 year after the relief date.

The guarantee excludes damage or displacement caused by an event outside your control including:

1. Normal wear and tear

2. Improper operation
3. Insufficient maintenance
4. Abuse
5. Unauthorized change
6. Act of God

During the guarantee period, repair or replace each work portion having a substantial defect.

The Department does not pay for corrective work.

During corrective work activities, provide insurance coverage specified for coverage before contract acceptance.

The contract bonds must be in full force and effect until the later of:

1. Expiration of guarantee period
2. Completion of corrective work

If a warranty specification conflicts with Section 6-1.075, "Guarantee," comply with the warranty specification.

During the guarantee period, the Engineer monitors the completed work. If the Engineer finds work having a substantial defect, the Engineer lists work parts and furnishes you the list.

Within 10 days of receipt of the list, submit for authorization a detailed plan for correcting the work. Include a schedule that includes:

1. Start and completion dates
2. List of labor, equipment, materials, and any special services you plan to use
3. Work related to the corrective work, including traffic control and temporary and permanent pavement markings

The Engineer notifies you when the plan is authorized. Start corrective work and related work within 15 days of notice.

If the Engineer determines corrective work is urgently required to prevent injury or property damage:

1. The Engineer furnishes you a request to start emergency repair work and a list of parts requiring corrective work
2. Mobilize within 24 hours and start work
3. Submit a corrective work plan within 5 days of starting emergency repair work

If you fail to perform work as specified, the Department may perform the work and bill you.

In Section 6-1.08 delete the 2nd paragraph.

Add:

6-1.085 BUY AMERICA (23 CFR 635.410)

For a Federal-aid contract, furnish steel and iron materials to be incorporated into the work that are produced in the United States except:

1. Foreign pig iron and processed, pelletized, and reduced iron ore may be used in the domestic production of the steel and iron materials [60 Fed Reg 15478 (03/24/1995)]
2. If the total combined cost of the materials does not exceed the greater of 0.1 percent of the total bid or $2,500, material produced outside the United States may be used

Production includes:

1. Processing steel and iron materials, including smelting or other processes that alter the physical form or shape (such as rolling, extruding, machining, bending, grinding, and drilling) or chemical composition
2. Coating application, including epoxy coating, galvanizing, and painting, that protects or enhances the value of steel and iron materials

For steel and iron materials to be incorporated into the work, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications that certifies all production processes occurred in the United States except for the above exceptions.

Add:

6-1.087 BUY AMERICA (PUB RES CODE § 42703(d))

Furnish crumb rubber to be incorporated into the work that is produced in the United States and is derived from waste tires taken from vehicles owned and operated in the United States.

For crumb rubber to be incorporated into the work, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications that certifies only crumb rubber manufactured in the United States and derived from waste tires taken from vehicles owned and operated in the United States is used.

In Section 6-2.01 delete the 4th paragraph.

In Section 6-2.01 replace the 7th paragraph with:

Upon the Contractor's written request, the Department tests materials from an untested local source. If satisfactory material from that source is used in the work, the Department does not charge the Contractor for the tests; otherwise, the Department deducts the test cost.

In Section 6-2.01 delete the 8th paragraph.

In Section 6-2.02 delete the 3rd paragraph.

In Section 6-2.02 in the 7th paragraph, replace the 2nd sentence with:

The Department deducts the charges for the removed material.

In Section 6-2.03 in the 3rd paragraph, replace the 5th sentence with:

No allowance or additional compensation will be made for lost time or for delay in completing the work due to moving the Contractor's plant from the designated mandatory source to the alternative mandatory source, other than a time adjustment as specified in Section 8-1.09, "Delays."

In Section 6-3.01 delete the 4th paragraph.

In Section 6-3.01 in the 6th paragraph, delete the 1st sentence.

In Section 6-3.01 add:

As used in Section 6-3.01, "Testing," tests are tests to assure the quality and to determine the acceptability of the work.

The Department deducts costs of testing work found to be noncompliant.

^^

SECTION 7 LEGAL RELATIONS AND RESPONSIBILITY

(Issued 07-27-12)

Replace Section 7-1.01 with:

7-1.01 LAWS TO BE OBSERVED

Comply with laws, regulations, orders, decrees, and PLACs applicable to the project. Indemnify and defend the State against any claim or liability arising from the violation of a law, regulation, order, decree, or PLAC by you or your employees. Immediately report to the Engineer in writing a discrepancy or inconsistency between the contract and a law, regulation, order, decree, or PLAC.

In Section 7-1.01A replace the 1st clause with:

Work on the job site must comply with Labor Code §§ 1727 and 1770-1815 and 8 CA Code of Regs § 16000 et seq. Work includes roadside production and processing of materials.

In Section 7-1.01A(2) in the 1st paragraph, replace item 3 with:

3. Upon becoming aware of the subcontractor's failure to pay the specified prevailing rate of wages to the subcontractor's workers, the Contractor must diligently take corrective action to stop or rectify the failure, including withholding sufficient funds due the subcontractor for work performed on the public works project.

In Section 7-1.01A(2), replace the 2nd paragraph with:

Pursuant to Section 1775 of the Labor Code, the Division of Labor Standards Enforcement must notify the Contractor on a public works project within 15 days of the receipt by the Division of Labor Standards Enforcement of a complaint of the failure of a subcontractor on that public works project to pay workers the general prevailing rate of per diem wages. If the Division of Labor Standards Enforcement determines that employees of a subcontractor were not paid the general prevailing rate of per diem wages and if the Department did not withhold sufficient money under the contract to pay those employees the balance of wages owed under the general prevailing rate of per diem wages, the Contractor must withhold an amount of moneys due the subcontractor sufficient to pay those employees the general prevailing rate of per diem wages if requested by the Division of Labor Standards Enforcement. The Contractor must pay any money withheld from and owed to a subcontractor upon receipt of notification by the Division of Labor Standards Enforcement that the wage complaint has been resolved. If notice of the resolution of the wage complaint has not been received by the Contractor within 180 days of the filing of a valid notice of completion or acceptance of the public works project, whichever occurs later, the Contractor must pay all moneys withheld from the subcontractor to the Department. The Department withholds these moneys pending the final decision of an enforcement action.

In Section 7-1.01A(2) replace 7th paragraph with:

Changes in general prevailing wage determinations apply to the contract when the Director of Industrial Relations has issued them at least 10 days before advertisement (Labor Code § 1773.6 and 8 CA Code of Regs 16204).

In Section 7-1.01A(3) replace the 2nd paragraph with:

The Department withholds the penalties specified in subdivision (g) of Labor Code § 1776 for noncompliance with the requirements in Section 1776.

In Section 7-1.01A(3) replace the 4th paragraph with:

The Department withholds for delinquent or inadequate payroll records (Labor Code § 1771.5). If the Contractor has not submitted an adequate payroll record by the month's 15th day for the period ending on or before the 1st of that month, the Department withholds 10 percent of the monthly progress estimate, exclusive of mobilization. The Department does not withhold more than $10,000 or less than $1,000.

In Section 7-1.01A(3) delete the 5th paragraph.

Replace Section 7-1.01A(6) with:

7-1.01A(6) (Blank)

Replace Section 7-1.01A(7) with:

7-1.01A(7) (Blank)

Replace Section 7-1.01F with:

7-1.01F Environmental Stewardship

Comply with Section 14.

Replace Section 7-1.01I with:

7-1.01I (Blank)

In Section 7-1.02 in the 2nd paragraph, replace the 4th sentence with:

Trucks used to haul treated base, portland cement concrete, or hot mix asphalt shall enter onto the base to dump at the nearest practical entry point ahead of spreading equipment.

In Section 7-1.02 between the 4th and 5th paragraphs, add:

Loads imposed on existing, new, or partially completed structures shall not exceed the load carrying capacity of the structure or any portion of the structure as determined by AASHTO LRFD with interims and California Amendments, Design Strength Limit State II. The compressive strength of concrete (f'_c) to be used in computing the load carrying capacity shall be the smaller of the following:

1. Actual compressive strength at the time of loading
2. Value of f'_c shown on the plans for that portion of the structure or 2.5 times the value of f_c (extreme fiber compressive stress in concrete at service loads) shown on the plans for portions of the structure where no f'_c is shown

Replace Section 7-1.04 with:

7-1.04 PERMITS, LICENSES, AGREEMENTS, AND CERTIFICATIONS

7-1.04A General

Comply with PLACs. The Department makes PLAC changes under Section 4-1.03, "Changes."

7-1.04B Before Award

To make a change to a PLAC made available to you before award, submit the proposed change. The Department sends the proposed change to the appropriate authority for consideration.

7-1.04C After Award

Confirm with the Engineer which after-award PLACs are obtained by the Department and which are obtained by the Contractor.

To make a change to an after-award PLAC obtained by the Department, submit the proposed change. The Department sends the proposed change to the appropriate authority for consideration.

Obtain those PLACs to be issued to you and pay fees and costs associated with obtaining them. Submit copies of Contractor-obtained after-award PLACs for review.

In Section 7-1.06 in the 1st paragraph, add:

The Contractor's Injury and Illness Prevention Program shall be submitted to the Engineer. The program shall address the use of personal and company issued electronic devices during work. The use of entertainment and personal communication devices in the work zone shall not be allowed. Workers may use a communication device for business purposes in the work area, at a location where their safety and the safety of other workers and the traveling public is not compromised.

Replace Section 7-1.07 with:

7-1.07 Lead Compliance Plan

Section 7-1.07 applies if a bid item for a lead compliance plan is included in the Contract.

Prepare a work plan to prevent or minimize worker exposure to lead while managing and handling earth materials, paint system debris, traffic stripe residue, and pavement marking residue containing lead. Regulations containing specific Cal/OSHA requirements when working with lead include 8 CA Code of Regs § 1532.1.

The plan must contain the items listed in 8 CA Code of Regs § 1532.1(e)(2)(B). Before submittal, a CIH must sign and seal the plan. Submit the plan at least 7 days before starting any activity that presents the potential for lead exposure. The Engineer notifies you of the acceptability of the plan within 4 business days of receipt.

Before starting any activity that presents the potential for lead exposure to employees who have no prior training, including State employees, provide a safety training program to these employees that complies with 8 CA Code of Regs § 1532.1 and your lead compliance program.

Submit copies of air monitoring or job site inspection reports made by or under the direction of the CIH under 8 CA Code of Regs § 1532.1 within 10 days after the date of monitoring or inspection.

Supply personal protective equipment, training, and washing facilities required by your lead compliance plan for 5 State employees.

The contract lump sum price paid for lead compliance plan includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in preparing and implementing the plan as specified in this section.

Replace Section 7-1.08 with:

7-1.08 PUBLIC CONVENIENCE

Compliance with the provisions of this section does not relieve you of your responsibility for public safety.

Construction activities must not inconvenience the public or abutting property owners. Schedule and conduct work to avoid unnecessary inconvenience to the public and abutting property owners. Avoid undue delay in construction activities to reduce the public's exposure to construction.

Where possible, route traffic on new or existing paved surfaces.

Maintain convenient access to driveways, houses, and buildings. When the abutting property owner's access across the right of way line is to be eliminated or replaced under the contract, the existing access must not be closed until the replacement access facilities are usable. Construct temporary approaches to crossings and intersecting highways.

Provide a reasonably smooth and even surface for use by traffic at all time during excavation of roadways and construction of embankments. Before other grading activities, place fill at culverts and bridges to allow traffic to cross. If ordered, excavate roadway cuts in layers and construct embankments in partial widths at a time alternating construction from one side to the other and routing traffic over the side opposite the one under construction. Install or construct culverts on only 1/2 the width of the traveled way at a time; keep the traveled way portion being used by traffic open and unobstructed until the opposite side of the traveled way is ready for use by traffic.

Upon completion of rough grading or placing any subsequent layer, bring the surface of the roadbed to a smooth and even condition, free of humps and depressions and satisfactory for the use of the public.

After subgrade preparation for a specified layer of material has been completed, repair any damage to the roadbed or completed subgrade, including damage due to use by the public.

While subgrade and paving activities are underway, allow the public to use the shoulders. If half-width paving methods are used, allow the public to use the side of the roadbed opposite the one under construction. If enough width is available, keep open a passageway wide enough to accommodate at least 2 lanes of traffic at locations where subgrade and paving activities are underway. Shape shoulders or reshape subgrade as necessary to accommodate traffic during subgrade preparation and paving activities.

Apply water or dust palliative for the prevention or alleviation of dust nuisance.

Install signs, lights, flares, temporary railing (Type K), barricades and other facilities to direct traffic. Furnish flaggers whenever necessary to direct the movement of the public through or around the work.

You will be required to pay the cost of replacing or repairing all facilities installed under extra work for the convenience or direction or warning of the public which are lost while in your custody, or are damaged by your operations to such an extent as to require replacement or repair.

The Engineer may order or consent to your request to open a completed section of surfacing, pavement, or structure roadway surface for public use. You will not be compensated for any delay to your construction activities caused by the public. This does not relieve you from any other contractual responsibility.

Replace Section 7-1.09 with:

7-1.09 PUBLIC SAFETY

You are responsible to provide for public safety.

Do not construct a temporary facility that interferes with the safe passage of traffic.

Control dust resulting from the work, inside and outside the right-of-way.

Move workers, equipment, and materials without endangering traffic.

Whenever your operations create a condition hazardous to the public, furnish, erect and maintain those fences, temporary railing, barricades, lights, signs, and other devices and take any other necessary protective measures to prevent damage or injury to the public.

Any fences, temporary railing, barricades, lights, signs, or other devices furnished, erected and maintained by you are in addition to those for which payment is provided elsewhere in the specifications.

Provide flaggers whenever necessary to ensure that the public is given safe guidance through the work zone. Except as ordered, at locations where traffic is being routed through construction under one-way controls, move your equipment in compliance with the one-way controls.

Use of signs, lights, flags, or other protective devices must conform with the California MUTCD and as ordered. Signs, lights, flags or other protective devices must not obscure the visibility of, nor conflict in intent, meaning and function of either existing signs, lights and traffic control devices or any construction area signs or traffic control devices.

Keep existing traffic signals and highway lighting in operation. Other entities perform routine maintenance of these facilities during the work.

Cover signs that direct traffic to a closed area. Providing, maintaining, and removing the covers on construction area signs is paid as extra work under Section 4-1.03D, "Extra Work."

Install temporary illumination in a manner which the illumination and the illumination equipment does not interfere with public safety. The installation of general roadway illumination does not relieve you from furnishing and maintaining any protective devices.

Equipment must enter and leave the highway via existing ramps and crossovers and must move in the direction of public traffic. All movements of workmen and construction equipment on or across lanes open to public traffic must be performed in a manner that will not endanger the public. Your vehicles or other mobile equipment leaving an open traffic lane to enter the construction area, must slow down gradually in advance of the location of the turnoff to give traffic following an opportunity to slow down. When leaving a work area and entering a roadway carrying public traffic, your vehicles and equipment must yield to public traffic.

Immediately remove hauling spillage from roadway lanes or shoulders open to traffic. When hauling on roadways, trim loads and remove material from shelf areas to minimize spillage.

Notify the Engineer not less than 25 days and not more than 125 days before the anticipated start of an activity that will change the vertical or horizontal clearance available to public traffic, including shoulders.

If vertical clearance is temporarily reduced to 15.5 feet or less, place low clearance warning signs in accordance with the California MUTCD and as ordered. Signs must comply with the dimensions, color, and legend requirements of the California MUTCD and these specifications except that the signs must have black letters and numbers on an orange retroreflective background. W12-2P signs must be illuminated so that the signs are clearly visible.

Pave or provide full width continuous and cleared wood walks for pedestrian openings through falsework. Protect pedestrians from falling objects and curing water for concrete. Extend overhead protection for pedestrians not less than 4 feet beyond the edge of the bridge deck. Illuminate all pedestrian openings through falsework. Temporary pedestrian facilities must comply with the American with Disabilities Act of 1990 (ADA).

Do not store vehicles, material, or equipment in a way that:

1. Creates a hazard to the public
2. Obstructs traffic control devices

Do not install or place temporary facilities used to perform the work which interfere with the free and safe passage of public traffic.

Temporary facilities which could be a hazard to public safety if improperly designed shall comply with design requirements specified in the contract for those facilities or, if none are specified, with standard design criteria or codes appropriate for the facility involved. Working drawings and design calculations for the temporary facilities shall be prepared and signed by an engineer who is registered as a Civil Engineer in the State of California and shall be submitted to the Engineer for approval pursuant to Section 5-1.02, "Plans and Working Drawings." The

submittals shall designate thereon the standard design criteria or codes used. Installation of the temporary facilities shall not start until the Engineer has reviewed and approved the drawings.

If you appear to be neglectful or negligent in furnishing warning devices and taking protective measures, the Engineer may direct your attention to the existence of a hazard and the necessary warning devices must be furnished and installed and protective measures taken by you. If the Engineer points out the inadequacy of warning devices and protective measures, that action on the part of the Engineer does not relieve you from your responsibility for public safety or abrogate the obligation to furnish and pay for these devices and measures.

Install temporary railing (Type K) or other approved protection system under the following conditions:

1. Excavations: Where the near edge of the excavation is within 15 feet from the edge of an open traffic lane
2. Temporarily Unprotected Permanent Obstacles: When the work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and you elect to install the obstacle before installing the protective system; or you, for your convenience and as authorized, remove a portion of an existing protective railing at an obstacle and do not replace such railing completely the same day
3. Storage Areas: When material or equipment is stored within 15 feet of the edge of an open traffic lane and the storage is not otherwise prohibited by the provisions of these Standard Specifications and the special provisions
4. Height Differentials: When construction operations create a height differential greater than 0.15 feet within 15 feet of the edge of traffic lane

Temporary railing (Type K) does not need to be installed where excavations within 15 feet from edge of an open traffic lane are:

1. Covered with steel plates or concrete covers of adequate thickness to prevent accidental entry by traffic or the public
2. In side slopes, where the downhill slope is 4:1 (horizontal:vertical) or less unless a naturally occurring condition
3. Protected by existing barrier or railing

Offset the approach end of temporary railing (Type K) a minimum of 15 feet from the edge of an open traffic lane. Install the temporary railing on a skew toward the edge of the traffic lane of not more than one foot transversely to 10 feet longitudinally with respect to the edge of the traffic lane. If the 15-foot minimum offset cannot be achieved, the temporary railing must be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules must be installed at the approach end of the temporary railing.

Secure in place temporary railing (Type K) before starting work for which the temporary railing is required.

Where 2 or more lanes in the same direction are adjacent to the area where the work is being performed, including shoulders, the adjacent lane must be closed under any of the following conditions:

1. Work is off the traveled way but within 6 feet of the edge of traveled way, and approach speed is greater than 45 miles per hour
2. Work is off the traveled way but within 3 feet of the edge of traveled way, and approach speed is less than 45 miles per hour

Closure of the adjacent traffic lane is not required when:

1. Performing work behind a barrier
2. Paving, grinding, or grooving
3. Installing, maintaining, or removing traffic control devices except temporary railing (Type K)

Do not reduce an open traffic lane width to less than 10 feet. When traffic cones or delineators are used for temporary edge delineation, the line of cones or delineators is considered the edge of the traveled way.

If a traffic lane is closed with channelizers for excavation work, move the devices to the adjacent edge of the traveled way when not excavating. Space the devices the same as specified for the lane closure.

Do not move or temporarily suspend anything over a traffic lane open to the public unless the public is protected.

Replace Section 7-1.11 with:

7-1.11 PRESERVATION OF PROPERTY

Comply with Section 5-1.18, "Property and Facility Preservation."

Replace Section 7-1.12 with:

7-1.12 INDEMNIFICATION AND INSURANCE

The Contractor's obligations regarding indemnification of the State of California and the requirements for insurance shall conform to the provisions in Section 3-1.05, "Insurance Policies," and Sections 7-1.12A, "Indemnification," and 7-1.12B, "Insurance," of this Section 7-1.12.

7-1.12A Indemnification

The Contractor shall defend, indemnify, and save harmless the State, including its officers, employees, and agents (excluding agents who are design professionals) from any and all claims, demands, causes of action, damages, costs, expenses, actual attorneys' fees, losses or liabilities, in law or in equity (Section 7-1.12A Claims) arising out of or in connection with the Contractor's performance of this contract for:

1. Bodily injury including, but not limited to, bodily injury, sickness or disease, emotional injury or death to persons, including, but not limited to, the public, any employees or agents of the Contractor, the State, or any other contractor; and
2. Damage to property of anyone including loss of use thereof; caused or alleged to be caused in whole or in part by any negligent or otherwise legally actionable act or omission of the Contractor or anyone directly or indirectly employed by the Contractor or anyone for whose acts the Contractor may be liable.

Except as otherwise provided by law, these requirements apply regardless of the existence or degree of fault of the State. The Contractor is not obligated to indemnify the State for Claims arising from conduct delineated in Civil Code Section 2782 and to Claims arising from any defective or substandard condition of the highway that existed at or before the start of work, unless this condition has been changed by the work or the scope of the work requires the Contractor to maintain existing highway facilities and the Claim arises from the Contractor's failure to maintain. The Contractor's defense and indemnity obligation shall extend to Claims arising after the work is completed and accepted if the Claims are directly related to alleged acts or omissions by the Contractor that occurred during the course of the work. State inspection is not a waiver of full compliance with these requirements.

The Contractor's obligation to defend and indemnify shall not be excused because of the Contractor's inability to evaluate liability or because the Contractor evaluates liability and determine that the Contractor is not liable. The Contractor shall respond within 30 days to the tender of any Claim for defense and indemnity by the State, unless this time has been extended by the State. If the Contractor fails to accept or reject a tender of defense and indemnity within 30 days, in addition to any other remedy authorized by law, the Department may withhold such funds the State reasonably considers necessary for its defense and indemnity until disposition has been made of the Claim or until the Contractor accepts or rejects the tender of defense, whichever occurs first.

With respect to third-party claims against the Contractor, the Contractor waives all rights of any type to express or implied indemnity against the State, its officers, employees, or agents (excluding agents who are design professionals).

Nothing in the Contract is intended to establish a standard of care owed to any member of the public or to extend to the public the status of a third-party beneficiary for any of these indemnification specifications.

7-1.12B Insurance

7-1.12B(1) General

Nothing in the contract is intended to establish a standard of care owed to any member of the public or to extend to the public the status of a third-party beneficiary for any of these insurance specifications.

7-1.12B(2) Casualty Insurance

The Contractor shall procure and maintain insurance on all of its operations with companies acceptable to the State as follows:

1. The Contractor shall keep all insurance in full force and effect from the beginning of the work through contract acceptance.

2. All insurance shall be with an insurance company with a rating from A.M. Best Financial Strength Rating of A- or better and a Financial Size Category of VII or better.
3. The Contractor shall maintain completed operations coverage with a carrier acceptable to the State through the expiration of the patent deficiency in construction statute of repose set forth in Code of Civil Procedure Section 337.15.

7-1.12B(3) Workers' Compensation and Employer's Liability Insurance

In accordance with Labor Code Section 1860, the Contractor shall secure the payment of worker's compensation in accordance with Labor Code Section 3700.

In accordance with Labor Code Section 1861, the Contractor shall submit to the Department the following certification before performing the work:

> I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

Contract execution constitutes certification submittal.

The Contractor shall provide Employer's Liability Insurance in amounts not less than:

1. $1,000,000 for each accident for bodily injury by accident
2. $1,000,000 policy limit for bodily injury by disease
3. $1,000,000 for each employee for bodily injury by disease

If there is an exposure of injury to the Contractor's employees under the U.S. Longshoremen's and Harbor Workers' Compensation Act, the Jones Act, or under laws, regulations, or statutes applicable to maritime employees, coverage shall be included for such injuries or claims.

7-1.12B(4) Liability Insurance

7-1.12B(4)(a) General

The Contractor shall carry General Liability and Umbrella or Excess Liability Insurance covering all operations by or on behalf of the Contractor providing insurance for bodily injury liability and property damage liability for the following limits and including coverage for:

1. Premises, operations, and mobile equipment
2. Products and completed operations
3. Broad form property damage (including completed operations)
4. Explosion, collapse, and underground hazards
5. Personal injury
6. Contractual liability

7-1.12B(4)(b) Liability Limits/Additional Insureds

The limits of liability shall be at least the amounts shown in the following table:

Total Bid	For Each Occurrence[1]	Aggregate for Products/Completed Operation	General Aggregate[2]	Umbrella or Excess Liability[3]
≤$1,000,000	$1,000,000	$2,000,000	$2,000,000	$5,000,000
>$1,000,000 ≤$10,000,000	$1,000,000	$2,000,000	$2,000,000	$10,000,000
>$10,000,000 ≤$25,000,000	$2,000,000	$2,000,000	$4,000,000	$15,000,000
>$25,000,000	$2,000,000	$2,000,000	$4,000,000	$25,000,000

1. Combined single limit for bodily injury and property damage.
2. This limit shall apply separately to the Contractor's work under this contract.
3. The umbrella or excess policy shall contain a clause stating that it takes effect (drops down) in the event the primary limits are impaired or exhausted.

The Contractor shall not require certified Small Business subcontractors to carry Liability Insurance that exceeds the limits in the table above. Notwithstanding the limits specified herein, at the option of the Contractor, the liability insurance limits for certified Small Business subcontractors of any tier may be less than those limits specified in the table. For Small Business subcontracts, "Total Bid" shall be interpreted as the amount of subcontracted work to a certified Small Business.

The State, including its officers, directors, agents (excluding agents who are design professionals), and employees, shall be named as additional insureds under the General Liability and Umbrella Liability Policies with respect to liability arising out of or connected with work or operations performed by or on behalf of the Contractor under this contract. Coverage for such additional insureds does not extend to liability:

1. Arising from any defective or substandard condition of the roadway which existed at or before the time the Contractor started work, unless such condition has been changed by the work or the scope of the work requires the Contractor to maintain existing roadway facilities and the claim arises from the Contractor's failure to maintain;
2. For claims occurring after the work is completed and accepted unless these claims are directly related to alleged acts or omissions of the Contractor that occurred during the course of the work; or
3. To the extent prohibited by Insurance Code Section 11580.04

Additional insured coverage shall be provided by a policy provision or by an endorsement providing coverage at least as broad as Additional Insured (Form B) endorsement form CG 2010, as published by the Insurance Services Office (ISO), or other form designated by the Department.

7-1.12B(4)(c) Contractor's Insurance Policy is Primary

The policy shall stipulate that the insurance afforded the additional insureds applies as primary insurance. Any other insurance or self-insurance maintained by the State is excess only and shall not be called upon to contribute with this insurance.

7-1.12B(5) Automobile Liability Insurance

The Contractor shall carry automobile liability insurance, including coverage for all owned, hired, and nonowned automobiles. The primary limits of liability shall be not less than $1,000,000 combined single limit each accident for bodily injury and property damage. The umbrella or excess liability coverage required under Section 7-1.12B(4)(b) also applies to automobile liability.

7-1.12B(6) Policy Forms, Endorsements, and Certificates

The Contractor shall provide its General Liability Insurance under Commercial General Liability policy form No. CG0001 as published by the Insurance Services Office (ISO) or under a policy form at least as broad as policy form No. CG0001.

7-1.12B(7) Deductibles

The State may expressly allow deductible clauses, which it does not consider excessive, overly broad, or harmful to the interests of the State. Regardless of the allowance of exclusions or deductions by the State, the Contractor is responsible for any deductible amount and shall warrant that the coverage provided to the State is in accordance with Section 7-1.12B, "Insurance."

7-1.12B(8) Enforcement

The Department may assure the Contractor's compliance with its insurance obligations. Ten days before an insurance policy lapses or is canceled during the contract period, the Contractor shall submit to the Department evidence of renewal or replacement of the policy.

If the Contractor fails to maintain any required insurance coverage, the Department may maintain this coverage and withhold or charge the expense to the Contractor or terminate the Contractor's control of the work in accordance with Section 8-1.08, "Termination of Control."

The Contractor is not relieved of its duties and responsibilities to indemnify, defend, and hold harmless the State, its officers, agents, and employees by the Department's acceptance of insurance policies and certificates.

Minimum insurance coverage amounts do not relieve the Contractor for liability in excess of such coverage, nor do they preclude the State from taking other actions available to it, including the withholding of funds under this contract.

7-1.12B(9) Self-Insurance

Self-insurance programs and self-insured retentions in insurance policies are subject to separate annual review and approval by the State.

If the Contractor uses a self-insurance program or self-insured retention, the Contractor shall provide the State with the same protection from liability and defense of suits as would be afforded by first-dollar insurance. Execution of the contract is the Contractor's acknowledgement that the Contractor will be bound by all laws as if the Contractor were an insurer as defined under Insurance Code Section 23 and that the self-insurance program or self-insured retention shall operate as insurance as defined under Insurance Code Section 22.

Replace Section 7-1.125 with:

7-1.125 Legal Actions Against the Department

If legal action is brought against the Department over compliance with a State or Federal law, rule, or regulation applicable to highway work, then:

1. If the Department, in complying with a court order, prohibits you from performing work, the resulting delay is a suspension related to your performance, unless the Department terminates the contract.
2. If a court order other than an order to show cause or the final judgment in the action prohibits the Department from requiring you to perform work, the Department may delete the prohibited work or terminate the contract.

In Section 7-1.13 delete the 5th and 6th paragraphs.

Add:

7-1.50 FEDERAL LAWS FOR FEDERAL-AID CONTRACTS

7-1.50A General

Section 7-1.50, "Federal Laws for Federal-Aid Contracts," includes specifications required in a Federal-aid construction contract and applies to a Federal-aid contract.

A copy of form FHWA-1273 is included in Section 7-1.50B, "FHWA-1273." The training and promotion section of section II refers to training provisions as if they were included in the special provisions. The Department specifies the provisions in section 7-1.11D of the Standard Specifications. If a number of trainees or apprentices is required, the Department specifies the number in the special provisions. Interpret each FHWA-1273 clause shown in the following table as having the same meaning as the corresponding Department clause:

FHWA-1273 Nondiscrimination Clauses

FHWA-1273 section	FHWA-1273 clause	Department clause
Training and Promotion	In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.	If section 7-1.11D applies, section 7-1.11D supersedes this subparagraph.
Records and Reports	If on-the-job training is being required by special provision, the contractor will be required to collect and report training data.	If the Contract requires on-the-job training, collect and report training data.

7-1.50B FHWA-1273

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under

this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are

applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor

will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH–1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or

will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b.(1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g. , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;
(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. **Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. “First Tier Covered Transactions” refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the

department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

7-1.50C Female and Minority Goals

To comply with Section II, "Nondiscrimination," of "Required Contract Provisions Federal-Aid Construction Contracts," the Department is including in Section 7-1.50C, "Female and Minority Goals," female and minority utilization goals for Federal-aid construction contracts and subcontracts that exceed $10,000.

The nationwide goal for female utilization is 6.9 percent.

The goals for minority utilization [45 Fed Reg 65984 (10/3/1980)] are as follows:

Minority Utilization Goals

Economic Area		Goal (Percent)
174	Redding CA: Non-SMSA Counties: CA Lassen; CA Modoc; CA Plumas; CA Shasta; CA Siskiyou; CA Tehema	6.8
175	Eureka, CA Non-SMSA Counties: CA Del Norte; CA Humboldt; CA Trinity	6.6
176	San Francisco-Oakland-San Jose, CA: SMSA Counties: 7120 Salinas-Seaside-Monterey, CA CA Monterey 7360 San Francisco-Oakland CA Alameda; CA Contra Costa; CA Marin; CA San Francisco; CA San Mateo 7400 San Jose, CA CA Santa Clara, CA 7485 Santa Cruz, CA CA Santa Cruz 7500 Santa Rosa CA Sonoma 8720 Vallejo-Fairfield-Napa, CA CA Napa; CA Solano Non-SMSA Counties: CA Lake; CA Mendocino; CA San Benito	 28.9 25.6 19.6 14.9 9.1 17.1 23.2
177	Sacramento, CA: SMSA Counties: 6920 Sacramento, CA CA Placer; CA Sacramento; CA Yolo Non-SMSA Counties CA Butte; CA Colusa; CA El Dorado; CA Glenn; CA Nevada; CA Sierra; CA Sutter; CA Yuba	 16.1 14.3
178	Stockton-Modesto, CA: SMSA Counties: 5170 Modesto, CA CA Stanislaus 8120 Stockton, CA CA San Joaquin Non-SMSA Counties CA Alpine; CA Amador; CA Calaveras; CA Mariposa; CA Merced; CA Toulumne	 12.3 24.3 19.8
179	Fresno-Bakersfield, CA SMSA Counties: 0680 Bakersfield, CA CA Kern 2840 Fresno, CA CA Fresno	 19.1 26.1

	Non-SMSA Counties: CA Kings; CA Madera; CA Tulare	23.6
180	Los Angeles, CA: SMSA Counties: 0360 Anaheim-Santa Ana-Garden Grove, CA CA Orange 4480 Los Angeles-Long Beach, CA CA Los Angeles 6000 Oxnard-Simi Valley-Ventura, CA CA Ventura 6780 Riverside-San Bernardino-Ontario, CA CA Riverside; CA San Bernardino 7480 Santa Barbara-Santa Maria-Lompoc, CA CA Santa Barbara Non-SMSA Counties CA Inyo; CA Mono; CA San Luis Obispo	 11.9 28.3 21.5 19.0 19.7 24.6
181	San Diego, CA: SMSA Counties 7320 San Diego, CA CA San Diego Non-SMSA Counties CA Imperial	 16.9 18.2

For each July during which work is performed under the contract, you and each non-material-supplier subcontractor with a subcontract of $10,000 or more must complete Form FHWA PR-1391 (Appendix C to 23 CFR 230). Submit the forms by August 15.

7-1.50D Training

Section 7-1.50D, "Training," applies if a number of trainees or apprentices is specified in the special provisions.

As part of your equal opportunity affirmative action program, provide on-the-job training to develop full journeymen in the types of trades or job classifications involved.

You have primary responsibility for meeting this training requirement.

If you subcontract a contract part, determine how many trainees or apprentices are to be trained by the subcontractor.

Include these training requirements in your subcontract.

Where feasible, 25 percent of apprentices or trainees in each occupation must be in their 1st year of apprenticeship or training.

Distribute the number of apprentices or trainees among the work classifications on the basis of your needs and the availability of journeymen in the various classifications within a reasonable recruitment area.

Before starting work, submit to the Department:

1. Number of apprentices or trainees to be trained for each classification
2. Training program to be used
3. Training starting date for each classification

Obtain the Department's approval for this submitted information before you start work. The Department credits you for each apprentice or trainee you employ on the work who is currently enrolled or becomes enrolled in an approved program.

The primary objective of Section 7-1.50D, "Training," is to train and upgrade minorities and women toward journeymen status. Make every effort to enroll minority and women apprentices or trainees, such as conducting systematic and direct recruitment through public and private sources likely to yield minority and women apprentices or trainees, to the extent they are available within a reasonable recruitment area. Show that you have made the efforts. In making these efforts, do not discriminate against any applicant for training.

Do not employ as an apprentice or trainee an employee:

1. In any classification in which the employee has successfully completed a training course leading to journeyman status or in which the employee has been employed as a journeyman

2. Who is not registered in a program approved by the US Department of Labor, Bureau of Apprenticeship and Training

Ask the employee if the employee has successfully completed a training course leading to journeyman status or has been employed as a journeyman. Your records must show the employee's answers to the questions.

In your training program, establish the minimum length and training type for each classification. The Department and FHWA approves a program if one of the following is met:

1. It is calculated to:

    1.1. Meet the your equal employment opportunity responsibilities
    1.2. Qualify the average apprentice or trainee for journeyman status in the classification involved by the end of the training period

2. It is registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training and it is administered in a way consistent with the equal employment responsibilities of federal-aid highway construction contracts

Obtain the State's approval for your training program before you start work involving the classification covered by the program.

Provide training in the construction crafts, not in clerk-typist or secretarial-type positions. Training is allowed in lower level management positions such as office engineers, estimators, and timekeepers if the training is oriented toward construction applications. Training is allowed in the laborer classification if significant and meaningful training is provided and approved by the division office. Off-site training is allowed if the training is an integral part of an approved training program and does not make up a significant part of the overall training.

The Department reimburses you 80 cents per hour of training given an employee on this contract under an approved training program:

1. For on-site training
2. For off-site training if the apprentice or trainee is currently employed on a federal-aid project and you do at least one of the following:

    2.1. Contribute to the cost of the training
    2.2. Provide the instruction to the apprentice or trainee
    2.3. Pay the apprentice's or trainee's wages during the off-site training period

3. If you comply with Section 7-1.50D, "Training"

Each apprentice or trainee must:

1. Begin training on the project as soon as feasible after the start of work involving the apprentice's or trainee's skill
2. Remain on the project as long as training opportunities exist in the apprentice's or trainee's work classification or until the apprentice or trainee has completed the training program

Furnish the apprentice or trainee:

1. Copy of the program you will comply with in providing the training
2. Certification showing the type and length of training satisfactorily completed

Maintain records and submit reports documenting your performance under Section 7-1.50D, "Training."

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SECTION 8 PROSECUTION AND PROGRESS
(Issued 06-05-09)

Replace Section 8 with:

SECTION 8 PROSECUTION AND PROGRESS

8-1.01 (BLANK)

8-1.02 ASSIGNMENT

No third-party agreement relieves you or your surety of your responsibility to complete the work. Do not sell, transfer, or otherwise dispose of any contract part without prior written consent from the Department.

If you assign the right to receive contract payments, the Department accepts the assignment upon the Engineer's receipt of a notice. Assigned payments remain subject to deductions and withholds described in the contract. The Department may use withheld payments for work completion whether payments are assigned or not.

8-1.025 PRECONSTRUCTION CONFERENCE

Attend a preconstruction conference with key personnel, including your assigned representative, at a time and location determined by the Engineer. Submit documents as required before the preconstruction conference. You may begin work before the preconstruction conference.

Be prepared to discuss the following topics and documents:

Topics	Document
Potential claim and dispute resolution	Potential claim forms
Contractor's representation	Assignment of Contractor's representative
DBE and DVBE	Final utilization reports
Equipment	Equipment list
Labor compliance and equal employment opportunity	Job site posters and benefit and payroll reports
Material inspection	Notice of Materials to be Used
Materials on hand	Request for Payment for Materials on Hand
Measurements	--
Partnering	Field Guide to Partnering on Caltrans Construction Projects
Quality control	QC plans
Safety	Injury and Illness Prevention Program and job site posters
Schedule	Baseline schedule and Weekly Statement of Working Days
Subcontracting	Subcontracting Request
Surveying	Survey Request
Traffic control	Traffic contingency plan and traffic control plans
Utility work	--
Weight limitations	--
Water pollution control	SWPPP or WPCP
Work restrictions	PLACs
Working drawings	--

8-1.03 BEGINNING OF WORK

Begin work within 15 days after receiving notice that the contract has been approved by the Attorney General or the attorney appointed and authorized to represent the Department. Submit a written notice 72 hours before beginning work. If the project has more than one location of work, submit a separate notice for each location.

You may begin work before receiving the notice of contract approval if you:

1. Deliver the signed contract, bonds, and evidence of insurance to the Department
2. Submit 72-hour notice
3. Obtain an encroachment permit from the Department
4. Are authorized by the Department to begin
5. Perform work at your own risk
6. Perform work under the contract

The Engineer does not count working days for days worked before contract approval.

If the contract is approved, work already performed that complies with the contract is authorized.

If the contract does not get approved, leave the job site in a neat condition. If a facility has been changed, restore it to its former or equivalent condition at your expense.

The Department does not adjust time for beginning before the approval date.

8-1.04 PROGRESS SCHEDULE

8-1.04A General

Reserved

8-1.04B Critical Path Method Schedule

The following definitions apply to critical path method schedules:

activity: Task, event, or other project element on a schedule that contributes to completing the project. Activities have a description, start date, finish date, duration, and one or more logic ties.

baseline schedule: The initial schedule showing the original work plan beginning on the date of contract approval. This schedule shows no completed work to date and no negative float or negative lag to any activity.

controlling activity: Construction activity that extends the scheduled completion date if delayed.

critical path: Longest continuous chain of activities for the project that has the least amount of total float of all chains. In general, a delay on the critical path extends the scheduled completion date.

critical path method (CPM): Network based planning technique using activity durations and relationships between activities to calculate a schedule for the entire project.

revised schedule: Schedule that incorporates a proposed or past change to logic or activity durations.

scheduled completion date: Planned project completion date shown on the current schedule.

updated schedule: Current schedule developed from the accepted baseline and any subsequent accepted updated or revised schedules through regular monthly review to incorporate actual past progress.

Before or at the preconstruction conference, submit a CPM baseline schedule.

Submit a monthly updated schedule that includes the status of work completed to date and the work yet to be performed as planned.

On each schedule, show:

1. Planned and actual start and completion date of each work activity, including applicable:
    1.1. Submittal development
    1.2. Submittal review and approval
    1.3. Material procurement
    1.4. Contract milestones and constraints
    1.5. Equipment and plant setup
    1.6. Interfaces with outside entities
    1.7. Erection and removal of falsework and shoring
    1.8. Test periods
    1.9. Major traffic stage change
    1.10. Final cleanup
2. Order that you propose to prosecute the work
3. Logical links between the time-scaled work activities
4. All controlling activities
5. Legible description of each activity
6. At least one predecessor and one successor to each activity, except for project start and project end milestones
7. Duration of not less than one working day for each activity
8. Start milestone date as the contract approval date

You may include changes on updated schedules that do not alter the critical path or extend the schedule completion date compared to the current schedule. Changes may include:

1. Adding or deleting activities

2. Changing activity constraints
3. Changing durations
4. Changing logic

If any proposed change in planned work results in altering the critical path or extending the scheduled completion date, submit a revised schedule within 15 days of the proposed change.

For each schedule submittal:

1. Submit a plotted original, time-scaled network diagram on a sheet of at least 8.5" x 11" with a title block and timeline
2. If a computer program is used to make the schedule, submit a read-only compact disc or diskette containing the schedule data. Label the compact disc or diskette with:

    2.1. Contract number
    2.2. CPM schedule number and date produced
    2.3. File name

If there is no contract item for progress schedule (critical path method), full compensation for this work is included in the contract prices paid for the items of work involved, and no additional compensation will be allowed therefor.

8-1.05 TEMPORARY SUSPENSION OF WORK

8-1.05A General

The Engineer may suspend work wholly or in part due to any of the following:

1. Conditions are unsuitable for work progress.
2. You fail to do any of the following:

    2.1. Fulfill the Engineer's orders.
    2.2. Fulfill a contract part.
    2.3. Perform weather-dependent work when conditions are favorable so that weather-related unsuitable conditions are avoided or do not occur.

Upon the Engineer's written order of suspension, suspend work immediately. Provide for public safety and a smooth and unobstructed passageway through the work zone during the suspension as specified in Sections 7-1.08, "Public Convenience," and 7-1.09, "Public Safety." Resume work when ordered.

8-1.05B Suspensions Unrelated to Contractor Performance

For a suspension unrelated to your performance, providing for a smooth and unobstructed passageway through the work during the suspension will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

The days during a suspension unrelated to your performance are non-working days.

8-1.05C Suspensions Related to Contractor Performance

For a suspension related to your performance, the Department may provide for a smooth and unobstructed passageway through the work during the suspension and deduct the cost from payments.

The days during a suspension related to your performance are working days.

8-1.06 TIME OF COMPLETION

The time to complete the work is specified in the special provisions.

The Engineer issues a Weekly Statement of Working Days by the end of the following week unless the contract is suspended for reasons unrelated to your performance.

The Weekly Statement of Working Days shows:

1. Working days and non–working days during the reporting week
2. Time adjustments
3. Work completion date computations, including working days remaining
4. Controlling activities

You may protest a Weekly Statement of Working Days.

8-1.07 LIQUIDATED DAMAGES

8-1.07A General

The Department specifies liquidated damages (Pub Cont Code § 10226). Liquidated damages, if any, accrue starting on the 1st day after the expiration of the working days through the day of contract acceptance except as specified in Sections 8-1.07B, "Failure to Complete Work Parts within Specified Times," and 8-1.07C, "Failure to Complete Work Parts by Specified Dates."

The Department withholds liquidated damages before the accrual date if the anticipated liquidated damages may exceed the value of the remaining work.

Liquidated damages for all work, except plant establishment, are:

Liquidated Damages		
Total Bid		Liquidated Damages per Day
From over	To	
$0	$50,000	$1,200
$50,000	$120,000	$1,500
$120,000	$1,000,000	$1,900
$1,000,000	$5,000,000	$3,000
$5,000,000	$10,000,000	$5,400
$10,000,000	$30,000,000	$8,300
$30,000,000	$100,000,000	$10,500
$100,000,000	$250,000,000	$28,500

If all work, except plant establishment, is complete and the total number of working days has expired, liquidated damages are $950 per day.

8-1.07B Failure to Complete Work Parts within Specified Times

The Department may deduct specified damages from payments for each day in completing a work part beyond the time specified for completing the work part.

Damages for untimely completion of work parts may not be equal to the daily amount specified as liquidated damages for the project as a whole, but the Department does not simultaneously assess damages for untimely completion of work parts and for the whole work.

Damages accrue starting the 1st day after a work part exceeds the specified time through the day the specified work part is complete.

8-1.07C Failure to Complete Work Parts by Specified Dates

The Department may deduct specified damages from payments for each day in completing a work part beyond the specified completion date for the work part.

Damages for untimely work part completion may not be equal to the daily amount specified as liquidated damages for the project as a whole, but the Department does not simultaneously assess damages for untimely work part completion and the whole work.

Damages accrue starting the 1st day after an unmet completion date through the day the work part is complete.

8-1.07D Director Days

If the work is not completed within the working days, the Director may grant director days if it serves the State's best interest.

By granting director days, the Director adds working days to the contract. The Director may either grant enough days to eliminate the liquidated damages or fewer. In the latter case, the Department deducts liquidated damages for the remaining overrun in contract time. The Director may deduct the Department's engineering, inspection, and overhead costs incurred during the period of extension granted as director days.

8-1.08 TERMINATION OF CONTROL

The Department may terminate your control of the work for failure to do any of the following (Pub Cont Code § 10253):

1. Supply an adequate workforce

2. Supply material as described
3. Pay subcontractors (Pub Cont Code §10262)
4. Prosecute the work as described in the contract

The Department may also terminate your control for failure to maintain insurance coverage.

For a Federal-aid contract, the Department may terminate your control of the work for failure to include "Required Contract Provisions, Federal-Aid Construction Contracts" in subcontracts.

The Department gives you and your surety notice at least 5 days before terminating control. The notice describes the failures and the time allowed to remedy the failures. If failures are not remedied within the time provided, the Department takes control of the work.

The Department may complete the work if the Department terminates your control or you abandon the project (Pub Cont Code § 10255). The Department determines the unpaid balance under Pub Cont Code § 10258 and the contract.

At any time before final payment of all claims, the Department may convert a termination of control to a termination of contract.

8-1.09 DELAYS

8-1.09A General

An excusable delay is a delay of a controlling activity beyond your control, not foreseeable when the work began such as:

1. Change in the work
2. Department action that is not part of the contract
3. Presence of an underground utility main not described in the contract or in a location different from that specified
4. Described facility reconstruction not reconstructed as described, by the utility owner by the date specified, unless the reconstruction is solely for your convenience
5. Department's failure to obtain timely access to the right-of-way
6. Department's failure to perform an action in the time specified

A critical delay is a delay that extends the schedule completion date.

To request a delay-related time or payment adjustment, submit an RFI.

8-1.09B Time Adjustments

For an excusable critical delay, the Department may make a time adjustment. The Engineer uses information from the schedule to evaluate requests for time adjustments.

If requesting an adjustment, submit a revised schedule showing the delay's effect on the controlling activity. If the delay has:

1. Occurred, submit records of dates and what work was performed during the delayed activity
2. Not occurred, submit the expected dates or duration of the delayed activity

If the Engineer requests, update the schedule to the last working day before the start of the delay.

8-1.09C Payment Adjustments

The Department may make a payment adjustment for an excusable delay that affects your costs.

Only losses for idle equipment, idle workers, and equipment moving or transporting are eligible for delay-related payment adjustments.

The Engineer determines payment for idle time of equipment in the same manner as determinations are made for equipment used in the performance of force account work under Section 9-1.03, "Force Account," with the following exceptions:

1. Delay factor in the Labor Surcharge and Equipment Rental Rates applies to each equipment rental rate.
2. Daily number of payable hours equals the normal working hours during the delay, not to exceed 8 hours per day.
3. Delay days exclude non–working days.
4. Markups are not added.

The Engineer determines payment adjustment for idle workers under Section 9-1.03B, "Labor," but does not add markups.

The Engineer includes costs due to necessary extra equipment moving or transporting.

8-1.10 (BLANK)

8-1.11 TERMINATION OF CONTRACT

8-1.11A General

The Director may terminate the contract if it serves the State's best interest. The Department issues you a written notice, implements the termination, and pays you.

8-1.11B Relief from Responsibility for Work

On receiving a termination notice:

1. Stop work
2. Notify subcontractors and suppliers of the contract termination and stop contract-related work
3. Perform the Engineer-ordered work to secure the job site for termination
4. Remove equipment
5. If authorized, settle termination-related claims and liabilities involving subcontractors and suppliers; assign to the Department the rights, titles, or interests held by you with respect to these parties

8-1.11C Responsibility for Materials

On receiving a termination notice, protect unused material until:

1. You submit an inventory of materials already produced, purchased, or ordered but not yet used; include the location of the material.
2. The Engineer identifies materials that will be retained by the Department. Submit bills of sales or other records of material title.
3. The Engineer confirms that unused materials paid by progress payment and materials furnished by the State have been delivered and stored as ordered.
4. Titles are transferred for materials purchased by the Department.

Dispose of materials that will not be retained by the Department.

8-1.11D Contract Acceptance after Termination

The Engineer recommends contract acceptance after determining completion of:

1. Contract work ordered to be completed before termination
2. Other work ordered to secure the project before termination
3. Material delivery and title transfer

The Department pays you under Section 9-1.08, "Payment After Contract Acceptance."

8-1.11E Payment Adjustment for Termination

If the Department issues a termination notice, the Engineer determines payment for termination based on the following:

1. Direct cost for the work:

    1.1. Including mobilization, demobilization, securing the job site for termination, and losses from the sale of materials

    1.2. Not including the cost of materials you keep, profit realized from the sale of materials, the cost of material damaged by an occurrence as defined in Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," and other credits.

2. Cost of remedial work, as estimated by the Engineer, is not reimbursed.

3. Allowance for profit not to exceed 4 percent of the cost of the work. Prove a likelihood of having made a profit had the contract not been terminated.
4. Material handling costs for material returned to the vendor or disposed of as ordered.
5. Costs in determining the payment adjustment due to the termination, excluding attorney fees and litigation costs.

Termination of the contract does not relieve the surety of its obligation for any just claims arising out of the work performed.

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SECTION 9 MEASUREMENT AND PAYMENT
(Issued 03-11-10)

Replace Section 9 with:

SECTION 9 MEASUREMENT AND PAYMENT

9-1.01 MEASUREMENT OF QUANTITIES

9-1.01A General

The Department determines bid item quantities under U.S. customary units.

9-1.01B Weighing Equipment and Procedures

9-1.01B(1) General

The Engineer measures material quantities for payment with devices that comply with:

1. 4 CA Code of Regs § 4000 et seq.
2. Bus & Prof Code § 12001 et seq.

To determine the material payment quantities, use measuring devices that have been sealed by the Department of Food and Agriculture's Division of Measurement Standards or its designated representative.

If a device is not type approved by the Division of Measurement Standards, type approve it under California Test 109.

Notify the Engineer at least 1 business day in advance of equipment testing.

Use material plant controllers having elements affecting the data accuracy and delivery that have been sealed by the Engineer. Make these elements available to the Engineer for inspection. If the elements are adequate for use, the Engineer seals them. If security seal manipulation occurs, stop material production. Do not resume production until the Engineer reinspects and reseals the device.

The Engineer measures material paid for by weight on Contractor-furnished sealed scales regularly inspected by the Department of Food and Agriculture's Division of Measurement Standards or its designated representative.

Obtain authorization of portable vehicle scale installations before sealing.

Proportioning scales must comply with Section 5-1.10, "Equipment."

9-1.01B(2) Equipment

Each scale must be long enough to fit an entire vehicle or a combination vehicle on the scale deck. The Department allows you to weigh a combination vehicle separately if you disconnect the vehicles.

Construct scale undersupports:

1. Using portland cement concrete containing at least 470 pounds of cement per cubic yard produced from commercial quality materials
2. Such that footing heights are at least 20 inches thick
3. With a bearing surface at least 30 inches wide and bearing pressure on the footing not over 4000 pounds per square foot

In constructing a scale:

1. Furnish drainage to prevent water from saturating the ground under the scale
2. Use bulkheads that prevent displacement
3. If shimming is necessary:

    3.1. Use securely attached metal shims or grout
    3.2 Do not use wedges to shim the supports
    3.3. Do not use shim material in excess of 3 inches

4. Install mechanical indicating elements level, plumb, and rigidly mounted on the concrete undersupports
5. For a hopper scale, rigidly attach hopper scale lever systems and mechanical indicating elements so no weight is lost from bending or support distortion

Each scale used to determine material payment quantities must be operated by a licensed weighmaster (Bus & Prof Code § 12700 et seq.).

Submit a public weighmaster's certificate or certified daily summary weigh sheets for each weighed material quantity. The Department may witness material weighing and check and compile the daily scale weight record.

Each vehicle operator must obtain weight or load slips from the weighmaster. Submit these records at the delivery point.

9-1.01B(3) Procedures

Daily, weigh empty vehicles used to haul material paid for by weight. Each vehicle must have a legible identification mark. The Department may verify material weight by having an empty and loaded vehicle weighed on any scale the Engineer designates.

For imported topsoil measured by volume, soil amendment, and mulch:

1. Each vehicle must allow a ready and accurate contents determination
2. Unless vehicles are of uniform capacity, each vehicle must have a legible identification mark showing its volume capacity
3. Load vehicles to at least the volume capacity
4. Level vehicle loads on arrival at the delivery point

If determining a quantity paid on a volume basis is impractical or if you request and the Engineer authorizes the request, the Engineer weighs the material and converts the result to a volume measurement. The Engineer determines the conversion factors and, if you agree, adopts this method of measurement.

9-1.01C Final Pay Items

The Department shows a bid item quantity as a final pay item for payment purposes only. For a final pay item, accept payment based on the verified Bid Item List quantity, regardless of actual quantity used unless dimensions are changed by the Engineer.

9-1.01D Quantities of Aggregate and Other Roadway Materials

The Engineer determines the weight of aggregate and other roadway materials that are being paid for by weight as shown and does not include the deducted weight of water in their payment quantities.

Material	Quantity Determination
Aggregate or other roadway material except as otherwise shown in this table	By deducting the weight of water in the material[a] in excess of 3 percent of the dry weight of the material from the weight of the material
Imported borrow, imported topsoil, aggregate subbase	By deducting the weight of water in the material[a] in excess of 6 percent of the dry weight of the material from the weight of the material
Straw	By deducting the weight of water in the material[a] in excess of 15 percent of the dry weight of the material from the weight of the material
Fiber[b]	Engineer does not deduct the weight of water
Aggregate base and aggregate for cement treated bases	As specified in Section 26, "Aggregate Bases," and Section 27, "Cement Treated Bases"

NOTE: Percentage of water is determined by California Test 226.
[a]At the time of weighing
[b]Weight of water in the fiber[a] must not exceed 15 percent of the dry weight of the fiber.

9-1.02 SCOPE OF PAYMENT

The Department pays you for furnishing the resources and activities required to complete the Contract work. The Department's payment is full compensation for furnishing the resources and activities, including:

1. Risk, loss, damage repair, or cost of whatever character arising from or relating to the work and performance of the work
2. PLACs and taxes

Full compensation for work specified in Sections 1 through 9 is included in the payment for the bid items involved unless:

1. Bid item for the work is shown on the verified Bid Item List
2. Work is specified as paid for as extra work

The Department does not pay for your loss, damage, repair, or extra costs of whatever character arising from or relating to the work that is a direct or indirect result of your choice of construction methods, materials, equipment, or manpower, unless specifically mandated by the Contract.

Payment is:

1. Full compensation for each bid item specified by the description and measurement unit shown on the verified Bid Item List
2. For the price bid for each bid item shown on the verified Bid Item List or as changed by change order with a specified price adjustment

If an alternative is described in the Contract, the Department pays based on the bid items for the details and specifications not described as an alternative.

The Department pays for work performed by change order based on one or a combination of the following:

1. Bid item prices
2. Force account
3. Agreed price
4. Specialist billing

If the Engineer chooses to pay for work performed by change order based on an agreed price, but you and the Engineer cannot agree on the price, the Department pays by force account.

If a portion of extra work is covered by bid items, the Department pays for this work as changed quantities in those items. The Department pays for the remaining portion of the extra work by force account or agreed price.

The Department pays 10 percent annual interest for unpaid and undisputed:

1. Progress payments
2. After-acceptance payment except for claims

For these payments, interest starts to accrue 30 days after the 1st working day following the 20th day of the month payment is due. For extra work bills not submitted within 7 days after performing the work as specified in 5-1.015E, "Extra Work Bills," interest starts to accrue 60 days after the 1st working day following the 20th day of the month payment is due.

The Department pays 6 percent annual interest for unpaid and undisputed claims. Interest starts to accrue 61 days after the Department accepts a claim statement.

The Department pays 6 percent annual interest for awards in arbitration (Civ Code § 3289).

If the amount of a deduction or withhold exceeds final payment, the Department invoices you for the difference, to be paid upon receipt.

9-1.03 FORCE ACCOUNT PAYMENT

9-1.03A General

For work paid by force account, the Engineer compares the Department's records to your daily force account work report. When you and the Engineer agree on the contents of the daily force account work reports, the Engineer accepts the report and the Department pays for the work. If the records differ, the Department pays for the work based only on the information shown on the Department's records.

If a subcontractor performs work at force account, accept an additional 10 percent markup to the total cost of that work paid at force account, including markups specified in Section 9-1.03, as reimbursement for additional administrative costs.

The markups specified in labor, materials, and equipment include compensation for all delay costs, overhead costs, and profit.

If an item's payment is adjusted for work-character changes, the Department excludes your cost of determining the adjustment.

Payment for owner-operated labor and equipment is made at the market-priced invoice submitted.

9-1.03B Labor

Labor payment is full compensation for the cost of labor used in the direct performance of the work plus a 35 percent markup. Force account labor payment consists of:

1. Employer payment to the worker for:

    1.1. Basic hourly wage
    1.2. Health and welfare
    1.3. Pension
    1.4. Vacation
    1.5. Training
    1.6. Other State and federal recognized fringe benefit payments

2. Labor surcharge percentage in Labor Surcharge and Equipment Rental Rates current during the work paid at force account for:

    2.1. Workers' compensation insurance
    2.2. Social security
    2.3. Medicare
    2.4. Federal unemployment insurance
    2.5. State unemployment insurance
    2.6. State training taxes

3. Subsistence and travel allowances paid to the workers
4. Employer payment to supervisors, if authorized

The 35 percent markup consists of payment for all overhead costs related to labor but not designated as costs of labor used in the direct performance of the work including:

1. Home office overhead
2. Field office overhead
3. Bond costs

4. Profit
5. Labor liability insurance
6. Other fixed or administrative costs that are not costs of labor used in the direct performance of the work

9-1.03C Materials

Material payment is full compensation for materials you furnish and use in the work. The Engineer determines the cost based on the material purchase price, including delivery charges, except:

1. A 15 percent markup is added.
2. Supplier discounts are subtracted whether you took them or not.
3. If the Engineer believes the material purchase prices are excessive, the Department pays the lowest current wholesale price for a similar material quantity.
4. If you procured the materials from a source you wholly or partially own, the determined cost is based on the lower of the:

    4.1. Price paid by the purchaser for similar materials from that source on Contract items
    4.2. Current wholesale price for those materials

5. If you do not submit a material cost record within 30 days of billing, the determined cost is based on the lowest wholesale price:

    5.1. During that period
    5.2. In the quantities used

9-1.03D Equipment Rental

9-1.03D(1) General

Equipment rental payment is full compensation for:

1. Rental equipment costs, including moving rental equipment to and from the site of work performed by change order using its own power.
2. Transport equipment costs for rental equipment that cannot be transported economically using its own power. No payment is made during transport for the transported equipment.
3. 15 percent markup.

If you want to return the equipment to a location other than its original location, the payment to move the equipment must not exceed the cost of returning the equipment to its original location. If you use the equipment for work other than work paid by force account, the transportation cost is included in the other work.

Before moving or loading the equipment, obtain authorization for the equipment rental's original location.

The Engineer determines rental costs:

1. Using rates in Labor Surcharge and Equipment Rental Rates:

    1.1. By classifying equipment using manufacturer's ratings and manufacturer-approved changes.
    1.2. Current during the work paid by force account.
    1.3. Regardless of equipment ownership; but the Department uses the rental document rates or minimum rental cost terms if:

        1.3.1. Rented from equipment business you do not own.
        1.3.2. The Labor Surcharge and Equipment Rental Rates hourly rate is $10.00 per hour or less.

2. Using rates established by the Engineer for equipment not listed in Labor Surcharge and Equipment Rental Rates. You may submit cost information that helps the Engineer establish the rental rate; but the Department uses the rental document rates or minimum rental cost terms if:

    2.1. Rented from equipment business you do not own.
    2.2. The Engineer establishes a rate of $10.00 per hour or less.

3. Using rates for transport equipment not exceeding the hourly rates charged by established haulers.

Equipment rental rates include the cost of:

1. Fuel
2. Oil
3. Lubrication
4. Supplies
5. Small tools that are not consumed by use
6. Necessary attachments
7. Repairs and maintenance
8. Depreciation
9. Storage
10. Insurance
11. Incidentals

The Department pays for small tools consumed by use. The Engineer determines payment for small tools consumed by use based on Contractor-submitted invoices.

9-1.03D(2) Equipment On the Job Site

For equipment on the job site at the time required to perform work paid by force account, the time paid is the time:

1. To move the equipment to the location of work paid by force account plus an equal amount of time to move the equipment to another location on the job site when the work paid by force account is completed
2. To load and unload equipment
3. Equipment is operated to perform work paid by force account and:

    3.1. Hourly rates are paid in 1/2-hour increments
    3.2 Daily rates are paid in 1/2-day increments

When rented equipment on the job site is used to perform work at force account not required by the original contract work, the Engineer may authorize rates in excess of those in Labor Surcharge and Equipment Rental Rates if:

1. You submit a request to use rented equipment
2. Equipment is not available from your owned equipment fleet or from your subcontractors
3. Rented equipment is from an independent rental company
4. Proposed equipment rental rate is reasonable
5. Engineer authorizes the equipment source and the rental rate before you use the equipment

The Department pays for fuel consumed during operation of rented equipment not included in the invoiced rental rate.

9-1.03D(3) Equipment Not On the Job Site Required for Original Contract Work

For equipment not on the job site at the time required to perform work paid by force account and required for original Contract work, the time paid is the time the equipment is operated to perform work paid by force account and the time to move the equipment to a location on the job site when the work paid by force account is completed.

The minimum total time paid is:

1. 1 day if daily rates are paid
2. 8 hours if hourly rates are paid

If daily rates are recorded, equipment:

1. Idled is paid as 1/2 day
2. Operated 4 hours or less is paid as 1/2 day
3. Operated 4 hours or more is paid as 1 day

If the minimum total time exceeds 8 hours and if hourly rates are listed, the Department rounds up hours operated to the nearest 1/2-hour increment and pays based on the following table. The table does not apply when equipment is not operated due to breakdowns; in which case rental hours are the hours the equipment was operated.

Equipment Rental Hours

Hours operated	Hours paid
0.0	4.00
0.5	4.25
1.0	4.50
1.5	4.75
2.0	5.00
2.5	5.25
3.0	5.50
3.5	5.75
4.0	6.00
4.5	6.25
5.0	6.50
5.5	6.75
6.0	7.00
6.5	7.25
7.0	7.5
7.5	7.75
>8.0	hours used

9-1.03D(4) Equipment Not On the Job Site Not Required for Original Contract Work

For equipment not on the job site at the time required to perform work paid by force account and not required for original Contract work, the time paid is the time:

1. To move the equipment to the location of work paid by force account plus an equal amount of time to return the equipment to its source when the work paid by force account is completed
2. To load and unload equipment
3. Equipment is operated to perform work paid by force account

For this equipment, the Engineer may authorize rates in excess of those in Labor Surcharge and Equipment Rental Rates subject to the following:

1. Equipment is not available from your normal sources or from one of your subcontractors
2. Proposed equipment rental rate is reasonable
3. Engineer authorizes the equipment source and the rental rate before you use the equipment

9-1.03D(5) Non-Owner-Operated Dump Truck Rental

Submit the rental rate for non-owner-operated dump truck rental. The Engineer determines the payment rate. Payment for non-owner-operated dump truck rental is for the cost of renting a dump truck, including its driver. For the purpose of markup payment only, the non-owner-operated dump truck is rental equipment and the owner is a subcontractor.

9-1.04 EXTRA WORK PERFORMED BY SPECIALISTS

If the Engineer determines that you or your subcontractors are not capable of performing specialty extra work, a specialist may be used. Itemize the labor, material, and equipment rental costs unless it is not the special service industry's established practice to provide itemization; in which case, the Engineer accepts current market-priced invoices for the work.

The Engineer may accept an invoice as a specialist billing for work performed at an off–job site manufacturing plant or machine shop.

The Engineer determines the cost based on the specialist invoice price minus any available or offered discounts plus a 10 percent markup.

9-1.05 CHANGED QUANTITY PAYMENT ADJUSTMENTS

9-1.05A General

The unit prices specified in Section 9-1.05 are adjusted under Section 9-1.03, "Force Account."

9-1.05B Increases of More Than 25 Percent

If the total bid item quantity exceeds 125 percent of the quantity shown on the verified Bid Item List and if no approved Contract Change Order addresses payment for the quantity exceeding 125 percent, the Engineer may adjust the unit price for the excess quantity under Section 9-1.03, "Force Account," or the following:

1. The adjustment is the difference between the unit price and the unit cost of the total item pay quantity.
2. In determining the unit cost, the Engineer excludes the item's fixed costs. You have recovered the fixed costs in the payment for 125 percent shown on the verified Bid Item List.
3. After excluding fixed costs, the Engineer determines the item unit cost under Section 9-1.03, "Force Account."

If the payment for the number of units of a bid item in excess of 125 percent of the verified Bid Item List is less than $5,000 at the unit price, the Engineer may not adjust the unit price unless you request it.

9-1.05C Decreases of More Than 25 Percent

If the total item pay quantity is less than 75 percent of the quantity shown on the verified Bid Item List and if no approved Contract Change Order addresses payment for the quantity less than 75 percent, you may request a unit price adjustment. The Engineer may adjust the unit price for the decreased quantity under Section 9-1.03, "Force Account" or the following:

1. The adjustment is the difference between the unit price and the unit cost of the total pay quantity.
2. In determining the unit cost, the Engineer includes the item's fixed costs.
3. After including fixed costs, the Engineer determines the item unit cost under Section 9-1.03, "Force Account."

The Department does not pay more than 75 percent of the item total in the verified Bid Item List.

9-1.05D Eliminated Items

If the Engineer eliminates an item, the Department pays your costs incurred before the Engineer's elimination notification date.

If you order authorized material for an eliminated item before the notification date and the order cannot be canceled, either of the following occurs:

1. If the material is returnable to the vendor, the Engineer orders you to return the material and the Department pays your handling costs and vendor charges.
2. The Department pays your cost for the material and its handling and becomes the material owner.

The Engineer determines the payment for the eliminated bid item under Section 9-1.03, "Force Account."

9-1.06 WORK-CHARACTER CHANGES

The Department adjusts a bid item unit price based on the difference between the cost to perform the work as planned and the cost to perform the work as changed. The Engineer determines the payment adjustment under Section 9-1.03, "Force Account." The Department adjusts payment for only the work portion that changed in character.

9-1.07 PROGRESS PAYMENTS

9-1.07A General

The Department pays you based on Engineer-prepared monthly progress estimates. Each estimate reflects:

1. Total work completed during the pay period
2. Extra work bills if:
   2.1. Submitted by the 15th of a month
   2.2. Approved by the 20th of a month

3. Amount for materials on hand
4. Amount earned for mobilization
5. Deductions
6. Withholds
7. Resolved potential claims
8. Payment adjustments

Submit certification stating the work complies with the QC procedures. The Engineer does not process a progress estimate without a signed certification.

You may protest a progress payment.

9-1.07B Schedule of Values

Section 9-1.07B applies to a lump sum bid item for which a schedule of values is specified to be submitted.

The sum of the amounts for the work units listed in the schedule of values must equal the lump sum price bid for the bid item.

Obtain authorization of a schedule of values before you perform work shown on the schedule. The Department does not process a progress payment for the bid item without an authorized schedule of values.

Accept progress payments for overhead, profit, bond costs, and other fixed or administrative costs as distributed proportionally among the items listed except that for a contract with a bid item for mobilization, accept progress payments for bond costs as included in the mobilization bid item.

For changed quantities of the work units listed, the Department adjusts payments in the same manner as specified for changed quantities of bid items under Section 9-1.05, "Changed Quantity Payment Adjustments."

9-1.07C Materials On Hand

A material on hand but not incorporated into the work is eligible for progress payment if:

1. Listed in a special provision as eligible and is in compliance with other Contract parts
2. Purchased
3. An invoice is submitted
4. Stored within the State and you submit evidence that the stored material is subject to the Department's control
5. Requested on the Department-furnished form

9-1.07D Mobilization

Mobilization is eligible for partial payments if the Contract includes a bid item for mobilization. The Department makes the partial payments under Pub Cont Code § 10264. If the Contract does not include a mobilization bid item, mobilization is included in the payment for the various bid items.

The Department pays the item total for mobilization in excess of 10 percent of the total bid in the 1st payment after Contract acceptance.

9-1.07E Withholds

9-1.07E(1) General

The Department may withhold payment for noncompliance.

The Department returns the noncompliance withhold in the progress payment following correction of noncompliance.

Withholds are not retentions under Pub Cont Code § 7107 and do not accrue interest under Pub Cont Code § 10261.5.

Withholds are cumulative and independent of deductions.

Section 9-1.07E does not include all withholds that may be taken; the Department may withhold other payments as specified.

9-1.07E(2) Progress Withholds

The Department withholds 10 percent of a partial payment for noncompliant progress. Noncompliant progress occurs when:

1. Total days to date exceed 75 percent of the revised Contract working days
2. Percent of working days elapsed exceeds the percent of value of work completed by more than 15 percent

The Engineer determines the percent of working days elapsed by dividing the total days to date by the revised Contract working days and converting the quotient to a percentage.

The Engineer determines the percent of value of work completed by summing payments made to date and the amount due on the current progress estimate, dividing this sum by the current total estimated value of the work, and converting the quotient to a percentage. These amounts are shown on the Progress Payment Voucher.

When the percent of working days elapsed minus the percent of value of work completed is less than or equal to 15 percent, the Department returns the withhold in the next progress payment.

9-1.07E(3) Performance Failure Withholds

During each estimate period you fail to comply with a Contract part, including submittal of a document as specified, the Department withholds a part of the progress payment. The documents include QC plans, schedules, traffic control plans, and water pollution control submittals.

For 1 performance failure, the Department withholds 25 percent of the progress payment but does not withhold more than 10 percent of the total bid.

For multiple performance failures, the Department withholds 100 percent of the progress payment but does not withhold more than 10 percent of the total bid.

9-1.07E(4) Stop Notice Withholds

The Department may withhold payments to cover claims filed under Civ Code § 3179 et seq.

Stop notice information may be obtained from the Office of External Accounts Payable, Division of Accounting.

9-1.07E(5) Penalty Withholds

Penalties include fines and damages that are proposed, assessed, or levied against you or the Department by a governmental agency or private lawsuit. Penalties are also payments made or costs incurred in settling alleged violations of federal, state, or local laws, regulations, requirements, or PLACs. The cost incurred may include the amount spent for mitigation or correcting a violation.

If you or the Department is assessed a penalty, the Department may withhold the penalty amount until the penalty disposition has been resolved. The Department may withhold penalty funds without notifying you.

Instead of the withhold, you may provide a bond equal to the highest estimated liability for any disputed penalties proposed.

9-1.07E(6)–9-1.07E(10) Reserved

9-1.07F Retentions

The Department does not retain moneys from progress payments due to the Contractor for work performed (Pub Cont Code § 7202).

9-1.07G–9-1.07K Reserved

9-1.08 PAYMENT AFTER CONTRACT ACCEPTANCE

9-1.08A General

Reserved

9-1.08B Payment Before Final Estimate

After Contract acceptance, the Department pays you based on the Engineer-prepared estimate that includes withholds and the balance due after deduction of previous payments.

9-1.08C Proposed Final Estimate

The Engineer estimates the amount of work completed and shows the amount payable in a proposed final estimate based on:

1. Contract items
2. Payment adjustments
3. Work paid by force account or agreed price

4. Extra work
5. Deductions

Submit either a written final estimate acceptance or a claim statement no later than the 30th day after receiving the proposed final estimate. Evidence of the Contractor's receipt of the final estimate and the Engineer's receipt of the Contractor's written acceptance or claim statement is a delivery service's proof of delivery or Engineer's written receipt if hand delivered.

If you claim that the final estimate is less than 90 percent of your total bid, the Department adjusts the final payment to cover your overhead. The adjustment is 10 percent of the difference between the total bid and the final estimate. The Department does not make this adjustment on a terminated contract.

9-1.08D Final Payment and Claims

9-1.08D(1) General

If you accept the proposed final estimate or do not submit a claim statement within 30 days of receiving the estimate, the Engineer furnishes the final estimate to you and the Department pays the amount due within 30 days. This final estimate and payment is conclusive except as specified in Sections 5-1.015, "Records," 6-1.075, "Guarantee," and 9-1.09, "Clerical Errors."

If you submit a claim statement within 30 days of receiving the Engineer's proposed final estimate, the Engineer furnishes a semifinal estimate to the Contractor and the Department pays the amount due within 30 days. The semifinal estimate is conclusive as to the amount of work completed and the amount payable except as affected by the claims or as specified in Sections 5-1.015, "Records," 6-1.075, "Guarantee," and 9-1.09, "Clerical Errors."

9-1.08D(2) Claim Statement

9-1.08D(2)(a) General

For each claim, submit a claim statement showing only the identification number that corresponds to the Full and Final Potential Claim Record and the final amount of additional payment requested except:

1. If the final amount of requested payment differs from the amount requested in the Full and Final Potential Claim Record
2. For a claim for quantities, withholds, deductions, liquidated damages, or change order bills
3. For an overhead claim

If the final amount of requested payment differs from the amount requested in the Full and Final Potential Claim Record, submit:

1. Identification number that corresponds to the Full and Final Potential Claim Record
2. Final amount of additional payment requested
3. Basis for the changed amount
4. Contract documentation that supports the changed amount
5. Statement of the reasons the Contract documentation supports the claim

The Engineer notifies you of an omission of or a disparity in the exclusive identification number. Within 15 days of the notification, correct the omission or disparity. If the omission or disparity is not resolved after the 15 days, the Engineer assigns a new number.

For a claim for quantities, withholds, deductions, or change order bills submit:

1. Final amount of additional payment requested
2. Enough detail to enable the Engineer to determine the basis and amounts of the additional payment requested

9-1.08D(2)(b) Overhead Claims

Include with an overhead claim:

1. Final amount of additional payment requested
2. Independent CPA audit report

Failure to submit the audit report with an overhead claim with the claim statement is a waiver of the overhead claim and operates as a bar to arbitration on the claim (Pub Cont Code § 10240.2).

The Department deducts an amount for field and home office overhead paid on added work from any claim for overhead. The value of the added work equals the value of the work completed minus the total bid. The home office overhead deduction equals 5 percent of the added work. The field office overhead deduction equals 5-1/2 percent of the added work.

If you intend to pursue a claim for reimbursement for field or home office overhead beyond that provided expressly by the Contract:

1. Notify the Engineer within 30 days of receipt of the proposed final estimate of your intent to seek reimbursement for specific overhead costs beyond that provided by the Contract
2. Specifically identify each claim and each date associated with each claim from which you seek reimbursement for specific overhead costs beyond that provided by the Contract
3. Timely submit all other claims
4. Within 30 days of receipt of the proposed final estimate, submit an audit report prepared by an independent CPA

    4.1. The audit report must show calculations with supporting documentation of actual home office and project field overhead costs
    4.2. The calculations must specify the actual daily rates for both field and home office overhead for the entire duration of the project expressed as a rate per working day
    4.3. The start and end dates of the actual project performance period, number of working days, overhead cost pools, and all allocation bases must be disclosed in the calculations of your actual field and home office overhead daily rates
    4.4. Neither daily rate may include a markup for profit

5. Field overhead costs from which the daily rate is calculated must be:

    5.1. Allowable under 48 CFR 31
    5.2. Supported by reliable records
    5.3. Related solely to the project
    5.4. Incurred during the actual project performance period
    5.5. Comprised of only time-related field overhead costs
    5.6. Not a direct cost

6. Home office overhead costs from which the daily rate is calculated must be:

    6.1. Allowable under 48 CFR 31
    6.2. Supported by reliable records
    6.3. Incurred during the actual project performance period
    6.4. Comprised of only fixed home office overhead costs
    6.5. Not a direct cost

The actual rate of time-related overhead is subject to authorization by the Engineer.

The CPA's audit must be performed under the Attestation Standards published by the American Institute of Certified Public Accountants. The CPA's audit report must express an opinion whether or not your calculations of your actual field and home office overhead daily rates comply with Section 9-1.08D(2)(b), "Overhead Claims." The attest documentation prepared by the CPA in connection with the audit must be reproduced and submitted for review with the audit report.

The Department provides markups for all work paid by force account. Overhead for field and home office costs are included in the markups. Overhead claims in excess of Contract markups are not allowed under the Contract. If you seek reimbursement for costs not allowed under the Contract, the Department does not pay your cost of performing the independent CPA examination specified in section 9-1.08D(2)(b), "Overhead Claims," including preparation of the audit report.

9-1.08D(2)(c) Declaration

Submit a declaration that includes the following language with the claim statement:

> I declare under penalty of perjury, according to the laws of the State of California, that the foregoing claims, with specific reference to the California False Claims Act (Govt Code § 12650 et seq.) and to the extent the project contains federal funding, the U.S. False Claims Act (31 USC § 3729 et seq.), are true and

correct, and that this declaration was signed on _____(date)_____, 20__ at _____, California.

9-1.08D(2)(d) Waiver

A claim is waived if:

1. Claim does not have a corresponding Full and Final Potential Claim Record identification number
2. Claim does not have the same nature, circumstances, and basis of claim as the corresponding Full and Final Potential Claim Record
3. Claim is not included in the claim statement
4. You do not comply with the claim procedures
5. You do not submit the declaration specified in 9-1.08D(2)(c), "Declaration"

9-1.08D(3) Final Determination of Claims

Failure to allow timely access to claim supporting data when requested waives the claim.

The Department's costs in reviewing or auditing a claim not supported by the Contractor's accounting or other records are damages incurred by the State within the meaning of the California False Claims Act.

If the Engineer determines that a claim requires additional analysis, the Engineer schedules a board of review meeting. Meet with the board of review and make a presentation supporting the claim.

After claim review completion by the Engineer or board of review, the Department makes the final determination of claims and furnishes it to the Contractor.

After the determination, the Engineer furnishes a final estimate to the Contractor and the Department pays the amount due within 30 days. The final estimate is conclusive as to the amount of work completed and the amount payable except as specified in Sections 5-1.015, "Records," 6-1.075, "Guarantee," and 9-1.09, "Clerical Errors."

The Contractor's failure to comply with the claim procedures is a bar to arbitration under Pub Cont Code § 10240.2.

9-1.09 CLERICAL ERRORS

For 3 years after Contract acceptance, estimates and payments are open to correction and adjustment for clerical errors. Either the Department or the Contractor pays to the other the amount due except for clerical errors resulting in an adjustment less than $200; in which case, no payment is made.

9-1.10 ARBITRATION

Pub Cont Code § 10240 through 10240.13 provides for the resolution of contract claims by arbitration.

Start arbitration by filing a complaint with the Office of Administrative Hearings in Sacramento (1 CA Code Regs § 1350). File the arbitration complaint no later than 90 days after receiving the Department's final written decision on a claim (Pub Cont Code § 10240.1).

^^

SECTION 10 DUST CONTROL
(Issued 02-06-09)

Replace Section 10 with:

SECTION 10 (BLANK)

^^

SECTION 11 MOBILIZATION
(Issued 06-05-09)

Replace Section 11 with:

SECTION 11 (BLANK)

^^

SECTION 12 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

(Issued 11-07-08)

In Section 12-1.01 in the 2nd paragraph, replace the 1st sentence with:

Attention is directed to Part 6 of the California MUTCD.

Replace Section 12-2.01 with:

12-2.01 FLAGGERS

Flaggers while on duty and assigned to traffic control or to give warning to the public that the highway is under construction and of any dangerous conditions to be encountered as a result thereof, shall perform their duties and shall be provided with the necessary equipment in conformance with Part 6 of the California MUTCD. The equipment shall be furnished and kept clean and in good repair by the Contractor at the Contractor's expense.

All flaggers shall wear safety apparel meeting the requirements of ANSI/ISEA 107-2004 for Class 2 or 3 garment and complying with 71 Fed Reg 67792.

In Section 12-3.01 replace the 1st paragraph with:

In addition to the requirements in Part 6 of the California MUTCD, all devices used by the Contractor in the performance of the work shall conform to the provisions in this Section 12-3.

In Section 12-3.06 in the 1st paragraph, replace the 2nd sentence with:

Construction area signs are shown in or referred to in Part 6 of the California MUTCD.

In Section 12-3.06 in the 4th paragraph, replace the 1st sentence with:

All construction area signs shall conform to the dimensions, color and legend requirements of the plans, Part 6 of the California MUTCD and these specifications.

In Section 12-3.06 in the 8th paragraph, replace the 1st sentence with:

Used signs with the specified sheeting material will be considered satisfactory if they conform to the requirements for visibility and legibility and the colors conform to the requirements in Part 6 of the California MUTCD.

^^

SECTION 14 (BLANK)

(Issued 06-01-11)

Replace Section 14 with:

SECTION 14 ENVIRONMENTAL STEWARDSHIP

14-1 GENERAL

14-1.01 GENERAL

Environmental stewardship includes both environmental compliance and environmental resource management.

If an ESA is shown on the plans:

1. The boundaries shown are approximate; the Department marks the exact boundaries on the ground
2. Do not enter the ESA unless authorized
3. If the ESA is breached, immediately:
   3.1. Secure the area and stop all operations within 60 feet of the ESA boundary
   3.2. Notify the Engineer
4. If the ESA is damaged, the Department determines what efforts are necessary to remedy the damage and who performs the remedy; you are responsible for remedies and charges.

14-2 CULTURAL RESOURCES

14-2.01 GENERAL

Reserved

14-2.02 ARCHAEOLOGICAL RESOURCES

If archaeological resources are discovered at the job site, do not disturb the resources and immediately:

1. Stop all work within a 60-foot radius of the discovery
2. Protect the discovery area
3. Notify the Engineer

The Department investigates. Do not move archaeological resources or take them from the job site. Do not resume work within the discovery area until authorized.

If, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of an archaeological find, or investigation or recovery of archeological materials, you will be compensated for resulting losses, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays."

If ordered, furnish resources to assist in the investigation or recovery of archaeological resources. This work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

14-2.03 ARCHAEOLOGICAL MONITORING AREA

Section 14-2.03 applies if an AMA is described in the Contract.

The Department assigns an archaeological monitor to monitor job site activities within the AMA. Do not work within the AMA unless the archeological monitor is present.

The Engineer and the Department archaeological monitor conduct an AMA location field review with you at least 5 business days before start of work. The Department marks the exact boundaries of the AMA on the ground.

If temporary fence (Type ESA) or other exclosure for an AMA is described in the Contract, install temporary fence (Type ESA) or other exclosure to define the boundaries of the AMA during the AMA location field review.

At least 5 business days before starting work within an AMA, submit a schedule of days and hours to be worked for the Engineer's approval. If you require changes in the schedule, submit an update for the Engineer's approval at least 5 business days before any changed work day.

If archaeological resources are discovered within an AMA, comply with Section 14-2.02, "Archaeological Resources."

14-2.04 HISTORIC STRUCTURES

Reserved

14-3 COMMUNITY IMPACTS AND ENVIRONMENTAL JUSTICE

Reserved

14-4 NATIVE AMERICAN CONCERNS

Reserved

14-5 AESTHETICS

Reserved

14-6 BIOLOGICAL RESOURCES

14-6.01 GENERAL

Reserved

14-6.02 BIRD PROTECTION

Protect migratory and nongame birds, their occupied nests, and their eggs.

The Department anticipates nesting or attempted nesting from February 15 to September 1.

The federal Migratory Bird Treaty Act, 16 USC § 703–711, and 50 CFR Pt 10 and Fish & Game Code §§ 3503, 3513, and 3800 protect migratory and nongame birds, their occupied nests, and their eggs.

The federal Endangered Species Act of 1973, 16 USC §§ 1531 and 1543, and the California Endangered Species Act, Fish & Game Code §§ 2050–2115.5, prohibit the take of listed species and protect occupied and unoccupied nests of threatened and endangered bird species.

The Bald and Golden Eagle Protection Act, 16 USC § 668, prohibits the destruction of bald and golden eagles and their occupied and unoccupied nests.

If migratory or nongame bird nests are discovered that may be adversely affected by construction activities or an injured or killed bird is found, immediately:

1. Stop all work within a 100-foot radius of the discovery.
2. Notify the Engineer.

The Department investigates. Do not resume work within the specified radius of the discovery until authorized.

When ordered, use exclusion devices, take nesting prevention measures, remove and dispose of partially constructed and unoccupied nests of migratory or nongame birds on a regular basis to prevent their occupation, or perform any combination of these. This work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

Prevent nest materials from falling into waterways.

Bird protection that causes a delay to the controlling activity is a condition unfavorable to the suitable prosecution of work as specified in Section 8-1.05, "Temporary Suspension of Work."

14-7 PALEONTOLOGICAL RESOURCES

If paleontological resources are discovered at the job site, do not disturb the material and immediately:

1. Stop all work within a 60-foot radius of the discovery
2. Protect the area
3. Notify the Engineer

The Department investigates and modifies the dimensions of the protected area if necessary. Do not move paleontological resources or take them from the job site. Do not resume work within the specified radius of the discovery until authorized.

14-8 NOISE AND VIBRATION

14-8.01 GENERAL

Reserved

14-8.02 NOISE CONTROL

Do not exceed 86 dBA LMax at 50 feet from the job site activities from 9 p.m. to 6 a.m.

Equip an internal combustion engine with the manufacturer-recommended muffler. Do not operate an internal combustion engine on the job site without the appropriate muffler.

14-9 AIR QUALITY

14-9.01 AIR POLLUTION CONTROL

Comply with air pollution control rules, regulations, ordinances, and statutes that apply to work performed under the Contract, including air pollution control rules, regulations, ordinances, and statutes provided in Govt Code § 11017 (Pub Cont Code § 10231).

Do not burn material to be disposed of.

14-9.02 DUST CONTROL

Prevent and alleviate dust by applying water, dust palliative, or both under Section 14-9.01.

Apply water under Section 17, "Watering."

Apply dust palliative under Section 18,"Dust Palliative."

If ordered, apply water, dust palliative, or both to control dust caused by public traffic. This work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

14-10 SOLID WASTE DISPOSAL AND RECYCLING

14-10.01 SOLID WASTE DISPOSAL AND RECYCLING

Submit an annual Solid Waste Disposal and Recycling Report between January 1 and 15 for each year work is performed under the Contract at any time during the previous calendar year. Show the types and amounts of project-generated solid waste taken to or diverted from landfills or reused on the project from January 1 through December 31 of the previous calendar year.

Submit a final annual Solid Waste Disposal and Recycling Report within 5 business days after Contract acceptance. Show the types and amounts of project-generated solid waste taken to or diverted from landfills or reused on the project from January 1 to Contract acceptance.

For each failure to submit a completed form, the Department withholds $10,000.

14-11 HAZARDOUS WASTE AND CONTAMINATION

14-11.01 GENERAL

Reserved

14-11.02 ASBESTOS AND HAZARDOUS SUBSTANCES

Upon discovery, immediately stop working in and notify the Engineer of areas where asbestos or a hazardous substance is present if the:

1. Contractor reasonably believes the substance is asbestos as defined in Labor Code § 6501.7 or a hazardous substance as defined in Health & Safety Code §§ 25316 and 25317
2. Presence is not described in the Contract
3. Substance has not been made harmless

14-12 OTHER INTERAGENCY RELATIONS

Reserved

14-13 PAYMENT

Payment for work specified in Section 14 is included in the payment for the bid items involved unless:

1. Bid item for the work is shown in the verified Bid Item List
2. Work is specified as paid for as extra work

^^

SECTION 15 EXISTING HIGHWAY FACILITIES

(Issued 05-01-09)

In Section 15-1.02 replace the 1st paragraph with:

Existing facilities which are to remain in place shall be protected in conformance with the provisions in Sections 5-1.18, "Property and Facility Preservation," and 7-1.12, "Indemnification and Insurance."

^^

SECTION 19 EARTHWORK

(Issued 09-16-11)

Replace Section 19-1.02 with:

19-1.02 (BLANK)

Replace Section 19-1.03 with:

19-1.03 GRADE TOLERANCE

Immediately prior to placing subsequent layers of material thereon, the grading plane shall conform to one of the following:

A. When hot mix asphalt is to be placed on the grading plane, the grading plane at any point shall not vary more than 0.05 foot above or below the grade established by the Engineer.
B. When subbase or base material to be placed on the grading plane is to be paid for by the ton, the grading plane at any point shall not vary more than 0.10 foot above or below the grade established by the Engineer.
C. When the material to be placed on the grading plane is to be paid for by the cubic yard, the grading plane at any point shall be not more than 0.05 foot above the grade established by the Engineer.

In Section 19-3.025C replace the 1st paragraph with:

Cementitious material used in soil cement bedding shall conform to the provisions in Section 90-2.01, "Cementitious Materials." Supplementary cementitious material will not be required.

In Section 19-3.025C replace the 4th paragraph with:

The aggregate, cementitious material, and water shall be proportioned either by weight or by volume. Soil cement bedding shall contain not less than 282 pounds of cementitious material per cubic yard. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

In Section 19-3.06 replace the 9th paragraph with:

Unless otherwise shown on the plans or specified in these specifications or the special provisions, material for structure backfill to be compacted to a relative compaction of not less than 90 percent, except material to be placed behind retaining walls, shall consist of material free of rocks, broken concrete, other solid material exceeding 3 inches in greatest dimension, or organic or other unsatisfactory material.

In Section 19-3.062 replace the 1st paragraph with:

Slurry cement backfill shall consist of a fluid, workable mixture of aggregate, cementitious material, and water.

In Section 19-3.062 replace the 5th paragraph with:

Cementitious material shall conform to the provisions in Section 90-2.01, "Cementitious Materials." Supplementary cementitious material will not be required.

In Section 19-3.062 replace the 8th paragraph with:

The aggregate, cementitious material, and water shall be proportioned either by weight or by volume. Slurry cement backfill shall contain not less than 188 pounds of cementitious material per cubic yard. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

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SECTION 20 EROSION CONTROL AND HIGHWAY PLANTING

(Issued 04-20-12)

Replace Section 20-2.03 with:

20-2.03 SOIL AMENDMENT

Soil amendment must comply with the Food & Agri Code.

In Section 20-2.10 delete the 8th, 9th, and 10th paragraphs.

In Section 20-3.04A delete the last paragraph.

In Section 20-4.026 replace the 3rd paragraph with:

Oil or pelleted forms of pesticides for weed control shall not be used.

Replace Section 20-4.055 with:

20-4.055 PRUNING

Prune plants under ANSI A300 (Part 1) published by the Tree Care Industry Association.

^^

SECTION 24 LIME STABILIZATION
(Issued 06-05-09)

Replace Section 24 with:

SECTION 24 LIME STABILIZED SOIL

24-1.01 GENERAL

24-1.01A Summary

Section 24 includes specifications for stabilizing soil by mixing lime and water with soil and compacting the mixture to the specified dimensions.

24-1.01B Definitions

lime: Quicklime made from high-calcium or dolomitic sources specified under ASTM C 51. For high-calcium quicklime, the calcium oxide content must be greater than 90 percent. For dolomitic quicklime, the calcium oxide content must be greater than 55 percent and the combined calcium oxide and magnesium oxide content must be greater than 90 percent.

mellowing period: The time between the initial and final mixing to promote initial chemical reactions between lime, water, and soil.

24-1.01C Submittals

From 30 to 180 days before use, submit one 10-pound sample of each lime product proposed and from each source.

Submit lime samples in airtight containers under ASTM C 50. Mark the sample date on the container. Include the MSDS and chemical and physical analysis with the submittal.

With the lime samples, submit a Certificate of Compliance from the pre-qualified lime source under Section 6-1.07, "Certificates of Compliance," with a statement certifying the lime furnished is the same as that pre-qualified.

Fifteen days before starting soil stabilization activities, submit for the Engineer's approval a laboratory to perform quality control tests. The laboratory must be qualified under the Department's Independent Assurance Program.

Before you apply lime in slurry form, submit the slurry's lime content for Engineer's approval 25 days before application.

Before performing quality control sampling and testing, submit the time and location the sampling and testing will occur. Submit quality control testing results within 24 hours of receiving the results.

Submit a weighmaster certificate or bill of lading with each load of lime delivered to the jobsite.

24-1.01D Quality Control and Assurance

General

Perform quality control testing in the presence of the Engineer.

Place unique, sequentially numbered lock seals on each load and affix them to trailer blow down valves that are locked open. The bill of lading for each lime delivery must have that specific lock seal number legibly and visibly imprinted.

The Engineer samples each lime delivery truck at the job site and randomly tests them off-site.

Pre-qualification of Lime Sources

Lime sources must be listed on the Department's pre-qualified products list. The list is available at the METS web site.

The pre-qualified list for lime sources describes the application procedures for inclusion on the list.

Preparing Soil

After you prepare an area for lime soil stabilization, test the soil to be stabilized every 500 cubic yards for relative compaction under California Test 231 and moisture content under California Test 226, and verify the surface grades.

Applying Lime

The Engineer determines the final application rate for each lime product proposed from the samples submitted. If the soil being stabilized changes, the Engineer changes the application rate. Based on California Test 373, the Engineer reports the application rates as the percent of lime by dry weight of soil. The Engineer provides the optimum moisture content determined under California Test 373 for each application rate.

Before applying lime, measure the temperature at the ground surface.

If lime in dry form is used, the Engineer verifies the application rate using the drop pan method once per 40,000 square feet stabilized, or twice per day, whichever is greater.

If lime in slurry form is used, report the quantity of slurry placed by measuring the volume of slurry in the holding tank once per 40,000 square feet stabilized, or twice per day, whichever is greater.

Mixing

For each day of initial mixing, test the moisture content. Sample the material immediately after initial mixing.

Randomly test the adequacy of the final mixing with a phenolphthalein indicator solution.

During mixing operations, measure the ground temperature at full mixing depth.

After mixing and before compacting, determine maximum density under California Test 216 from composite samples of the mixed material and at each distinct change in material. Test the moisture content of the mixed material under California Test 226. Test the gradation for compliance with "Materials."

Compaction

Test relative compaction on a wet weight basis.

After initial compaction, determine in-place density under California Test 231 and moisture content under California Test 226 at the same locations. The testing frequency must be 1 test per 250 cubic yards of lime stabilized soil. Test in 0.50-foot depth intervals.

Before requesting to compact material in layers greater than 0.50 foot, construct a test strip in the production area and demonstrate the test strip passes compaction tests using the proposed thickness. The test strip must contain no more material than 1 day's production. The Engineer tests at not more than 0.50-foot depth intervals regardless of the thickness of your layers.

Construct test pads by scraping away material to the depth ordered by the Engineer. If a compaction test fails corrective action must include the layers of material already placed above the test pad elevation.

Finish Grading

Do not proceed with construction activities for subsequent layers of material until the Engineer verifies the final grades of the lime stabilized soil.

Dispute Resolution

You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer within 5 days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit written quality control test results and copies of paperwork including worksheets used to determine the disputed test results to the Engineer. An Independent Third Party (ITP) performs referee testing. Before the ITP participates in a dispute resolution, the ITP must be accredited under the Department's Independent Assurance Program. The ITP must be independent of the project. By mutual agreement, the ITP is chosen from:

1. A Department laboratory
2. A Department laboratory in a district or region not in the district or region the project is located
3. The Transportation Laboratory
4. A laboratory not currently employed by you or your lime producer

If split quality control or acceptance samples are not available, the ITP uses any available material representing the disputed material for evaluation.

24-1.02 MATERIALS

24-1.02A Lime

Lime must comply with ASTM C 977 and the following:

Lime

Quality Characteristic	ASTM	Specification
Available Calcium and Magnesium Oxide(min., %)	C 25[a]	High Calcium Quicklime: CaO > 90 Dolomitic Quicklime: CaO > 55 and CaO + MgO > 90
Loss on ignition (max., %)	C 25	7 (total loss) 5 (carbon dioxide) 2 (free moisture)
Slaking rate	C 110	30 °C rise in 8 minutes

Notes:
[a] You may use ASTM C25 or ASTM C1301 and ASTM C1271.

A 0.5-pound sample of lime dry-sieved in a mechanical sieve shaker for 10 minutes ±30 seconds must comply with:

Sieve Sizes	Percentage Passing
3/8-inch	98-100

Slurry must:

1. Be free of contaminants
2. Contain at least the minimum dry solids
3. Have uniform consistency

If you prepare lime slurry, prepare it at the jobsite.

24-1.02B Water

If available, use potable water. Inform the Engineer if a water source other than potable water is used. If not using potable water, water for mixing soil and lime must:

1. Contain no more than 650 parts per million of chlorides as Cl, and no more than 1,300 parts per million of sulfates as SO_4
2. Not contain an amount of impurities that will cause a reduction in the strength of the stabilize soil

24-1.02C Mixed Material

Take a composite sample from 5 random locations after initial mixing. The moisture content of the composite sample tested under California Test 226 must be a minimum of 3 percent greater than optimum. Determine the moisture versus density relationship of the composite sample material determined under California Test 216, except Part 2, Section E, Paragraph 6 is modified as follows:

> After adjustment of the moisture content, compact each of the remaining test specimens in the mold, then record the water adjustment, tamper reading, and the corresponding adjusted wet density from the chart on Table 1 using the column corresponding to the actual wet weight of the test specimen compacted. Note each of these wet weights on Line I.

The mixed material before compaction excluding rock must comply with:

Sieve Sizes	Percentage Passing
1"	98 - 100
No. 4	60 - 100

24-1.02D Curing Treatment

Curing treatment may be any of the following:

1. Water cure
2. Curing seal
3. Moist material blanket

Curing seal must be SS or CSS grade asphaltic emulsion under Section 94, "Asphaltic Emulsions."

24-1.03 CONSTRUCTION

24-1.03A General

If using different types of lime or lime from more than one source, do not mix them. The Engineer determines separate application rates.

Deliver lime in full loads unless it is the last load needed for a work shift.

Apply lime at ground temperatures above 35 °F. Do not apply lime if you expect the ground temperature to drop below 35 °F before you complete mixing and compacting.

During mixing, maintain the in-place moisture of the soil to be stabilized a minimum 3 percent above the optimum moisture determined under California Test 216 as modified in "Mixed Material." During compaction and finish grading, add water to the surface to prevent drying until the next layer of mixed material is placed, or until you apply curing treatment.

Scarify the surface of lime stabilized soil at least 2 inches between each layer. Do not scarify the final surface of the lime stabilized soil.

Between the time of applying lime and 3 days after applying curing treatment, only allow equipment or vehicles on the soil being stabilized that are essential to the work.

24-1.03B Preparing Soil

Except for soil clods, remove rocks or solids larger than 1/3 of the layer thickness. Regardless of the layer thickness, remove rocks and solids greater than 4 inches. Notify the Engineer if you encounter rocks or solids greater than 1/3 of the layer thickness.

Before adding lime, place the soil to be stabilized to within 0.08 foot of the specified lines and grades and compact to not less than 90 percent relative compaction.

24-1.03C Applying Lime

Apply lime uniformly over the area to be stabilized using a vane spreader.

The Engineer determines the final application rate. Do not vary from this application rate by more than 5 percent.

Apply lime in dry form. If you request and the Engineer approves, you may apply lime in slurry form.

Lime slurry must be in suspension during application. Apply lime slurry uniformly making successive passes over a measured section or roadway until the specified lime content is reached. Apply the residue from lime slurry over the length of the roadway being processed.

24-1.03D Mixing

Lime and soil to be stabilized must be mixed uniformly at least twice to within 0.10 foot of the specified depth at any point. If the mixing depth exceeds the specified depth by more than 10 percent, add lime in proportion to the exceeded depth. The Department does not pay for this added lime.

Mix lime on the same day it is applied. After the initial mixing, allow a mellowing period for at least 36 hours before final mixing. Moisture content during the mellowing period determined under California Test 226 must be at least 3 percent higher than the optimum moisture content. You may add water and mix during the mellowing period.

Remix until the mixture is uniform with no streaks or pockets of lime.

Except for clods larger than 1 inch, mixed material must have a color reaction with sprayed phenolphthalein alcohol indicator solution.

Complete all the mixing work within 7 days of the initial application of lime.

24-1.03E Compaction

Begin compacting immediately after final mixing, but not less than 36 hours after the beginning of initial mixing.

Compact by using sheepsfoot or segmented wheel rollers immediately followed by steel drum or pneumatic-tired rollers. Do not use vibratory rollers.

If you request and the Engineer approves, you may compact mixed material in layers greater than 0.50 foot.

If the specified thickness is 0.50 foot or less, compact in one layer. If the specified thickness is more than 0.50 foot, compact in 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer must not exceed 0.50 foot unless you first demonstrate your equipment and methods provide uniform distribution of lime and achieve the specified compaction.

Use other compaction methods in areas inaccessible to rollers.

Compact the lime stabilized soil to at least 95 percent relative compaction determined under California Test 216 as modified under "Mixed Material." The relative compaction is determined on a wet weight basis.

24-1.03F Finish Grading

Maintain the moisture content of the lime stabilized soil through the entire finish grading operation at a minimum of 3 percent above optimum moisture content.

The finished surface of the lime stabilized soil must not vary more than 0.08 foot above or below the grade established by the Engineer unless the lime stabilized soil is to be covered by material paid for by the cubic yard, in which case the finished surface may not vary above the grade established by the Engineer.

If lime stabilized soil is above the allowable tolerance, trim, remove, and dispose of the excess material. Do not leave loose material on the finished surface. If finish rolling cannot be completed within 2 hours of trimming, defer trimming.

If lime stabilized soil is below the allowable tolerance, you may use trimmed material to fill low areas only if final grading and final compaction occurs within 48 hours of beginning initial compaction. Before placing trimmed material, scarify the surface of the area to be filled at least 2 inches deep.

Finish rolling of trimmed surfaces must be performed with at least 1 complete coverage with steel drum or pneumatic-tired rollers.

24-1.03G Curing

General

Choose the method of curing.

Apply the chosen cure method within 48 hours of completing the sheepsfoot or segmented wheel compaction. Apply the chosen cure method within the same day of any trimming and finish grading.

Water Cure

Water may be used to cure the finished surface before you place a moist material blanket, or apply curing seal. Keep the surface above the optimum moisture content of the lime stabilized soil. Use this method for no more than 3 days, after which you must place a curing seal or moist material blanket.

Curing Seal

Curing seal equipment must have a gage indicating the volume of curing seal in the storage tank.

If curing seal is used, apply it:

1. To the finished surface of lime stabilized soil under Section 94-1.06, "Applying," of the Standard Specifications
2. At a rate from 0.10 to 0.20 gallon per square yard. The Engineer determines the exact rate
3. When the lime stabilized soil is at optimum moisture
4. When the ambient temperature is above 40 °F and rising

Repair damaged curing seal the same day the damage occurs.

Moist Material Blanket

Moist material blanket consists of moist structural material. Moist material blanket may be a temporary or permanent layer of material of sufficient thickness to prevent drying of the lime stabilized soil. You may use moist material blanket if the lime stabilized soil can bear the weight of construction equipment. Maintain the moist material blanket above the optimum moisture content, as appropriate, until the next structural layer is placed.

24-1.04 MEASUREMENT AND PAYMENT

Lime stabilized soil is measured by the square yard determined from horizontal measurements of the planned surface of the lime stabilized soil.

Curing seal is measured under Section 94, "Asphaltic Emulsions." The amount of curing seal used is determined from the gauge specified for the curing equipment.

The contract item prices for the work involved with lime stabilized soil are paid:

1. Per square yard for lime stabilized soil
2. Per ton for lime
3. Per ton for asphaltic emulsion (curing seal)

Payment for the contract items involved with lime stabilized soil includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the lime stabilized soil, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The Department does not adjust payment for lime.

Quantities of lime wasted or disposed of in a manner not specified, or remaining on hand after completion of the work, will not be paid for. If you use a partial load of lime, weigh the truck and the remaining lime on a scale under Section 9-1.01, "Measurement of Quantities," and submit a weighmaster certificate to the Engineer.

Full compensation for preparing soil to be stabilized is included in the contract price paid per square yard for lime stabilized soil, and no separate payment is made therefor, except removing and disposing of rocks and solids larger 1/3 of the layer thickness and larger than 4 inches from native soil or embankment other than imported borrow is paid for as extra work as provided in Section 4-1.03D, "Extra Work." Removing and disposing of rocks and solids larger than 1/3 of the lift thickness and larger than 4 inches from imported borrow is at your expense.

Full compensation for mixing, compacting, and maintaining the moisture content of the lime stabilized soil is included in the contract price paid per square yard for lime stabilized soil, and no separate payment is made therefor.

Full compensation for applying lime is included in the contract price paid per ton for lime, and no additional compensation is allowed therefor.

If the dispute resolution ITP determines the Engineer's test results are correct, the Engineer deducts the ITP's testing costs from payments. If the ITP determines your test results are correct, the State pays the ITP testing costs.

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SECTION 25 AGGREGATE SUBBASES
(Issued 02-16-07)

In Section 25-1.02A replace the 1st paragraph with:

Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

Replace Section 25-1.02B with:

25-1.02B Class 4 Aggregate Subbase

Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

^^

SECTION 26 AGGREGATE BASES
(Issued 02-16-07)

In Section 26-1.02A replace the 1st paragraph with:

Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

In Section 26-1.02B replace the 1st paragraph with:

Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

^^

SECTION 27 CEMENT TREATED BASES

(Issued 07-31-07)

In Section 27-1.02 replace the 1st paragraph with:

Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

In Section 27-1.02 replace the 3rd paragraph with:

Aggregate for use in Class A cement treated base shall be of such quality that when mixed with cement in an amount not to exceed 5 percent by weight of the dry aggregate and compacted at optimum moisture content, the compressive strength of a sample of the compacted mixture shall not be less than 750 pounds per square inch at 7 days, when tested by California Test 312.

In Section 27-1.02 replace the 4th paragraph with:

Aggregate for use in Class B cement treated base shall have a Resistance (R-value) of not less than 60 before mixing with cement and a Resistance (R-value) of not less than 80 after mixing with cement in an amount not to exceed 2.5 percent by weight of the dry aggregate.

In Section 27-1.07 replace the 9th paragraph with:

When surfacing material is hot mix asphalt, the low areas shall be filled with hot mix asphalt conforming to the requirements for the lowest layer of hot mix asphalt to be placed as surfacing. This filling shall be done as a separate operation prior to placing the lowest layer of surfacing, and full compensation for this filling will be considered as included in the contract price paid for cement treated base and no additional compensation will be allowed therefor.

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SECTION 28 LEAN CONCRETE BASE

(Issued 05-15-09)

In Section 28-1.02 replace the 1st paragraph with:

Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

In Section 28-1.02 replace the 6th paragraph with:

Aggregate shall be of such quality that, when mixed with cement in an amount not to exceed 300 pounds per cubic yard, and tested in conformance with the requirements in California Test 548, the compressive strength of a sample will be not less than 700 pounds per square inch at 7 days.

Replace Section 28-1.05 with:

Placing of lean concrete base shall conform to the provisions for placing concrete pavement in Section 40-3.04, "Placing Concrete," except that the third paragraph in Section 40-3.04A, "General," shall not apply.

Unless otherwise required by the plans or the special provisions, lean concrete base shall be constructed in not less than 12-foot widths separated by construction joints. Lean concrete base constructed monolithically in widths greater than 26 feet shall be constructed with a longitudinal contraction joint offset not more than 3 feet from the centerline of the width being constructed.

Longitudinal contraction joints in lean concrete base shall be constructed in conformance with the provisions in Section 40-3.08E, "Sawing Method."

When concrete pavement is to be placed over lean concrete base, longitudinal construction joints and longitudinal contraction joints in the lean concrete base shall not be within one foot of planned longitudinal contraction joints nor longitudinal construction joints in the concrete pavement.

Lean concrete base shall not be mixed nor placed while the atmospheric temperature is below 35 °F, and shall not be placed on frozen ground.

In Section 28-1.06 replace the 1st and 2nd paragraphs with:

Lean concrete base shall be spread, compacted, and shaped in conformance with the provisions in Section 40-3.04D, "Stationary Side Form Construction," and Section 40-3.04E, "Slip-Form Construction."

In advance of curing operations, lean concrete base to be surfaced with hot mix asphalt shall be textured with a drag strip of burlap, a broom or a spring steel tine device which will produce scoring in the finished surface. The scoring shall be parallel with the centerline or transverse thereto. The operation shall be performed at a time and in a manner to produce the coarsest texture practical for the method used.

In Section 28-1.08 replace the 2nd paragraph with:

Hardened lean concrete base with a surface lower than 0.05 foot below the grade established by the Engineer shall be removed and replaced with lean concrete base which complies with these specifications, or if permitted by the Engineer, the low areas shall be filled with pavement material as follows:

1. When pavement material is hot mix asphalt, the low areas shall be filled with hot mix asphalt conforming to the requirements for the lowest layer of hot mix asphalt to be placed as pavement. This shall be done as a separate operation prior to placing the lowest layer of pavement, and full compensation for this filling will be considered as included in the contract price paid per cubic yard for lean concrete base and no additional compensation will be allowed therefor.
2. When pavement material is portland cement concrete, the low areas shall be filled with pavement concrete at the time and in the same operation that the pavement is placed. Full compensation for this filling will be considered as included in the contract price paid per cubic yard for lean concrete base and no additional compensation will be allowed therefor.

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SECTION 29 TREATED PERMEABLE BASES

(Issued 05-15-09)

In Section 29-1.02B replace the 2nd paragraph with:

Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

In Section 29-1.04A replace the 1st paragraph with:

Aggregates and asphalt for asphalt treated permeable base shall be stored, proportioned and mixed in the same manner provided for storing, proportioning and mixing aggregates and asphalt for hot mix asphalt in Section 39-1.08, "Production," except as follows:

1. The aggregate need not be separated into sizes.
2. The temperature of the aggregate before adding the asphalt binder shall be not less than 275° F nor more than 325° F.
3. Asphalt treated permeable base stored in excess of 2 hours shall not be used in the work.
4. The aggregate shall be combined with 2.5 percent paving asphalt by weight of the dry aggregate. After testing samples of the Contractor's proposed aggregate supply, the Engineer may order an increase or decrease in the asphalt content. If an increase or decrease is ordered, and the increase or decrease exceeds the specified amount by more than 0.1 percent by weight of the dry aggregate, the compensation payable to the Contractor for the asphalt treated permeable base will be increased or decreased on the basis of the total increase or decrease in asphalt.
5. The asphalt content of the asphalt mixture will be determined, at the option of the Engineer, by extraction tests in conformance with the requirements in California Test 310 or 362, or will be determined in conformance with the requirements in California Test 379. The bitumen ratio pounds of asphalt per 100 pounds of dry aggregate shall not vary by more than 0.5 pound of asphalt above or 0.5 pound of asphalt below the amount designated by the Engineer. Compliance with this requirement will be determined either by taking samples from trucks at the plant or from the mat behind the paver before rolling. If the sample is taken from the mat behind the paver, the bitumen ratio shall be not less than the amount designated by the Engineer, less 0.7 pound of asphalt per 100 pounds of dry aggregate.

In Section 29-1.04B replace the 2nd paragraph with:

Cement treated permeable base shall contain not less than 287 pounds of cement per cubic yard.

In Section 29-1.05 replace the 1st paragraph with:

Asphalt treated permeable base shall be spread and compacted as specified for hot mix asphalt under the "Method" construction process in Section 39, "Hot Mix Asphalt," and these specifications.

In Section 29-1.05 in the 8th paragraph, replace the 2nd sentence with:

The filter fabric shall conform to the provisions in Section 88-1.02, "Filtration," and shall be placed in conformance with the provisions for placing filter fabric for edge drains in Section 68-3.03, "Installation."

In Section 29-1.06 replace the 1st and 2nd paragraphs with:

Cement treated base shall be placed, spread, compacted, and shaped in conformance with the provisions in Section 40-3.04D, "Stationary Side Form Construction," and Section 40-3.04E, "Slip-Form Construction," except that vibrators shall not be used and the third paragraph in Section 40-3.04A, "General," shall not apply.

In Section 29-1.06 in the 9th paragraph, replace the 2nd sentence with:

The filter fabric shall conform to the provisions in Section 88-1.02, "Filtration," and shall be placed in conformance with the provisions for placing filter fabric for edge drains in Section 68-3.03, "Installation."

In Section 29-1.07 replace the 2nd paragraph with:

Hardened treated permeable base with a surface lower than 0.05 foot below the grade established by the Engineer shall be removed and replaced with treated permeable base which complies with these specifications, or if permitted by the Engineer, the low areas shall be filled with pavement material as follows:

1. When pavement material is hot mix asphalt, the low areas shall be filled with hot mix asphalt conforming to the requirements for the lowest layer of hot mix asphalt to be placed as pavement. This shall be done as a separate operation prior to placing the lowest layer of pavement.

2. When pavement material is portland cement concrete, the low areas shall be filled with pavement concrete at the time and in the same operation in which the pavement is placed.
3. Full compensation for filling low areas will be considered as included in the contract price paid per cubic yard for treated permeable base and no additional compensation will be allowed therefor.

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SECTION 37 BITUMINOUS SEALS
(Issued 06-05-09)

In Section 37-1.03 replace the 4th through 6th paragraphs with:

On 2-lane two-way roadways, W8-7 "LOOSE GRAVEL" signs and W13-1 (35) speed advisory signs shall be furnished and placed adjacent to both sides of the traveled way where screenings are being spread on a traffic lane. The first W8-7 sign in each direction shall be placed where traffic first encounters loose screenings, regardless of which lane the screenings are being spread on. The W13-1 (35) signs need not be placed in those areas with posted speed limits of less than 40 MPH. The signs shall be placed at maximum 2,000-foot intervals along each side of the traveled way and at public roads or streets entering the seal coat area as directed by the Engineer.

On multilane roadways (freeways, expressways and multilane conventional highways) where screenings are being spread on a traffic lane, W8-7 "LOOSE GRAVEL" signs and W13-1 (35) speed advisory signs shall be furnished and placed adjacent to the outside edge of the traveled way nearest to the lane being worked on. The first W8-7 sign shall be placed where the screenings begin with respect to the direction of travel on that lane. The W13-1 (35) signs need not be placed in those areas with posted speed limits of less than 40 MPH. The signs shall be placed at maximum 2,000-foot intervals along the edge of traveled way and at on-ramps, public roads or streets entering the seal coat area as directed by the Engineer.

The W8-7 and W13-1 signs shall be maintained in place at each location until final brooming of the seal coat surface at that location is completed. The W8-7 and W13-1 signs shall conform to the provisions for construction area signs in Section 12, "Construction Area Traffic Control Devices." The signs may be set on temporary portable supports with the W13-1 below the W8-7 or on barricades with the W13-1 sign alternating with the W8-7 sign.

In Section 37-1.07 replace the 2nd paragraph with:

Rollers shall be oscillating type pneumatic-tired rollers. A minimum of 2 pneumatic-tired rollers conforming to the provisions in Section 39-3.03 "Spreading and Compacting Equipment," shall be furnished.

In Section 37-1.09 replace the 2nd paragraph with:

The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in applying seal coat, complete in place, including furnishing, placing, maintaining, and removing W8-7 and W13-1 signs, when required, and temporary supports or barricades for the signs, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

In Section 37-2.05 replace the 6th paragraph with:

In addition to conforming to the provisions in Section 5-1.10, "Equipment," the identifying number of mixer-spreader trucks shall be at least 2 inches in height, located on the front and rear of the vehicle.

^^

SECTION 39 ASPHALT CONCRETE
(Issued 10-19-12)

Replace Section 39 with:

SECTION 39 HOT MIX ASPHALT

39-1 GENERAL

39-1.01 DESCRIPTION

Section 39 includes specifications for producing and placing hot mix asphalt (HMA) by mixing aggregate and asphalt binder at a mixing plant and spreading and compacting the HMA mixture.

The special provisions specify one or more types of HMA, including:

1. Type A
2. Type B
3. Open graded friction course (OGFC). OGFC includes hot mix asphalt (open graded)[HMA-O], rubberized hot mix asphalt (open graded) [RHMA-O] and rubberized hot mix asphalt (open graded high binder) [RHMA-O-HB]
4. Rubberized hot mix asphalt (gap graded) [RHMA-G]

The special provisions specify the HMA construction process, including:

1. Standard
2. Method
3. Quality Control / Quality Assurance (QC / QA)

39-1.02 MATERIALS

39-1.02A Geosynthetic Pavement Interlayer

Geosynthetic pavement interlayer must comply with the specifications in Section 88-1.07, "Pavement Interlayer," for the type of interlayer shown on the plans.

39-1.02B Tack Coat

Tack coat must comply with the specifications for asphaltic emulsion in Section 94, "Asphaltic Emulsion," or asphalt binder in Section 92, "Asphalts." Choose the type and grade.

Notify the Engineer if you dilute asphaltic emulsion with water. The weight ratio of added water to asphaltic emulsion must not exceed 1 to 1.

Measure added water either by weight or volume in compliance with the specifications for weighing, measuring, and metering devices under Section 9-1.01, "Measurement of Quantities," or you may use water meters from water districts, cities, or counties. If you measure water by volume, apply a conversion factor to determine the correct weight.

With each dilution, submit in writing:

1. The weight ratio of water to bituminous material in the original asphaltic emulsion
2. The weight of asphaltic emulsion before diluting
3. The weight of added water
4. The final dilution weight ratio of water to asphaltic emulsion

39-1.02C Asphalt Binder

Asphalt binder in HMA must comply with Section 92, "Asphalts," or Section 39-1.02D, "Asphalt Rubber Binder." The special provisions specify the grade.

Asphalt binder for geosynthetic pavement interlayer must comply with Section 92, "Asphalts." Choose from Grades PG 64-10, PG 64-16, or PG 70-10.

39-1.02D Asphalt Rubber Binder

General

Use asphalt rubber binder in RHMA-G, RHMA-O, and RHMA-O-HB. Asphalt rubber binder must be a combination of:

1. Asphalt binder

2. Asphalt modifier
3. Crumb rubber modifier (CRM)

The combined asphalt binder and asphalt modifier must be 80.0 ± 2.0 percent by weight of the asphalt rubber binder.

Asphalt Modifier

Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon, and comply with:

Asphalt Modifier for Asphalt Rubber Binder

Quality Characteristic	ASTM	Specification
Viscosity, m^2/s (x 10^{-6}) at 100 °C	D 445	X ± 3 [a]
Flash Point, CL.O.C., °C	D 92	207 minimum
Molecular Analysis		
Asphaltenes, percent by mass	D 2007	0.1 maximum
Aromatics, percent by mass	D 2007	55 minimum

Note:
[a] The symbol "X" is the proposed asphalt modifier viscosity. "X" must be between 19 and 36. A change in "X" requires a new asphalt rubber binder design.

Asphalt modifier must be from 2.0 percent to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder.

Crumb Rubber Modifier

CRM consists of a ground or granulated combination of scrap tire CRM and high natural CRM. CRM must be 75.0 ± 2.0 percent scrap tire CRM and 25.0 ± 2.0 percent high natural CRM by total weight of CRM. Scrap tire CRM must be from any combination of automobile tires, truck tires, or tire buffings.

Sample and test scrap tire CRM and high natural CRM separately. CRM must comply with:

Crumb Rubber Modifier for Asphalt Rubber Binder

Quality Characteristic	Test Method	Specification
Scrap tire CRM gradation (% passing No. 8 sieve)	LP-10	100
High natural CRM gradation (% passing No. 10 sieve)	LP-10	100
Wire in CRM (% max.)	LP-10	0.01
Fabric in CRM (% max.)	LP-10	0.05
CRM particle length (inch max.) [a]	--	3/16
CRM specific gravity [a]	CT 208	1.1 – 1.2
Natural rubber content in high natural CRM (%) [a]	ASTM D 297	40.0 – 48.0

Note:
[a] Test at mix design and for Certificate of Compliance.

Only use CRM ground and granulated at ambient temperature. If steel and fiber are cryogenically separated, it must occur before grinding and granulating. Only use cryogenically produced CRM particles that can be ground or granulated and not pass through the grinder or granulator.

CRM must be dry, free-flowing particles that do not stick together. CRM must not cause foaming when combined with the asphalt binder and asphalt modifier. You may add calcium carbonate or talc up to 3 percent by weight of CRM.

Asphalt Rubber Binder Design and Profile

Submit in writing an asphalt rubber binder design and profile that complies with the asphalt rubber binder specifications. In the design, designate the asphalt, asphalt modifier, and CRM and their proportions. The profile is not a performance specification and only serves to indicate expected trends in asphalt rubber binder properties during binder production. The profile must include the same component sources for the asphalt rubber binder used.

Design the asphalt rubber binder from testing you perform for each quality characteristic and for the reaction temperatures expected during production. The 24-hour (1,440-minute) interaction period determines the design

profile. At a minimum, mix asphalt rubber binder components, take samples, and perform and record the following tests:

Asphalt Rubber Binder Reaction Design Profile

Test	Minutes of Reaction [a]							Limits
	45	60	90	120	240	360	1440	
Cone penetration @ 77 °F, 0.10-mm (ASTM D 217)	X [b]				X		X	25 - 70
Resilience @ 77 °F, percent rebound (ASTM D 5329)	X				X		X	18 min.
Field softening point, °F (ASTM D 36)	X				X		X	125 - 165
Viscosity, centipoises (LP-11)	X	X	X	X	X	X	X	1,500 - 4,000

Notes:
[a] Six hours (360 minutes) after CRM addition, reduce the oven temperature to 275 °F for a period of 16 hours. After the 16-hour (1320 minutes) cool-down after CRM addition, reheat the binder to the reaction temperature expected during production for sampling and testing at 24 hours (1440 minutes).
[b] "X" denotes required testing

Asphalt Rubber Binder

After interacting for a minimum of 45 minutes, asphalt rubber binder must comply with:

Asphalt Rubber Binder

Quality Characteristic	Test for Quality Control or Acceptance	Test Method	Specification	
			Minimum	Maximum
Cone penetration @ 77 °F, 0.10-mm	Acceptance	ASTM D 217	25	70
Resilience @ 77 °F, percent rebound	Acceptance	ASTM D 5329	18	--
Field softening point, °F	Acceptance	ASTM D 36	125	165
Viscosity @ 375 °F, centipoises	Quality Control	LP-11	1,500	4,000

39-1.02E Aggregate

Aggregate must be clean and free from deleterious substances. Aggregate:

1. Retained on the No. 4 sieve is coarse
2. Passing the No. 4 sieve is fine
3. Added and passing the No. 30 sieve is supplemental fine, including:

    3.1. Hydrated lime
    3.2. Portland cement
    3.3. Fines from dust collectors

The special provisions specify the aggregate gradation for each HMA type.

The specified aggregate gradation is before the addition of asphalt binder and includes supplemental fines. The Engineer tests for aggregate grading under California Test 202, modified by California Test 105 if there is a difference in specific gravity of 0.2 or more between the coarse and fine parts of different aggregate blends.

Choose a sieve size target value (TV) within each target value limit presented in the aggregate gradation tables.

Aggregate Gradation
(Percentage Passing)
HMA Types A and B

3/4–inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	90 - 100	TV ±5
1/2"	70 - 90	TV ±6
No. 4	45 - 55	TV ±7
No. 8	32 - 40	TV ±5
No. 30	12 - 21	TV ±4
No. 200	2 - 7	TV ±2

1/2–inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	95 - 99	TV ±6
3/8"	75 - 95	TV ±6
No. 4	55 - 66	TV ±7
No. 8	38 - 49	TV ±5
No. 30	15 - 27	TV ±4
No. 200	2 - 8	TV ±2

3/8–inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	—
3/8"	95 - 100	TV ±6
No. 4	58 - 72	TV ±7
No. 8	34 - 48	TV ±6
No. 30	18 - 32	TV ±5
No. 200	2 - 9	TV ±2

No. 4 HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/8"	100	—
No. 4	95 - 100	TV ±7
No. 8	72 - 77	TV ±7
No. 30	37 - 43	TV ±7
No. 200	2 - 12	TV ±4

Rubberized Hot Mix Asphalt - Gap Graded (RHMA-G)

3/4–inch RHMA-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	95 - 100	TV ±5
1/2"	83 - 87	TV ±6
3/8"	65 - 70	TV ±6
No. 4	28 - 42	TV ±7
No. 8	14 - 22	TV ±5
No. 200	0 - 6	TV ±2

1/2–inch RHMA-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	90 - 100	TV ±6
3/8"	83 - 87	TV ±6
No. 4	28 - 42	TV ±7
No. 8	14 - 22	TV ±5
No. 200	0 - 6	TV ±2

Open Graded Friction Course (OGFC)

1–inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
1 1/2"	100	—
1"	99 - 100	TV ±5
3/4"	85 - 96	TV ±5
1/2"	55 - 71	TV ±6
No. 4	10 - 25	TV ±7
No. 8	6 - 16	TV ±5
No. 200	1 - 6	TV ±2

1/2–inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	95 - 100	TV ±6
3/8"	78 - 89	TV ±6
No. 4	28 - 37	TV ±7
No. 8	7 - 18	TV ±5
No. 30	0 - 10	TV ±4
No. 200	0 - 3	TV ±2

3/8–inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	—
3/8"	90 - 100	TV ±6
No. 4	29 - 36	TV ±7
No. 8	7 - 18	TV ±6
No. 30	0 - 10	TV ±5
No. 200	0 - 3	TV ±2

Before the addition of asphalt binder and lime treatment, aggregate must comply with:

Aggregate Quality

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Percent of crushed particles	CT 205				
Coarse aggregate (% min.)					
One fractured face		90	25	--	90
Two fractured faces		75	--	90	75
Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.)					
One fractured face		70	20	70	90
Los Angeles Rattler (% max.)	CT 211				
Loss at 100 Rev.		12	--	12	12
Loss at 500 Rev.		45	50	40	40
Sand equivalent (min.) [a]	CT 217	47	42	47	--
Fine aggregate angularity (% min.) [b]	CT 234	45	45	45	--
Flat and elongated particles (% max. by weight @ 5:1)	CT 235	10	10	10	10

Notes:

[a] Reported value must be the average of 3 tests from a single sample.

[b] The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

39-1.02F Reclaimed Asphalt Pavement

You may produce HMA using reclaimed asphalt pavement (RAP). HMA produced using RAP must comply with the specifications for HMA except aggregate quality specifications do not apply to RAP. You may substitute RAP aggregate for a part of the virgin aggregate in HMA in a quantity not exceeding 15.0 percent of the aggregate blend. Do not use RAP in OGFC and RHMA-G.

Assign the substitution rate of RAP aggregate for virgin aggregate with the job mix formula (JMF) submittal. The JMF must include the percent of RAP used. If you change your assigned RAP aggregate substitution rate by more than 5 percent (within the 15.0 percent limit), submit a new JMF.

Process RAP from asphalt concrete. You may process and stockpile RAP throughout the project's life. Prevent material contamination and segregation. Store RAP in stockpiles on smooth surfaces free of debris and organic material. Processed RAP stockpiles must consist only of homogeneous RAP.

39-1.03 HOT MIX ASPHALT MIX DESIGN REQUIREMENTS

39-1.03A General

A mix design consists of performing California Test 367 and laboratory procedures on combinations of aggregate gradations and asphalt binder contents to determine the optimum binder content (OBC) and HMA mixture qualities. If RAP is used, use Laboratory Procedure LP-9. The result of the mix design becomes the proposed JMF.

Use Form CEM-3512 to document aggregate quality and mix design data. Use Form CEM-3511 to present the JMF.

Laboratories testing aggregate qualities and preparing the mix design and JMF must be qualified under the Department's Independent Assurance Program. Take samples under California Test 125.

The Engineer reviews the aggregate qualities, mix design, and JMF and verifies and accepts the JMF.

You may change the JMF during production. Do not use the changed JMF until the Engineer accepts it. Except when adjusting the JMF in compliance with Section 39-1.03E, "Job Mix Formula Verification," perform a new mix design and submit in writing a new JMF submittal for changing any of the following:

1. Target asphalt binder percentage
2. Asphalt binder supplier
3. Asphalt rubber binder supplier
4. Component materials used in asphalt rubber binder or percentage of any component materials
5. Combined aggregate gradation
6. Aggregate sources
7. Substitution rate for RAP aggregate of more than 5 percent
8. Any material in the JMF

For OGFC, submit in writing a complete JMF submittal except asphalt binder content. The Engineer determines the asphalt binder content under California Test 368 within 20 days of your complete JMF submittal and provides you a Form CEM-3513.

39-1.03B Hot Mix Asphalt Mix Design

Perform a mix design that produces HMA in compliance with:

Hot Mix Asphalt Mix Design Requirements

Quality Characteristic	Test Method	HMA Type		
		A	B	RHMA-G
Air voids content (%)	CT 367[a]	4.0	4.0	Special Provisions
Voids in mineral aggregate (% min.)	LP-2			
No. 4 grading		17.0	17.0	--
3/8" grading		15.0	15.0	--
1/2" grading		14.0	14.0	18.0 – 23.0[b]
3/4" grading		13.0	13.0	18.0 – 23.0[b]
Voids filled with asphalt (%)	LP-3			
No. 4 grading		76.0 – 80.0	76.0 – 80.0	Note d
3/8" grading		73.0 – 76.0	73.0 – 76.0	
1/2" grading		65.0 – 75.0	65.0 – 75.0	
3/4" grading		65.0 – 75.0	65.0 – 75.0	
Dust proportion	LP-4			
No. 4 and 3/8" gradings		0.9 – 2.0	0.9 – 2.0	Note d
1/2" and 3/4" gradings		0.6 – 1.3	0.6 – 1.3	
Stabilometer value (min.) [c]	CT 366			
No. 4 and 3/8" gradings		30	30	--
1/2" and 3/4" gradings		37	35	23

Notes:

[a] Calculate the air voids content of each specimen using California Test 309 and Lab Procedure LP-1. Modify California Test 367, Paragraph C5, to use the exact air voids content specified in the selection of OBC.
[b] Voids in mineral aggregate for RHMA-G must be within this range.
[c] Modify California Test 304, Part 2.B.2.c: "After compaction in the compactor, cool to 140 °± 5 °F by allowing the briquettes to cool at room temperature for 0.5-hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[d] Report this value in the JMF submittal.

For stability and air voids content, prepare 3 briquettes at the OBC and test for compliance. Report the average of 3 tests. Prepare new briquettes and test if the range of stability for the 3 briquettes is more than 8 points. The average air void content may vary from the specified air void content by ±0.5 percent.

You may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If you use the same briquettes and tests using bulk specific gravity fail, you may prepare 3 new briquettes and determine a new bulk specific gravity.

39-1.03C Job Mix Formula Submittal

Each JMF submittal must consist of:

1. Proposed JMF on Form CEM-3511
2. Mix design documentation on Form CEM-3512 dated within 12 months of submittal
3. JMF verification on Form CEM-3513, if applicable
4. JMF renewal on Form CEM-3514, if applicable
5. Materials Safety Data Sheets (MSDS) for:

    5.1. Asphalt binder
    5.2. Base asphalt binder used in asphalt rubber binder
    5.3. CRM and asphalt modifier used in asphalt rubber binder
    5.4. Blended asphalt rubber binder mixture

5.5. Supplemental fine aggregate except fines from dust collectors
5.6. Antistrip additives

If the Engineer requests in writing, sample the following materials in the presence of the Engineer and place in labeled containers weighing no more than 50 pounds each:

1. Coarse, fine, and supplemental fine aggregate from stockpiles, cold feed belts, or hot bins. Samples must include at least 120 pounds for each coarse aggregate, 80 pounds for each fine aggregate, and 10 pounds for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF target values submitted on Form CEM-3511.
2. RAP from stockpiles or RAP system. Samples must be at least 60 pounds.
3. Asphalt binder from the binder supplier. Samples must be in two 1-quart cylindrical shaped cans with open top and friction lids.
4. Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical shaped cans with open top and friction lids.

Notify the Engineer in writing at least 2 business days before sampling materials. For aggregate and RAP, split the samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

39-1.03D Job Mix Formula Review

The Engineer reviews each mix design and proposed JMF within 5 business days from the complete JMF submittal. The review consists of reviewing the mix design procedures and comparing the proposed JMF with the specifications.

The Engineer may verify aggregate qualities during this review period.

39-1.03E Job Mix Formula Verification

If you cannot submit a Department-verified JMF on Form CEM-3513 dated within 12 months before HMA production, the Engineer verifies the JMF.

Based on your testing and production experience, you may submit on Form CEM-3511 an adjusted JMF before the Engineer's verification testing. JMF adjustments may include a change in the:

1. Asphalt binder content target value up to ±0.6 percent from the optimum binder content value submitted on Form CEM-3512 except do not adjust the target value for asphalt rubber binder for RHMA-G below 7.0 percent
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation tables

For HMA Type A, Type B, and RHMA-G, the Engineer verifies the JMF from samples taken from HMA produced by the plant to be used. Notify the Engineer in writing at least 2 business days before sampling materials.

In the Engineer's presence and from the same production run, take samples of:

1. Aggregate
2. Asphalt binder
3. RAP
4. HMA

Sample aggregate from cold feed belts or hot bins. Sample RAP from the RAP system. Sample HMA under California Test 125 except if you request in writing and the Engineer approves, you may sample from any of the following locations:

1. The plant
2. A truck
3. A windrow
4. The paver hopper
5. The mat behind the paver

You may sample from a different project including a non-Department project if you make arrangements for the Engineer to be present during sampling.

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 split parts to the Engineer and use 1 part for your testing.

The Engineer verifies each proposed JMF within 20 days of receiving all verification samples and the JMF submittal has been accepted. If you request in writing, the Engineer verifies RHMA-G quality requirements within 3 business days of sampling. Verification is testing for compliance with the specifications for:

1. Aggregate quality
2. Aggregate gradation (JMF TV ± tolerance)
3. Asphalt binder content (JMF TV ± tolerance)
4. HMA quality specified in the table Hot Mix Asphalt Mix Design Requirements except:

    4.1. Air voids content (design value ± 2.0 percent)
    4.2. Voids filled with asphalt (report only if an adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC)
    4.3. Dust proportion (report only if an adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC)

The Engineer prepares 3 briquettes from a single split sample. To verify the JMF for stability and air voids content, the Engineer tests the 3 briquettes and reports the average of 3 tests. The Engineer prepares new briquettes if the range of stability for the 3 briquettes is more than 8 points.

The Engineer may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If the Engineer uses the same briquettes and the tests using bulk specific gravity fail, the Engineer prepares 3 new briquettes and determines a new bulk specific gravity.

If the Engineer verifies the JMF, the Engineer provides you a Form CEM-3513.

If the Engineer's tests on plant-produced samples do not verify the JMF, the Engineer notifies you in writing and you must submit a new JMF submittal or submit an adjusted JMF based on your testing. JMF adjustments may include a change in the:

1. Asphalt binder content target value up to ±0.6 percent from the optimum binder content value submitted on Form CEM-3512 except do not adjust the target value for asphalt rubber binder for RHMA-G below 7.0 percent
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation tables

You may adjust the JMF only once due to a failed verification test. An adjusted JMF requires a new Form CEM-3511 and verification of a plant-produced sample.

A verified JMF is valid for 12 months.

For each HMA type and aggregate size specified, the Engineer verifies at the State's expense up to 2 proposed JMF including a JMF adjusted after verification failure. The Engineer deducts $3,000 from payments for each verification exceeding this limit. This deduction does not apply to verifications initiated by the Engineer or JMF renewal.

39-1.03F Job Mix Formula Renewal

You may request a JMF renewal by submitting the following:

1. Proposed JMF on Form CEM-3511
2. A previously verified JMF documented on Form CEM-3513 dated within 12 months
3. Mix design documentation on Form CEM-3512 used for the previously verified JMF

If the Engineer requests in writing, sample the following materials in the presence of the Engineer and place in labeled containers weighing no more than 50 pounds each:

1. Coarse, fine, and supplemental fine aggregate from stockpiles, cold feed belts, or hot bins. Samples must include at least 120 pounds for each coarse aggregate, 80 pounds for each fine aggregate, and 10 pounds for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF target values submitted on Form CEM-3511.
2. RAP from stockpiles or RAP system. Samples must be at least 60 pounds.
3. Asphalt binder from the binder supplier. Samples must be in two 1-quart cylindrical shaped cans with open top and friction lids.

4. Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical shaped cans with open top and friction lids.

Notify the Engineer in writing at least 2 business days before sampling materials. For aggregate and RAP, split samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

The Engineer may verify aggregate qualities during this review period.

Notify the Engineer in writing at least 2 business days before sampling materials. For aggregate, RAP, and HMA, split the samples into at least 4 parts. Submit 3 parts to the Engineer and use 1 part for your testing.

The Engineer verifies the JMF renewal submittal under Section 39-1.03E, "Job Mix Formula Verification," except:

1. The Engineer retains samples until you provide test results for your part on Form CEM-3514.
2. The Engineer tests samples of materials obtained from the HMA production unit after you submit test results that comply with the specifications for the quality characteristics under Section 39-1.03E, "Job Mix Formula Verification."
3. The Engineer verifies each proposed JMF renewal within 20 days of receiving verification samples.
4. You may not adjust the JMF due to a failed verification.
5. For each HMA type and aggregate gradation specified, the Engineer verifies at the State's expense 1 proposed JMF renewal within a 12-month period.

The most recent aggregate quality test results within the past 12 months may be used for verification of JMF renewal or the Engineer may perform aggregate quality tests for verification of JMF renewal.

If the Engineer verifies the JMF renewal, the Engineer provides you a Form CEM-3513.

39-1.03G Job Mix Formula Modification

For an accepted JMF, you may change binder source one time during production.

Submit your modified JMF request a minimum of 3 business days before production. Each modified JMF submittal must consist of:

1. Proposed modified JMF on Form CEM-3511.
2. Mix design records on Form CEM-3512 for the accepted JMF to be modified.
3. JMF verification on Form CEM-3513 for the accepted JMF to be modified.
4. Quality characteristics test results for the modified JMF as specified in section 39-1.03B. Perform tests at the mix design OBC as shown on Form CEM-3512.
5. If required, California Test 371 test results for the modified JMF.

With an accepted modified JMF submittal, the Engineer verifies each modified JMF within 5 business days of receiving all verification samples. If California Test 371 is required, the Engineer tests for California Test 371 within 10 days of receiving verification samples.

The Engineer verifies the modified JMF after the modified JMF HMA is placed on the project and verification samples are taken within the first 750 tons following sampling requirements in Section 39-1.03E, "Job Mix Formula Verification." The Engineer tests verification samples for compliance with:

1. Stability as shown in the table titled "Hot Mix Asphalt Mix Design Requirements"
2. Air void content at design value ±2.0 percent
3. Voids in mineral aggregate as shown in the table titled "Hot Mix Asphalt Mix Design Requirements"
4. Voids filled with asphalt if an adjustment for asphalt binder content TV is more than ±0.3 percent from the original OBC shown on Form CEM-3512.
5. Dust proportion if an adjustment for asphalt binder content TV is more than ±0.3 percent from OBC shown on Form CEM-3512.

If the modified JMF is verified, the Engineer revises your Form CEM-3513 to include the new binder source. Your revised Form CEM-3513 will have the same expiration date as the original Form CEM-3513 for the accepted JMF that is modified.

If a modified JMF is not verified, stop production and any HMA placed using the modified JMF is rejected.

The Engineer deducts $2,000 from payments for each modified JMF verification. The Engineer deducts an additional $2,000 from payments for each modified JMF verification that requires California Test 371.

39-1.03H Job Mix Formula Acceptance

You may start HMA production if:

1. The Engineer's review of the JMF shows compliance with the specifications.
2. The Department has verified the JMF within 12 months before HMA production.
3. The Engineer accepts the verified JMF.

39-1.04 CONTRACTOR QUALITY CONTROL

39-1.04A General

Establish, maintain, and change a quality control system to ensure materials and work comply with the specifications. Submit quality control test results to the Engineer within 3 business days of a request except when QC / QA is specified.

You must identify the HMA sampling location in your Quality Control Plan. During production, take samples under California Test 125. You may sample HMA from:

1. The plant
2. The truck
3. A windrow
4. The paver hopper
5. The mat behind the paver

39-1.04B Prepaving Conference

Meet with the Engineer at a prepaving conference at a mutually agreed time and place. Discuss methods of performing the production and paving work.

39-1.04C Asphalt Rubber Binder

Take asphalt rubber binder samples from the feed line connecting the asphalt rubber binder tank to the HMA plant. Sample and test asphalt rubber binder under Laboratory Procedure LP-11.

Test asphalt rubber binder for compliance with the viscosity specifications in Section 39-1.02, "Materials." During asphalt rubber binder production and HMA production using asphalt rubber binder, measure viscosity every hour with not less than 1 reading for each asphalt rubber binder batch. Log measurements with corresponding time and asphalt rubber binder temperature. Submit the log daily in writing.

Submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance." With the Certificate of Compliance, submit test results in writing for CRM and asphalt modifier with each truckload delivered to the HMA plant. A Certificate of Compliance for asphalt modifier must not represent more than 5,000 pounds. Use an AASHTO-certified laboratory for testing.

Sample and test gradation and wire and fabric content of CRM once per 10,000 pounds of scrap tire CRM and once per 3,400 pounds of high natural CRM. Sample and test scrap tire CRM and high natural CRM separately.

Submit certified weight slips in writing for the CRM and asphalt modifier furnished.

39-1.04D Aggregate

Determine the aggregate moisture content and RAP moisture content in continuous mixing plants at least twice a day during production and adjust the plant controller. Determine the RAP moisture content in batch mixing plants at least twice a day during production and adjust the plant controller.

39-1.04E Reclaimed Asphalt Pavement

Perform RAP quality control testing each day.

Sample RAP once daily and determine the RAP aggregate gradation under Laboratory Procedure LP-9 and submit the results to the Engineer in writing with the combined aggregate gradation.

39-1.04F Density Cores

To determine density for Standard and QC / QA projects, take 4-inch or 6-inch diameter density cores at least once every 5 business days. Take 1 density core for every 250 tons of HMA from random locations the Engineer designates. Take density cores in the Engineer's presence and backfill and compact holes with material authorized by the Engineer. Before submitting a density core to the Engineer, mark it with the density core's location and place it in a protective container.

If a density core is damaged, replace it with a density core taken within 1 foot longitudinally from the original density core. Relocate any density core located within 1 foot of a rumble strip to 1 foot transversely away from the rumble strip.

39-1.04G Briquettes

Prepare 3 briquettes for each stability and air voids content determination. Report the average of 3 tests. Prepare new briquettes and test if the range of stability for the 3 briquettes is more than 12 points.

You may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If you use these briquettes and tests using bulk specific gravity fail, you may prepare 3 new briquettes and determine a new bulk specific gravity.

39-1.05 ENGINEER'S ACCEPTANCE

The Engineer's acceptance of HMA is specified in the sections for each HMA construction process.

The Engineer samples materials for testing under California Test 125 and the applicable test method except samples may be taken from:

1. The plant from:

    1.1. A truck
    1.2. An automatic sampling device

2. The mat behind the paver

Sampling must be independent of Contractor quality control, statistically-based, and random.

If you request, the Engineer splits samples and provides you with a part.

The Engineer accepts HMA based on:

1. Accepted JMF
2. Accepted QCP for Standard and QC / QA
3. Compliance with the HMA Acceptance tables
4. Acceptance of a lot for QC / QA
5. Visual inspection

The Engineer prepares 3 briquettes for each stability and air voids content determination. The Engineer reports the average of 3 tests. The Engineer prepares new briquettes and test if the range of stability for the 3 briquettes is more than 8 points.

The Engineer may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If the Engineer uses the same briquettes and the tests using bulk specific gravity fail, the Engineer prepares 3 new briquettes and determines a new bulk specific gravity.

39-1.06 DISPUTE RESOLUTION

You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer in writing within 5 business days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit written quality control test results and copies of paperwork including worksheets used to determine the disputed test results to the Engineer. An Independent Third Party (ITP) performs referee testing. Before the ITP participates in a dispute resolution, the ITP must be accredited under the Department's Independent Assurance Program. The ITP must be independent of the project. By mutual agreement, the ITP is chosen from:

1. A Department laboratory
2. A Department laboratory in a district or region not in the district or region the project is located
3. The Transportation Laboratory
4. A laboratory not currently employed by you or your HMA producer

If split quality control or acceptance samples are not available, the ITP uses any available material representing the disputed HMA for evaluation.

39-1.07 PRODUCTION START-UP EVALUATION

The Engineer evaluates HMA production and placement at production start-up.

Within the first 750 tons produced on the first day of HMA production, in the Engineer's presence and from the same production run, take samples of:

1. Aggregate
2. Asphalt binder
3. RAP
4. HMA

Sample aggregate from cold feed belts or hot bins. Take RAP samples from the RAP system. Sample HMA under California Test 125 except if you request in writing and the Engineer approves, you may sample HMA from:

1. The plant
2. The truck
3. A windrow
4. The paver hopper
5. The mat behind the paver

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 split parts to the Engineer and keep 1 part.

For Standard and QC / QA projects, you and the Engineer must test the split samples and report test results in writing within 3 business days of sampling. If you proceed before receipt of the test results, the Engineer may consider the HMA placed to be represented by these test results.

For Standard and QC / QA projects, take 4-inch or 6-inch diameter density cores within the first 750 tons on the first day of HMA production. For each density core, the Engineer reports the bulk specific gravity determined under California Test 308, Method A in addition to the percent of maximum theoretical density. You may test for in-place density at the density core locations and include them in your production tests for percent of maximum theoretical density.

39-1.08 PRODUCTION

39-1.08A General

Produce HMA in a batch mixing plant or a continuous mixing plant. Proportion aggregate by hot or cold feed control.

HMA plants must be Department-qualified. Before production, the HMA plant must have a current qualification under the Department's Materials Plant Quality Program.

During production, you may adjust:

1. Hot or cold feed proportion controls for virgin aggregate and RAP
2. The set point for asphalt binder content

39-1.08B Mixing

Mix HMA ingredients into a homogeneous mixture of coated aggregates.

Asphalt binder must be between 275 °F and 375 °F when mixed with aggregate.

Asphalt rubber binder must be between 375 °F and 425 °F when mixed with aggregate.

When mixed with asphalt binder, aggregate must not be more than 325 °F except aggregate for OGFC with unmodified asphalt binder must be not more than 275 °F. Aggregate temperature specifications do not apply when you use RAP.

HMA with or without RAP must not be more than 325 °F.

39-1.08C Asphalt Rubber Binder

Deliver scrap tire CRM and high natural CRM in separate bags.

Either proportion and mix asphalt binder, asphalt modifier, and CRM simultaneously or premix the asphalt binder and asphalt modifier before adding CRM. If you premix asphalt binder and asphalt modifier, asphalt binder must be from 375 to 425 degrees F when you add the asphalt modifier. Mix them for at least 20 minutes. When you add CRM, the asphalt binder and asphalt modifier must be between 375 °F and 425 °F.

Do not use asphalt rubber binder during the first 45 minutes of the reaction period. During this period, the asphalt rubber binder mixture must be between 375 °F and the lower of 425 °F or 25 °F below the asphalt binder's flash point indicated in the MSDS.

If any asphalt rubber binder is not used within 4 hours after the reaction period, discontinue heating. If the asphalt rubber binder drops below 375 °F, reheat before use. If you add more scrap tire CRM to the reheated asphalt rubber binder, the binder must undergo a 45-minute reaction period. The added scrap tire CRM must not exceed 10 percent of the total asphalt rubber binder weight. Reheated and reacted asphalt rubber binder must comply with the viscosity specifications for asphalt rubber binder in Section 39-1.02, "Materials." Do not reheat asphalt rubber binder more than twice.

39-1.09 SUBGRADE, TACK COAT, AND GEOSYNTHETIC PAVEMENT INTERLAYER

39-1.09A General

Prepare subgrade or apply tack coat to surfaces receiving HMA. If specified, place geosynthetic pavement interlayer over a coat of asphalt binder.

39-1.09B Subgrade

Subgrade to receive HMA must comply with the compaction and elevation tolerance specifications in the sections for the material involved. Subgrade must be free of loose and extraneous material. If HMA is paved on existing base or pavement, remove loose paving particles, dirt, and other extraneous material by any means including flushing and sweeping.

39-1.09C Tack Coat

Apply tack coat:

1. To existing pavement including planed surfaces
2. Between HMA layers
3. To vertical surfaces of:

    3.1. Curbs
    3.2. Gutters
    3.3. Construction joints

Before placing HMA, apply tack coat in 1 application at the minimum residual rate specified for the condition of the underlying surface:

Tack Coat Application Rates for HMA Type A, Type B, and RHMA-G

HMA over:	Minimum Residual Rates (gallons per square yard)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA (between layers)	0.02	0.03	0.02
PCC and existing HMA (AC) surfaces	0.03	0.04	0.03
Planed PCC and HMA (AC) surfaces	0.05	0.06	0.04

Tack Coat Application Rates for OGFC

OGFC over:	Minimum Residual Rates (gallons per square yard)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA	0.03	0.04	0.03
PCC and existing HMA (AC) surfaces	0.05	0.06	0.04
Planed PCC and HMA (AC) surfaces	0.06	0.07	0.05

If you dilute asphaltic emulsion, mix until homogeneous before application.

Apply to vertical surfaces with a residual tack coat rate that will thoroughly coat the vertical face without running off.

If you request in writing and the Engineer authorizes, you may:

1. Change tack coat rates
2. Omit tack coat between layers of new HMA during the same work shift if:

    2.1. No dust, dirt, or extraneous material is present
    2.2. The surface is at least 140 °F

Immediately in advance of placing HMA, apply additional tack coat to damaged areas or where loose or extraneous material is removed.

Close areas receiving tack coat to traffic. Do not track tack coat onto pavement surfaces beyond the job site.

Asphalt binder tack coat must be between 285 °F and 350 °F when applied.

39-1.09D Geosynthetic Pavement Interlayer

Place geosynthetic pavement interlayer in compliance with the manufacturer's recommendations.

Before placing the geosynthetic pavement interlayer and asphalt binder:

1. Repair cracks 1/4 inch and wider, spalls, and holes in the pavement. The State pays for this repair work under Section 4-1.03D, "Extra Work."
2. Clean the pavement of loose and extraneous material.

Immediately before placing the interlayer, apply 0.25 gallon ± 0.03 gallon of asphalt binder per square yard of interlayer or until the fabric is saturated. Apply asphalt binder the width of the geosynthetic pavement interlayer plus 3 inches on each side. At interlayer overlaps, apply asphalt binder on the lower interlayer the same overlap distance as the upper interlayer.

Asphalt binder must be from 285 °F to 350 °F and below the minimum melting point of the geosynthetic pavement interlayer when applied.

Align and place the interlayer with no overlapping wrinkles, except a wrinkle that overlaps may remain if it is less than 1/2 inch thick. If the overlapping wrinkle is more than 1/2 inch thick, cut the wrinkle out and overlap the interlayer no more than 2 inches.

The minimum HMA thickness over the interlayer must be 0.12 foot thick including conform tapers. Do not place the interlayer on a wet or frozen surface.

Overlap the interlayer borders between 2 inches and 4 inches. In the direction of paving, overlap the following roll with the preceding roll at any break.

You may use rolling equipment to correct distortions or wrinkles in the interlayer.

If asphalt binder tracked onto the interlayer or brought to the surface by construction equipment causes interlayer displacement, cover it with a small quantity of HMA.

Before placing HMA on the interlayer, do not expose the interlayer to:

1. Traffic except for crossings under traffic control and only after you place a small HMA quantity
2. Sharp turns from construction equipment
3. Damaging elements

Pave HMA on the interlayer during the same work shift.

39-1.10 SPREADING AND COMPACTING EQUIPMENT

Paving equipment for spreading must be:

1. Self-propelled
2. Mechanical
3. Equipped with a screed or strike-off assembly that can distribute HMA the full width of a traffic lane
4. Equipped with a full-width compacting device
5. Equipped with automatic screed controls and sensing devices that control the thickness, longitudinal grade, and transverse screed slope

Install and maintain grade and slope references.

The screed must produce a uniform HMA surface texture without tearing, shoving, or gouging.

The paver must not leave marks such as ridges and indentations unless you can eliminate them by rolling.

Rollers must be equipped with a system that prevents HMA from sticking to the wheels. You may use a parting agent that does not damage the HMA or impede the bonding of layers.

In areas inaccessible to spreading and compacting equipment:

1. Spread the HMA by any means to obtain the specified lines, grades and cross sections.
2. Use a pneumatic tamper, plate compactor, or equivalent to achieve thorough compaction.

39-1.11 TRANSPORTING, SPREADING, AND COMPACTING

Do not pave HMA on a wet pavement or frozen surface.

You may deposit HMA in a windrow and load it in the paver if:

1. Paver is equipped with a hopper that automatically feeds the screed
2. Loading equipment can pick up the windrowed material and deposit it in the paver hopper without damaging base material
3. Activities for deposit, pick-up, loading, and paving are continuous
4. HMA temperature in the windrow does not fall below 260 °F

You may pave HMA in 1 or more layers on areas less than 5 feet wide and outside the traveled way including shoulders. You may use mechanical equipment other than a paver for these areas. The equipment must produce a uniform smoothness and texture.

HMA handled, spread, or windrowed must not stain the finished surface of any improvement including pavement.

Do not use petroleum products such as kerosene or diesel fuel to release HMA from trucks, spreaders, or compactors.

HMA must be free of:

1. Segregation
2. Coarse or fine aggregate pockets
3. Hardened lumps

Longitudinal joints in the top layer must match specified lane edges. Alternate longitudinal joint offsets in lower layers at least 0.5 foot from each side of the specified lane edges. You may request in writing other longitudinal joint placement patterns.

Until the adjoining through lane's top layer has been paved, do not pave the top layer of:

1. Shoulders
2. Tapers
3. Transitions
4. Road connections
5. Driveways
6. Curve widenings
7. Chain control lanes

8. Turnouts
9. Turn pockets

If the number of lanes change, pave each through lane's top layer before paving a tapering lane's top layer. Simultaneous to paving a through lane's top layer, you may pave an adjoining area's top layer including shoulders. Do not operate spreading equipment on any area's top layer until completing final compaction.

If HMA (leveling) is specified, fill and level irregularities and ruts with HMA before spreading HMA over base, existing surfaces, or bridge decks. You may use mechanical equipment other than a paver for these areas. The equipment must produce a uniform smoothness and texture. HMA used to change an existing surface's cross slope or profile is not HMA (leveling).

If placing HMA against the edge of existing pavement, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material without damaging the surface remaining in place. If placing HMA against the edge of a longitudinal or transverse construction joint and the joint is damaged or not placed to a neat line, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material without damaging the surface remaining in place. Repair or remove and replace damaged pavement at your expense.

Rolling must leave the completed surface compacted and smooth without tearing, cracking, or shoving. Complete finish rolling activities before the pavement surface temperature is:

1. Below 150 °F for HMA with unmodified binder
2. Below 140 °F for HMA with modified binder
3. Below 200 °F for RHMA-G

If a vibratory roller is used as a finish roller, turn the vibrator off.

Do not use a pneumatic tired roller to compact RHMA-G.

For Standard and QC/QA, if a 3/4-inch aggregate grading is specified, you may use a 1/2-inch aggregate grading if the specified total paved thickness is at least 0.15 foot and less than 0.20 foot thick.

Spread and compact HMA under Section 39-3.03, "Spreading and Compacting Equipment," and Section 39-3.04, "Transporting, Spreading, and Compacting," for any of the following:

1. Specified paved thickness is less than 0.15 foot.
2. Specified paved thickness is less than 0.20 foot and a 3/4-inch aggregate grading is specified and used.
3. You spread and compact at:

    3.1. Asphalt concrete surfacing replacement areas
    3.2. Leveling courses
    3.3. Areas the Engineer determines conventional compaction and compaction measurement methods are impeded

Do not open new HMA pavement to public traffic until its mid-depth temperature is below 160 °F.

If you request in writing and the Engineer authorizes, you may cool HMA Type A and Type B with water when rolling activities are complete. Apply water under Section 17, "Watering."

Spread sand at a rate between 1 pound and 2 pounds per square yard on new RHMA-G, RHMA-O, and RHMA-O-HB pavement when finish rolling is complete. Sand must be free of clay or organic matter. Sand must comply with Section 90-3.03, "Fine Aggregate Grading." Keep traffic off the pavement until spreading sand is complete.

39-1.12 SMOOTHNESS

39-1.12A General

Determine HMA smoothness with a profilograph and a straightedge.

Smoothness specifications do not apply to OGFC placed on existing pavement not constructed under the same project.

If portland cement concrete is placed on HMA:

1. Cold plane the HMA finished surface to within specified tolerances if it is higher than the grade specified by the Engineer.
2. Remove and replace HMA if the finished surface is lower than 0.05 foot below the grade specified by the Engineer.

39-1.12B Straightedge

The HMA pavement top layer must not vary from the lower edge of a 12-foot long straightedge:

1. More than 0.01 foot when the straight edge is laid parallel with the centerline
2. More than 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. More than 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

39-1.12C Profilograph

Under California Test 526, determine the zero (null) blanking band Profile Index (PI_0) and must-grinds on the top layer of HMA Type A, Type B, and RHMA-G pavement. Take 2 profiles within each traffic lane, 3 feet from and parallel with the edge of each lane.

A must-grind is a deviation of 0.3 inch or more in a length of 25 feet. You must correct must-grinds.

For OGFC, only determine must-grinds when placed over HMA constructed under the same project. The top layer of the underlying HMA must comply with the smoothness specifications before placing OGFC.

Profile pavement in the Engineer's presence. Choose the time of profiling.

On tangents and horizontal curves with a centerline radius of curvature 2,000 feet or more, the PI_0 must be at most 2.5 inches per 0.1-mile section.

On horizontal curves with a centerline radius of curvature between 1,000 feet and 2,000 feet including pavement within the superelevation transitions, the PI_0 must be at most 5 inches per 0.1-mile section.

Before the Engineer accepts HMA pavement for smoothness, submit written final profilograms.

Submit 1 electronic copy of profile information in Microsoft Excel and 1 electronic copy of longitudinal pavement profiles in ".erd" format or other ProVAL compatible format to the Engineer and to:

Smoothness@dot.ca.gov

The following HMA pavement areas do not require a PI_0. You must measure these areas with a 12-foot straightedge and determine must-grinds with a profilograph:

1. New HMA with a total thickness less than 0.25 foot
2. HMA sections of city or county streets and roads, turn lanes and collector lanes that are less than 1,500 feet in length

The following HMA pavement areas do not require a PI_0. You must measure these areas with a 12-foot straightedge:

1. Horizontal curves with a centerline radius of curvature less than 1,000 feet including pavement within the superelevation transitions of those curves
2. Within 12 feet of a transverse joint separating the pavement from:

    2.1. Existing pavement not constructed under the same project
    2.2. A bridge deck or approach slab

3. Exit ramp termini, truck weigh stations, and weigh-in-motion areas
4. If steep grades and superelevation rates greater than 6 percent are present on:

    4.1. Ramps
    4.2. Connectors

5. Turn lanes
6. Areas within 15 feet of manholes or drainage transitions
7. Acceleration and deceleration lanes for at-grade intersections
8. Shoulders and miscellaneous areas
9. HMA pavement within 3 feet from and parallel to the construction joints formed between curbs, gutters, or existing pavement

39-1.12D Smoothness Correction

If the top layer of HMA Type A, Type B, or RHMA-G pavement does not comply with the smoothness specifications, grind the pavement to within tolerances, remove and replace it, or place a layer of HMA. The Engineer must authorize your choice of correction before the work begins.

Remove and replace the areas of OGFC not in compliance with the must-grind and straightedge specifications, except you may grind OGFC for correcting smoothness:

1. At a transverse joint separating the pavement from pavement not constructed under the same project
2. Within 12 feet of a transverse joint separating the pavement from a bridge deck or approach slab

Corrected HMA pavement areas must be uniform rectangles with edges:

1. Parallel to the nearest HMA pavement edge or lane line
2. Perpendicular to the pavement centerline

Measure the corrected HMA pavement surface with a profilograph and a 12-foot straightedge and correct the pavement to within specified tolerances. If a must-grind area or straightedged pavement cannot be corrected to within specified tolerances, remove and replace the pavement.

On ground areas not overlaid with OGFC, apply fog seal coat under Section 37-1, "Seal Coats."

39-1.13 MISCELLANEOUS AREAS AND DIKES

Miscellaneous areas are outside the traveled way and include:

1. Median areas not including inside shoulders
2. Island areas
3. Sidewalks
4. Gutters
5. Gutter flares
6. Ditches
7. Overside drains
8. Aprons at the ends of drainage structures

Spread miscellaneous areas in 1 layer and compact to the specified lines and grades.

For miscellaneous areas and dikes:

1. Do not submit a JMF.
2. Choose the 3/8-inch or 1/2-inch HMA Type A and Type B aggregate gradations.
3. Minimum asphalt binder content must be 6.8 percent for 3/8-inch aggregate and 6.0 percent for 1/2-inch aggregate. If you request in writing and the Engineer authorizes, you may reduce the minimum asphalt binder content.
4. Choose asphalt binder Grade PG 70-10 or the same grade specified for HMA.

39-2 STANDARD

39-2.01 DESCRIPTION

If HMA is specified as Standard, construct it under Section 39-1, "General," this Section 39-2, "Standard," and Section 39-5, "Measurement and Payment."

39-2.02 CONTRACTOR QUALITY CONTROL

39-2.02A Quality Control Plan

Establish, implement, and maintain a Quality Control Plan (QCP) for HMA. The QCP must describe the organization and procedures you will use to:

1. Control the quality characteristics
2. Determine when corrective actions are needed (action limits)
3. Implement corrective actions

When you submit the proposed JMF, submit the written QCP. You and the Engineer must discuss the QCP during the prepaving conference.

The QCP must address the elements affecting HMA quality including:

1. Aggregate
2. Asphalt binder
3. Additives
4. Production
5. Paving

The Engineer reviews each QCP within 5 business days from the submittal. Hold HMA production until the Engineer accepts the QCP in writing. The Engineer's QCP acceptance does not mean your compliance with the QCP will result in acceptable HMA. Section 39-1.05, "Engineer's Acceptance," specifies HMA acceptance.

39-2.02B Quality Control Testing

Perform sampling and testing at the specified frequency for the following quality characteristics:

Minimum Quality Control – Standard

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	HMA Type			
			A	B	RHMA-G	OGFC
Aggregate gradation[a]	CT 202	1 per 750 tons and any remaining part at the end of the project	JMF ± Tolerance[b]	JMF ± Tolerance[b]	JMF ± Tolerance[b]	JMF ± Tolerance[b]
Sand equivalent (min.)[c]	CT 217		47	42	47	--
Asphalt binder content (%)	CT 379 or 382		JMF ± 0.45	JMF ± 0.45	JMF ± 0.50	JMF ± 0.50
HMA moisture content (%, max.)	CT 226 or CT 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	1.0
Field compaction, (%, max. theoretical density)[d,e]	Quality control plan	2 per business day (min.)	91 - 97	91 - 97	91 - 97	--
Stabilometer value (min.)[c, f]	CT 366	One per 4,000 tons or 2 per 5 business days, which-ever is more				
No. 4 and 3/8" gradings			30	30	--	--
1/2" and 3/4" gradings			37	35	23	--
Air voids content (%)[c, g]	CT 367		4 ± 2	4 ± 2	Specification ± 2	--
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants[h]	CT 226 or CT 370	2 per day during production	--	--	--	--
Percent of crushed particles coarse aggregate (%, min.)	CT 205	As necessary and designat-ed in the QCP. At least once per project				
One fractured face			90	25	--	90
Two fractured faces			75	--	90	75
Fine aggregate (%, min)						
(Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face			70	20	70	90
Los Angeles Rattler (%, max.)	CT 211					
Loss at 100 rev.			12	--	12	12
Loss at 500 rev.			45	50	40	40

Flat and elongated particles (%, max. by weight @ 5:1)	CT 235		Report only	Report only	Report only	Report only
Fine aggregate angularity (%, min.)[i]	CT 234		45	45	45	--
Voids filled with asphalt (%)[j] No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-3		 76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	 76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	Report only	--
Voids in mineral aggregate (% min.)[j] No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-2		 17.0 15.0 14.0 13.0	 17.0 15.0 14.0 13.0	 -- -- 18.0 – 23.0 [k] 18.0 – 23.0 [k]	--
Dust proportion[j] No. 4 and 3/8" gradings 1/2" and 3/4" gradings	LP-4		 0.9 – 2.0 0.6 – 1.3	 0.9 – 2.0 0.6 – 1.3	Report only	--
Smoothness	Section 39-1.12	--	12-foot straightedge, must-grind, and PI_0	12-foot straightedge, must-grind, and PI_0	12-foot straightedge, must-grind, and PI_0	12-foot straightedge and must-grind
Asphalt rubber binder viscosity @ 375 °F, centipoises	Section 39-1.02D	Section 39-1.04C	--	--	1,500 – 4,000	1,500 – 4,000
Asphalt modifier	Section 39-1.02D	Section 39-1.04C	--	--	Section 39-1.02D	Section 39-1.02D
Crumb rubber modifier	Section 39-1.02D	Section 39-1.04C	--	--	Section 39-1.02D	Section 39-1.02D

Notes:

[a] Determine combined aggregate gradation containing RAP under Laboratory Procedure LP-9.

[b] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."

[c] Report the average of 3 tests from a single split sample.

[d] Determine field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, No. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

[e] To determine field compaction use:

1. In-place density measurements using the method specified in your QC.
2. California Test 309 to determine maximum theoretical density at the frequency specified in California Test 375, Part 5C.

[f] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."

[g] Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

[h] For adjusting the plant controller at the HMA plant.

[i] The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

[j] Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.

[k] Voids in mineral aggregate for RHMA-G must be within this range.

For any single quality characteristic except smoothness, if 2 consecutive quality control test results do not comply with the action limits or specifications:

1. Stop production.
2. Notify the Engineer in writing.
3. Take corrective action.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

39-2.03 ENGINEER'S ACCEPTANCE

39-2.03A Testing

The Engineer samples for acceptance testing and tests for:

HMA Acceptance - Standard

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Aggregate gradation [a]	CT 202	JMF ± Tolerance [c]	JMF ± Tolerance [c]	JMF ± Tolerance [c]	JMF ± Tolerance [c]
Sieve: 3/4" / 1/2" / 3/8"					
1/2": X [b] / /					
3/8": / X /					
No. 4: / / X					
No. 8: X / X / X					
No. 200: X / X / X					
Sand equivalent (min.) [d]	CT 217	47	42	47	--
Asphalt binder content (%)	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.50	JMF ± 0.50
HMA moisture content (%, max.)	CT 226 or CT 370	1.0	1.0	1.0	1.0
Field compaction (% max. theoretical density) [e,f]	CT 375	91 – 97	91 – 97	91 – 97	--
Stabilometer value (min.) [d,g]	CT 366				
No. 4 and 3/8" gradings		30	30	--	--
1/2" and 3/4" gradings		37	35	23	--
Air voids content (%) [d, h]	CT 367	4 ± 2	4 ± 2	Specification ± 2	--
Percent of crushed particles	CT 205				
Coarse aggregate (%, min.)					
One fractured face		90	25	--	90
Two fractured faces		75	--	90	75
Fine aggregate (%, min) (Passing No. 4 sieve and retained on No. 8 sieve.)					
One fractured face		70	20	70	90
Los Angeles Rattler (%, max.)	CT 211				
Loss at 100 rev.		12	--	12	12
Loss at 500 rev.		45	50	40	40
Fine aggregate angularity (%, min.) [i]	CT 234	45	45	45	--
Flat and elongated particles (%, max. by weight @ 5:1)	CT 235	Report only	Report only	Report only	Report only
Voids filled with asphalt (%) [j]	LP-3				
No. 4 grading		76.0 – 80.0	76.0 – 80.0	Report only	
3/8" grading		73.0 – 76.0	73.0 – 76.0		--
1/2" grading		65.0 – 75.0	65.0 – 75.0		
3/4" grading		65.0 – 75.0	65.0 – 75.0		
Voids in mineral aggregate (% min.) [j]	LP-2				
No. 4 grading		17.0	17.0	--	
3/8" grading		15.0	15.0	--	--
1/2" grading		14.0	14.0	18.0 – 23.0 [k]	
3/4" grading		13.0	13.0	18.0 – 23.0 [k]	
Dust proportion [j]	LP-4				
No. 4 and 3/8" gradings		0.9 – 2.0	0.9 – 2.0	Report only	--
1/2" and 3/4" gradings		0.6 – 1.3	0.6 – 1.3		
Smoothness	Section 39-1.12	12-foot straightedge, must-grind, and PI_0	12-foot straightedge, must-grind, and PI_0	12-foot straightedge, must-grind, and PI_0	12-foot straightedge and must-grind
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92
Asphalt rubber binder	Various	--	--	Section 92-	Section 92-

				1.02(C) and Section 39-1.02D	1.02(C) and Section 39-1.02D
Asphalt modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D
Crumb rubber modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D

[a] The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.
[b] "X" denotes the sieves the Engineer considers for the specified aggregate gradation.
[c] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."
[d] The Engineer reports the average of 3 tests from a single split sample.
[e] The Engineer determines field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or No.4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

[f] To determined field compaction, the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each density core.
2. California Test 309 to determine maximum theoretical density at the frequency specified in California Test 375, Part 5C.

[g] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ±5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[h] The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
[i] The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.
[j] Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.
[k] Voids in mineral aggregate for RHMA-G must be within this range.

No single test result may represent more than the smaller of 750 tons or 1 day's production.

For any single quality characteristic except smoothness, if 2 consecutive acceptance test results do not comply with the specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

The Engineer tests the density core you take from each 250 tons of HMA production. The Engineer determines the percent of maximum theoretical density for each density core by determining the density core's density and dividing by the maximum theoretical density.

The Engineer determines the percent of maximum theoretical density from density cores taken from the final layer measured the full depth of the total paved HMA thickness if any of the following applies:

1. 1/2-inch, 3/8-inch, or No. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot and any layer is less than 0.20 foot.

For percent of maximum theoretical density, the Engineer determines a deduction for each test result outside the specifications in compliance with:

Reduced Payment Factors for Percent of Maximum Theoretical Density

HMA Type A and B and RHMA-G Percent of Maximum Theoretical Density	Reduced Payment Factor	HMA Type A and B and RHMA-G Percent of Maximum Theoretical Density	Reduced Payment Factor
91.0	0.0000	97.0	0.0000
90.9	0.0125	97.1	0.0125
90.8	0.0250	97.2	0.0250
90.7	0.0375	97.3	0.0375
90.6	0.0500	97.4	0.0500
90.5	0.0625	97.5	0.0625
90.4	0.0750	97.6	0.0750
90.3	0.0875	97.7	0.0875
90.2	0.1000	97.8	0.1000
90.1	0.1125	97.9	0.1125
90.0	0.1250	98.0	0.1250
89.9	0.1375	98.1	0.1375
89.8	0.1500	98.2	0.1500
89.7	0.1625	98.3	0.1625
89.6	0.1750	98.4	0.1750
89.5	0.1875	98.5	0.1875
89.4	0.2000	98.6	0.2000
89.3	0.2125	98.7	0.2125
89.2	0.2250	98.8	0.2250
89.1	0.2375	98.9	0.2375
89.0	0.2500	99.0	0.2500
< 89.0	Remove and Replace	> 99.0	Remove and Replace

39-2.04 TRANSPORTING, SPREADING, AND COMPACTING

Determine the number of rollers needed to obtain the specified density and surface finish.

39-3 METHOD

39-3.01 DESCRIPTION

If HMA is specified as Method, construct it under Section 39-1, "General," this Section 39-3, "Method," and Section 39-5, "Measurement and Payment."

39-3.02 ENGINEER'S ACCEPTANCE

39-3.02A Testing

The Engineer samples for acceptance testing and tests for:

HMA Acceptance - Method

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Aggregate gradation [a]	CT 202	JMF ± Tolerance [b]	JMF ± Tolerance [b]	JMF ± Tolerance [b]	JMF ± Tolerance [b]
Sand equivalent (min.) [c]	CT 217	47	42	47	--
Asphalt binder content (%)	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.50	JMF ± 0.50
HMA moisture content (%, max.)	CT 226 or CT 370	1.0	1.0	1.0	1.0
Stabilometer value (min.) [c,d]	CT 366				
No. 4 and 3/8" gradings		30	30	--	--
1/2" and 3/4" gradings		37	35	23	--
Percent of crushed particles	CT 205				
Coarse aggregate (% min.)					
One fractured face		90	25	--	90
Two fractured faces		75	--	90	75
Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.)					
One fractured face		70	20	70	90
Los Angeles Rattler (% max.)	CT 211				
Loss at 100 rev.		12	--	12	12
Loss at 500 rev.		45	50	40	40
Air voids content (%) [c, e]	CT 367	4 ± 2	4 ± 2	Specification ± 2	--
Fine aggregate angularity (% min.) [f]	CT 234	45	45	45	--
Flat and elongated particles (% max. by weight @ 5:1)	CT 235	Report only	Report only	Report only	Report only
Voids filled with asphalt (%) [g]	LP-3			Report only	
No. 4 grading		76.0 – 80.0	76.0 – 80.0		--
3/8" grading		73.0 – 76.0	73.0 – 76.0		
1/2" grading		65.0 – 75.0	65.0 – 75.0		
3/4" grading		65.0 – 75.0	65.0 – 75.0		
Voids in mineral aggregate (% min.) [g]	LP-2				
No. 4 grading		17.0	17.0	--	--
3/8" grading		15.0	15.0	--	
1/2" grading		14.0	14.0	18.0 – 23.0 [h]	
3/4" grading		13.0	13.0	18.0 – 23.0 [h]	
Dust proportion [g]	LP-4				
No. 4 and 3/8" gradings		0.9 – 2.0	0.9 – 2.0	Report only	--
1/2" and 3/4" gradings		0.6 – 1.3	0.6 – 1.3		
Smoothness	Section 39-1.12	12-foot straightedge and must-grind	12-foot straightedge and must-grind	12-foot straightedge and must-grind	12-foot straightedge and must-grind
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92
Asphalt rubber binder	Various	--	--	Section 92-1.02(C) and Section 39-	Section 92-1.02(C) and Section 39-

				1.02D	1.02D
Asphalt modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D
Crumb rubber modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D

[a] The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.
[b] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."
[c] The Engineer reports the average of 3 tests from a single split sample.
[d] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ±5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[e] The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
[f] The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.
[g] Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.
[h] Voids in mineral aggregate for RHMA-G must be within this range.

No single test result may represent more than the smaller of 750 tons or 1 day's production.

For any single quality characteristic except smoothness, if 2 consecutive acceptance test results do not comply with the specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

39-3.03 SPREADING AND COMPACTING EQUIPMENT

Each paver spreading HMA Type A and Type B must be followed by 3 rollers:

1. One vibratory roller specifically designed to compact HMA. The roller must be capable of at least 2,500 vibrations per minute and must be equipped with amplitude and frequency controls. The roller's gross static weight must be at least 7.5 tons.
2. One oscillating type pneumatic-tired roller at least 4 feet wide. Pneumatic tires must be of equal size, diameter, type, and ply. The tires must be inflated to 60 psi minimum and maintained so that the air pressure does not vary more than 5 psi.
3. One steel-tired, 2-axle tandem roller. The roller's gross static weight must be at least 7.5 tons.

Each roller must have a separate operator. Rollers must be self-propelled and reversible.

Compact RHMA-G under the specifications for compacting HMA Type A and Type B except do not use pneumatic-tired rollers.

Compact OGFC with steel-tired, 2-axle tandem rollers. If placing over 300 tons of OGFC per hour, use at least 3 rollers for each paver. If placing less than 300 tons of OGFC per hour, use at least 2 rollers for each paver. Each roller must weigh between 126 pounds to 172 pounds per linear inch of drum width. Turn the vibrator off.

39-3.04 TRANSPORTING, SPREADING, AND COMPACTING

Pave HMA in maximum 0.25-foot thick compacted layers.

If the surface to be paved is both in sunlight and shade, pavement surface temperatures are taken in the shade.

Spread HMA Type A and Type B only if atmospheric and surface temperatures are:

Minimum Atmospheric and Surface Temperatures

Compacted Layer Thickness, feet	Atmospheric,° F		Surface,° F	
	Unmodified Asphalt Binder	Modified Asphalt Binder[a]	Unmodified Asphalt Binder	Modified Asphalt Binder[a]
< 0.15	55	50	60	55
0.15 – 0.25	45	45	50	50

Note:
[a] Except asphalt rubber binder.

If the asphalt binder for HMA Type A and Type B is:

1. Unmodified asphalt binder, complete:

   1.1. First coverage of breakdown compaction before the surface temperature drops below 250 °F
   1.2. Breakdown and intermediate compaction before the surface temperature drops below 200 °F
   1.3. Finish compaction before the surface temperature drops below 150 °F

2. Modified asphalt binder, complete:

   2.1. First coverage of breakdown compaction before the surface temperature drops below 240 °F
   2.2. Breakdown and intermediate compaction before the surface temperature drops below 180 °F
   2.3. Finish compaction before the surface temperature drops below 140 °F

For RHMA-G:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and the surface temperature is at least 60 °F.
2. Complete the first coverage of breakdown compaction before the surface temperature drops below 285 °F.
3. Complete breakdown and intermediate compaction before the surface temperature drops below 250 °F.
4. Complete finish compaction before the surface temperature drops below 200 °F.
5. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For OGFC with unmodified asphalt binder:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and the surface temperature is at least 60 °F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 °F.
3. Complete all compaction before the surface temperature drops below 200 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For OGFC with modified asphalt binder except asphalt rubber binder:

1. Only spread and compact if the atmospheric temperature is at least 50 °F and the surface temperature is at least 50 °F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 °F.
3. Complete all compaction before the surface temperature drops below 180 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

For RHMA-O and RHMA-O-HB:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and surface temperature is at least 60 °F.

2 Complete the 1st coverage using 2 rollers before the surface temperature drops below 280 °F.
3. Complete compaction before the surface temperature drops below 250 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until the mixture is transferred to the paver's hopper or to the pavement surface.

For RHMA-G and OGFC, tarpaulins are not required if the time from discharge to truck until transfer to the paver's hopper or the pavement surface is less than 30 minutes.

HMA compaction coverage is the number of passes needed to cover the paving width. A pass is 1 roller's movement parallel to the paving in either direction. Overlapping passes are part of the coverage being made and are not a subsequent coverage. Do not start a coverage until completing the prior coverage.

Start rolling at the lower edge and progress toward the highest part.

Perform breakdown compaction of each layer of HMA Type A, Type B, and RHMA-G with 3 coverages using a vibratory roller. The speed of the vibratory roller in miles per hour must not exceed the vibrations per minute divided by 1,000. If the HMA layer thickness is less than 0.08 foot, turn the vibrator off. The Engineer may order fewer coverages if the HMA layer thickness is less than 0.15 foot.

Perform intermediate compaction of each layer of HMA Type A and Type B with 3 coverages using a pneumatic-tired roller at a speed not to exceed 5 mph.

Perform finish compaction of HMA Type A, Type B, and RHMA-G with 1 coverage using a steel-tired roller.

Compact OGFC with 2 coverages using steel-tired rollers.

39-4 QUALITY CONTROL / QUALITY ASSURANCE

39-4.01 DESCRIPTION

If HMA is specified as Quality Control / Quality Assurance, construct it under Section 39-1, "General," this Section 39-4, "Quality Control / Quality Assurance," and Section 39-5, "Measurement and Payment."

39-4.02 GENERAL

The QC / QA construction process consists of:

1. Establishing, maintaining, and changing if needed a quality control system providing assurance the HMA complies with the specifications
2. Sampling and testing at specified intervals, or sublots, to demonstrate compliance and to control process
3. The Engineer sampling and testing at specified intervals to verify testing process and HMA quality
4. The Engineer using test results, statistical evaluation of verified quality control tests, and inspection to accept HMA for payment

A lot is a quantity of HMA. The Engineer designates a new lot when:

1. 20 sublots are complete
2. The JMF changes
3. Production stops for more than 30 days

Each lot consists of no more than 20 sublots. A sublot is 750 tons except HMA paved at day's end greater than 250 tons is a sublot. If HMA paved at day's end is less than 250 tons, you may either make this quantity a sublot or include it in the previous sublot's test results for statistical evaluation.

39-4.03 CONTRACTOR QUALITY CONTROL

39-4.03A General

Use a composite quality factor, QF_C, and individual quality factors, QF_{QCi}, to control your process and evaluate your quality control program. For quality characteristics without quality factors, use your quality control plan's action limits to control process.

Control HMA quality including:

1. Materials
2. Proportioning
3. Spreading and compacting
4. Finished roadway surface

Develop, implement, and maintain a quality control program that includes:

1. Inspection
2. Sampling
3. Testing

39-4.03B Quality Control Plan

With the JMF submittal, submit a written Quality Control Plan (QCP). The QCP must comply with the Department's Quality Control Manual for Hot Mix Asphalt Production and Placement. Discuss the QCP with the Engineer during the prepaving conference.

The Engineer reviews each QCP within 5 business days from the submittal. Hold HMA production until the Engineer accepts the QCP in writing. The Engineer's QCP acceptance does not mean your compliance with the QCP will result in acceptable HMA. Section 39-1.05, "Engineer's Acceptance," specifies HMA acceptance.

The QCP must include the name and qualifications of a Quality Control Manager. The Quality Control Manager administers the QCP and during paving must be at the job site within 3 hours of receiving notice. The Quality Control Manager must not be any of the following on the project:

1. Foreman
2. Production or paving crewmember
3. Inspector
4. Tester

The QCP must include action limits and details of corrective action you will take if a test result for any quality characteristic falls outside an action limit.

As work progresses, you must submit a written QCP supplement to change quality control procedures, personnel, tester qualification status, or laboratory accreditation status.

39-4.03C Quality Control Inspection, Sampling, And Testing

Sample, test, inspect, and manage HMA quality control.

Provide a roadway inspector while HMA paving activities are in progress. Provide a plant inspector during HMA production.

Inspectors must comply with the Department's Quality Control Manual for Hot Mix Asphalt Production and Placement.

Provide a testing laboratory and personnel for quality control testing. Provide the Engineer unrestricted access to the quality control activities. Before providing services for the project, the Engineer reviews, accredits, and qualifies the testing laboratory and personnel under the Department's Independent Assurance Program.

The minimum random sampling and testing for quality control is:

Minimum Quality Control – QC / QA

Quality Characteristic	Test Method	Min-imum Sampl-ing and Testing Frequen-cy	HMA Type			Location of Sampling	Max. Report-ing Time Allow-ance
			A	B	RHMA-G		
Aggregate gradation [a]	CT 202	1 per 750 tons	JMF ± Tolerance [b]	JMF ± Tolerance [b]	JMF ± Tolerance [b]	CT 125	24 hours
Asphalt binder content (%)	CT 379 or 382		JMF ±0.45	JMF ±0.45	JMF ±0.5	Loose Mix Behind Paver See CT 125	
Field compaction (% max. theoretical density) [c,d]	QC Plan		92 - 96	92 - 96	91 - 96	QC Plan	
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants [e]	CT 226 or CT 370	2 per day during produc-tion	--	--	--	Stock-piles or cold feed belts	--
Sand equivalent (min.) [f]	CT 217	1 per 750 tons	47	42	47	CT 125	24 hours
HMA moisture content (%,max.)	CT 226 or CT 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	Loose Mix Behind Paver See CT 125	24 hours
Stabilometer Value (min.) [f, g] No. 4 and 3/8" gradings 1/2" and 3/4" gradings	CT 366	1 per 4,000 tons or 2 per 5 bus-iness days, which-ever is more	30 37	30 35	-- 23		48 hours
Air voids content (%)[f, h]	CT 367		4 ± 2	4 ± 2	Specifica-tion ± 2		

Percent of crushed particles coarse aggregate (% min.) One fractured face Two fractured faces Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face	CT 205	As necessary and designated in QCP. At least once per project.	 90 75 70	 25 -- 20	 -- 90 70	CT 125	48 hours
Los Angeles Rattler (% max.) Loss at 100 rev. Loss at 500 rev.	CT 211		 12 45	 -- 50	 12 40	CT 125	
Fine aggregate angularity (% min.)[i]	CT 234		45	45	45	CT 125	
Flat and elongated particle (% max. by weight @ 5:1)	CT 235		Report only	Report only	Report only	CT 125	
Voids filled with asphalt (%)[j] No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-3		 76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	 76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	Report only	LP-3	
Voids in mineral aggregate (% min.)[j] No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-2		 17.0 15.0 14.0 13.0	 17.0 15.0 14.0 13.0	 -- -- 18.0 – 23.0[k] 18.0 – 23.0[k]	LP-2	
Dust proportion[j] No. 4 and 3/8" gradings 1/2" and 3/4" gradings	LP-4		 0.9 – 2.0 0.6 – 1.3	 0.9 – 2.0 0.6 – 1.3	Report only	LP-4	
Smoothness	Section 39-1.12	--	12-foot straight-edge, must-grind, and PI_0	12-foot straight-edge, must-grind, and PI_0	12-foot straight-edge, must-grind, and PI_0	--	
Asphalt rubber binder viscosity @ 375 °F, centipoises	Section 39-1.02D	--	--	--	1,500 – 4,000	Section 39-1.02D	24 hours
Crumb rubber modifier	Section 39-1.02D	--	--	--	Section 39-1.02D	Section 39-1.02D	48 hours

Notes:

[a] Determine combined aggregate gradation containing RAP under Laboratory Procedure LP-9.

[b] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."

[c] Determine field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, No. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

[d] To determine field compaction use:

1. In-place density measurements using the method specified in your QC.
2. California Test 309 to determine maximum theoretical density at the frequency specified in California Test 375, Part 5C.

[e] For adjusting the plant controller at the HMA plant.

[f] Report the average of 3 tests from a single split sample.

[g] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."

[h] Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

[i] The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

[j] Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.

[k] Voids in mineral aggregate for RHMA-G must be within this range.

Within the specified reporting time, submit written test results including:

1. Sampling location, quantity, and time
2. Testing results
3. Supporting data and calculations

If test results for any quality characteristic are beyond the action limits in the QCP, take corrective actions. Document the corrective actions taken in the inspection records under Section 39-4.03E, "Records of Inspection and Testing."

Stop production, notify the Engineer in writing, take corrective action, and demonstrate compliance with the specifications before resuming production and placement on the State highway if:

1. A lot's composite quality factor, QF_C, or an individual quality factor, QF_{QCi} for i = 3, 4, or 5, is below 0.90 determined under Section 39-4.03F, "Statistical Evaluation," using quality control data
2. An individual quality factor, QF_{QCi} for i = 1 or 2, is below 0.75 using quality control data
3. Quality characteristics for which a quality factor, QF_{QCi}, is not determined has 2 consecutive quality control tests not in compliance with the specifications

39-4.03D Charts And Records

Record sampling and testing results for quality control on forms provided in the "Quality Control Manual for Hot Mix Asphalt," or on forms you submit with the QCP. The QCP must also include form posting locations and submittal times.

Submit quality control test results using the Department's statistical evaluation program, HMAPay, available at

www.dot.ca.gov/hq/construc/hma/index.htm

39-4.03E Records Of Inspection And Testing

During HMA production, submit in writing a daily:

1. HMA Construction Daily Record of Inspection. Also make this record available at the HMA plant and job site each day.
2. HMA Inspection and Testing Summary. Include in the summary:

    2.1. QC worksheet with updated test results from the HMAPay program
    2.2. Test forms with the testers' signatures and Quality Control Manager's initials.
    2.3. Inspection forms with the inspectors' signatures and Quality Control Manager's initials.
    2.4. A list and explanation of deviations from the specifications or regular practices.
    2.5. A signed statement by the Quality Control Manager that says:

    "It is hereby certified that the information contained in this record is accurate, and that information, tests, or calculations documented herein comply with the specifications of the contract and the

standards set forth in the testing procedures. Exceptions to this certification are documented as part of this record."

Retain for inspection the records generated as part of quality control including inspection, sampling, and testing for at least 3 years after final acceptance.

39-4.03F Statistical Evaluation

General

Determine a lot's composite quality factor, QF_C, and the individual quality factors, QF_{QCi}. Perform statistical evaluation calculations to determine these quality factors based on quality control test results for:

1. Aggregate gradation
2. Asphalt binder content
3. Percent of maximum theoretical density

The Engineer grants a waiver and you must use 1.0 as the individual quality factor for percent of maximum theoretical density, QF_{QC5}, for HMA paved in:

1. Areas where the total paved thickness is less than 0.15 foot
2. Areas where the total paved thickness is less than 0.20 foot and a 3/4-inch grading is specified and used
3. Dig outs
4. Leveling courses
5. Areas where, in the opinion of the Engineer, compaction or compaction measurement by conventional methods is impeded

Statistical Evaluation Calculations

Use the Variability-Unknown / Standard Deviation Method to determine the percentage of a lot not in compliance with the specifications.

Determine the percentage of work not in compliance with the specification limits for each quality characteristic as follows:

1. Calculate the arithmetic mean ($\overline{X}$) of the test values

$$\overline{X} = \frac{\Sigma x}{n}$$

where:

x = individual test values
n = number of test values

2. Calculate the standard deviation

$$s = \sqrt{\frac{n\,(\Sigma x^2)-(\Sigma x)^2}{n(n-1)}}$$

where:

$\sum(x^2)$ = sum of the squares of individual test values
$(\sum x)^2$ = sum of the individual test values squared
n = number of test values

3. Calculate the upper quality index (Qu)

$$Q_u = \frac{USL - \overline{X}}{s}$$

where:

USL = target value plus the production tolerance or upper specification limit

s = standard deviation
$\bar{X}$ = arithmetic mean

4. Calculate the lower quality index (QL);

$$Q_L = \frac{\bar{X} - LSL}{s}$$

where:
LSL = target value minus production tolerance or lower specification limit
s = standard deviation
$\bar{X}$ = arithmetic mean

5. From the table, Upper Quality Index Q_U or Lower Quality Index Q_L, of this Section 39-4.03F, "Statistical Evaluation", determine P_U ;

where:
P_U = the estimated percentage of work outside the USL.
$P_U = 0$, when USL is not specified.

6. From the table, Upper Quality Index Q_U or Lower Quality Index Q_L, of this Section 39-4.03F, "Statistical Evaluation," determine P_L;

where:
P_L = the estimated percentage of work outside the LSL.
$P_L = 0$, when LSL is not specified.

7. Calculate the total estimated percentage of work outside the USL and LSL, percent defective

Percent defective = $P_U + P_L$

P_U and P_L are determined from:

P_U or P_L	**Upper Quality Index Q_U or Lower Quality Index Q_L** Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
0	1.72	1.88	1.99	2.07	2.13	2.20	2.28	2.34	2.39	2.44	2.48	2.51	2.56
1	1.64	1.75	1.82	1.88	1.91	1.96	2.01	2.04	2.07	2.09	2.12	2.14	2.16
2	1.58	1.66	1.72	1.75	1.78	1.81	1.84	1.87	1.89	1.91	1.93	1.94	1.95
3	1.52	1.59	1.63	1.66	1.68	1.71	1.73	1.75	1.76	1.78	1.79	1.80	1.81
4	1.47	1.52	1.56	1.58	1.60	1.62	1.64	1.65	1.66	1.67	1.68	1.69	1.70
5	1.42	1.47	1.49	1.51	1.52	1.54	1.55	1.56	1.57	1.58	1.59	1.59	1.60
6	1.38	1.41	1.43	1.45	1.46	1.47	1.48	1.49	1.50	1.50	1.51	1.51	1.52
7	1.33	1.36	1.38	1.39	1.40	1.41	1.41	1.42	1.43	1.43	1.44	1.44	1.44
8	1.29	1.31	1.33	1.33	1.34	1.35	1.35	1.36	1.36	1.37	1.37	1.37	1.38
9	1.25	1.27	1.28	1.28	1.29	1.29	1.30	1.30	1.30	1.31	1.31	1.31	1.31
10	1.21	1.23	1.23	1.24	1.24	1.24	1.25	1.25	1.25	1.25	1.25	1.26	1.26
11	1.18	1.18	1.19	1.19	1.19	1.19	1.20	1.20	1.20	1.20	1.20	1.20	1.20
12	1.14	1.14	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
13	1.10	1.10	1.10	1.10	1.10	1.10	1.11	1.11	1.11	1.11	1.11	1.11	1.11
14	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
15	1.03	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
16	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
17	0.97	0.96	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94
18	0.93	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90
19	0.90	0.89	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
20	0.87	0.86	0.85	0.85	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83
21	0.84	0.82	0.82	0.81	0.81	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.79
22	0.81	0.79	0.79	0.78	0.78	0.77	0.77	0.77	0.76	0.76	0.76	0.76	0.76
23	0.77	0.76	0.75	0.75	0.74	0.74	0.74	0.73	0.73	0.73	0.73	0.73	0.73
24	0.74	0.73	0.72	0.72	0.71	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70
25	0.71	0.70	0.69	0.69	0.68	0.68	0.67	0.67	0.67	0.67	0.67	0.67	0.66
26	0.68	0.67	0.67	0.65	0.65	0.65	0.64	0.64	0.64	0.64	0.64	0.64	0.63
27	0.65	0.64	0.63	0.62	0.62	0.62	0.61	0.61	0.61	0.61	0.61	0.61	0.60
28	0.62	0.61	0.60	0.59	0.59	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.57
29	0.59	0.58	0.57	0.57	0.56	0.56	0.55	0.55	0.55	0.55	0.55	0.55	0.54
30	0.56	0.55	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.52	0.52	0.52
31	0.53	0.52	0.51	0.51	0.50	0.50	0.50	0.49	0.49	0.49	0.49	0.49	0.49
32	0.50	0.49	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.46
33	0.47	0.48	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.43
34	0.45	0.43	0.43	0.42	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.40
35	0.42	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38
36	0.39	0.38	0.37	0.37	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
37	0.36	0.35	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32
38	0.33	0.32	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30
39	0.30	0.30	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
40	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
41	0.25	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
42	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
43	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
44	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
45	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
46	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
47	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
48	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
49	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1. If the value of Q_U or Q_L does not correspond to a value in the table, use the next lower value.
2. If Q_U or Q_L are negative values, P_U or P_L is equal to 100 minus the table value for P_U or P_L.

Quality Factor Determination

Determine individual quality factors, QF_{QCi}, using percent defective = $P_U + P_L$ and:

Quality Factors

Quality Factor	Maximum Allowable Percent Defective ($P_U + P_L$) Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
1.05				0	0	0	0	0	0	0	0	0	0
1.04			0	1	3	5	4	4	4	3	3	3	3
1.03		0	2	4	6	8	7	7	6	5	5	4	4
1.02		1	3	6	9	11	10	9	8	7	7	6	6
1.01	0	2	5	8	11	13	12	11	10	9	8	8	7
1.00	22	20	18	17	16	15	14	13	12	11	10	9	8
0.99	24	22	20	19	18	17	16	15	14	13	11	10	9
0.98	26	24	22	21	20	19	18	16	15	14	13	12	10
0.97	28	26	24	23	22	21	19	18	17	16	14	13	12
0.96	30	28	26	25	24	22	21	19	18	17	16	14	13
0.95	32	29	28	26	25	24	22	21	20	18	17	16	14
0.94	33	31	29	28	27	25	24	22	21	20	18	17	15
0.93	35	33	31	29	28	27	25	24	22	21	20	18	16
0.92	37	34	32	31	30	28	27	25	24	22	21	19	18
0.91	38	36	34	32	31	30	28	26	25	24	22	21	19
0.90	39	37	35	34	33	31	29	28	26	25	23	22	20
0.89	41	38	37	35	34	32	31	29	28	26	25	23	21
0.88	42	40	38	36	35	34	32	30	29	27	26	24	22
0.87	43	41	39	38	37	35	33	32	30	29	27	25	23
0.86	45	42	41	39	38	36	34	33	31	30	28	26	24
0.85	46	44	42	40	39	38	36	34	33	31	29	28	25
0.84	47	45	43	42	40	39	37	35	34	32	30	29	27
0.83	49	46	44	43	42	40	38	36	35	33	31	30	28
0.82	50	47	46	44	43	41	39	38	36	34	33	31	29
0.81	51	49	47	45	44	42	41	39	37	36	34	32	30
0.80	52	50	48	46	45	44	42	40	38	37	35	33	31
0.79	54	51	49	48	46	45	43	41	39	38	36	34	32
0.78	55	52	50	49	48	46	44	42	41	39	37	35	33
0.77	56	54	52	50	49	47	45	43	42	40	38	36	34
0.76	57	55	53	51	50	48	46	44	43	41	39	37	35
0.75	58	56	54	52	51	49	47	46	44	42	40	38	36
	60	57	55	53	52	51	48	47	45	43	41	40	37
	61	58	56	55	53	52	50	48	46	44	43	41	38
Reject	62	59	57	56	54	53	51	49	47	45	44	42	39
	63	61	58	57	55	54	52	50	48	47	45	43	40
	64	62	60	58	57	55	53	51	49	48	46	44	41
Reject Values Greater Than Those Shown Above													

Notes:

1. To obtain a quality factor when the estimated percent outside specification limits from table, "Upper Quality Index Q_U or Lower Quality Index Q_L," does not correspond to a value in the table, use the next larger value.

Compute the composite of single quality factors, QF_C, for a lot using:

$$QF_C = \sum_{i=1}^{5} w_i \, QF_{QC_i}$$

where:

QF_C = the composite quality factor for the lot rounded to 2 decimal places.
QF_{QCi} = the quality factor for the individual quality characteristic.
w = the weighting factor listed in the table HMA Acceptance – QC / QA.

i = the quality characteristic index number in the table HMA Acceptance – QC / QA.

39-4.04 ENGINEER'S QUALITY ASSURANCE

39-4.04A General

The Engineer assures quality by:

1. Reviewing mix designs and proposed JMF
2. Inspecting procedures
3. Conducting oversight of quality control inspection and records
4. Verification sampling and testing during production and paving

39-4.04B Verification Sampling And Testing

General

The Engineer samples:

1. Aggregate to verify gradation
2. HMA to verify asphalt binder content

Verification

For aggregate gradation and asphalt binder content, the minimum ratio of verification testing frequency to quality control testing frequency is 1:5. The Engineer performs at least 3 verification tests per lot.

Using the t-test, the Engineer compares quality control tests results for aggregate gradation and asphalt binder content with corresponding verification test results. The Engineer uses the average and standard deviation of up to 20 sequential sublots for the comparison. The Engineer uses production start-up evaluation tests to represent the first sublot. When there are less than 20 sequential sublots, the Engineer uses the maximum number of sequential sublots available. The 21st sublot becomes the 1st sublot (n = 1) in the next lot.

The t-value for a group of test data is computed as follows:

$$t = \frac{\left|\overline{X}_c - \overline{X}_v\right|}{S_p\sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \qquad \text{and} \qquad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

n_c = Number of quality control tests (2 minimum, 20 maximum).
n_v = Number of verification tests (minimum of 1 required).
$\overline{X}_c$ = Mean of quality control tests.
$\overline{X}_v$ = Mean of verification tests.
S_p = Pooled standard deviation (When $n_v = 1$, $S_p = S_c$).
S_c = Standard deviation of quality control tests.
S_v = Standard deviation of verification tests (when $n_v > 1$).

The comparison of quality control test results and the verification test results is at a level of significance of $\alpha = 0.025$. The Engineer computes t and compares it to the critical t-value, t_{crit}, from:

Critical T-Value

Degrees of freedom (n_c+n_v-2)	t_{crit} (for $\alpha = 0.025$)	Degrees of freedom (n_c+n_v-2)	t_{crit} (for $\alpha = 0.025$)
1	24.452	18	2.445
2	6.205	19	2.433
3	4.177	20	2.423
4	3.495	21	2.414
5	3.163	22	2.405
6	2.969	23	2.398
7	2.841	24	2.391
8	2.752	25	2.385
9	2.685	26	2.379
10	2.634	27	2.373
11	2.593	28	2.368
12	2.560	29	2.364
13	2.533	30	2.360
14	2.510	40	2.329
15	2.490	60	2.299
16	2.473	120	2.270
17	2.458	∞	2.241

If the t-value computed is less than or equal to t_{crit}, quality control test results are verified.

If the t-value computed is greater than t_{crit} and both $\overline{X}_v$ and $\overline{X}_c$ comply with acceptance specifications, the quality control tests are verified. You may continue to produce and place HMA with the following allowable differences:

1. $\left|\overline{X}_v - \overline{X}_c\right| \leq 1.0$ percent for any grading
2. $\left|\overline{X}_v - \overline{X}_c\right| \leq 0.1$ percent for asphalt binder content

If the t-value computed is greater than t_{crit} and the $\left|\overline{X}_v - \overline{X}_c\right|$ for grading or asphalt binder content are greater than the allowable differences, quality control test results are not verified and:

1. The Engineer notifies you in writing.
2. You and the Engineer must investigate why the difference exist.
3. If the reason for the difference cannot be found and corrected, the Engineer's test results are used for acceptance and pay.

39-4.05 ENGINEER'S ACCEPTANCE

39-4.05A Testing

The Engineer samples for acceptance testing and tests for:

HMA Acceptance – QC / QA

Index (i)	Quality Characteristic				Weight-ing Factor (w)	Test Method	HMA Type		
							A	B	RHMA-G
		Aggregate gradation [a]				CT 202	JMF ± Tolerance [c]		
	Sieve	3/4"	1/2"	3/8"					
1	1/2"	X [b]	--	--	0.05				
1	3/8"	--	X	--	0.05				
1	No. 4	--	--	X	0.05				
2	No. 8	X	X	X	0.10				
3	No. 200	X	X	X	0.15				
4	Asphalt binder content (%)				0.30	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.5
5	Field compaction (% max. theoretical density) [d,e]				0.40	CT 375	92 – 96	92 – 96	91 – 96
	Sand equivalent (min.) [f]					CT 217	47	42	47
	Stabilometer value (min.) [f, g]					CT 366			
	No. 4 and 3/8" gradings						30	30	--
	1/2" and 3/4" gradings						37	35	23
	Air voids content (%) [f, h]					CT 367	4 ± 2	4 ± 2	Specification ± 2
	Percent of crushed particles coarse aggregate (% min.)					CT 205			
	One fractured face						90	25	--
	Two fractured faces						75	--	90
	Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.)								
	One fractured face						70	20	70
	HMA moisture content (%, max.)					CT 226 or CT 370	1.0	1.0	1.0
	Los Angeles Rattler (% max.)					CT 211			
	Loss at 100 rev.						12	--	12
	Loss at 500 rev.						45	50	40
	Fine aggregate angularity (% min.) [i]					CT 234	45	45	45
	Flat and elongated particle (% max. by weight @ 5:1)					CT 235	Report only	Report only	Report only
	Voids in mineral aggregate (% min.) [j]								(Note k)
	No. 4 grading						17.0	17.0	--
	3/8" grading					LP-2	15.0	15.0	--
	1/2" grading						14.0	14.0	18.0 - 23.0
	3/4" grading						13.0	13.0	18.0 - 23.0
	Voids filled with asphalt (%) [j]								
	No. 4 grading					LP-3	76.0 - 80.0	76.0 - 80.0	Report only
	3/8" grading						73.0 - 76.0	73.0 - 76.0	
	1/2" grading						65.0 - 75.0	65.0 - 75.0	
	3/4" grading						65.0 - 75.0	65.0 - 75.0	
	Dust proportion [j]					LP-4			
	No. 4 and 3/8" gradings						0.9 - 2.0	0.9 – 2.0	Report only
	1/2" and 3/4" gradings						0.6 - 1.3	0.6 – 1.3	

	Smoothness		Section 39-1.12	12-foot straight-edge, must-grind, and PI_0	12-foot straight-edge, must-grind, and PI_0	12-foot straight-edge, must-grind, and PI_0
	Asphalt binder		Various	Section 92	Section 92	Section 92
	Asphalt rubber binder		Various	--	--	Section 92-1.02(C) and Section 39-1.02D
	Asphalt modifier		Various	--	--	Section 39-1.02D
	Crumb rubber modifier		Various	--	--	Section 39-1.02D

Notes:
[a] The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.
[b] "X" denotes the sieves the Engineer considers for the specified aggregate gradation.
[c] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."
[d] The Engineer determines field compaction for any of the following conditions:
1. 1/2-inch, 3/8-inch, or No.4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.
2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

[e] To determined field compaction, the Engineer uses:
1. California Test 308, Method A, to determine in-place density of each density core.
2. California Test 309 to determine maximum theoretical density at the frequency specified in California Test 375, Part 5C.

[f] The Engineer reports the average of 3 tests from a single split sample.
[g] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[h] The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
[i] The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.
[j] Report only if the adjustment for asphalt binder content target value is less than or equal to ± 0.3 percent from OBC.
[k] Voids in mineral aggregate for RHMA-G must be within this range.

The Engineer determines the percent of maximum theoretical density from the average density of 3 density cores you take from every 750 tons of production or part thereof divided by the maximum theoretical density.

The Engineer determines the percent of maximum theoretical density from density cores taken from the final layer measured the full depth of the total paved HMA thickness if any of the following applies:

1. If 1/2-inch, 3/8-inch, or No. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot.
2. If 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot and any layer is less than 0.20 foot.

The Engineer calculates QF_{QCi} for i = 1, 2, 3, and 4 using quality control data and QF_{QCi} for i = 5 using quality assurance data.

The Engineer stops production and terminates a lot if:

1. The lot's composite quality factor, QF_C, or an individual quality factor, QF_{QCi} for i = 3, 4, or 5, is below 0.90 determined under Section 39-4.03F, "Statistical Evaluation"
2. An individual quality factor, QF_{QCi} for i = 1 or 2, is below 0.75

3. Quality characteristics for which a quality factor, QF_{QCi}, is not determined has 2 consecutive acceptance or quality control tests not in compliance with the specifications

For any single quality characteristic for which a quality factor, QF_{QCi}, is not determined, except smoothness, if 2 consecutive acceptance test results do not comply with specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

39-4.05B Statistical Evaluation, Determination Of Quality Factors And Acceptance

Statistical Evaluation and Determination of Quality Factors

To determine the individual quality factor, $QF_{QCi,}$ for any quality factor i = 1 through 5 or a lot's composite quality factor, QF_C, for acceptance and payment adjustment, the Engineer uses the evaluation specifications under Section 39-4.03F, "Statistical Evaluation," and:

1. Verified quality control test results for aggregate gradation
2. Verified quality control test results for asphalt binder content
3. The Engineer's test results for percent of maximum theoretical density

Lot Acceptance Based on Quality Factors

The Engineer accepts a lot based on the quality factors determined for aggregate gradation and asphalt binder content, QF_{QCi} for i = 1 through 4, using the total number of verified quality control test result values and the total percent defective ($P_U + P_L$).

The Engineer accepts a lot based on the quality factor determined for maximum theoretical density, QF_{QC5}, using the total number of test result values from density cores and the total percent defective ($P_U + P_L$).

The Engineer calculates the quality factor for the lot, QF_C, which is a composite of weighted individual quality factors, QF_{QCi}, determined for each quality characteristic in the HMA Acceptance – QC / QA table in Section 39-4.05A, "Testing."

The Engineer accepts a lot based on quality factors if:

1. The current composite quality factor, QF_C, is 0.90 or greater
2. Each individual quality factor, QF_{QCi} for i = 3, 4, and 5, is 0.90 or greater
3. Each individual quality factor, QF_{QCi} for i = 1 and 2, is 0.75 or greater

No single quality characteristic test may represent more than the smaller of 750 tons or 1 day's production.

Payment Adjustment

If a lot is accepted, the Engineer adjusts payment with the following formula:

$$PA = \sum_{i=1}^{n} HMACP * wi * \left[QFQCi * (HMATT - WHMATTi) + WHMATTi\right] - (HMACP * HMATT)$$

where:

PA =	Payment adjustment rounded to 2 decimal places.
HMACP =	HMA contract price.
HMATT =	HMA total tons represented in the lot.
$WHMATT_i$ =	Total tons of waived quality characteristic HMA.
QF_{QCi} =	Running quality factor for the individual quality characteristic. QF_{QCi} for i = 1 through 4 must be from verified Contractor's QC results. QF_{QC5} must be determined from the Engineer's results on density cores taken for percent of maximum theoretical density determination.
w =	Weighting factor listed in the HMA acceptance table.

i = Quality characteristic index number in the HMA acceptance table.

If the payment adjustment is a negative value, the Engineer deducts this amount from payment. If the payment adjustment is a positive value, the Engineer adds this amount to payment.

The 21st sublot becomes the 1st sublot (n = 1) in the next lot. When the 21st sequential sublot becomes the 1st sublot, the previous 20 sequential sublots become a lot for which the Engineer determines a quality factor. The Engineer uses this quality factor to pay for the HMA in the lot. If the next lot consists of less than 8 sublots, these sublots must be added to the previous lot for quality factor determination using 21 to 27 sublots.

39-4.05C Dispute Resolution

For a lot, if you or the Engineer dispute any quality factor, QF_{QCi}, or verification test result, every sublot in that lot must be retested.

Referee tests must be performed under the specifications for acceptance testing.

Any quality factor, QF_{QCi}, must be determined using the referee tests.

For any quality factor, QF_{QCi}, for i = 1 through 5, dispute resolution:

1. If the difference between the quality factors for QF_{QCi} using the referee test result and the disputed test result is less than or equal to 0.01, the original test result is correct.
2. If the difference between the quality factor for QF_{QCi} using the referee test result and the disputed test result is more than 0.01, the quality factor determined from the referee tests supersedes the previously determined quality factor.

39-5 MEASUREMENT AND PAYMENT

39-5.01 MEASUREMENT

The contract item for HMA is measured by weight. The weight of each HMA mixture designated in the Engineer's Estimate must be the combined mixture weight.

If tack coat, asphalt binder, and asphaltic emulsion are paid with separate contract items, their contract items are measured under Section 92, "Asphalts," or Section 94, "Asphaltic Emulsions," as the case may be.

If recorded batch weights are printed automatically, the contract item for HMA is measured by using the printed batch weights, provided:

1. Total aggregate and supplemental fine aggregate weight per batch is printed. If supplemental fine aggregate is weighed cumulatively with the aggregate, the total aggregate batch weight must include the supplemental fine aggregate weight.
2. Total asphalt binder weight per batch is printed.
3. Each truckload's zero tolerance weight is printed before weighing the first batch and after weighing the last batch.
4. Time, date, mix number, load number and truck identification is correlated with a load slip.
5. A copy of the recorded batch weights is certified by a licensed weighmaster and submitted to the Engineer.

The contract item for placing HMA dike is measured by the linear foot along the completed length. The contract item for placing HMA in miscellaneous areas is measured as the in-place compacted area in square yards. In addition to the quantities measured on a linear foot or square yard basis, the HMA for dike and miscellaneous areas are measured by weight.

The contract item for geosynthetic pavement interlayer is measured by the square yard for the actual pavement area covered.

39-5.02 PAYMENT

The contract prices paid per ton for hot mix asphalt as designated in the Engineer's Estimate include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in constructing hot mix asphalt, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

If HMA is specified to comply with Section 39-4, "Quality Control / Quality Assurance," the Engineer adjusts payment under that section.

Full compensation for the Quality Control Plan and prepaving conference is included in the contract prices paid per ton for hot mix asphalt as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

Full compensation for performing and submitting mix designs and for Contractor sampling, testing, inspection, testing facilities, and preparation and submittal of results is included in the contract prices paid per ton for HMA as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

Full compensation for reclaimed asphalt pavement is included in the contract prices paid per ton for HMA as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

The contract price paid per ton for hot mix asphalt (leveling) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in hot mix asphalt (leveling), complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The State pays for HMA dike at the contract price per linear foot for place HMA dike and by the ton for HMA. The contract prices paid per linear foot for place hot mix asphalt dike as designated in the Engineer's Estimate include full compensation for furnishing all labor, tools, equipment, and incidentals, and for doing all the work involved in placing HMA dike, complete in place, including excavation, backfill, and preparation of the area to receive the dike, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The State pays for HMA specified to be a miscellaneous area at the contract price per square yard for place hot mix asphalt (miscellaneous area) and per ton for hot mix asphalt. The contract price paid per square yard for place hot mix asphalt (miscellaneous area) includes full compensation for furnishing all labor, tools, equipment, and incidentals, and for doing all the work involved in placing HMA (miscellaneous area) complete in place, including excavation, backfill, and preparation of the area to receive HMA (miscellaneous area), as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

If the Quality Control / Quality Assurance construction process is specified, HMA placed in dikes and miscellaneous areas is paid for at the contract price per ton for hot mix asphalt under Section 39-4, "Quality Control / Quality Assurance." Section 39-4.05B, "Statistical Evaluation, Determination of Quality Factors and Acceptance," does not apply to HMA placed in dikes and miscellaneous areas.

If there are no contract items for place hot mix asphalt dike and place hot mix asphalt (miscellaneous area) and the work is specified, full compensation for constructing HMA dikes and HMA (miscellaneous areas) including excavation, backfill, and preparation of the area to receive HMA dike or HMA (miscellaneous area) is included in the contract price paid per ton for the hot mix asphalt designated in the Engineer's Estimate and no separate payment will be made therefor.

The contract price paid per square yard for geosynthetic pavement interlayer of the type shown on the verified Bid Item List includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing geosynthetic pavement interlayer, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The contract price paid per ton for paving asphalt (binder, geosynthetic pavement interlayer) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying paving asphalt (binder, geosynthetic pavement interlayer), complete in place, including spreading sand to cover exposed binder material, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

Full compensation for small quantities of HMA placed on geosynthetic pavement interlayer to prevent displacement during construction is included in the contract price paid per ton for the HMA being paved over the interlayer and no separate payment will be made therefor.

The contract price paid per ton for tack coat includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying tack coat, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The Engineer does not adjust payment for increases or decreases in the quantities for tack coat, regardless of the reason for the increase or decrease. Section 4-1.03B, "Increased or Decreased Quantities," does not apply to the items for tack coat.

Full compensation for performing smoothness testing, submitting written and electronic copies of tests, and performing corrective work including applying fog seal coat is included in the contract price paid per ton for the HMA designated in the Engineer's Estimate and no separate payment will be made therefor.

Full compensation for spreading sand on RHMA-G, RHMA-O, and RHMA-O-HB surfaces and for sweeping and removing excess sand is included in the contract price paid per ton for rubberized hot mix asphalt as designated in the Engineer's Estimate and no separate payment will be made therefor.

If the dispute resolution ITP determines the Engineer's test results are correct, the Engineer deducts the ITP's testing costs from payments. If the ITP determines your test results are correct, the State pays the ITP's testing costs. If, in the Engineer's opinion, work completion is delayed because of incorrect Engineer test results, the Department makes payment and time adjustments under Section 8-1.09, "Delays."

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SECTION 40 PORTLAND CEMENT CONCRETE PAVEMENT
(Issued 01-20-12)

Replace Section 40 with:
SECTION 40 CONCRETE PAVEMENT

40-1 GENERAL

40-1.01 SUMMARY

Section 40 includes specifications for constructing concrete pavement on a prepared subgrade.

40-1.02 SUBMITTALS

40-1.02A Certificates of Compliance

Submit Certificates of Compliance under Section 6-1.07, "Certificates of Compliance." Include a test result report for any specified test with certification that test was performed within 12 months before the tested material's use.

Submit Certificates of Compliance for:

1. Tie bars
2. Threaded tie bar splice couplers
3. Dowel bars
4. Tie bar baskets
5. Dowel bar baskets
6. Chemical adhesive (drill and bond)
7. Silicone joint sealant
8. Asphalt rubber joint sealant
9. Preformed compression seal
10. Backer rods. Include the manufacturer's statement of compatibility with the sealant to be used.
11. Joint filler material
12. Curing compound. For each delivery to the job site, submit a copy of the Certificate of Compliance to the Engineer and the Transportation Laboratory. Each Certificate of Compliance must not represent more than 10,000 gallons and must include a test result report for:

    12.1. Moisture loss at 24 hours under California Test 534
    12.2. Reflectance under ASTM E 1347
    12.3. Viscosity under ASTM D 2196
    12.4. Nonvolatile content under ASTM D 2369
    12.5. Pigment content under ASTM D 3723
13. Epoxy powder coating

40-1.02B Curing Compound Samples

Submit split curing compound samples to the Transportation Laboratory.

40-1.02C Drilled Corings

Submit each core taken for Engineer's acceptance in a plastic bag. Mark each core with a location description.

40-1.02D Independent Third Party Air Content Testing Laboratory

Before testing, submit for the Engineer's approval the name of a laboratory that will test drilled core specimens for air content in cases of dispute.

40-1.02E Dowel Bars

Before placing dowel bars, submit a procedure for identifying transverse contraction joint locations relative to the dowel bars' longitudinal center and a procedure for consolidating concrete around the dowel bars.

40-1.02F Concrete Field Qualification

Submit field qualification data and test reports including:

1. Mixing date
2. Mixing equipment and procedures used
3. Batch volume in cubic yards
4. Type and source of ingredients used
5. Penetration of the concrete
6. Air content of the plastic concrete
7. Age and strength at time of concrete beam testing

Field qualification test reports must be certified with a signature by an official in responsible charge of the laboratory performing the tests.

40-1.02G Frequency Measuring Device (Tachometer)

Submit calibration documentation and operational guidelines for frequency measuring devices for concrete consolidation vibrators.

40-1.02H Manufacturer's Recommendations and Instructions

If used and at least 15 days before delivery to the job site, submit manufacturer's recommendations and instructions for storage and installation of:

1. Threaded tie bar splice couplers
2. Chemical adhesive (drill and bond)
3. Silicone liquid sealant
4. Asphalt rubber liquid sealant
5. Preformed compression seals
6. Joint filler material

40-1.02I Mix Proportions

At least 15 days before starting testing for mix proportions , submit a copy of the AASHTO accreditation for your laboratory determining the mix proportions. At least 30 days before starting field qualification, submit the proposed concrete mix proportions, the corresponding mix identifications, and laboratory test reports including the modulus of rupture for each trial mixture at 10, 21, 28, and 42 days.

40-1.02J Preformed Compression Seal

Submit the manufacturer's data sheet used to develop the recommended preformed compression seal based on the joint dimensions.

40-1.02K Concrete Pavement Early Age Crack Mitigation System

At least 24 hours before each paving shift, submit:

1. Early age stress and strength predictions
2. Scheduled sawing and curing activities
3. Contingency plan if volunteer cracking occurs

At least 24 hours before paving, meet with the Engineer to review the submittals for the early age crack mitigation system.

During paving, update the system with current weather data obtained from a portable weather station. Before paving concrete pavement with these updates, submit new stress and strength predictions and curing and sawing activity schedules.

40-1.02L Profilograms

Submit profilograms within 5 business days of initial profiling and within 2 business days of profiling corrected sections.

Submit 1 electronic copy of profile information in ".erd" format or other ProVAL compatible format to the Engineer and to:

Smoothness@dot.ca.gov

Submit the original of final profilograms before the Engineer accepts the contract.
Submitted profilograms become the Department's property.

40-1.02M Protecting Concrete Pavement During Cold Weather

Submit a plan for protecting concrete pavement during the initial 72 hours after paving when the forecasted minimum ambient temperature is below 40 degrees F.

40-1.02N Quality Control Charts

Submit updated quality control charts each paving day.

40-1.02O Quality Control Plan

At least 30 days before the start of field qualification, submit a concrete pavement quality control plan (QCP).

40-1.03 QUALITY CONTROL AND ASSURANCE

40-1.03A Contractor Quality Control Plan

Establish, implement, and maintain a QCP for concrete pavement. The QCP must describe the organization and procedures you use to:

1. Control the production process
2. Determine if changes to the production process are needed
3. Implement changes

The QCP must address the elements affecting concrete pavement quality including:

1. Mix proportions
2. Aggregate gradation
3. Materials quality
4. Stockpile management
5. Line and grade control
6. Proportioning
7. Mixing and transportation
8. Placing and consolidation
9. Contraction and construction joints
10. Dowel bar placement, alignment, and anchorage
11. Tie bar placement
12. Modulus of rupture
13. Finishing and curing
14. Surface smoothness
15. Joint sealant and compression seal installation

The QCP must include details of corrective action to be taken if any process is out of control. As a minimum, a process is out of control if any of the following occurs:

1. For fine and coarse aggregate gradation, 2 consecutive running averages of 4 tests are outside the specification limits
2. For individual penetration or air content measurements:

    2.1. One point falls outside the suspension limit line
    2.2. Two points in a row fall outside the action limit line

Stop production and take corrective action for out of control processes or the Engineer rejects subsequent material.

40-1.03B Quality Control Testing

Select random locations and perform sampling and testing in compliance with:

Quality Control Testing

Test	Frequency	Test Method
Cleanness value	2 per day	CT 227
Sand equivalent	2 per day	CT 217
Aggregate gradation	2 per day	CT 202
Air content (freeze thaw) [a]	1 per hour	CT 504
Air content (non-freeze thaw)	1 per 4 hours	CT 504
Density	1 per 4 hours	CT 518
Penetration	1 per 4 hours	CT 533
Calibration of moisture meter [b, c]	1 per day	CT 223 or CT 226

Notes:

[a] If air entrainment is specified, make at least 1 air content measurement per hour. If air entrainment is not specified, make at least 1 air content measurement per 4 hours.

[b] Make at least 1 measurement of moisture content per week to check the calibration of an electronically actuated moisture meter.

[c] Random location sampling and testing is not applicable.

If air entrainment is specified, the testing laboratory and tester must be qualified under the Department's Independent Assurance Manual. The manual is available from the Transportation Laboratory.

40-1.03C Control Charts

Maintain control charts to identify potential problems and assignable causes. Post a copy of each control chart at a location determined by the Engineer.

Individual measurement control charts must use the target values in the mix proportions as indicators of central tendency.

Develop linear control charts for:

1. Cleanness value
2. Sand equivalent
3. Fine and coarse aggregate gradation
4. Air content
5. Penetration

Control charts must include:

1. Contract number
2. Mix proportions
3. Test number
4. Each test parameter
5. Action and suspension limits
6. Specification limits
7. Quality control test results

For fine and coarse aggregate gradation control charts, record the running average of the previous 4 consecutive gradation tests for each sieve and superimpose the specification limits.

For penetration and air content control charts, record the individual measurements and superimpose the following action and suspension limits:

Penetration and Air Content Action and Suspension Limits

Control Parameter	Individual Measurements	
	Action Limit	Suspension Limit
Penetration, CT 533	1 inch	1-1/2 inch
Air content, CT 504	±1.0 percent	±1.5 percent

40-1.03D Contractor's Laboratory

Use a laboratory that complies with ASTM C 1077 to determine the mix proportions for concrete pavement. The laboratory must have a current AASHTO accreditation for:

1. AASHTO T 97 or ASTM C 78
2. ASTM C 192/C 192M

40-1.03E Joint Sealant and Compression Seal Installation Training

Before installing joint sealant or compression seals, arrange for a representative from the joint sealant or compression seal manufacturer to provide training on the cleaning and preparation of the joint and installing the sealant or seal. Until your personnel and the Department's personnel have been trained, do not install joint sealant or compression seals.

40-1.03F Frequency Measuring Device (Tachometer)

Before each day's concrete pavement placement and at intervals not to exceed 4 hours of production, test and record vibration frequency for concrete consolidation vibrators.

40-1.03G Early Age Concrete Pavement Crack Mitigation System

Develop and implement a system for predicting concrete pavement stresses and strength during the initial 72 hours after paving. The system must include:

1. Subscribing to a weather service to obtain forecasts for wind speed, ambient temperatures, humidity, and cloud cover
2. Portable weather station with anemometer, temperature and humidity sensors, located at the paving site
3. Early age concrete pavement stress and strength prediction computer program
4. Analyzing, monitoring, updating, and reporting the system's predictions

40-1.03H Curing Compound

Sample curing compound from shipping containers at the manufacturer's source of supply. Split the samples.

40-1.03I Concrete Pavement Smoothness

Within 10 days after paving, measure the Profile Index (PI_0) of the concrete pavement surface using a zero (null) blanking band under California Test 526.

For the following concrete pavement areas, the Engineer does not require a profilograph and you must test and correct high points determined by a 12-foot straightedge placed parallel with and perpendicular to the centerline:

1. Horizontal curves with a centerline radius of curvature less than 1,000 feet including concrete pavement within the superelevation transitions of those curves.
2. Exit ramp termini, truck weigh stations, and weigh-in-motion areas
3. Where steep grades and superelevation rates greater than 6 percent are present on:

    3.1. Ramps
    3.2. Connectors

4. Turn lanes and areas around manholes or drainage transitions
5. Acceleration and deceleration lanes for at-grade intersections
6. Shoulders and miscellaneous gore areas

Use a California Profilograph to determine the concrete pavement profile. If the profilograph uses a mechanical recorder, use an electronic scanner to reduce the profilogram.

The profilograph operator must be qualified under the Department's Independent Assurance Manual. The manual is available from the Department's Materials Engineering and Testing Services Web site.

40-1.03J Profilograph Test Procedure

Notify the Engineer at least 2 business days before performing profilograph testing. Each day before performing profilograph testing, notify the Engineer of the start location. Perform profilograph testing in the Engineer's presence.

Before starting profilograph testing, remove foreign objects from the concrete pavement surface.

Before starting profilograph testing, calibrate the profilograph in the Engineer's presence. If the Engineer chooses not to be present during profilograph testing, you may perform the testing with the Engineer's written approval. Note the Engineer's absence on the profilogram.

Determine PI_0 values for the final concrete pavement surface of each 0.1-mile section of a traffic lane. Take 2 profiles within each traffic lane, 3 feet from and parallel with the edge of each lane. Each section's PI_0 is the average of the PI_0 values for the measurements within that traffic lane. A section that is less than 0.01 mile and is the result of an interruption to continuous concrete pavement surface must comply with the PI_0 specifications for a full section. Adjust the PI_0 for a partial section to reflect a full section.

Use stationing to locate vertical deviations greater than 0.3 inches. The profilogram stationing must be the same as the project stationing. Note 0.1-mile segments on the profilogram.

Label the profilogram with:

1. Contract number
2. County and route number
3. Stationing
4. Operator's name
5. Test date
6. Test number
7. Traffic direction
8. Traffic lane (numbered from left to right in direction of travel)
9. Test wheel path (left or right in direction of travel)
10. Test direction
11. Paving direction

40-1.03K Smoothness Corrective Action

Correct concrete pavement not complying with the Engineer's acceptance specifications for smoothness by grinding under Section 42-2, "Grinding."

Do not grind before:

1. Ten days after concrete pavement placement
2. The concrete has developed a modulus of rupture of at least 550 psi

Grind the entire lane width. When completed, the lane width must be uniform in texture and appearance. Square the corrected area's start and end normal to the paved surface's centerline.

Retest sections where corrections were made.

40-1.03L Acceptance Criteria

General

Concrete pavement is accepted based on the Department's testing for the concrete pavement quality characteristics shown in the following table:

Concrete Pavement Acceptance Testing

Quality Characteristic	Quantity	Test
28-day modulus of rupture	1,000 cubic yards	CT 523
Thickness	1,200 square yards for primary area measurements	CT 531
Dowel bar placement	700 square yards	Measurement
Tie bar placement	4,000 square yards	Measurement
Coefficient of friction	One day's paving	CT 342
Air content (freeze-thaw) [a]	One day's paving	CT 504

Note:
[a] Air content tests must be performed under California Test 504 if air entrainment is specified.

Pavement smoothness may be accepted based on the Department's testing. A single test represents no more than 0.1 mile.

Acceptance of modulus of rupture, thickness, dowel bar and tie bar placement, coefficient of friction, smoothness, and air content, does not constitute final concrete pavement acceptance.

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Modulus of Rupture

The Engineer accepts concrete pavement for modulus of rupture on a lot basis. The minimum modulus of rupture for each lot is 570 psi at 28 days.

For each lot of concrete for concrete pavement:

1. Quantity must not exceed 1,000 cubic yards.
2. Department determines the modulus of rupture of test beams aged 10 days and 28 days.
3. Department calculates the modulus of rupture by averaging the individual test results of 2 beams aged for 28 days.

The Department provides molds and machines for modulus of rupture acceptance testing. Provide material and labor the Engineer may require.

Concrete Pavement Smoothness

If the Department tests for smoothness, the tests are performed under Section 40-1.03I, "Concrete Pavement Smoothness."

The Engineer accepts concrete pavement for smoothness in compliance with the following:

1. For tangents and horizontal curves having a centerline radius of curvature 2,000 feet or more, the PI_0 must be at most 2-1/2 inches per 0.1-mile section.
2. For horizontal curves having a centerline radius of curvature from 1,000 to 2,000 feet including concrete pavement within the superelevation transitions of those curves, the PI_0 must be at most 5 inches per 0.1-mile section.
3. If using a profilograph to measure smoothness, the surface must not have individual high points greater than 0.3 inch.
4. If using a straightedge to measure smoothness, the surface must be within 0.02 foot of the straightedge's lower edge.

Profile index specifications apply to existing pavement within 50 feet of the transverse joint separating new concrete pavement and the existing pavement.

If the Department's profilograph test results do not match yours, the Engineer may order you to recalibrate your profilograph equipment and perform a retest. If your test results are inaccurate due to operator error, the Engineer may disqualify your profilograph operator. If the Engineer determines your test results are inaccurate, the Engineer does not make adjustments to payment or contract time for recalibrating, retesting, and delays.

Concrete Pavement Thickness

The Engineer accepts concrete pavement for thickness based on coring in the primary area, which is the area placed in 1 day for each thickness. Concrete pavement thickness must not be deficient by more than 0.05 foot.

After corrective grinding has been completed, core concrete pavement in the primary area under Section 40-3.16, "Obtaining Drilled Cores," at locations determined by the Engineer and in the Engineer's presence. The core specimen diameter must be 4 inches. To identify the limits of concrete pavement deficient in thickness by more than 0.05 foot, you may divide primary areas into secondary areas. Specifications that may affect concrete pavement thickness such as allowable tolerances for subgrade construction do not change the thickness specified for concrete pavement.

In each primary area, the Engineer measures concrete pavement thickness every 1,200 square yards and any remaining area. The Engineer measures cores under California Test 531 to the nearest 0.01 foot. Core at least 1 foot from existing, contiguous, and parallel concrete pavement not constructed as part of this contract.

You may request the Engineer make additional thickness measurements and use them to determine the average thickness variation. The Engineer determines the locations with random sampling methods.

If each thickness measurement in a primary area is less than 0.05 foot deficient, the Engineer calculates the average thickness deficiency in that primary area. The Engineer uses 0.02 foot for a thickness difference more than 0.02 foot over the specified thickness.

For each thickness measurement in a primary area deficient by more than 0.05 foot, the Engineer determines a secondary area where the thickness deficiency is more than 0.05 foot. The Engineer determines this secondary area

by measuring the thickness of each concrete pavement slab adjacent to the measurement found to be more than 0.05 foot deficient. The Engineer continues to measure the thickness until an area that is bound by slabs with thickness deficient by 0.05 foot or less is determined.

Slabs without bar reinforcement are defined as the areas bound by longitudinal and transverse joints and concrete pavement edges. Slabs with bar reinforcement are defined as the areas bound by longitudinal joints and concrete pavement edges and 15-foot lengths. Secondary area thickness measurements in a slab determine that entire slab's thickness.

The Engineer measures the remaining primary area thickness after removing the secondary areas from consideration for determining the average thickness deficiency.

The Engineer determines the slabs to remove and replace.

Required Use of Air-Entraining Admixtures

If air-entraining admixtures are specified, the Engineer may choose to accept concrete pavement for air content based on your air content quality control tests. The Engineer decides to use your air content quality control tests based on a *t*-test that determines the difference in the means of your test and the Engineer's verification tests. The Engineer calculates the t-value of the test data as follows:

$$t = \frac{\left|\overline{X}_c - \overline{X}_v\right|}{S_p\sqrt{\frac{1}{n_c}+\frac{1}{n_v}}} \qquad \text{and} \qquad S_p^2 = \frac{S_c^2(n_c - 1)+S_v^2(n_v - 1)}{n_c+n_v-2}$$

where:

n_c = Number of your quality control tests (minimum of 6 required)
n_v = Number of verification tests (minimum of 2 required)
$\overline{X}_c$ = Mean of your quality control tests
$\overline{X}_v$ = Mean of the verification tests
S_p = Pooled standard deviation
(When $n_v = 1$, $S_p = S_c$)
S_c = Standard deviation of your quality control tests
S_v = Standard deviation of the verification tests (when $n_v > 1$)

The Engineer compares your quality control test results with the Department's verification test results at a level of significance of $\alpha = 0.01$. The Engineer compares the *t*-value to t_{crit}, determined from:

t_{crit}

degrees of freedom (n_c+n_v-2)	t_{crit} (for $\alpha = 0.01$)
1	63.657
2	9.925
3	5.841
4	4.604
5	4.032
6	3.707
7	3.499
8	3.355
9	3.250
10	3.169

If the *t*-value calculated is less than or equal to t_{crit}, your quality control test results are verified. If the *t*-value calculated is greater than t_{crit}, quality control test results are not verified.

If your quality control test results are not verified, core at least 3 specimens from concrete pavement under Section 40-3.16, "Obtaining Drilled Cores." The Engineer selects the core locations. Your approved third party independent testing laboratory must test these specimens for air content under ASTM C 457. The Engineer

compares these test results with your quality control test results using the *t*-test method. If your quality control test results are verified based on this comparison, the Engineer uses the quality control test results for acceptance of concrete pavement for air content. If your quality control test results are not verified based on this comparison, the Engineer uses the air content of core specimens determined under ASTM C 457 for acceptance.

Dowel Bar and Tie Bar Placement

Dowel bar alignment must comply with section 40-3.06. Tie bar alignment must comply with Section 40-3.05. Except for CRCP, core specimens for:

1. Dowel bar placement
2. Tie bar placement
3. Concrete consolidation

Obtain cores under Section 40-3.16, "Obtaining Drilled Cores." The Engineer determines the core locations. Each core must have a nominal diameter of 4 inches. Core each day's paving within 2 business days in compliance with:

1. One test for every 700 square yards of doweled concrete pavement or remaining fraction of that area. Each dowel bar test consists of 2 cores, 1 on each dowel bar end to expose both ends and allow measurement.
2. One test for every 4,000 square yards of concrete pavement with tie bars or remaining fraction of that area. Each tie bar test consists of 2 cores, 1 on each tie bar end to expose both ends and allow measurement.

If the tests indicate dowel or tie bars are not placed within the specified tolerances or if there are air voids around the dowel or tie bars, core additional specimens to determine the limits of unacceptable work.

The Engineer determines the slabs to remove and replace.

If the Engineer approves your request, slabs may remain in place with an adjustment in payment for:

1. Dowel bars with centers from ±2 inches to ±3 inches from the saw cut of a transverse contraction joint or with deficient concrete consolidation around the dowel bars
2. Tie bars placed outside their specified placement and position or with deficient concrete consolidation around the tie bars

Bar Reinforcing Steel

The Engineer accepts concrete pavement for bar reinforcing steel based on inspection before concrete placement.

Curing Compound

Curing compound sampled from shipping containers from the manufacturer's supply source or from the job site must match the test results for viscosity, nonvolatile content, and pigment content within the specified tolerances listed in the precision and bias statements for the test methods.

40-2 MATERIALS

40-2.01 CONCRETE

40-2.01A General

Concrete must comply with Section 90, "Portland Cement Concrete."

40-2.01B Aggregate

The specifications for reduction in Operating Range and Contract Compliance for cleanness value and sand equivalent specified under Section 90-2.02A, "Coarse Aggregate," and Section 90-2.02B, "Fine Aggregate," do not apply to concrete pavement.

Combined aggregate gradings must comply with Section 90-3, "Aggregate Gradings," and the difference between the percent passing the 3/8-inch sieve and the percent passing the No. 8 sieve must not be less than 16 percent of the total aggregate.

40-2.01C Cementitious Material

Concrete for concrete pavement must contain from 505 pounds to 675 pounds cementitious material per cubic yard. Determine the minimum cementitious materials content. Use your value for minimum cementitious material content for *MC* in equation 1 and equation 2 of section 90-1.02B(3).

40-2.01D Mix Proportions

Your laboratory determining mix proportions must determine the minimum cementitious materials content or the maximum water to cementitious materials ratio and:

1. You must make trial mixtures no more than 24 months before field qualification.
2. Modulus of rupture used to determine the minimum cementitious materials content or maximum water to cementitious materials ratio must be 570 psi at 28 days age and 650 psi at 42 days age.
3. Your laboratory must determine an increase in the cementitious materials content or a decrease in the water to cementitious materials ratio from the trial mixtures to ensure concrete pavement complies with the specifications.

If changing an aggregate supply source or the mix proportions, produce a trial batch and field-qualify the new concrete. The Engineer does not adjust contract time for performing sampling, testing, and qualifying new mix proportions or changing an aggregate supply source.

40-2.01E Field Qualification

Proposed mix proportions must be field qualified before you place concrete pavement. Use an American Concrete Institute (ACI) certified "Concrete Laboratory Technician, Grade I" to perform field qualification tests and calculations.

The Engineer accepts field qualification if five beams made and tested under California Test 523 comply with the following:

1. At a minimum, beams are tested at 10, 21, and 28 days of age
2. At your choice of age not later than 28 days, no single beam's modulus of rupture is less than 550 psi and the average modulus of rupture is at least 570 psi

40-2.02 TIE BARS

Tie bars must be deformed bars.

If the project is not shown to be in high desert or any mountain climate region, tie bars must be one of the following:

1. Epoxy-coated bar reinforcement. Bars must comply with Section 52-1.02B, "Epoxy-coated Reinforcement" except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60.
2. Stainless-steel bars. Bars must be descaled, pickled, polished, and solid stainless-steel bars under ASTM A 955/A 955M, Grade 60, UNS Designation S31603 or S31803.
3. Low carbon, chromium-steel bars complying with ASTM A 1035/A 1035M.

If the project is shown to be in high desert or any mountain climate region, tie bars must be one of the following:

1. Epoxy-coated bar reinforcement. Bars must comply with "Epoxy-coated Prefabricated Reinforcement" in the special provisions except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60.
2. Stainless-steel bars. Bars must be descaled, pickled, polished, and solid stainless-steel bars under ASTM A 955/A 955M, Grade 60, UNS Designation S31603 or S31803.

Fabricate, sample, and handle epoxy-coated deformed tie bars at the job site under ASTM D 3963/D 3963M and Section 52-1.02B, "Epoxy-coated Reinforcement."

Do not bend tie bars.

40-2.03 DOWEL BARS

40-2.03A General

Dowel bars must be plain bars. Fabricate, sample, and handle epoxy-coated dowel bars under ASTM D 3963/D 3963M and section 52-1.02B, "Epoxy-coated Reinforcement," except each sample must be 18 inches long.

If the project is not shown to be in high desert or any mountain climate region, dowel bars must be one of the following:

1. Epoxy-coated bars. Bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with either (1) Section 52-1.02B, "Epoxy-coated Reinforcement" or (2) "Epoxy-coated Prefabricated Reinforcement" in the special provisions.
2. Stainless-steel bars. Bars must be descaled, pickled, polished, and solid stainless-steel bars under ASTM A 955/A 955M, Grade 60, UNS Designation S31603 or S31803.
3. Low carbon, chromium-steel bars under ASTM A 1035/A 1035M.

If the project is shown to be in high desert or any mountain climate region, dowel bars must be one of the following:

1. Epoxy-coated bars. Bars must comply with ASTM A 615/A 615M, Grade 40 or 60. Epoxy coating must comply with "Epoxy-coated Prefabricated Reinforcement" in the special provisions.
2. Stainless-steel bars. Bars must be descaled, pickled, polished, and solid stainless-steel bars under ASTM A 955/A 955M, Grade 60, UNS Designation S31603 or S31803.

40-2.03B Dowel Bar Lubricant

Dowel bar lubricant must be either (1) petroleum paraffin based or (2) curing compound no. 3. Paraffin-based lubricant must be either Dayton Superior DSC BB-Coat, Valvoline Tectyl 506, or an approved equal. Petroleum paraffin based lubricant must be factory-applied.

40-2.04 CURING COMPOUND

Curing compound must be curing compound (1) or (2) with white pigment under Section 90-7.01B, "Curing Compound Method."

Reflectance must be at least 60 percent when tested under ASTM E 1347.

40-2.05 CHEMICAL ADHESIVE (DRILL AND BOND)

Chemical adhesive for drilling and bonding dowels and tie bars must be prequalified. A list of prequalified chemical adhesives is available on the Department's Materials Engineering and Testing Services website. The prequalified list indicates the appropriate chemical adhesive system for the concrete temperature and installation conditions.

Each chemical adhesive system must clearly and permanently show the following:

1. Manufacturer's name
2. Model number of the system
3. Manufacture date
4. Batch number
5. Expiration date
6. Current International Conference of Building Officials Evaluation Report number
7. Directions for use
8. Warnings or precautions required by state and federal laws and regulations

40-2.06 DOWEL AND TIE BAR BASKETS

For dowel and tie bar baskets, wire must comply with ASTM A 82/A 82M and be welded under ASTM A 185/A 185M, Section 7.4. The minimum wire-size no. is W10. Use either U-frame or A-frame shaped assemblies.

If the project is not shown to be in high desert or any mountain climate region. Baskets may be epoxy-coated, and the epoxy coating must comply with either (1) Section 52-1.02B, "Epoxy-coated Reinforcement" or (2) "Epoxy-coated Prefabricated Reinforcement" in the special provisions.

If the project is shown to be in high desert or any mountain climate region, wire for dowel bar and tie bar baskets must be one of the following:

1. Epoxy-coated wire under "Epoxy-coated Prefabricated Reinforcement" in the special provisions
2. Stainless-steel wire. Wire must be descaled, pickled, and polished solid stainless-steel. Wire must comply with (1) the chemical requirements in ASTM A 276/A 276M, UNS Designation S31603 or S31803 and (2) the tension requirements in ASTM A 1022/ A 1022M.

Handle epoxy-coated tie bar and dowel bar baskets under ASTM D 3963/D 3963M and either (1) Section 52-1.02B, "Epoxy-coated Reinforcement" or (2) "Epoxy-coated Prefabricated Reinforcement" in the special provisions.

Fasteners must be driven fasteners under ASTM F 1667. Fasteners on lean concrete base or HMA must have a minimum shank diameter of 3/16 inch and a minimum shank length of 2-1/2 inches. For asphalt treated permeable base or cement treated permeable base, the shank diameter must be at least 3/16 inch and the shank length must be at least 5 inches.

Fasteners, clips, and washers must have a minimum 0.2-mil thick zinc coating applied either by electroplating or galvanizing.

40-2.07 BACKER RODS

Backer rods must be Type 1 under ASTM D 5249. Backer rod diameter must be at least 25 percent greater than the sawcut joint width. Backer rod material must be expanded, crosslinked, closed-cell polyethylene foam. No bond or adverse reaction may occur between the backer rod and sealant.

40-2.08 JOINT FILLER MATERIAL

Joint filler for isolation joints must be preformed expansion joint filler for concrete (bituminous type) under ASTM D 994.

40-2.09 HYDRAULIC CEMENT GROUT (NON-SHRINK)

Hydraulic cement grout (non-shrink) must comply with ASTM C 1107/ C 1107M. Use clean, uniform, rounded aggregate filler to extend the grout. Aggregate filler must not exceed 60 percent of the grout mass or the maximum recommended by the manufacturer, whichever is less. Aggregate filler moisture content must not exceed 0.5 percent. Aggregate filler must comply with:

Aggregate Filler Grading

Sieve Size	Percentage Passing
1/2-inch	100
3/8-inch	85 - 100
No. 4	10 - 30
No. 8	0 - 10
No. 16	0 - 5

40-2.10 BAR REINFORCEMENT

Bar reinforcement must be deformed bars.

If the project is not shown to be in high desert or any mountain climate region, bar reinforcement must comply with section 52.

If the project is shown to be in high desert or any mountain climate regions, bar reinforcement must be one of the following:

1. Epoxy-coated bar reinforcement under section 52-2.03B except bars must comply with either ASTM A 706/A 706M; ASTM A 996/A 996M; or ASTM A 615/A 615M, Grade 40 or 60. Bars must be handled under ASTM D 3963/D 3963M and section 52-2.02C.
2. Low carbon, chromium steel bar complying with ASTM A 1035/A 1035M

40-2.11 JOINT SEALANT

40-2.11A General

Do not use hot-pour sealant that will melt the backer rod.

40-2.11B Silicone Joint Sealant

Silicone joint sealant must be prequalified. A list of prequalified silicone joint sealant available on the Department's Materials Engineering and Testing Services Web site at:

http://www.dot.ca.gov/hq/esc/approved_products_list/

40-2.11C Asphalt Rubber Joint Sealant

Asphalt rubber joint sealant must:

1. Be a mixture of paving asphalt and ground rubber containing not less than 22 percent ground rubber by weight. One hundred percent of ground rubber must pass a No. 8 sieve. Ground rubber must be vulcanized or a combination of vulcanized and devulcanized materials.
2. Comply with ASTM D 6690, Type II except:

    2.1. The cone penetration requirement must not exceed 120 at 77 F, 5 ounces, 5 seconds.
    2.2. The resilience requirement must be a minimum 50 percent recovery when tested at 77 F.

3. Have a Ring and Ball softening point of 135 °F minimum when tested under AASHTO T 53.
4. Be capable of being melted and applied to cracks and joints at temperatures below 400 °F.
5. Not be applied when the concrete pavement surface temperature is below 50 °F.

40-2.11D Preformed Compression Joint Seals

Preformed compression joint seals must comply with ASTM D 2628. Lubricant adhesive used with the seals must comply with ASTM D 2835. Preformed compression joint seals must have 5 or 6 cells, except seals for Type A2 and Type B joints may have 4 cells. Install preformed compression joint seals in compliance with the manufacturer's recommendations. Show evidence that the seals are compressed from 30 to 50 percent for the joint width at the time of installation.

40-2.12 WATER

Water for core drilling may be obtained from a potable water source, or submit proof that it does not contain:

1. More than 1,000 parts per million of chlorides as Cl
2. More than 1,300 parts per million of sulfates as $S0_4$
3. Impurities that cause pavement discoloration or surface etching

40-3 CONSTRUCTION

40-3.01 WATER SUPPLY

Before placing concrete pavement, develop enough water supply for the work.

40-3.02 SUBGRADE PREPARATION

Immediately before placing concrete, the subgrade to receive concrete pavement must be:

1. In compliance with the specified compaction and elevation tolerances
2. Free of loose and extraneous material
3. Uniformly moist, but free of standing or flowing water
4. Excavated for thickened parts of concrete pavement end anchors with no disturbed compaction outside the end anchor dimensions

If cement treated permeable base is specified, cover the base surface with asphaltic emulsion before placing concrete pavement. Apply the asphaltic emulsion uniformly at a rate of 0.1 gallons per square yard. Asphaltic emulsion must comply with anionic slow-setting type, SS1h grade in Section 94, "Asphaltic Emulsions." Repair damaged asphaltic emulsion before placing concrete pavement.

40-3.03 PROPORTIONING

Proportion aggregate and bulk cementitious materials under Section 90-5, "Proportioning."

40-3.04 PLACING CONCRETE

40-3.04A General

Place concrete pavement with stationary side forms or slip-form paving equipment.

Place consecutive concrete loads within 30 minutes of each other. Construct a transverse construction joint when concrete placement is interrupted by more than 30 minutes. The transverse construction joint must coincide with the next contraction joint location, or you must remove fresh concrete pavement to the preceding transverse joint location.

Place concrete pavement in full slab widths separated by construction joints or monolithically in multiples of full lane widths with a longitudinal contraction joint at each traffic lane line.

Do not retemper concrete.

If the concrete pavement surface width is constructed as specified, you may construct concrete pavement sides on a batter not flatter than 6:1 (vertical:horizontal).

40-3.04B Concrete Pavement Widening

If concrete pavement is placed adjacent to existing pavement not constructed as part of the contract, grind the existing concrete pavement lane or shoulder adjacent to the new concrete pavement. Perform the grinding before new concrete pavement is placed. The new concrete pavement must match the elevation of the existing concrete pavement after grinding. Grind existing concrete pavement under Section 42-2, "Grinding," except profile index must comply with the pavement smoothness specifications in Section 40-1.03, "Quality Control and Assurance."

Use paving equipment with padded crawler tracks or rubber-tired wheels on the existing concrete pavement with enough offset to avoid breaking or cracking the existing concrete pavement's edge.

40-3.04C Concrete Pavement Transition Panel

For concrete pavement placed in a transition panel, texture the surface with a drag strip of burlap, a broom, or a spring steel tine device that produces scoring in the finished surface. The scoring must be either parallel with or transverse to the centerline. For the method you choose, texture at the time that produces the coarsest texture.

40-3.04D Stationary Side Form Construction

Stationary side forms must be straight and without defects including warps, bends, and indentations. Side forms must be metal except at end closures and transverse construction joints where other materials may be used.

You may build up side forms by attaching a section to the top or bottom. If attached to the top of metal forms, the attached section must be metal.

The side form's base width must be at least 80 percent of the specified concrete pavement thickness.

Side forms including interlocking connections with adjoining forms must be rigid enough to prevent springing from subgrading and paving equipment and concrete pressure.

Construct subgrade to final grade before placing side forms. Side forms must bear fully on the foundation throughout their length and base width. Place side forms to the specified grade and alignment of the finished concrete pavement's edge. Support side forms during concrete placing, compacting, and finishing.

After subgrade work is complete and immediately before placing concrete, true side forms and set to line and grade for a distance that avoids delays due to form adjustment.

Clean and oil side forms before each use.

Side forms must remain in place for at least 1 day after placing concrete and until the concrete pavement edge no longer requires protection from the forms.

Spread, screed, shape, and consolidate concrete with 1 or more machines. The machine must uniformly distribute and consolidate the concrete. The machines must operate to place the concrete pavement to the specified cross section with minimal hand work.

Consolidate the concrete without segregation. If vibrators are used:

1. The vibration rate must be at least 3,500 cycles per minute for surface vibrators and 5,000 cycles per minute for internal vibrators
2. Amplitude of vibration must cause perceptible concrete surface movement at least 1 foot from the vibrating element
3. Use a calibrated tachometer for measuring frequency of vibration
4. Vibrators must not rest on side forms or new concrete pavement
5. Power to vibrators must automatically cease when forward or backward motion of the paving machine is stopped

Use high-frequency internal vibrators within 15 minutes of depositing concrete on the subgrade to uniformly consolidate the concrete across the paving width including adjacent to forms. Do not use vibrators to shift the mass of concrete.

40-3.04E Slip-Form Construction

If slip-form construction is used, spread, screed, shape, and consolidate concrete to the specified cross section with slip-form machines and minimal hand work. Slip-form paving machines must be equipped with traveling side forms and must not segregate the concrete.

Do not deviate from the specified concrete pavement alignment by more than 0.1 foot.

Slip-form paving machines must use high frequency internal vibrators to consolidate concrete. You may mount vibrators with their axes parallel or normal to the concrete pavement alignment. If mounted with axes parallel to the concrete pavement alignment, space vibrators no more than 2.5 feet measured center to center. If mounted with axes normal to the concrete pavement alignment, space the vibrators with a maximum 0.5-foot lateral clearance between individual vibrators.

Each vibrator must have a vibration rate from 5,000 cycles per minute to 8,000 cycles per minute. The amplitude of vibration must cause perceptible concrete surface movement at least 1 foot from the vibrating element. Use a calibrated tachometer to measure frequency of vibration.

40-3.05 TIE BAR PLACEMENT

Place tie bars in compliance with the tolerances shown in the following table:

Tie Bar Tolerance

Dimension	Tolerance
Horizontal and vertical skew	10 degrees maximum
Longitudinal translation	±2 inch maximum
Horizontal offset (embedment)	±2 inch maximum
Vertical depth	1. Not less than 1/2 inch below the saw cut depth of joints 2. When measured at any point along the bar, not less than 2 inches clear of the pavement's surface and bottom

Install tie bars at longitudinal joints by 1 of the following methods:

1. Drill concrete and bond tie bars with chemical adhesive in compliance with the manufacturer's instructions. Clean and dry drilled holes before placing chemical adhesive and tie bars. After inserting tie bars into chemical adhesive, support the bars to prevent movement during curing. If the Engineer rejects a tie bar installation, cut the tie bar flush with the joint face and coat the exposed end of the tie bar with chemical adhesive under Section 40-2, "Materials." Offset new holes 3 inches horizontally from the rejected hole's center.
2. Insert tie bars into plastic slip-formed concrete before finishing. Inserted tie bars must have full contact between the bar and the concrete. If tie bars are inserted through the plastic concrete surface, eliminate evidence of the insertion by reworking the concrete over the tie bars.
3. Use threaded tie bar splice couplers fabricated from deformed bar reinforcement free of external welding or machining.
4. Use tie bar baskets. Anchor baskets at least 200 feet in advance of concrete pavement placement activity. If you request a waiver, describe the construction limitations or restricted access preventing the advanced anchoring. After the baskets are anchored and before paving, demonstrate the tie bars do not move from their specified depth and alignment during paving. Use fasteners to anchor tie bar baskets.

If tie bars are not placed correctly, stop paving activities until you demonstrate to the Engineer correction of the cause.

40-3.06 DOWEL BAR PLACEMENT

Center dowel bars within 2 inches in the longitudinal direction on transverse contraction joints or construction joints.

If using curing compound as lubricant, apply the curing compound to dowels in 2 separate applications. Lubricate each dowel bar entirely with bond breaker before placement. The last application must be applied not more than 8 hours before placing the dowel bars. Apply each curing compound application at a rate of 1 gallon per 150 square feet.

If dowel bars are placed by mechanical insertion, eliminate evidence of the insertion by reworking the concrete over the dowel bars. If drilling and bonding dowel bars at construction joints, use a grout retention ring.

If using dowel bar baskets, anchor them with fasteners.

Use at least 10 fasteners for basket sections greater than 12 feet and less than or equal to 16 feet. Baskets must be anchored at least 200 feet in advance of the concrete placement activity unless the Engineer approves your waiver request. If requesting a waiver, describe the construction limitations or restricted access preventing the advanced anchoring. After the baskets are anchored and before the concrete is placed, cut and remove temporary spacer wires and demonstrate the dowel bars do not move from their specified depth and alignment during concrete placement.

Place dowel bars in compliance with:

Dowel Bar Tolerances

Dimension	Tolerance
Horizontal offset	±1 inch
Longitudinal translation	±2 inches
Horizontal skew	3/8 inch, max
Vertical skew	3/8 inch, max
Vertical depth	The minimum distance below the concrete pavement surface must be: DB = d/3 + 1/2 inch where: DB = vertical distance in inches, measured from concrete pavement surface to any point along the top of dowel bar d = concrete pavement thickness in inches The maximum distance below the depth shown must be 5/8 inch..

If dowel bars are not placed correctly, stop paving activities until you demonstrate to the Engineer correction of the cause.

Remove and replace the concrete pavement 3 feet on either side of a joint with a rejected dowel bar.

40-3.07 BAR REINFORCEMENT

Place bar reinforcement under Section 52, "Reinforcement." Bar reinforcement must be more than 1/2 inch below the saw cut depth at concrete pavement joints.

40-3.08 JOINTS

40-3.08A General

Concrete pavement joints consist of:

1. Longitudinal and transverse construction joints
2. Longitudinal and transverse contraction joints
3. Isolation joints

Construction joints must be normal to the concrete pavement surface.

Until contract acceptance and except for joint filler material, keep joints free of foreign material including soil, gravel, concrete, or asphalt mix.

Volunteer cracks are cracks not coincident with constructed joints.

Repair concrete pavement damaged during joint construction under Section 40-3.17B, "Repair of Spalls, Raveling, and Tearing."

Do not bend tie bars or reinforcement in existing concrete pavement joints.

40-3.08B Construction Joints

Construction joints form where fresh concrete is placed against hardened concrete, existing pavements, or structures.

Before placing concrete at construction joints, apply a curing compound under Section 90-7.01B, "Curing Compound Method," to the vertical surface of existing or hardened concrete and allow it to dry.

Use a metal or wooden bulkhead to form transverse construction joints. If dowel bars are specified, the bulkhead must allow dowel bar installation.

40-3.08C Contraction Joints

In multilane monolithic concrete pavement, use the sawing method to construct longitudinal contraction joints. Construct transverse contraction joints by the sawing method.

Construct transverse contraction joints within 1 foot of their specified spacing. If a slab length of less than 5 feet would be formed, adjust the transverse contraction joint spacing.

Construct transverse contraction joints across the full concrete pavement width regardless of the number or types of longitudinal joints crossed. In areas of converging and diverging pavements, space transverse contraction joints so their alignment is continuous across the full width where converging and diverging pavements are contiguous. Longitudinal contraction joints must be parallel with the concrete pavement centerline. Transverse and longitudinal contraction joints must not deviate by more than 0.1 foot from either side of a 12-foot straight line, except for longitudinal joints parallel to a curving centerline.

40-3.08D Isolation Joints

Construct isolation joints by saw cutting a minimum 1/8-inch width to full concrete pavement depth at the existing concrete pavement's edge and removing the concrete to expose a flat vertical surface. Before placing concrete, secure joint filler material that prevents new concrete from adhering to the existing concrete face.

Dispose of concrete saw cutting residue under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."

40-3.08E Sawing Method

The sawing method is cutting a groove in the concrete pavement with a power driven concrete saw. Grooves for longitudinal and transverse contraction joints must be the minimum width possible for the type of saw used. If necessary, the top of the joint must be sawn wider to provide space for joint sealant. Immediately wash slurry from the joint with water under 100 psi maximum pressure.

Saw longitudinal and transverse contraction joints before volunteer cracking occurs and after the concrete is hard enough to saw without spalling, raveling, or tearing.

To keep foreign material out of grooves before joint sealant or compression seal installation, you may use joint filler in sawed contraction joints. Joint filler must not react adversely with the concrete or cause concrete pavement damage. After sawing and washing a joint, install joint filler material that keeps moisture in the adjacent concrete during the 72 hours after paving. If you install joint filler material, the specifications for spraying the sawed joint with additional curing compound under Section 40-3.13, "Curing," do not apply. If using absorptive filler material, moisten the filler immediately before or after installation.

40-3.09 JOINT SEALANT AND COMPRESSION SEAL INSTALLATION

40-3.09A General

At least 7 days after concrete pavement placement and not more than 4 hours before installing joint sealant or compression seal materials, use dry sand blasting and other methods to clean the joint walls of objectionable material such as soil, asphalt, curing compound, paint, and rust. The maximum sand blasting nozzle diameter must be 1/4 inch. The minimum pressure must be 90 psi. Sand blast each side of the joint at least once, in at least 2 separate passes. Hold the nozzle at an angle to the joint from 1 to 2 inches from the concrete pavement. Using a vacuum, collect sand, dust, and loose material at least 2 inches on each side of the joint. Remove surface moisture and dampness at the joints with compressed air that may be moderately hot.

Before you install joint sealant or compression seal, the joint wall must be free of moisture, residue, or film.

If grinding or grooving over or adjacent to sealed joints, remove joint sealant or compression seal materials and dispose of them under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way." After grinding or grooving, replace the joint sealant or compression seal materials.

40-3.09B Liquid Sealant

Do not install liquid sealant in construction joints.

Install backer rods when the concrete pavement temperature is above the air dew point and when the air temperature is at least 40 °F.

Install liquid sealant immediately after installing the backer rod. Install sealant using a mechanical device with a nozzle shaped to introduce the sealant from inside the joint. Extrude sealant evenly and with continuous contact with the joint walls. Recess the sealant surface after placement. Remove excess sealant from the concrete pavement surface.

Do not allow traffic over sealed joints until the sealant is set.

40-3.09C Preformed Compression Seal

Install preformed compression seal in construction or isolation joints when specified in the special provisions.

Install longitudinal seals before transverse seals. Longitudinal seals must be continuous except splicing is allowed at intersections with transverse seals. Transverse seals must be continuous for the entire transverse length of concrete pavement except splices are allowed for widenings and staged construction. With a sharp instrument, cut across the longitudinal seal at the intersection with transverse construction joints. If the longitudinal seal does not relax enough to properly install the transverse seal, trim the longitudinal seal to form a tight seal between the 2 joints.

If splicing is authorized, splicing must comply with the manufacturer's written instructions.

Use a machine specifically designed for preformed compression seal installation. The machine must install the seal:

1. To the specified depth
2. To make continuous contact with the joint walls
3. Without cutting, nicking, or twisting the seal
4. With less than 4 percent stretch

Lay a length of preformed compression seal material cut to the exact length of the pavement joint to be sealed. The Engineer measures this length. After you install the length of preformed compression joint sealant, the Engineer measures the excess amount of material at the joint end. The Engineer divides the excess amount length by the original measured length to determine the percentage of stretch.

40-3.10 SHOULDER RUMBLE STRIP

If specified, construct shoulder rumble strips by rolling or grinding indentations in new concrete pavement.

Select the method and equipment for constructing ground-in indentations.

Do not construct shoulder rumble strips on structures or approach slabs.

Construct rumble strips within 2 inches of the specified alignment. Roller or grinding equipment must be equipped with a sighting device enabling the operator to maintain the rumble strip alignment.

Indentations must not vary from the specified dimensions by more than 1/16 inch in depth or more than 10 percent in length and width.

The Engineer orders grinding or removal and replacement of noncompliant rumble strips to bring them within specified tolerances. Ground surface areas must be neat and uniform in appearance.

The grinding equipment must be equipped with a vacuum attachment to remove residue.

Dispose of removed material under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way."

40-3.11 PRELIMINARY FINISHING

40-3.11A General

Preliminary finishing must produce a smooth and true-to-grade finish. After preliminary finishing, mark each day's concrete pavement with a stamp. The stamp must be approved by the Engineer before paving starts. The stamp must be approximately 1' x 2' in size. The stamp must form a uniform mark from 1/8 to 1/4 inch deep. Locate the mark 20 feet ± 5 feet from the transverse construction joint formed at each day's start of paving and 1 foot ± 0.25 foot from the concrete pavement's outside edge. The stamp mark must show the month, day, and year of placement and the station of the transverse construction joint. Orient the stamp mark so it can be read from the concrete pavement's outside edge.

Do not apply more water to the concrete pavement surface than can evaporate before float finishing and texturing are completed.

40-3.11B Stationary Side Form Finishing

If stationary side form construction is used, give the concrete a preliminary finish by the machine float method or the hand method.

If using the machine float method:

1. Use self-propelled machine floats.
2. Determine the number of machine floats required to perform the work at a rate equal to the concrete delivery rate. When the time from concrete placement to machine float finishing exceeds 30 minutes, stop concrete delivery . When machine floats are in proper position, you may resume concrete delivery and paving.
3. Machine floats must run on side forms or adjacent concrete pavement lanes. If running on adjacent concrete pavement, protect the adjacent concrete pavement surface under Section 40-3.15, "Protecting Concrete Pavement."
4. Floats must be hardwood, steel, or steel-shod wood. Floats must be equipped with devices that adjust the underside to a true flat surface.

If using the hand method, finish concrete smooth and true to grade with manually operated floats or powered finishing machines.

40-3.11C Slip-Form Finishing

If slip-form construction is used, the slip-form paver must give the concrete pavement a preliminary finish. You may supplement the slip-form paver with machine floats.

Before the concrete hardens, correct concrete pavement edge slump in excess of 0.02 foot exclusive of edge rounding.

40-3.12 FINAL FINISHING

After completing preliminary finishing, round the edges of the initial paving widths to a 0.04-foot radius. Round transverse and longitudinal construction joints to a 0.02-foot radius.

Before curing, texture the pavement. Perform initial texturing with a burlap drag or broom device that produces striations parallel to the centerline. Perform final texturing with a steel-tined device that produces grooves parallel with the centerline.

Construct longitudinal grooves with a self-propelled machine designed specifically for grooving and texturing concrete pavement. The machine must have tracks to maintain constant speed, provide traction, and maintain accurate tracking along the pavement surface. The machine must have a single row of rectangular spring steel tines. The tines must be from 3/32 to 1/8 inch wide, on 3/4-inch centers, and must have enough length, thickness, and resilience to form grooves approximately 3/16 inch wide. The machine must have horizontal and vertical controls. The machine must apply constant down pressure on the pavement surface during texturing. The machines must not cause ravels.

Construct grooves over the entire pavement width in a single pass except do not construct grooves 3 inches from the concrete pavement edges and longitudinal joints. Final texture must be uniform and smooth. Use a guide to properly align the grooves. Grooves must be parallel and aligned to the pavement edge across the pavement width. Grooves must be from 1/8 to 3/16 inch deep after concrete has hardened.

For irregular areas and areas inaccessible to the grooving machine, you may hand-construct grooves in compliance with the hand method under Section 40-3.11B, "Stationary Side Form Finishing." Hand-constructed grooves must comply with the specifications for machine-constructed grooves.

Initial and final texturing must produce a coefficient of friction of at least 0.30 when tested under California Test 342. Notify the Engineer when the concrete pavement is scheduled to be opened to traffic to allow at least 25 days for the Department to schedule for test for coefficient of friction. Notify the Engineer when the pavement is ready for testing which is the latter of:

1. Seven days after concrete placement
2. When the concrete pavement has attained a modulus of rupture of 550 psi

The Department tests for coefficient of friction within 7 days of receiving notification that the pavement is ready for testing.

Do not open the concrete pavement to traffic unless the coefficient of friction is at least 0.30.

Correct concrete pavement not complying with the Engineer's acceptance criteria for coefficient of friction by grooving or grinding under Section 42, "Groove and Grind Pavement."

Do not grind before:

1. Ten days after concrete pavement placement
2. Concrete has developed a modulus of rupture of at least 550 psi

Before opening to traffic, allow at least 25 days for the Department to retest sections for coefficient of friction after corrections are made.

40-3.13 CURING

Cure the concrete pavement's exposed area with waterproof membrane or curing compound (1) or (2) under Section 90-7.01, "Methods of Curing." When side forms are removed within 72 hours of the start of curing, also cure the concrete pavement edges.

If curing compound is used, apply it with mechanical sprayers. Reapply curing compound to sawcuts and disturbed areas.

40-3.14 EARLY USE OF CONCRETE PAVEMENT

If requesting early use of concrete pavement:

1. Furnish molds and machines for modulus of rupture testing
2. Sample concrete
3. Fabricate beam specimens
4. Test for modulus of rupture under California Test 523

When you request early use, concrete pavement must have a modulus of rupture of at least 350 psi. Protect concrete pavement under Section 40-3.15, "Protecting Concrete Pavement."

40-3.15 PROTECTING CONCRETE PAVEMENT

Protect concrete pavement under Section 90-8, "Protecting Concrete."

Maintain the concrete pavement temperature at not less than 40 °F for the initial 72 hours.

Protect the concrete pavement surface from activities that cause damage and reduce texture and coefficient of friction. Do not allow soil, gravel, petroleum products, concrete, or asphalt mixes on the concrete pavement surface.

Construct crossings for traffic convenience. If the Engineer approves your request, you may use rapid strength concrete for crossings. Do not open crossings until the Department determines by California Test 523 the concrete pavement's modulus of rupture is at least 550 psi.

Do not open concrete pavement to traffic or use equipment on the concrete pavement for 10 days after paving nor before the concrete has attained a modulus of rupture of 550 psi except:

1. If the equipment is for sawing contraction joints
2. If the Engineer approves your request, one side of paving equipment's tracks may be on the concrete pavement after a modulus of rupture of 350 psi has been attained, provided:

    2.1. Unit pressure exerted on the concrete pavement by the paver does not exceed 20 psi
    2.2. You change the paving equipment tracks to prevent damage or the paving equipment tracks travel on protective material such as planks
    2.3. No part of the track is closer than 1 foot from the concrete pavement's edge

If concrete pavement damage including visible cracking occurs, stop operating paving equipment on the concrete pavement and repair the damage.

40-3.16 OBTAINING DRILLED CORES

Drill concrete pavement cores under ASTM C 42/ C 42M. Core drilling equipment must use diamond impregnated bits.

Clean, dry, and fill core holes with hydraulic cement grout (non-shrink) or pavement concrete. Coat the core hole walls with epoxy under the specifications for epoxy adhesive for bonding new concrete to old concrete in Section 95, "Epoxy." The backfill must match the adjacent concrete pavement surface elevation and texture.

Do not allow residue from core drilling to fall on traffic, flow across shoulders or lanes occupied by traffic, or flow into drainage facilities including gutters.

40-3.17 REPAIR, REMOVAL, AND REPLACEMENT

40-3.17A General

Working cracks are full-depth cracks essentially parallel to a planned contraction joint beneath which a contraction crack has not formed. If the Engineer orders, take 4-inch nominal diameter cores on designated cracks under Section 40-3.16, "Obtaining Drilled Cores."

40-3.17B Repair of Spalls, Raveling, and Tearing

Before concrete pavement is open to traffic, repair spalls, raveling, and tearing in sawed joints. Make repairs in compliance with the following:

1. Saw a rectangular area with a diamond-impregnated blade at least 2 inches deep.
2. Remove unsound and damaged concrete between the saw cut and the joint and to the saw cut's depth. Do not use a pneumatic hammer heavier than 15 pounds. Do not damage concrete pavement to remain in place.
3. Dispose of removed concrete pavement under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."
4. Clean the repair area's exposed surfaces with high pressure abrasive water blasting. Further clean and dry the exposed surfaces with compressed air free of moisture and oil.
5. Apply epoxy as specified for epoxy resin adhesive for bonding new concrete to old concrete under Section 95, "Epoxy." Apply the epoxy with a stiff bristle brush.
6. Apply a portland cement concrete or mortar patch immediately following the epoxy application. Install an insert to prevent bonding of the sides of planned joints.

Repair spalls if they are:

1. Deeper than 0.05 foot
2. Wider than 0.04 foot
3. Longer than 0.3 foot

40-3.17C Route and Seal Working Cracks

Treat working cracks within 0.5 foot of either side of a planned contraction joint in compliance with the following:

1. Route and seal the crack with epoxy resin in compliance with the following:

    1.1. Use a powered rotary router mounted on wheels, with a vertical shaft and a routing spindle that casters as it moves along the crack
    1.2. Form a reservoir 3/4 inch deep by 3/8 inch wide in the crack
    1.3. Use equipment that does not cause raveling or spalling
    1.4. Place liquid sealant

2. Treat the contraction joint adjacent to the working crack in compliance with the following:

    2.1. Use epoxy resin under ASTM C 881/C 881M, Type IV, Grade 2 for Type B joints and secondary saw cuts for Type A1 and Type A2 joints
    2.2. Pressure inject epoxy resin under ASTM C 881/C881M, Type IV, Grade 1 for narrow saw cuts including initial saw cuts for Type A1 and Type A2 joints

If a working crack intersects a contraction joint, route and seal the working crack and seal the contraction joint as specified for installing liquid sealant under Section 40-3.09, "Joint Seal and Joint Sealant Installation."

40-3.17D Removal and Replacement of Slabs

As specified, remove and replace slabs or partial slabs for:

1. Insufficient thickness
2. Dowel bar misalignment
3. Working cracks more than 0.5 foot from a planned contraction joint

40-4 MEASUREMENT AND PAYMENT

40-4.01 MEASUREMENT

Concrete pavement is measured by the cubic yard. The Engineer calculates the pay quantity volume based on the dimensions shown on the plans and as ordered

The contract items for sealing joints as designated in the Verified Bid Item List are measured by the linear foot. Sealing joints are measured from field measurements for each type of sealed joint.

The contract item for shoulder rumble strips is measured by the station along each shoulder on which the rumble strips are constructed without deductions for gaps between indentations.

40-4.02 PAYMENT

The contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the concrete pavement, complete in place including bar reinforcement, tie bars, dowel bars, anchors, fasteners, tack coat, and providing the facility for and attending the prepaving conference, as shown on the plans and as specified in these specifications and the special provisions, and as directed by the Engineer.

The Engineer adjusts payment for each primary area deficient in average thickness in compliance with the following:

Pay Adjustments for Deficient Thickness

Average Thickness Deficiency (foot)	Deficiency Adjustment ($/sq yd)
0.01	0.90
0.02	2.30
0.03	4.10
0.04	6.40
0.05	9.11

If the average thickness deficiency is less than 0.01 foot, the Engineer does not adjust payment for thickness deficiency. If the average thickness deficiency is more than 0.01 foot, the Engineer rounds to the nearest 0.01 foot and uses the adjustment table.

Full compensation for core drilling and backfilling the cores ordered by the Engineer for measuring concrete pavement thickness and determining full-depth cracks is included in the contract price paid per cubic yard for concrete pavement as designated in the Engineer's Estimate and no additional compensation will be allowed therefor. The Department does not pay for additional concrete pavement thickness measurements requested by the Contractor.

The Department does not pay for the portion of concrete that penetrates treated permeable base.

Full compensation for the quality control plan is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for furnishing and applying asphaltic emulsion on cement treated permeable base is included in the contract price paid per cubic yard for concrete pavement as designated in the Engineer's Estimate and no separate payment will be made therefor.

Full compensation for repairing joints is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for furnishing, calibrating, and operating profilograph equipment for Profile Index, for submitting profilograms, and for performing corrective work is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for grooving and grinding for final finishing is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for removing and replacing joint material for grooving and grinding is included in the contract price per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for removing and replacing slabs is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

Full compensation for drilling holes and bonding tie bars with chemical adhesive is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no additional compensation will be allowed therefor.

Full compensation for repairing damage caused by operating paving equipment on new concrete pavement is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no separate payment will be made therefor.

The material and work necessary for the construction of crossings for public convenience, and their subsequent removal and disposal, will be paid for at the contract prices for the items of work involved and if there are no contract items for the work involved, payment for concrete pavement crossings will be made by extra work as specified in Section 4-1.03D, "Extra Work."

The Department will reduce payments to the Contractor by $56.12 per square yard for concrete pavement slabs allowed to remain in place represented by cores indicating dowel bars placed with their centers from ±2 inches to ±3 inches from the saw cut of a transverse contraction joint

The Engineer will calculate the reduced payment using the slab dimensions adjacent to and inclusive of the joints with misplaced dowel bars. This reduced payment is in addition to other specified payment reductions.

The Department will reduce payments to the Contractor by $59.56 per square yard for concrete pavement allowed to remain in place represented by cores indicating either of the following:

1. Tie bars placed outside their specified placement and position tolerances
2. Bar reinforcement placed outside their specified placement and position tolerances

The Engineer will calculate the reduced payment using the slab dimensions adjacent to and inclusive of the joints with misplaced tie bars. This reduced payment is in addition to other specified payment reductions.

Full compensation for core drilling for checking dowel or tie bar alignment and backfilling the cores is included in the contract price paid per cubic yard for concrete pavement as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.

If the initial cores show that dowel bars or tie bars are out of tolerance for alignment and the Engineer orders additional dowel or tie bar coring, full compensation for drilling the additional cores is included in the contract price paid per cubic yard for concrete pavement as designated in the Verified Bid Item List and no additional compensation will be allowed therefor.

If the initial cores show that dowel bars or tie bars are within alignment tolerances and the Engineer orders more dowel or tie bar coring, the additional cores will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

The Department will not pay for additional coring to check dowel or tie bar alignment you request.

Full compensation for performing profilograph tests, furnishing the profilograms and electronic files to the Engineer, and for performing corrective work is included in the contract price paid per cubic yard for the type of concrete pavement as designated in the Verified Bid Item List and no additional compensation will be allowed therefor.

The contract prices paid per linear foot for seal pavement joint and seal isolation joint include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in sealing pavement joints and sealing isolation joints, complete in place, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

The contract price paid per station for shoulder rumble strip includes full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing the rumble strip complete in place, as shown on the plans, as specified in these Standard Specifications and as directed by the Engineer.

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SECTION 41 PAVEMENT SUBSEALING AND JACKING
(Issued 01-05-07)

In Section 41-1.02 replace the 2nd and 3rd paragraphs with:

Cement for grout shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

Fly ash shall conform to the requirements in AASHTO Designation: M 295 for either Class C or for Class F. The brand of fly ash used in the work shall conform to the provisions for approval of admixture brands in Section 90-4.03, "Admixture Approval."

In Section 41-1.02 replace the 5th paragraph with:

Chemical admixtures and calcium chloride may be used. Chemical admixtures in the grout mix shall conform to the provisions in Section 90-4, "Admixtures." Calcium chloride shall conform to ASTM Designation: D 98.

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SECTION 42 GROOVE AND GRIND PAVEMENT
(Issued 05-15-09)

In Section 42-2.02 replace the 3rd paragraph with:

Existing portland cement concrete pavement not constructed as part of the project shall be ground as follows:

Grinding shall be performed so that the pavement surface on both sides of all transverse joints and cracks has essentially the same depth of texture and does not vary from a true plane enough to permit a 0.006-foot thick shim 0.25-foot wide to pass under a 3-foot straightedge adjacent to either side of the joint or crack when the straightedge is laid on the pavement parallel to centerline with its midpoint at the joint or crack. After grinding has been completed, the pavement shall conform to the straightedge and profile requirements specified in Section 40-1.03, "Quality Control and Assurance."

Abnormally depressed areas due to subsidence or other localized causes will be excluded from testing with the profilograph and 12-foot straightedge specified in Section 40-1.03. The accumulated total of the excluded areas shall not exceed 5 percent of the total area to be ground. Profilograph testing shall end 25 feet prior to excluded areas and shall resume 25 feet following the excluded areas.

In Section 42-2.03 replace the 2nd paragraph with:

Replacement concrete paving shall conform to the provisions in Section 40, "Concrete Pavement." Replacement pavement may be spread and shaped by any suitable powered finishing machines, supplemented by handwork as necessary. Consolidation of the concrete shall be by means of high-frequency internal vibrators within 15 minutes after the concrete is deposited on the subgrade. Vibrating shall be done with care and in such manner to assure adequate consolidation adjacent to forms and uniformly across the full paving width. Use of vibrators for extensive shifting of the mass of concrete will not be permitted. Methods of spreading, shaping and compacting that result in segregation, voids or rock pockets shall be discontinued, and the Contractor shall adopt methods which will produce dense homogeneous pavement conforming to the required cross section. Finishing may be performed by hand method, as specified in Section 40-3.11B, "Stationary Side Form Finishing."

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SECTION 49 PILING
(Issued 07-20-12)

In Section 49-1.03 replace the 4th paragraph with:

Modification to the specified installation methods and specified pile tip elevation will not be considered at locations where settlement, tension demands, or lateral load demands control design pile tip elevations or when the plans state that specified pile tip elevation shall not be revised.

In Section 49-1.03 in the 7th paragraph, replace the 2nd sentence with:

The loading apparatus described as "Tensile Load Applied by Hydraulic Jack(s) Acting Upward at One End of Test Beam(s)" shall not be used.

In Section 49-1.03 replace the 9th paragraph with:

The Contractor shall furnish piling of sufficient length to obtain the specified tip elevation shown on the plans or specified in the special provisions.

In Section 49-1.04 replace the 6th paragraph with:

The Contractor may use additional cementitious material in the concrete for the load test and anchor piles.

In Section 49-4.01 replace the 2nd paragraph with:

The drilling of holes shall conform to the provisions in these specifications. Concrete filling for cast-in-place concrete piles shall be prequalified in conformance with the provisions in Section 90-9, "Compressive Strength," and shall have a minimum 28-day compressive strength of 3,600 psi. At the option of the Contractor, the combined aggregate grading for the concrete shall be either the one-inch maximum grading, the 1/2-inch maximum grading, or the 3/8-inch maximum grading. Concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," and Section 51, "Concrete Structures." Reinforcement shall conform to the provisions in Section 52, "Reinforcement."

In Section 49-6.01 replace the 1st paragraph with:

The length of timber, steel, and precast prestressed concrete piles, and of cast-in-place concrete piles consisting of driven shells filled with concrete, shall be measured along the longest side, from the tip elevation shown on the plans to the plane of pile cut-off.

In Section 49-6.02 add:

When pile tips are revised by the Engineer for timber, steel, and precast prestressed concrete piles, and for cast-in-place concrete piles consisting of driven shells filled with concrete, the additional length required, including all materials, equipment, and labor for furnishing, splicing, and installing the piling, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

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SECTION 50 PRESTRESSING CONCRETE
(Issued 04-20-12)

In Section 50-1.02 replace the 2nd paragraph with:

The working drawings of the prestressing system shall show complete details and substantiating calculations of the method and materials the Contractor proposes to use in the prestressing operations, including any additions or rearrangement of reinforcing steel from that shown on the plans. The details shall outline the method and sequence of stressing and shall include complete specifications and details of the prestressing steel and anchoring devices, jacking stresses, elongation calculations, type of ducts and all other data pertaining to the prestressing, including the proposed arrangement of the prestressing steel in the members. The drawings shall also show (1) the exact location of anchorage system components, ducts, and other related elements and (2) the duct location data, including elevations at least every 1/8th point of the span for each span.

In Section 50-1.05 replace the 1st paragraph with:

Prestressing steel shall be high-tensile wire conforming to the requirements in ASTM Designation: A 421, including Supplement I; high-tensile seven-wire strand conforming to the requirements in ASTM Designation: A 416; or uncoated deformed (Type II) high-strength steel bars conforming to the requirements in ASTM Designation: A 722, including all supplementary requirements. The maximum weight requirement of ASTM Designation: A 722 will not apply.

In Section 50-1.05 in the 3rd paragraph, delete item A.

In Section 50-1.05 in the 3rd paragraph, replace item E with:

E. In addition to the requirements in Section 50-1.10, "Samples for Testing," four 4-foot-long samples of coated strand and one 5-foot-long sample of uncoated strand of each size and reel shall be furnished to the Engineer for testing. These samples, as selected by the Engineer, shall be representative of the material to be used in the work.

In Section 50-1.05 between the 3rd and 4th paragraphs, add:

The Contractor shall furnish to the Transportation Laboratory a representative 8-ounce sample from each batch of epoxy patching material to be used. Each sample shall be packaged in an airtight container identified with the manufacturer's name and batch number.

In Section 50-1.07 replace the 2nd paragraph with:

Ducts shall be fabricated with either welded or interlocked seams. Galvanizing of the welded seam will not be required. Ducts shall have sufficient strength to maintain their correct alignment during placing of concrete. Joints between sections of duct shall be positive metallic connections which do not result in angle changes at the joints. Waterproof tape shall be used at the connections. Ducts shall be bent without crimping or flattening. Transition couplings connecting the ducts to anchoring devices shall be either ferrous metal or polyolefin. Ferrous metal transition couplings need not be galvanized.

Ducts shall have an inside cross-sectional area of at least:

1. 2.5 times the net area of the prestressing steel for multistrand tendons that will be placed by the pull-through method.
2. 2.0 times the net area of the prestressing steel for multistrand tendons that will not be placed by the pull-through method.

Ducts shall have an outside diameter not exceeding 50 percent of the girder web width.

In Section 50-1.07 replace the 7th paragraph with:

All ducts having a vertical duct profile change of 6 inches or more shall be vented. Vents shall be placed within 6 feet of every high point in the duct profile. Vents shall be 1/2 inch minimum diameter standard pipe or suitable plastic pipe. Connections to ducts shall be made with metallic or plastic structural fasteners. Plastic components, if selected, shall not react with the concrete or enhance corrosion of the prestressing steel and shall be free of water soluble chlorides. The vents shall be mortar tight, taped as necessary, and shall provide means for injection of grout through the vents and for sealing the vents. Ends of vents shall be removed one inch below the roadway surface after grouting has been completed.

In Section 50-1.08 replace the 2nd paragraph with:

The maximum temporary tensile stress (jacking stress) in prestressing steel of post-tensioned members shall not exceed 75 percent of the specified minimum ultimate tensile strength of the prestressing steel.

In Section 50-1.08 delete the 4th, 5th, and 6th paragraphs.

In Section 50-1.08 replace the 11th paragraph with:

Prestressing forces shall not be applied to cast-in-place concrete until at least 10 days after the last concrete has been placed in the member to be prestressed and until the concrete compressive strength has reached the strength shown on the plans or specified in the specifications.

In Section 50-1.08 replace the 15th paragraph with:

When prestressing steel in pretensioned members is tensioned at a temperature appreciably lower than the estimated temperature of the concrete and the prestressing steel at the time of initial set of the concrete, the calculated elongation of the prestressing steel shall be increased to compensate for the loss in stress.

The maximum temporary tensile stress in the prestressing steel of pretensioned members shall not exceed 80 percent of the specified minimum ultimate tensile strength of the prestressing steel.

Pretensioned prestressing steel shall be anchored at stresses that will result in the ultimate retention of working forces at not less than those shown on the plans.

In Section 50-1.09 replace the 2nd and 3rd paragraphs with:

Grout shall consist of cement and water and may contain an admixture if approved by the Engineer.

Cement shall conform to the provisions in Section 90-2.01A, "Cement."

In Section 50-1.10 between the 3rd and 4th paragraphs, add:

Each sample shall be identified by location and Contract number with weatherproof markings. A completed Sample Identification Card shall also be attached to each sample. The card is available from the Transportation Laboratory.

In Section 50-1.10 in the 5th paragraph, replace item A with:

A. For wire or bars, one 7-foot-long sample and for strand, one 4-foot-long sample, of each size shall be furnished for each heat or reel.

In Section 50-1.11 replace the 1st paragraph with:

No separate payment will be made for pretensioning precast concrete members. Payment for pretensioning precast concrete members shall be considered as included in the contract price paid for furnish precast members as provided for in Section 51, "Concrete Structures."

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SECTION 51 CONCRETE STRUCTURES

(Issued 08-05-11)

In Section 51-1.05 in the 11th paragraph, replace the 1st sentence with:

Form panels for exposed surfaces shall be furnished and placed in uniform widths of not less than 3 feet and in uniform lengths of not less than 6 feet, except at the end of continuously formed surfaces where the final panel length required is less than 6 feet.

In Section 51-1.06A(3) in the 1st paragraph, replace items E and F with:

E. When timber members are used to brace falsework bents which are located adjacent to roadways or railroads, all connections for the timber bracing shall be of the bolted type using 5/8-inch diameter or larger bolts or coil rod with a root diameter equal to that of the shank of a 5/8-inch diameter bolt.

F. Falsework member clearances must be at least those shown in the following table:

Falsework member	Clearances	
	To railing members, barriers, and anchored temporary railings	To unanchored temporary railings
Footings	0'-3"	2'-0"
Piles	1'-0"	2'-9"
Other members	2'-0"	2'-9"

In Section 51-1.06C in the 11th paragraph, replace the 1st sentence with:

Falsework for box culverts and other structures with decks lower than the roadway pavement and with span lengths of 14 feet or less shall not be released until the last placed concrete has attained a compressive strength of 1,600 psi, provided that curing of the concrete is not interrupted.

In Section 51-1.11 replace the 6th paragraph with:

Construction methods and equipment employed by the Contractor shall conform to the provisions in Section 7-1.02, "Load Limitations."

In Section 51-1.12D replace the 4th paragraph with:

Expanded polystyrene shall be a commercially available polystyrene board. Expanded polystyrene shall have a minimum flexural strength of 35 psi determined in conformance with the requirements in ASTM Designation: C 203 and a compressive yield strength of between 16 and 40 psi at 5 percent compression. Surfaces of expanded polystyrene against which concrete is placed shall be faced with hardboard. Hardboard shall be 1/8 inch minimum thickness, conforming to ANSI A135.4, any class. Other facing materials may be used provided they furnish equivalent protection. Boards shall be held in place by nails, waterproof adhesive, or other means approved by the Engineer.

In Section 51-1.12F replace the 3rd paragraph with:

Type A and AL joint seals shall consist of a groove in the concrete that is filled with field-mixed silicone sealant.

In Section 51-1.12F in the 6th paragraph, replace the table with:

Movement Rating (MR)	Seal Type
MR ≤ 1 inch	Type A or Type B
1 inch < MR ≤ 2 inches	Type B
2 inches < MR ≤ 4 inches	Joint Seal Assembly (Strip Seal)
MR > 4 inches	Joint Seal Assembly (Modular Unit) or Seismic Joint

In Section 51-1.12F(3)(a) replace the 1st and 2nd paragraphs with:

The sealant must consist of a 2-component silicone sealant that will withstand up to ±50 percent movement. Silicone sealants must be tested under California Test 435 and must comply with the following:

Specification	Requirement
Modulus at 150 percent elongation	8-75 psi
Recovery	21/32 inch max.
Notch Test	Notched or loss of bond 1/4 inch, max.
Water Resistance	Notched or loss of bond 1/4 inch, max.
Ultraviolet Exposure ASTM Designation: G 154, Table X2.1,Cycle 2.	No more than slight checking or cracking.
Cone Penetration	4.5-12.0 mm

In Section 51-1.12F(3)(a) delete the 3rd and 8th paragraphs.

In Section 51-1.12F(3)(a) replace the 10th paragraph with:

A Certificate of Compliance accompanied by a certified test report must be furnished for each batch of silicone sealant in conformance with the provisions in Section 6-1.07, "Certificates of Compliance."

In Section 51-1.12F(3)(b) replace the 2nd paragraph with:

The preformed elastomeric joint seal must conform to the requirements in ASTM D 2628 and the following:

1. The seal must consist of a multichannel, nonporous, homogeneous material furnished in a finished extruded form.
2. The minimum depth of the seal measured at the contact surface must be at least 95 percent of the minimum uncompressed width of the seal as designated by the manufacturer.
3. When tested in conformance with the requirements in California Test 673 for Type B seals, joint seals must provide a movement rating (MR) of not less than that shown on the plans.

4. The top and bottom edges of the joint seal must maintain continuous contact with the sides of the groove over the entire range of joint movement.
5. The seal must be furnished full length for each joint with no more than 1 shop splice in any 60-foot length of seal.
6. The Contractor must demonstrate the adequacy of the procedures to be used in the work before installing seals in the joints.
7. One field splice per joint may be made at locations and by methods approved by the Engineer. The seals are to be manufactured full length for the intended joint, then cut at the approved splice section and rematched before splicing. The Contractor must submit splicing details prepared by the joint seal manufacturer for approval before beginning splicing work.
8. Shop splices and field splices must have no visible offset of exterior surfaces and must show no evidence of bond failure.
9. At all open ends of the seal that would admit water or debris, each cell must be filled to a depth of 3 inches with commercial quality open cell polyurethane foam or closed by other means subject to approval by the Engineer.

In Section 51-1.12F(3)(b) replace the 7th paragraph with:

The joint seal must be installed full length for each joint with equipment that does not twist or distort the seal, elongate the seal longitudinally, or otherwise cause damage to the seal or to the concrete forming the groove.

In Section 51-1.12F(3)(b) in the 11th paragraph, replace the 1st sentence with:

Samples of the prefabricated joint seals, not less than 3 feet in length, will be taken by the Engineer from each lot of material.

In Section 51-1.12H(1) in the 6th paragraph, replace the 4th and 5th sentences with:

Each ply of fabric shall have a breaking strength of not less than 800 pounds per inch of width in each thread direction when 3" x 36" samples are tested on split drum grips. The bond between double plies shall have a minimum peel strength of 20 pounds per inch.

In Section 51-1.12H(1) in the 8th paragraph in the table, replace the hardness (Type A) requirements with:

Hardness (Type A)	D 2240 with 2kg mass.	55 ±5

In Section 51-1.12H(2) in the 1st paragraph in item A, replace the 1st and 2nd sentences with:

The bearings shall consist of alternating steel laminates and internal elastomer laminates with top and bottom elastomer covers. Steel laminates shall have a nominal thickness of 0.075 inch (14 gage).

In Section 51-1.13 replace the 2nd, 3rd, and 4th paragraphs with:

Surfaces of fresh concrete at horizontal construction joints shall be thoroughly consolidated without completely removing surface irregularities. Additionally, surfaces of fresh concrete at horizontal construction joints between girder stems and decks shall be roughened to at least a 1/4-inch amplitude.

Construction joint surfaces shall be cleaned of surface laitance, curing compound, and other foreign materials using abrasive blast methods before fresh concrete is placed against the joint surface.

Construction joint surfaces shall be flushed with water and allowed to dry to a surface dry condition immediately before placing concrete.

In Section 51-1.135 replace the 1st paragraph with:

Mortar shall be composed of cementitious material, sand, and water proportioned and mixed as specified in this Section 51-1.135.

In Section 51-1.135 replace the 3rd paragraph with:

The proportion of cementitious material to sand, measured by volume, shall be 1 to 2 unless otherwise specified.

In Section 51-1.17 in 4th paragraph, replace the 3rd sentence with:

The surfaces shall have a profile trace showing no high points in excess of 0.25 inch, and the portions of the surfaces within the traveled way shall have a profile count of 5 or less in any 100 foot section.

Add:

51-1.17A Deck Crack Treatment

The Contractor shall use all means necessary to minimize the development of shrinkage cracks.

The Contractor shall remove all equipment and materials from the deck and clean the surface as necessary for the Engineer to measure the surface crack intensity. Surface crack intensity will be determined by the Engineer after completion of concrete cure, before prestressing, and before the release of falsework. In any 500 square foot portion of deck within the limits of the new concrete deck, should the intensity of cracking be such that there are more than 50 feet of cracks whose width at any location exceeds 0.02 inch, the deck shall be treated with a high molecular weight methacrylate (HMWM) resin system. The area of deck to be treated shall have a width that extends for the entire width of new deck inside the concrete barriers and a length that extends at least 5 feet beyond the furthest single continuous crack outside the 500 square foot portion, measured from where that crack exceeds 0.02 inch in width, as determined by the Engineer.

Deck crack treatment shall include furnishing, testing, and applying the HMWM resin system, with sand and absorbent material. If grinding is required, deck crack treatment shall take place before grinding.

51-1.17A(1) Submittals

Submit a HMWM resin system placement plan. When HMWM resin is to be applied within 100 feet of a residence, business, or public space including sidewalks under a structure, also submit a public safety plan. Submit plans under Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. The review time is 15 days.

The HMWM resin system placement plan must include:

1. Schedule of work and testing for each bridge
2. Description of equipment for applying HMWM resin
3. Range of gel time and final cure time for HMWM resin
4. Absorbent material to be used
5. Description of equipment for applying and removing excess sand and absorbent material
6. Procedure for removing HMWM resin from the deck, including equipment
7. Storage and handling of HMWM resin components and absorbent material
8. Disposal of excess HMWM resin and containers

The public safety plan must include:

1. A public notification letter with a list of delivery and posting addresses. The letter must state HMWM resin work locations, dates, times, and what to expect. Deliver the letter to residences and businesses within 100 feet of HMWM resin work locations and to local fire and police officials at least 7 days before starting work. Post the letter at the job site.
2. An airborne emissions monitoring plan prepared and executed by a certified industrial hygienist (CIH) certified in comprehensive practice by the American Board of Industrial Hygiene. The plan must have at least 4 monitoring points including the mixing point, application point, and point of nearest public contact. Monitor airborne emissions during HMWM resin work and submit emissions monitoring results after completing the work.
3. An action plan for protection of the public when airborne emissions levels exceed permissible levels.
4. A copy of the CIH's certification.

If the measures proposed in the safety plan are inadequate to provide for public safety associated with the use of HMWM resin, the Engineer will reject the plan and direct the Contractor to revise the plan. Directions for revisions will be in writing and include detailed comments. The Engineer will notify the Contractor of the approval or rejection of a submitted or revised plan within 15 days of receipt of that plan.

51-1.17A(2) Quality Control and Assurance

Submit samples of HMWM resin components 15 days before use under Section 6-3, "Testing," of the Standard Specifications. Notify the Engineer 15 days before delivery of HMWM resin components in containers over 55 gallons to the job site.

Complete a test area before starting work. Results from airborne emissions monitoring of the test area must be submitted to the Engineer before starting production work.

The test area must:

1. Be approximately 500 square feet
2. Be placed within the project limits outside the traveled way at an approved location
3. Be constructed using the same equipment as the production work
4. Replicate field conditions for the production work
5. Demonstrate proposed means and methods meet the acceptance criteria
6. Demonstrate production work will be completed within the time allowed
7. Demonstrate suitability of the airborne emissions monitoring plan

The test area will be acceptable if:

1. The treated deck surface is tack free and non-oily
2. The sand cover adheres and resists brushing by hand
3. Excess sand and absorbent material has been removed
4. The coefficient of friction is at least 0.35 when tested under California Test 342

51-1.17A(3) Materials

HMWM resin system consists of a resin, promoter, and initiator. HMWM resin must be low odor and comply with the following:

HMWM Resin

Property	Requirement	Test Method
Volatile Content*	30 percent, maximum	ASTM D 2369
Viscosity *	25 cP, maximum, (Brookfield RVT with UL adaptor, 50 RPM at 77°F)	ASTM D 2196
Specific Gravity *	0.90 minimum, at 77°F	ASTM D 1475
Flash Point *	180°F, minimum	ASTM D 3278
Vapor Pressure *	1.0 mm Hg, maximum, at 77°F	ASTM D 323
Tack-free Time	400 minutes, maximum, at 25°C	Specimens prepared per California Test 551
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21 ± 1°C	California Test 551

* Test must be performed before adding initiator.

Sand for abrasive sand finish must:

1. Be commercial quality dry blast sand
2. Have at least 95 percent pass the No. 8 sieve and at least 95 percent retained on the No. 20 sieve when tested under California Test 205

Absorbent material must be diatomaceous earth, abrasive blast dust, or substitute recommended by the HMWM resin supplier and approved by the Engineer.

51-1.17A(4) Construction

HMWM resin system applied by machine must be:

1. Combined in volumetric streams of promoted resin to initiated resin by static in-line mixers
2. Applied without atomization

HMWM resin system may be applied manually. Limit the quantity of resin mixed for manual application to 5 gallons at a time.

Prepare the area to be treated by abrasive blasting. Curing compound, surface contaminants, and foreign material must be removed from the bridge deck surface. Sweep the deck surface clean after abrasive blasting and blow loose material from cracks using high-pressure air.

The deck surface must be dry when abrasive blast cleaning is performed. When abrasive blast cleaning within 10 feet of public traffic, remove dust and residue from abrasive blast cleaning using a vacuum attachment operating concurrently with blasting equipment . If the deck surface becomes contaminated before placing HMWM, abrasive blast clean the contaminated area and sweep the deck clean.

The deck must be dry before applying HMWM resin. The concrete surface must be at least 50 degrees F and at most 100 degrees F. Relative humidity must be expected to be at most 85 percent during the work shift.

Thoroughly mix all components of the HMWM resin system. Apply HMWM resin to the deck surface within 5 minutes of mixing at approximately 90 sq ft per gallon. The Engineer determines the exact application rate. The resin gel time must be between 40 and 90 minutes. HMWM resin that thickens during application is rejected.

Spread the HMWM resin system uniformly. Completely cover surfaces to be treated and fill all cracks. Redistribute excess resin using squeegees or brooms within 10 minutes of application. For textured or grooved deck surfaces, excess resin must be removed from the texture indentations.

Apply the abrasive sand finish of at least 2 pounds per square yard or until saturation as determined by the Engineer no sooner than 20 minutes after applying resin. Apply absorbent material before opening lane to traffic. Remove excess sand and absorbent material by vacuuming or power sweeping.

Traffic or equipment will be allowed on the overlay after the Engineer has determined:

1. The treated deck surface is tack free and non-oily
2. The sand cover adheres and resists brushing by hand
3. Excess sand and absorbent material has been removed
4. No material will be tracked beyond limits of treatment by traffic

In Section 51-1.18C replace the 2nd paragraph with:

When Class 2 surface finish (gun finish) is specified, ordinary surface finish shall first be completed. The concrete surfaces shall then be abrasive blasted to a rough texture and thoroughly washed down with water. While the washed surfaces are damp, but not wet, a finish coating of machine applied mortar, approximately 1/4 inch thick, shall be applied in not less than 2 passes. The coating shall be pneumatically applied and shall consist of either (1) sand, cementitious material, and water mechanically mixed prior to its introduction to the nozzle, or (2) premixed sand and cementitious material to which water is added prior to its expulsion from the nozzle. The use of admixtures shall be subject to the approval of the Engineer as provided in Section 90, "Portland Cement Concrete." Unless otherwise specified, supplementary cementitious materials will not be required. The proportion of cementitious material to sand shall be not less than one to 4, unless otherwise directed by the Engineer. Sand shall be of a grading suitable for the purpose intended. The machines shall be operated and the coating shall be applied in conformance with standard practice. The coating shall be firmly bonded to the concrete surfaces on which it is applied.

In Section 51-1.18C replace the 5th paragraph with:

When surfaces to be finished are in pedestrian undercrossings, the sand shall be silica sand and the cementitious material shall be standard white portland cement.

In Section 51-1.23 add:

Full compensation for deck crack treatment, including the public safety plan, shall be considered as included in the contract price paid per cubic yard for structural concrete, bridge, and no additional compensation will be allowed therefor.

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SECTION 52 REINFORCEMENT
(Issued 06-05-09)

In Section 52-1.02(B) between the 3rd and 4th paragraphs, add:

The epoxy powder coating shall be selected from the Department's Pre-Qualified Products List.

In Section 52-1.02(B) replace the 14th paragraph with:

Except for lap splices, splices for epoxy-coated reinforcement shall be coated with a corrosion protection covering that is selected from the Department's Pre-Qualified Products List. The covering shall be installed in accordance with the manufacturer's recommendations.

In Section 52-1.07 in the 11th paragraph, replace the table with:

Height Zone (H) (Feet above ground)	Wind Pressure Value (psf)
$H \leq 30$	20
$30 < H \leq 50$	25
$50 < H \leq 100$	30
$H > 100$	35

In Section 52-1.08B(1) replace the 1st paragraph with:

Mechanical splices to be used in the work shall be selected from the Department's Pre-Qualified Products List.

In Section 52-1.08B(1) in the 2nd paragraph, replace the table with:

Reinforcing Bar Number	Total Slip
4	0.020-inch
5	0.020-inch
6	0.020-inch
7	0.028-inch
8	0.028-inch
9	0.028-inch
10	0.036-inch
11	0.036-inch
14	0.048-inch
18	0.060-inch

In Section 52-1.08B(1), in the 6th paragraph, delete item C.

In Section 52-1.08B(2) in the 6th paragraph, replace the subparagraph with:

The minimum preheat and interpass temperatures shall be 400º F for Grade 40 bars and 600º F for Grade 60 bars. Immediately after completing the welding, at least 6 inches of the bar on each side of the splice shall be covered by an insulated wrapping to control the rate of cooling. The insulated wrapping shall remain in place until the bar has cooled below 200º F.

Replace Section 52-1.08B(3) with:

52-1.08B(3) Resistance Butt Welds

Shop produced resistance butt welds shall be produced by a fabricator who is selected from the Department's Pre-Qualified Products List.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished for each shipment of splice material. The Certificate of Compliance shall include heat number, lot number and mill certificates.

In Section 52-1.08C replace the 3rd paragraph with:

Testing on prequalification and production sample splices shall be performed at an approved independent testing laboratory. The laboratory shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors who will provide other services or materials for the project.

The independent testing laboratory shall be selected from the Department's Pre-Qualified Products List.

In Section 52-1.08C replace the 5th paragraph with:

Prequalification and production sample splices and testing shall conform to California Test 670 and these specifications.

In Section 52-1.08C delete the 6th paragraph.

In Section 52-1.08C replace the 8th paragraph with:

Each sample splice, as defined herein, shall be identified as representing either a prequalification or production test sample splice.

In Section 52-1.08C in the 10th paragraph, delete the last sentence.

Replace Section 52-1.08C(1) with:

52-1.08C(1) Splice Prequalification Report

Before using any service splices or ultimate butt splices in the work, the Contractor shall submit a Splice Prequalification Report. The report shall include the following:

A. A copy of the manufacturer's product literature giving complete data on the splice material and installation procedures.
B. Names of the operators who will be performing the splicing.
C. Descriptions of the positions, locations, equipment, and procedures that will be used in the work.
D. Certifications from the fabricator for prequalification of operators and procedures based on sample tests performed no more than 2 years before submitting the report. Each operator shall be certified by performing 2 sample splices for each bar size of each splice type that the operator will be performing in the work. For deformation-dependent types of splice devices, each operator shall be certified by performing 2 additional samples for each bar size and deformation pattern that will be used in the work.

Prequalification sample splices shall be tested by an approved independent testing laboratory and shall conform to the appropriate production test criteria and slip requirements specified herein. When epoxy-coated reinforcement is required, resistance butt welded sample splices shall have the weld flash removed by the same procedure as will be used in the work, before coating and testing. The Splice Prequalification Report shall include the certified test results for all prequalification sample splices.

The QCM shall review and approve the Splice Prequalification Report before submitting it to the Engineer for approval. The Contractor shall allow 2 weeks for the review and approval of a complete report before performing any service splicing or ultimate butt splicing in the work.

In Section 52-1.08C(2)(a) replace the 1st, 2nd, 3rd, 4th, and 5th paragraphs with:

Production tests shall be performed by an approved independent testing laboratory for all service splices used in the work. A production test shall consist of testing 4 sample splices prepared for each lot of completed splices. The samples shall be prepared by the Contractor using the same splice material, position, operators, location, and equipment, and following the same procedure as used in the work.

At least one week before testing, the Contractor shall notify the Engineer in writing of the date and location where the testing of the samples will be performed.

The 4 samples from each production test shall be securely bundled together and identified with a completed sample identification card before shipment to the approved independent testing laboratory. The card will be furnished by the Engineer. Bundles of samples containing fewer than 4 samples of splices shall not be tested.

Before performing any tensile tests on production test sample splices, one of the 4 samples shall be tested for, and shall conform to, the requirements for total slip in Section 52-1.08B(1), "Mechanical Splices." Should this sample not meet the total slip requirements, one retest, in which the 3 remaining samples are tested for total slip, will be allowed. Should any of the 3 remaining samples not conform to the total slip requirements, all splices in the lot represented by this production test will be rejected.

If 3 or more sample splices from a production test conform to the provisions in this Section 52-1.08C(2), "Service Splice Test Criteria," all splices in the lot represented by this production test will be considered acceptable.

Replace Section 52-1.08C(2)(b) with:

52-1.08C(2)(b) Quality Assurance Test Requirements for Service Splices

In addition to the required production tests, the Contractor shall concurrently prepare 4 service quality assurance sample splices for:

A. The first production test performed.
B. One of every 5 subsequent production tests, or fraction thereof, randomly selected by the Engineer.

These service quality assurance sample splices shall be prepared in the same manner as specified herein for service production sample splices.

The service quality assurance sample splices shall be shipped to the Transportation Laboratory for quality assurance testing. Each set of 4 sample splices shall be securely bundled together and identified by location and contract number with weatherproof markings before shipment. Bundles containing fewer than 4 samples of splices will not be tested. Sample splices not accompanied by the supporting documentation required in Section 52-1.08B(1), "Mechanical Splices," for mechanical splices, or in Section 52-1.08B(3), "Resistance Butt Welds," for resistance butt welds, will not be tested.

Quality assurance testing will be performed in conformance with the requirements for service production sample splices in Section 52-1.08C(2)(a), "Production Test Requirements for Service Splices."

Replace Section 52-1.08C(3) with:

52-1.08C(3) Ultimate Butt Splice Test Criteria

Ultimate production and quality assurance sample splices shall be tensile tested in conformance with the requirements described in ASTM Designation: A 370 and California Test 670.

Each sample splice shall be identified as representing a prequalification, production, or quality assurance sample splice.

The portion of hoop reinforcing bar, removed to obtain a sample splice, shall be replaced using a prequalified ultimate mechanical butt splice, or the hoop shall be replaced in kind.

Reinforcing bars, other than hoops, from which sample splices are removed, shall be repaired using ultimate mechanical butt splices conforming to the provisions in Section 52-1.08C(1), "Splice Prequalification Report," or the bars shall be replaced in kind. These bars shall be repaired or replaced such that no splices are located in any "No Splice Zone" shown on the plans.

Ultimate production and quality assurance sample splices shall rupture either: 1) in the reinforcing bar but outside of the affected zone, provided that the sample splice has visible necking or 2) anywhere, provided that the sample splice has achieved the strain requirement for necking.

When tested in conformance with the requirements in California Test 670, "Necking (Option I)," the visible necking shall be such that there is a visible decrease in the sample's cross-sectional area at the point of rupture.

When tested in conformance with the requirements in California Test 670, "Necking (Option II)," the strain requirement for necking shall be such that the largest measured strain is not less than 6 percent for No. 11 and larger bars, or not less than 9 percent for No. 10 and smaller bars.

The affected zone is the portion of the reinforcing bar where any properties of the bar, including the physical, metallurgical, or material characteristics, have been altered by fabrication or installation of the splice. The weld and one inch adjacent to the weld will be considered part of the affected zone.

In Section 52-1.08C(3)(a) replace the 1st paragraph with:

Production tests shall be performed for all ultimate butt splices used in the work. A production test shall consist of testing 4 sample splices removed from each lot of completed splices.

In Section 52-1.08C(3)(a) replace the 3rd paragraph with:

After notification has been received, the Engineer will randomly select the 4 sample splices to be removed from the lot and place tamper-proof markings or seals on them. These ultimate production sample splices shall be removed by the Contractor, and tested by an approved independent testing laboratory.

In Section 52-1.08(C)(3)(a) replace the 5th, 6th, and 7th paragraphs with:

A sample splice will be rejected if a tamper-proof marking or seal is disturbed before testing.

The 4 sample splices from each production test shall be securely bundled together and identified with a completed sample identification card before shipment to the approved independent testing laboratory. The card will be furnished by the Engineer. Bundles of samples containing fewer than 4 sample splices shall not be tested.

Before performing any tensile tests on production test sample splices, one of the 4 sample splices shall be tested for, and shall conform to, the requirements for total slip in Section 52-1.08B(1), "Mechanical Splices." Should this sample splice not meet these requirements, one retest, in which the 3 remaining sample splices are tested for total slip, will be allowed. Should any of the 3 remaining sample splices not conform to these requirements, all splices in the lot represented by this production test will be rejected.

Replace Section 52-1.08C(3)(b) with:

52-1.08C(3)(b) Quality Assurance Test Requirements for Ultimate Butt Splices

In addition to the required production tests, the Contractor shall concurrently prepare 4 ultimate quality assurance sample splices for:

A. The first production test performed.
B. One of every 5 subsequent production tests, or fraction thereof, randomly selected by the Engineer.

These ultimate quality assurance sample splices shall be prepared in the same manner as specified herein for ultimate production sample splices.

The ultimate quality assurance sample splices shall be shipped to the Transportation Laboratory for quality assurance testing. Each set of 4 sample splices shall be securely bundled together and identified by location and contract number with weatherproof markings before shipment. Bundles containing fewer than 4 samples of splices will not be tested. Sample splices not accompanied by the supporting documentation required in Section 52-1.08B(1), "Mechanical Splices," for mechanical splices, or in Section 52-1.08B(3), "Resistance Butt Welds," for resistance butt welds, will not be tested.

Quality assurance testing will be performed in conformance with the requirements for ultimate production sample splices in Section 52-1.08C(3)(a), "Production Test Requirements for Ultimate Butt Splices."

Replace Section 52-1.08D with:

A Production Test Report for all testing performed on each lot shall be prepared by the approved independent testing laboratory performing the testing and submitted to the QCM for review and approval. The report shall be signed by an engineer who represents the laboratory and is registered as a Civil Engineer in the State of California. The report shall include, as a minimum, the following information for each test: contract number, bridge number, lot number and location, bar size, type of splice, length of mechanical splice, length of test specimen, physical condition of test sample splice, any notable defects, total measured slip, and ultimate tensile strength of each splice. In addition, the report shall include location of visible necking area and largest measured strain for ultimate butt splices.

The QCM must review, approve, and forward each Production Test Report to the Engineer for review before the splices represented by the report are encased in concrete. The Engineer will have 3 working days to review each Production Test Report and respond in writing after a complete report has been received. Should the Contractor elect to encase any splices before receiving notification from the Engineer, it is expressly understood that the Contractor will not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection.

Quality assurance test results for each bundle of 4 samples of splices will be reported in writing to the Contractor within 3 working days after receipt of the bundle by the Transportation Laboratory. In the event that more than one bundle is received on the same day, 2 additional working days shall be allowed for providing test results for each additional bundle received. A test report will be made for each bundle received. Should the Contractor elect to encase splices before receiving notification from the Engineer, it is expressly understood that the

Contractor will not be relieved of the responsibility for incorporating material in the work that conforms to the requirements of the plans and specifications. Material not conforming to these requirements will be subject to rejection.

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SECTION 53 SHOTCRETE
(Issued 11-02-07)

In Section 53-1.01 replace the 3rd paragraph with:

The dry-mix process shall consist of delivering dry mixed aggregate and cementitious material pneumatically or mechanically to the nozzle body and adding water and mixing the materials in the nozzle body. The wet-mix process shall consist of delivering mixed aggregate, cement, and water pneumatically to the nozzle and adding any admixture at the nozzle.

In Section 53-1.02 replace the 1st through 4th paragraphs with:

Cementitious material, fine aggregate, and mixing water shall conform to the provisions in Section 90, "Portland Cement Concrete."

Shotcrete to be mixed and applied by the dry-mix process shall consist of one part cementitious material to not more than 4.5 parts fine aggregate, thoroughly mixed in a dry state before being charged into the machine. Measurement may be either by volume or by weight. The fine aggregate shall contain not more than 6 percent moisture by weight.

Shotcrete to be mixed and applied by the wet-mix process shall consist of cementitious material, fine aggregate, and water and shall contain not less than 632 pounds of cementitious material per cubic yard. A maximum of 30 percent pea gravel may be substituted for fine aggregate. The maximum size of pea gravel shall be such that 100 percent passes the 1/2 inch screen and at least 90 percent passes the 3/8 inch screen.

Admixtures may be added to shotcrete and shall conform to the provisions in Section 90-4, "Admixtures."

In Section 53-1.04 in the 3rd paragraph, replace item C with:

C. Aggregate and cementitious material that have been mixed for more than 45 minutes shall not be used unless otherwise permitted by the Engineer.

Replace Section 53-1.07 with:

53-1.07 MEASUREMENT

Quantities of shotcrete will be measured by the cubic yard computed from measurements, along the slope, of actual areas placed and the theoretical thickness shown on the plans. The Department does not pay for shotcrete placed outside the dimensions shown on the plans or to fill low foundation.

Replace Section 53-1.08 with:

53-1.08 PAYMENT

The contract price paid per cubic yard for shotcrete shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing shotcrete, including preparing the foundation, wire reinforcement, structure backfill, joint filling material, and if required by the plans, drains with sacked pervious backfill material, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

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SECTION 54 WATERPROOFING

(Issued 07-01-11)

In Section 54-1.02, replace the 1st paragraph with:

Waterproofing asphalt shall conform to the requirements in ASTM Designation: D 449, Type I for below ground and Type II for above ground.

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SECTION 55 STEEL STRUCTURES

(Issued 08-05-11)

In Section 55-1.01 replace the 4th paragraph with:

Design details, fabrication, and workmanship for steel railway bridges shall conform to the provisions in Chapter 15, "Steel Structures," of the AREMA Manual for Railway Engineering.

In Section 55-1.05 replace the 3rd paragraph with:

Construction methods and equipment employed by the Contractor shall conform to the provisions in Section 7-1.02, "Load Limitations."

In Section 55-2.01 replace the table in the 5th paragraph with:

Material Conforming to ASTM Designation: A 709/A 709M	CVN Impact Value (Ft. Lbs at Temp.)
Grade 36	15 at 40º F
Grade 50* (2 inches and under in thickness)	15 at 40º F
Grade 50W* (2 inches and under in thickness)	15 at 40º F
Grade 50* (Over 2 inches to 4 inches in thickness)	20 at 40º F
Grade 50W* (Over 2 inches to 4 inches in thickness)	20 at 40º F
Grade HPS 50W* (4 inches and under in thickness)	20 at 10º F
Grade HPS 70W (4 inches and under in thickness)	25 at -10º F
Grade 100 ($2\frac{1}{2}$ inches and under in thickness)	25 at 0º F
Grade 100W (Over $2\frac{1}{2}$ inches to 4 inches in thickness)	35 at 0º F

* If the yield point of the material exceeds 65,000 psi, the temperature for the CVN impact value for acceptability shall be reduced 15º F for each increment of 10,000 psi above 65,000 psi

In Section 55-2.01 replace the Structural Steel Materials table with:

Structural Steel Materials

Material	Specification
Structural steel:	
Carbon steel	ASTM: A 709/A 709M, Grade 36 or {A 36/A 36M}[a]
High strength low alloy columbium vanadium steel	ASTM: A 709/A 709M, Grade 50 or {A 572/A 572M, Grade 50}[a]
High strength low alloy structural steel	ASTM: A 709/A 709M, Grade 50W, Grade HPS 50W, or {A 588/A 588M}[a]
High strength low alloy structural steel plate	ASTM: A 709/A 709M, Grade HPS 70W
High-yield strength, quenched and tempered alloy steel plate suitable for welding	ASTM: A 709/A 709M, Grade 100 and Grade 100W, or {A 514/A 514M}[a]
Steel fastener components for general applications:	
Bolts and studs	ASTM: A 307
Anchor bolts	ASTM: F 1554 or A 307, Grade C
High-strength bolts and studs	ASTM: A 449, Type 1
High-strength threaded rods	ASTM: A 449, Type 1
High-strength nonheaded anchor bolts	ASTM: F 1554, Grade 105, Class 2A
Nuts	ASTM: A 563, including Appendix X1[b]
Washers	ASTM: F 844
Components of high-strength steel fastener assemblies for use in structural steel joints:	
Bolts	ASTM: A 325, Type 1
Tension control bolts	ASTM: F 1852, Type 1
Nuts	ASTM: A 563, including Appendix X1[b]
Hardened washers	ASTM : F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM: F 959, Type 325, zinc-coated
Carbon steel for forgings, pins and rollers	ASTM: A 668/A 668M, Class D
Alloy steel for forgings	ASTM: A 668/A 668M, Class G
Pin nuts	ASTM: A 36/A 36M
Carbon-steel castings	ASTM: A 27/A 27M, Grade 65-35, Class 1
Malleable iron castings	ASTM: A 47/A 47M, Grade 32510 (Grade 22010)
Gray iron castings	ASTM: A 48, Class 30B
Carbon steel structural tubing	ASTM: A 500, Grade B or A 501
Steel pipe (Hydrostatic testing will not apply)	ASTM: A 53, Type E or S, Grade B; A 106, Grade B; or A 139, Grade B
Stud connectors	AASHTO/AWS D1.5

a Grades that may be substituted for the equivalent ASTM Designation: A 709 steel, at the Contractor's option, subject to the modifications and additions specified and to the requirements of A 709.

b Zinc-coated nuts that will be tightened beyond snug or wrench tight shall be furnished with a dry lubricant conforming to Supplementary Requirement S2 in ASTM Designation: A 563.

In Section 55-2.04 delete the 1st paragraph.

Delete Section 55-2.05.

In Section 55-3.05 replace the 1st paragraph with:

Surfaces of bearing and base plates and other metal surfaces that are to come in contact with each other or with ground concrete surfaces shall be flat to within 1/32-inch tolerance in 12 inches and to within 1/16-inch tolerance overall. Surfaces of bearing and base plates and other metal bearing surfaces that are to come in contact with preformed fabric pads, elastomeric bearing pads, or mortar shall be flat to within 1/8-inch tolerance in 12 inches and to within 3/16-inch tolerance overall.

In Section 55-3.07 in the 1st paragraph, replace item B with:

B. The radius of bend measured to the concave face shall conform to the requirements in ASTM Designation: A6/A6M

In Section 55-3.10 in the 1st paragraph, replace item B with:

B. Internal threads shall conform to the requirements in ASTM Designation: A 563.

In Section 55-3.19 replace the 3rd paragraph with:

Immediately before setting bearing assemblies or masonry plates directly on ground concrete surfaces, the Contractor shall thoroughly clean the surfaces of the concrete and the metal to be in contact and shall apply a coating of nonsag polysulfide or polyurethane caulking conforming to the requirements in ASTM Designation: C 920 to contact areas to provide full bedding.

In Section 55-4.01 in the 1st paragraph, replace item D with:

D. To determine the pay quantities of galvanized metal, the weight to be added to the calculated weight of the base metal for the galvanizing will be determined from the table of weights of zinc coatings specified in ASTM Designation: A 153/A 153M.

^^

SECTION 56 SIGNS

(Issued 07-20-12)

In Section 56-1.01 in the 2nd paragraph, replace the 1st sentence with:

Sign structures shall be of the following types: truss, tubular, lightweight and bridge mounted.

In Section 56-1.02A replace the 1st paragraph with:

Bars and plates shall be structural steel complying with one or more of the following:

1. ASTM Designation: A36/A36M
2. ASTM Designation: A709/A709M, Grade 36 or 50
3. ASTM Designation: A572/A572M, Grade 50

Other open shapes shall be structural steel complying with one or more of the following:

1. ASTM Designation: A36/A36M
2. ASTM Designation: A709/A709M, Grade 36 or 50
3. ASTM Designation: A992/A992M

Light fixture mounting channel shall be a continuous slot channel made from one of the following:

1. Steel complying with ASTM Designation: A1011/A1011M, Designation SS, Grade 33
2. Extruded aluminum of alloy 6063-T6 complying with ASTM Designation: B221 or B221M

In Section 56-1.02B delete the 2nd paragraph.

In Section 56-1.02E replace the 1st paragraph with:

Pipe posts shall be welded or seamless steel pipe conforming to the requirements in ASTM Designation: A 53/A 53M, Grade B; ASTM Designation: A 106/A 106M, Grade B; or API Specification 5L PSL2 Grade B or Grade X42R or Grade X42M. At the option of the Contractor, posts may be fabricated from structural steel conforming to the requirements in ASTM Designation: A 36/A 36M.

Pipe posts shall not be spiral seam welded.

In Section 56-1.02F replace item B of the 1st paragraph with:

B. Material for gratings shall be structural steel conforming to the requirements in ASTM Designation: A 1011/A 1011M, Designation CS, Type B or Designation SS, Grade 36, Type 1.

In Section 56-1.03 replace the 5th paragraph with:

Clips, eyes, or removable brackets shall be affixed to all signs and all posts and shall be used to secure the sign during shipping and for lifting and moving during erection as necessary to prevent damage to the finished galvanized or painted surfaces. Brackets on tubular sign structures shall be removed after erection. Details of the devices shall be shown on the working drawings.

In Section 56-1.03 delete the 12th paragraph.

In Section 56-1.05 replace the 1st paragraph with:

Excepting tubular type, all ferrous metal parts of sign structures shall be galvanized and not painted, unless otherwise specified in the special provisions.

In Section 56-1.05 replace the 2nd paragraph with:

Except as herein provided, all exterior surfaces including those areas to be covered by sign panels of tubular type of sign structures shall be cleaned and painted as provided in Section 59-5, "Painting Sign Structures," and as provided in the special provisions. There shall be no chemical treatment of galvanized surfaces prior to cleaning and painting. Walkway gratings, walkway brackets, gutters, safety railings, steel mountings for light fixtures, and all nuts, bolts, and washers for sign structures shall be galvanized after fabrication and shall not be painted.

In Section 56-1.05 replace the 3rd paragraph with:

Galvanizing shall conform to the provisions in Section 75-1.05, "Galvanizing," except that when permission is granted by the Engineer, surfaces may be coated with zinc by the metalizing process. Metalizing shall be performed in conformance with the AWS requirements. The thickness of the sprayed zinc coat shall be 10 ± 2 mils. The thickness of the sprayed zinc coat on faying surfaces shall not be more than 10 mils.

In Section 56-1.05, add:

Zinc solders or zinc alloys that contain tin shall not be used to repair a damaged galvanized surface.

In Section 56-1.07, add:

Bridge-mounted signs shall not be fastened to concrete elements of bridges or railings before the concrete attains a compressive strength of 2,500 psi.

In Section 56-1.10 replace the 4th paragraph with:

The contract price paid per pound for install sign structure of the type or types designated in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in installing sign structures, complete in place, including installing anchor bolt assemblies, removable sign panel frames, and sign panels and performing any welding, painting or galvanizing required during installation, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

In Section 56-2.03 replace the 4th paragraph with:

Backfill material for metal posts shall consist of minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," and shall contain not less than 463 pounds of cementitious material per cubic yard.

^^

SECTION 59 PAINTING

(Issued 10-19-12)

In Section 59-1.01 add:

Coatings selected for use shall conform to the volatile organic compound limits specified for the air quality district where the project is located.

In Section 59-1.03 replace the 3rd paragraph with:

Painting shall be done in a neat and workmanlike manner. Unless otherwise specified, paint shall be applied by brush, or spray, or roller, or any combination of these methods. Gun extensions shall not be used.

In Section 59-1.03 replace the 5th paragraph with:

Unless otherwise specified, should 7 days elapse between paint applications, the painted surface shall be pressure rinsed prior to the next paint application. Pressure rinsing is defined as a pressurized water rinse with a minimum nozzle pressure of 1,160 psi. During rinsing, the tip of the pressure nozzle shall be placed between 12 inches and 18 inches from the surface to be rinsed. The nozzle shall have a maximum fan tip angle of 30°.

In Section 59-2.01 replace the 2nd paragraph with:

Unless otherwise specified, no painting Contractors or subcontractors will be permitted to perform work without having the following current "SSPC: The Society for Protective Coatings" (formerly the Steel Structures Painting Council) certifications in good standing throughout the duration of the contract:

A. For cleaning and painting structural steel in the field, certification in conformance with the requirements in Qualification Procedure No. 1, "Standard Procedure For Evaluating Painting Contractors (Field Application to Complex Industrial Structures)" (SSPC-QP 1).
B. For removing paint from structural steel, certification in conformance with the requirements in Qualification Procedure No. 2, "Standard Procedure for the Qualification of Painting Contractors (Field Removal of Hazardous Coatings from Complex Structures)" (SSPC-QP 2, Category A).
C. For cleaning and painting structural steel in a permanent painting facility, certification in conformance with the requirements in AISC-420-10/SSPC-QP 3, "Certification Standard for Shop Application of Complex Protective Coating Systems." All cleaning and painting of structural steel shall be performed in an Enclosed Shop.

In Section 59-2.03 replace the 3rd paragraph with:

Exposed steel or other metal surfaces to be blast cleaned shall be cleaned in conformance with the requirements in SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," of the "SSPC: The Society for Protective Coatings." Blast cleaning shall leave all surfaces with a dense, uniform, angular anchor pattern of not less than 1.5 mil as measured in conformance with the requirements in ASTM Designation: D 4417.

Replace Section 59-2.05 with:

59-2.05 CLEANING PAINTED SURFACES

All previously painted surfaces shall be cleaned by pressure washing or steam cleaning before other cleaning or painting activities are performed. Gloss on the existing paint shall be removed without removing sound paint. Areas

of gloss remaining after cleaning shall be roughened using 100 to 200-grit sandpaper. Any paint that becomes loose, curled, lifted, or that loses its bond after cleaning shall be removed to sound paint or metal.

Pressure washing includes cleaning surfaces using a pressure wash system with a nozzle pressure from 2,500 to 5,000 psi and a maximum fan tip angle of 45 degrees.

Steam cleaning includes cleaning dirt, grease, loose chalky paint, and other foreign material from surfaces using steam. The steam temperature at the nozzle shall be from 265 to 375 degrees F. A biodegradable detergent shall be used during steam cleaning. After steam cleaning, cleaned surfaces shall be rinsed clean with fresh water. Steam cleaning shall not be performed more than 2 weeks before painting or other phases of cleaning. Steam-cleaned surfaces shall not be painted until they are thoroughly dry and 24 hours have elapsed after steam cleaning.

In Section 59-2.12 replace the 3rd and 4th paragraphs with:

Contact surfaces of stiffeners, railings, built up members or open seam exceeding 6 mils in width that would retain moisture, shall be caulked with polysulfide or polyurethane sealing compound conforming to the requirements in ASTM Designation: C 920, Type S, Grade NS, Class 25, Use O, or other approved material.

The dry film thickness of the paint will be measured in place with a calibrated Type 2 magnetic film thickness gage in conformance with the requirements in SSPC-PA 2, "Measurement of Dry Coating Thickness with Magnetic Gages," of the "SSPC: The Society for Protective Coatings," except that there shall be no limit to the number or location of spot measurements to verify compliance with specified thickness requirements.

In Section 59-5.01 replace the 1st paragraph with:

Tubular sign structures shall be cleaned and painted in conformance with the provisions in Section 59-1, "General," and this Section 59-5. Sign structures, other than tubular sign structures, shall not be painted unless otherwise specified in the special provisions.

^^

SECTION 63: CAST-IN-PLACE CONCRETE PIPE
(Issued 10-21-11)

Replace Section 63 with:
SECTION 63: (BLANK)

^^

SECTION 64 PLASTIC PIPE
(Issued 06-05-09)

In Section 64-1.02 replace the 5th paragraph with:

HDPE compounds used in the manufacture of corrugated polyethylene pipe and fittings shall comply with AASHTO M 294 except that the mix shall contain not less than 2 nor greater than 4 percent well dispersed carbon black. HDPE compounds used in the manufacture of ribbed profile wall polyethylene pipe shall comply with ASTM F 894 except that Type E ultraviolet stabilizers shall not be allowed and carbon black shall be well dispersed in an amount not less than 2 percent nor greater than 4 percent.

Manufacturers of corrugated polyethylene pipe shall:

1. Participate in the National Transportation Product Evaluation Control Program (NTPEP) for each plant supplying corrugated polyethylene pipe and fittings for the project.
2. Conduct and maintain a quality control program under NTPEP.

3. Submit a copy to the Engineer of manufacturing plant audits and NTPEP test results from the current cycle of NTPEP testing for all pipe diameters supplied.

Type D corrugated polyethylene pipe is not allowed. Corrugated polyethylene pipe greater than 60 inches in nominal diameter is not allowed.

In Section 64-1.05 replace the 1st paragraph with:

Excavation, backfill, and shaped bedding shall comply with Section 19-3, "Structure Excavation and Backfill," except the following:

1. At locations where pipe is to be backfilled with concrete, the backfill shall comply with Section 64-1.06, "Concrete Backfill."
2. Corrugated polyethylene pipe that is greater than 48 inches in nominal diameter but not exceeding 60 inches in nominal diameter shall be backfilled with either controlled low strength material under the special provisions or slurry cement backfill under Section 19-3.062, "Slurry Cement Backfill."
3. Where cementitious or flowable backfill is used for structure backfill, the backfill shall be placed to a level not less than 12 inches above the crown of the pipe.

In Section 64-1.06 replace the 1st paragraph with:

At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete conforming to the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item or shown on the plans.

In Section 64-1.06 replace the 3rd paragraph with:

The surface of the concrete backfill shall be broomed with a heavy broom to produce a uniform rough surface if hot mix asphalt is to be placed directly thereon.

^^

SECTION 65 REINFORCED CONCRETE PIPE

(Issued 07-20-12)

In Section 65-1.02 replace the 1st paragraph with:

Cementitious material and aggregate shall conform to the provisions in Section 90-2, "Materials" except that grading requirements shall not apply to the aggregate. Use of supplemental cementitious material shall conform to AASHTO Designation: M 170.

In Section 65-1.02A(1) in the 11th paragraph, replace item c with:

c. Cementitious material and aggregate for non-reinforced concrete pipe shall conform to the provisions in Section 65-1.02, "Materials."

In Section 65-1.035 replace the 1st paragraph with:

At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete in conformance with the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item.

In Section 65-1.035 replace the 3rd paragraph with:

The surface of the concrete backfill shall be broomed with a heavy broom to produce a uniform rough surface if hot mix asphalt is to be placed directly thereon.

Replace Section 65-1.05 with:

65-1.05 (BLANK)

In Section 65-1.06 in the 2nd paragraph, replace the 1st subparagraph with:

Cement Mortar. - Mortar shall be composed of one part cementitious material and 2 parts sand by volume. Supplementary cementitious material will not be required.

In Section 65-1.10 in the 1st paragraph in the 1st sentence, delete "jacked reinforced concrete pipe."

In Section 65-1.10 delete the 2nd paragraph.

^^

SECTION 66 CORRUGATED METAL PIPE
(Issued 07-20-12)

In Section 66-1.045 replace the 1st paragraph with:

At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete conforming to the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item or shown on the plans.

In Section 66-1.045 replace the 3rd paragraph with:

The surface of the concrete backfill shall be broomed with a heavy broom to produce a uniform rough surface if hot mix asphalt is to be placed directly thereon.

Replace Section 66-3.10 with:

66-3.10 (BLANK)

In Section 66-4.02 delete the 2nd paragraph.

^^

SECTION 68 SUBSURFACE DRAINS
(Issued 07-31-07)

In Section 68-3.02D replace the 1st and 2nd paragraphs with:

Concrete for splash pads shall be produced from minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

Mortar placed where edge drain outlets and vents connect to drainage pipe and existing drainage inlets shall conform to the provisions in Section 51-1.135, "Mortar."

In Section 68-3.03 replace the 13th paragraph with:

Cement treated permeable material, which is not covered with hot mix asphalt within 12 hours after compaction of the permeable material, shall be cured by either sprinkling the material with a fine spray of water every 4 hours during daylight hours or covering the material with a white polyethylene sheet, not less than 6 mils thick. The above curing requirements shall begin at 7:00 a.m. on the morning following compaction of the cement treated permeable material and continue for the next 72 hours or until the material is covered with hot mix asphalt, whichever is less. The cement treated permeable material shall not be sprayed with water during the first 12 hours after compacting, but may be covered with the polyethylene sheet during the first 12 hours or prior to the beginning of the cure period.

In Section 68-3.03 replace the 17th and 18th paragraphs with:

Hot mix asphalt for backfilling trenches in existing paved areas shall be produced from commercial quality aggregates and asphalt and mixed at a central mixing plant. The aggregate shall conform to the 3/4 inch grading, or the 1/2 inch grading for Type A and Type B hot mix asphalt specified in Section 39-1.02E, "Aggregate." The amount of asphalt binder to be mixed with the aggregate shall be between 4 percent and 7 percent by weight of the dry aggregate, as determined by the Engineer.

Hot mix asphalt backfill shall be spread and compacted in approximately 2 equal layers by methods that will produce a hot mix asphalt surfacing of uniform smoothness, texture and density. Each layer shall be compacted before the temperature of the mixture drops below 250 ºF. Prior to placing the hot mix asphalt backfill, a tack coat of asphaltic emulsion conforming to the provisions in Section 94, "Asphaltic Emulsions," shall be applied to the vertical edges of existing pavement at an approximate rate of 0.05 gallon per square yard.

In Section 68-3.03 replace the 20th paragraph with:

Type A pavement markers conforming to the details shown on the plans and the provisions in Section 85, "Pavement Markers," shall be placed on paved shoulders or dikes at outlet, vent and cleanout locations as directed by the Engineer. The waiting period for placing pavement markers on new hot mix asphalt surfacing will not apply.

Replace Section 68-3.05 with:

68-3.05 PAYMENT

The contract price paid per linear foot for plastic pipe (edge drain) of the size or sizes shown in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in installing edge drains complete in place, including excavation (and removal of any concrete deposits that may occur along the lower edge of the concrete pavement in Type 1 installations) and hot mix asphalt backfill for Type 1 edge drain installation, tack coat, filter fabric, and treated permeable material, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The contract price paid per linear foot for plastic pipe (edge drain outlet) of the size or sizes shown in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in installing edge drain outlets, vents and cleanouts complete in place, including outlet and vent covers, expansion plugs, pavement markers, concrete splash pads, connecting outlets and vents to drainage facilities, and excavation and backfill [aggregate base, hot mix asphalt, tack coat, and native material] for outlets, vents, and cleanouts to be installed in embankments and existing shoulders, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

^^

SECTION 69 OVERSIDE DRAINS

(Issued 07-31-07)

In Section 69-1.01 replace the 1st paragraph with:

This work shall consist of furnishing and installing entrance tapers, pipe downdrains, tapered inlets, flume downdrains, anchor assemblies, reducers, slip joints and hot mix asphalt overside drains to collect and carry surface

drainage down the roadway slopes as shown on the plans or as directed by the Engineer and as specified in these specifications and the special provisions.

Replace Section 69-1.02D with:

69-1.02D Hot Mix Asphalt

Hot mix asphalt for overside drains shall conform to the provisions in Section 39-1.13, "Miscellaneous Areas."

Replace Section 69-1.04 with:

69-1.04 HOT MIX ASPHALT OVERSIDE DRAINS

Hot mix asphalt overside drains shall be constructed as shown on the plans or as directed by the Engineer. The hot mix asphalt shall be placed in conformance with the provisions in Section 39-1.13, "Miscellaneous Areas."

In Section 69-1.06 replace the 2nd paragraph with:

Quantities of hot mix asphalt placed for overside drains will be paid for as provided in Section 39-5, "Measurement and Payment," for hot mix asphalt placed in miscellaneous areas.

^^

SECTION 70 MISCELLANEOUS FACILITIES

(Issued 01-20-12)

In Section 70-1.02C replace the 2nd paragraph with:

Precast concrete flared end sections shall conform to the requirements for Class III Reinforced Concrete Pipe in AASHTO Designation: M 170M. Cementitious materials and aggregate shall conform to the provisions in Section 90-2, "Materials," except that grading requirements shall not apply to the aggregate. Use of supplementary cementitious material shall conform to the requirements in AASHTO Designation: M 170. The area of steel reinforcement per linear foot of flared end section shall be at least equal to the minimum steel requirements for circular reinforcement in circular pipe for the internal diameter of the circular portion of the flared end section. The basis of acceptance of the precast concrete flared end section shall conform to the requirements of Section 5.1.2 of AASHTO Designation: M 170.

In Section 70-1.02C replace the 3rd paragraph with:

Plastic flared end sections shall conform to the requirements in ASTM Designation: D 3350.

In Section 70-1.02H replace the 1st paragraph with:

Precast concrete pipe risers and pipe reducers, and precast concrete pipe sections, adjustment rings and tapered sections for pipe energy dissipators, pipe inlets and pipe manholes shall conform to the requirements in AASHTO Designation: M 199M/M 199, except that the cementitious material and aggregate shall conform to the provisions in Section 90-2, "Materials," except that grading requirements shall not apply to the aggregate. Use of supplementary cementitious material shall conform to the requirements in AASHTO Designation: M 170.

In Section 70-1.03 replace the 2nd paragraph with:

Cutoff walls for precast concrete flared end sections shall be constructed of minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

^^

SECTION 72 SLOPE PROTECTION
(Issued 07-20-12)

In Section 72-4.04 replace the 6th paragraph with:

Pervious backfill material, if required by the plans, shall be placed as shown. A securely tied sack containing one cubic foot of pervious backfill material shall be placed at each weep hole and drain hole. The sack material shall conform to the requirements for filter fabric in Section 88-1.02, "Filtration."

Replace Section 72-5.05 with:

72-5.05 Measurement

Concreted-rock slope protection is measured by the ton or cubic yard.

Quantities of concreted-rock slope protection to be paid for by the cubic yard will be determined from the dimensions shown on the plans or the dimensions directed by the Engineer, and concreted-rock slope protection placed in excess of these dimensions will not be paid for.

Quantities of concreted-rock slope protection to be paid for by the ton will be determined from the weight of the rock in conformance with the provisions in Section 9-1.01, "Measurement of Quantities."

In Section 72-5.06 replace the 1st sentence with:

The contract price paid per cubic yard or per ton for concreted-rock slope protection designated in the Engineer's Estimate includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all work involved in constructing the concreted-rock slope protection, complete in place, including excavating and backfilling footing trenches and furnishing and placing concrete, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

^^

SECTION 73 CONCRETE CURBS AND SIDEWALKS
(Issued 06-05-09)

In Section 73-1.01 in the 2nd paragraph, replace item 2 with:

2. Minor concrete shall contain not less than 463 pounds of cementitious material per cubic yard except that when extruded or slip-formed curbs are constructed using 3/8-inch maximum size aggregate, minor concrete shall contain not less than 505 pounds of cementitious material per cubic yard.

In Section 73-1.06 replace the 15th paragraph with:

Where hot mix asphalt or portland cement concrete pavements are to be placed around or adjacent to manholes, pipe inlets or other miscellaneous structures in sidewalk, gutter depression, island paving, curb ramps or driveway areas, the structures shall not be constructed to final grade until after the pavements have been constructed for a reasonable distance on each side of the structures.

^^

SECTION 74 PUMPING PLANT EQUIPMENT
(Issued 07-01-08)

In Section 74-1.02 delete the 2nd paragraph.

^^

SECTION 75 MISCELLANEOUS METAL
(Issued 07-01-11)

In Section 75-1.02 replace the 6th paragraph with:

Manhole frames and covers shall conform to AASHTO M 306.

In Section 75-1.02 replace the 10th paragraph with:

Unless otherwise specified, materials shall conform to the following specifications:

Material	Specification
Steel bars, plates and shapes	ASTM Designation: A 36/A 36M or A 575, A 576 (AISI or M Grades 1016 through 1030)
Steel fastener components for general applications:	
Bolts and studs	ASTM Designation: A 307
Headed anchor bolts	ASTM Designation: A 307, Grade B, including S1 supplementary requirements
Nonheaded anchor bolts	ASTM Designation: F 1554 or A 307, Grade C, including S1 supplementary requirements and S1.6 of AASHTO Designation: M 314 supplementary requirements, or AASHTO Designation: M 314, Grade 36 or 55, including S1 supplementary requirements
High-strength bolts and studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: A 449, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Washers	ASTM Designation: F 844
Components of high-strength steel fastener assemblies for use in structural steel joints:	
Bolts	ASTM Designation: A 325, Type 1
Tension control bolts	ASTM Designation: F 1852, Type 1
Nuts	ASTM Designation: A 563, including Appendix X1*
Hardened washers	ASTM Designation: F 436, Type 1, Circular, including S1 supplementary requirements
Direct tension indicators	ASTM Designation: F 959, Type 325, zinc-coated
Stainless steel fasteners (Alloys 304 & 316) for general applications:	
Bolts, screws, studs, threaded rods, and nonheaded anchor bolts	ASTM Designation: F 593 or F 738M
Nuts	ASTM Designation: F 594 or F 836M
Washers	ASTM Designation: A 240/A 240M and ANSI B 18.22M
Carbon-steel castings	ASTM Designation: A 27/A 27M, Grade 65-35, Class 1
Malleable iron castings	ASTM Designation: A 47, Grade 32510 or A 47M, Grade 22010
Gray iron castings Inside a roadbed Outside a roadbed	 AASHTO M 306 AASHTO M306 except only AASHTO M105, Class 35B is allowed
Ductile iron castings	ASTM Designation: A 536, Grade 65-45-12
Cast iron pipe	Commercial quality
Steel pipe	Commercial quality, welded or extruded
Other parts for general applications	Commercial quality

*Zinc-coated nuts that will be tightened beyond snug or wrench tight shall be furnished with a dyed dry lubricant conforming to Supplementary Requirement S2 in ASTM Designation: A 563.

In Section 75-1.03 replace the 13th paragraph with:

Concrete anchorage devices shall be mechanical expansion or resin capsule types installed in drilled holes or cast-in-place insert types. The anchorage devices shall be selected from the Department's Pre-Qualified Products List. The qualification requirements for concrete anchorage devices may be obtained from the Pre-Qualified Products List Web site.

The anchorage devices shall be a complete system, including threaded studs, hex nuts, and cut washers. Thread dimensions for externally threaded concrete anchorage devices prior to zinc coating shall conform to the requirements in ASME Standard: B1.1 having Class 2A tolerances or ASME Standard: B1.13M having Grade 6g tolerances. Thread dimensions for internally threaded concrete anchorage devices shall conform to the requirements in ASTM A 563.

In Section 75-1.03 replace the 18th paragraph with:

Mechanical expansion anchors shall, when installed in accordance with the manufacturer's instructions and these specifications and tested in conformance with the requirements in California Test 681, withstand the application of a sustained tension test load of at least the following values for at least 48 hours with a movement not greater than 0.035 inch:

Stud Diameter (inches)	Sustained Tension Test Load (pounds)
*3/4	5,000
5/8	4,100
1/2	3,200
3/8	2,100
1/4	1,000

* Maximum stud diameter permitted for mechanical expansion anchors.

Resin capsule anchors shall, when installed in accordance with the manufacturer's instructions and these specifications and tested in conformance with the requirements in California Test 681, withstand the application of a sustained tension test load of at least the following values for at least 48 hours with a movement not greater than 0.010 inch:

Stud Diameter (inches)	Sustained Tension Test Load (pounds)
1-1/4	31,000
1	17,900
7/8	14,400
3/4	5,000
5/8	4,100
1/2	3,200
3/8	2,100
1/4	1,000

At least 25 days before use, the Contractor shall submit one sample of each resin capsule anchor per lot to the Transportation Laboratory for testing. A lot of resin capsule anchors is 100 units, or fraction thereof, of the same brand and product name.

In Section 75-1.03 replace the 20th paragraph with:

A Certificate of Compliance for concrete anchorage devices shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance."

In Section 75-1.03 replace the 24th paragraph with:

Sealing compound, for caulking and adhesive sealing, shall be a polysulfide or polyurethane material conforming to the requirements in ASTM Designation: C 920, Type S, Grade NS, Class 25, Use O.

In Section 75-1.035 in the 3rd paragraph, replace the 1st sentence with:

Cables shall be 3/4 inch preformed, 6 x 19, wire strand core or independent wire rope core (IWRC), galvanized in conformance with the requirements in Federal Specification RR-W-410, right regular lay, manufactured of improved plow steel with a minimum breaking strength of 23 tons.

In Section 75-1.035 in the 4th paragraph, replace item C with:

C. Nuts shall conform to the requirements in ASTM Designation: A 563 including Appendix X1, except lubrication is not required.

In Section 75-1.035 replace the 12th paragraph with:

Concrete for filling cable drum units shall conform to the provisions in Section 90-10, "Minor Concrete," or at the option of the Contractor, may be a mix with 3/8-inch maximum size aggregate and not less than 675 pounds of cementitious material per cubic yard.

In Section 75-1.05 replace the 6th paragraph with:

Galvanizing of iron and steel hardware and nuts and bolts, when specified or shown on the plans, shall conform to the requirements in ASTM Designation: A 153/A 153M, except whenever threaded studs, bolts, nuts, and washers are specified to conform to the requirements in ASTM Designation: A 307, A 325, A 449, A 563, F 436, or F 1554 and zinc coating is required, they shall be hot-dip zinc coated or mechanically zinc coated in conformance with the requirements in the ASTM Designations. Unless otherwise specified, galvanizing shall be performed after fabrication.

In Section 75-1.05 replace the 8th paragraph with:

Tapping of nuts or other internally threaded parts to be used with zinc coated bolts, anchor bars or studs shall be done after galvanizing and shall conform to the requirements for thread dimensions and overtapping allowances in ASTM Designation: A 563.

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SECTION 80 FENCES

(Issued 01-05-07)

In Section 80-3.01F replace the 4th paragraph with:

Portland cement concrete for metal post and brace footings and for deadmen shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

In Section 80-4.01C replace the 4th paragraph with:

Portland cement concrete for metal post and for deadmen shall be produced from minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

^^

SECTION 83 RAILINGS AND BARRIERS
(Issued 07-01-11)

In Section 83-1.02 replace the 7th paragraph with:

Mortar shall conform to the provisions in Section 51-1.135, "Mortar," and shall consist of one part by volume of cementitious material and 3 parts of clean sand.

In Section 83-1.02B in the 24th paragraph in the 8th subparagraph, replace the 1st sentence with:

Anchor cable shall be 3/4 inch preformed, 6 x 19, wire strand core or independent wire rope core (IWRC), galvanized in conformance with the requirements in Federal Specification RR-W-410, right regular lay, manufactured of improved plow steel with a minimum breaking strength of 23 tons.

In Section 83-1.02E in the 6th paragraph, replace the 2nd sentence with:

Cable shall be galvanized in conformance with the requirements in Federal Specification RR-W-410.

In Section 83-1.02I replace the 5th paragraph with:

Where shown on the plans, cables used in the frame shall be 5/16 inch in diameter, wire rope, with a minimum breaking strength of 5,000 pounds and shall be galvanized in conformance with the requirements in Federal Specification RR-W-410.

In Section 83-1.02I replace the 14th paragraph with:

Chain link fabric shall be 11-gage conforming to one of the following:

1. AASHTO Designation: M181, Type I, Class C
2. AASHTO Designation: M181, Type IV, Class A
3. ASTM F 1345, Class 2

In Section 83-2.02D(1) replace the 5th paragraph with:

When concrete barriers are to be constructed on existing structures, the dowels shall be bonded in holes drilled in the existing concrete. Drilling of holes and bonding of dowels shall conform to the following:

1. The bonding materials shall be either magnesium phosphate concrete, modified high alumina based concrete or portland cement based concrete. Magnesium phosphate concrete shall be either single component (water activated) or dual component (with a prepackaged liquid activator). Modified high alumina based concrete and portland cement based concrete shall be water activated. Bonding materials shall conform to the following requirements:

Property	Test Method	Requirements
Compressive Strength		
at 3 hours, MPa	California Test 551	21 min.
at 24 hours, MPa	California Test 551	35 min.
Flexure Strength		
at 24 hours, MPa	California Test 551	3.5 min.
Bond Strength: at 24 hours		
SSD Concrete, MPa	California Test 551	2.1 min.
Dry Concrete, MPa	California Test 551	2.8 min.
Water Absorption, %	California Test 551	10 max.
Abrasion Resistance		
at 24 hours, grams	California Test 550	25 max.
Drying Shrinkage at 4 days, %	ASTM Designation: C 596	0.13 max.
Soluble Chlorides by weight, %	California Test 422	0.05 max.
Water Soluble Sulfates by weight, %	California Test 417	0.25 max.

2. Magnesium phosphate concrete shall be formulated for minimum initial set time of 15 minutes and minimum final set time of 25 minutes at 70° F. The materials, prior to use, shall be stored in a cool, dry environment.
3. Mix water used with water activated material shall conform to the provisions in Section 90-2.03, "Water."
4. The quantity of water for single component type or liquid activator (for dual component type) to be blended with the dry component, shall be within the limits recommended by the manufacturer and shall be the least amount required to produce a pourable batter.
5. Addition of retarders, when required and approved by the Engineer, shall be in conformance with the manufacturer's recommendations.
6. Before using concrete material that has not been previously approved, a minimum of 45 pounds shall be submitted to the Engineer for testing. The Contractor shall allow 45 days for the testing. Each shipment of concrete material that has been previously approved shall be accompanied by a Certificate of Compliance as provided in Section 6-1.07, "Certificates of Compliance."
7. Magnesium phosphate concrete shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum or copper metals. Modified high alumina based concrete shall not be mixed in containers or worked with tools containing aluminum.
8. The surface of any dowel coated with zinc or cadmium shall be coated with a colored lacquer before installation of the dowel. The lacquer shall be allowed to dry thoroughly before embedment of the dowels.
9. The holes shall be drilled by methods that will not shatter or damage the concrete adjacent to the hole. The diameter of the drilled hole shall be $1/2$ inch larger than the nominal diameter of the dowels.
10. The drilled holes shall be clean and dry at the time of placing the bonding material and the steel dowels. Bonding material and dowel shall completely fill the drilled hole. The surface temperature shall be 40° F or above when the bonding material is placed.
11. After bonding, dowels shall remain undisturbed for a minimum of 3 hours or until the bonding material has reached a strength sufficient to support the dowels. Dowels that are improperly bonded, as determined by the Engineer, shall be removed. The holes shall be cleaned or new holes shall be drilled and the dowels replaced and securely bonded to the concrete. Removing, redrilling and replacing improperly bonded dowels shall be performed at the Contractor's expense. Modified high alumina based concrete and portland cement based concrete shall be cured in conformance with the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. Magnesium phosphate concrete shall not be cured.

In Section 83-2.02D(1) replace the 8th paragraph with:

Granular material for backfill between the 2 walls of concrete barrier (Types 50E, 60F, 60GE and 60SF), as shown on the plans, shall be placed without compaction.

In Section 83-2.02D(2) in the 1st paragraph, replace item b with:

b. If the 3/8-inch maximum size aggregate grading is used to construct extruded or slip-formed concrete barriers, the cementitious material content of the minor concrete shall be not less than 675 pounds per cubic yard.

In Section 83-2.02D(2) replace the 3rd paragraph with:

The concrete paving between the tops of the 2 walls of concrete barrier (Types 50E, 60F, 60GE, and 60SF) and the optional concrete slab at the base between the 2 walls of concrete barrier (Types 50E, 60F, 60GE, and 60SF) shall be constructed of minor concrete conforming to the provisions of Section 90-10, "Minor Concrete," except that the minor concrete shall contain not less than 505 pounds of cementitious material per cubic yard.

In Section 83-2.02D(2) replace the 8th paragraph with:

Granular material for backfill between the 2 walls of concrete barrier (Types 50E, 60F, 60GE and 60SF) shall be earthy material suitable for the purpose intended, having no rocks, lumps or clods exceeding1-1/2 inches in greatest dimension.

In Section 83-2.03 replace the 8th and 9th paragraphs with:

Concrete barriers, except Type 50E, Type 60F, Type 60GE, and Type 60SF will be measured along the top of the barrier.

Concrete barriers Type 50E, Type 60F, Type 60GE, and Type 60SF will be measured once along the centerline between the 2 walls of the barrier.

In Section 83-2.04 replace the 3rd paragraph with:

The contract prices paid per linear foot for concrete barrier of the type or types listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing the concrete barriers, complete in place, including bar reinforcing steel, steel dowels and drilling and bonding dowels in structures, hardware for steel plate barrier, miscellaneous metal, excavation, backfill (including concrete paving for, and granular material or concrete slab used as backfill in Type 50E, Type 60F, Type 60GE, and Type 60SF concrete barrier), and disposing of surplus material and for furnishing, placing, removing and disposing of the temporary railing for closing the gap between existing barrier and the concrete barrier being constructed, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

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SECTION 85 PAVEMENT MARKERS

(Issued 07-31-07)

In Section 85-1.06 replace the 6th paragraph with:

Pavement markers shall not be placed on new hot mix asphalt surfacing or seal coat until the surfacing or seal coat has been opened to public traffic for a period of not less than 7 days when hot melt bituminous adhesive is used, and not less than 14 days when epoxy adhesive is used.

In Section 85-1.06 in the 14th paragraph, replace the 2nd sentence with:

Cleaning shall be done by blast cleaning on all surfaces regardless of age or type, except that blast cleaning of clean, new hot mix asphalt and clean, new seal coat surfaces will not be required when hot melt bituminous adhesive is used.

^^

SECTION 86 SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

(Issued 01-20-12)

Replace Section 86 with:

SECTION 86 ELECTRICAL SYSTEMS

86-1 GENERAL

86-1.01 DESCRIPTION

Section 86 includes specifications for installing, modifying, and removing:

1. Traffic signal
2. Interconnect system
3. Ramp metering system
4. Flashing beacon system
5. Lighting system
6. Sign illumination system
7. Traffic monitoring station
8. Communication system
9. Electrical equipment in structure
10. Falsework lighting

Comply with Part 4 of the California MUTCD. Nothing in this Section 86 is to be construed as to reduce the minimum standards in this manual.

The locations of electrical system elements are approximate; the Engineer will approve final location.

86-1.015 DEFINITIONS

Definitions pertain only to Section 86, "Electrical Systems."

actuation: As defined in the California MUTCD.

channel: Discrete information path.

controller assembly: Controller unit and auxiliary equipment housed in a rainproof cabinet to control a system's operations.

controller unit: Part of the controller assembly performing the basic timing and logic functions.

detector: As defined in the California MUTCD.

electrolier: Complete assembly of lighting standard and luminaire.

flasher: Device to open and close signal circuits at a repetitive rate.

flashing beacon control assembly: Switches, circuit breakers, terminal blocks, flasher, wiring, and necessary electrical components all housed in a single enclosure to properly operate a beacon.

inductive loop detector: Detector capable of being actuated by inductance change caused by vehicle passing or standing over the loop.

lighting standard: Pole and mast arm supporting the luminaire.

luminaire: Assembly that houses the light source and controls the light emitted from the light source.

magnetic detector: Detector capable of being actuated by induced voltage caused by vehicle passing through the earth's magnetic field.

powder coating: A coating applied electrostatically using UV-stable polymer exterior grade powder.

pre-timed controller assembly: Operates traffic signals under a predetermined cycle length.

signal face: As defined in the California MUTCD.

signal head: As defined in the California MUTCD.

signal indication: As defined in the California MUTCD.

signal section: As defined in the California MUTCD.

signal standard: Pole and mast arm supporting one or more signal faces with or without a luminaire mast arm.

traffic-actuated controller assembly: Operates traffic signals under the varying demands of traffic as registered by detector actuation.

traffic phase: Signal phase as defined in the California MUTCD.

vehicle: As defined in the California Vehicle Code.

86-1.02 REGULATIONS AND CODE Electrical equipment must comply with one or more of the following:

1. ANSI
2. ASTM
3. 8 CA Code of Regs § 2299 et seq.
4. EIA
5. NEMA

6. NETA
7. UL

Materials and workmanship must comply with:

1. FCC
2. ITE
3. NEC
4. NRTL
5. Public Utilities Commission, General Order No. 95, "Rules for Overhead Electrical Line Construction"
6. Public Utilities Commission, General Order No. 128, "Rules for Construction of Underground Electric Supply and Communication Systems"

86-1.03 COST BREAK-DOWN

Determine quantities required to complete work. Submit the quantities as part of the cost breakdown.

The sum of the amounts for the units of work listed in the cost breakdown must equal the contract lump sum price bid for the work. Include overhead and profit for each unit of work listed in the cost breakdown. If mobilization is a bid item, include bond premium, temporary construction facilities, and material plants into the mobilization bid item, otherwise, include in each unit of work listed in the cost breakdown. Do not include costs for traffic control system in the cost breakdown.

The cost breakdown may be used to determine partial payment and to calculate payment adjustments for additional costs incurred due to a change order. If a change order increases or decreases the quantities, payment adjustment may be determined under Section 4-1.03B, "Increased or Decreased Quantities."

The cost breakdown must include type, size, and installation method for:

1. Foundations
2. Standards and poles
3. Conduit
4. Pull boxes
5. Conductors and cables
6. Service equipment enclosures
7. Telephone demarcation cabinet
8. Signal heads and hardware
9. Pedestrian signal heads and hardware
10. Pedestrian push buttons
11. Loop detectors
12. Luminaires and lighting fixtures

86-1.04 EQUIPMENT LIST AND DRAWINGS

Within 15 days of contract approval, submit for review a list of equipment and materials that you propose to install. Comply with Section 5-1.02, "Plans and Working Drawings." The list must include:

1. Name of manufacturer
2. Dimension
3. Item identification number
4. List of components

The list must be supplemented by other data as required, including:

1. Schematic wiring diagrams
2. Scale drawings of cabinets showing location and spacing of shelves, terminal blocks, and equipment, including dimensioning
3. Operation manual

Submit 2 copies of the above data. The Engineer will review within 15 days.

Electrical equipment that is manufactured as detailed on the plans will not require detailed drawings and diagrams.

Furnish 3 sets of computer-generated cabinet schematic wiring diagrams.

The cabinet schematic wiring diagram must be placed in a heavy duty plastic envelope and attached to the inside of the door of each cabinet.

Prepare diagrams, plans, and drawings using graphic symbols in IEEE 315, "Graphic Symbols for Electrical and Electronic Diagrams."

86-1.05 CERTIFICATE OF COMPLIANCE

Submit a Certificate of Compliance for all electrical material and equipment to the Engineer under Section 6-1.07, "Certificates of Compliance."

86-1.06 MAINTAINING EXISTING AND TEMPORARY ELECTRICAL SYSTEMS

Keep existing electrical system or approved temporary replacement in working order during the progress of the work. Shutdown is allowed for alteration or removal of the system. Traffic signal shutdown must be limited to normal working hours. Lighting system shutdown must not interfere with the regular lighting schedule.

Notify the Engineer before performing work on the existing system.

Notify the local traffic enforcement agency before traffic signal shutdown.

If existing or temporary system must be modified, work not shown on the plans or specified in the special provisions, but required to keep the system in working order will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

The State or local agency will:

1. Continue the operation and maintenance of existing electrical facilities
2. Continue to provide electrical energy to operate existing electrical facilities
3. Repair or replace existing facilities damaged by public traffic
4. Pay for electrical energy to operate existing or new facilities undergoing the functional tests described in Section 86-2.14C, "Functional Testing"

Verify location and depth of existing detectors, conduits, pull boxes, and other electrical facilities before using tools or equipment that may damage those facilities or interfere with an electrical system.

Notify the Engineer immediately if existing facility is damaged by your activities. Repair or replace damaged facility promptly. If you fail to complete the repair or replacement, promptly, the State will repair or replace and deduct the costs.

Damaged detectors must be replaced within 24 hours at your expense. If you fail to complete the repair within 24 hours, the State will repair and deduct the repair costs.

If roadway remains open to traffic while an existing lighting system is modified:

1. Keep existing system in working order
2. Make final connection so the modified circuit is in operation by nightfall

Keep temporary electrical installations in working order until no longer required. Remove temporary installations as specified in Section 86-7, "Removing, Reinstalling or Salvaging Electrical Equipment."

These provisions do not void your responsibilities as specified in Section 7-1.12, "Indemnification and Insurance," and Section 7-1.16, "Contractor's Responsibility for the Work and Materials."

During traffic signal system shutdown, place W3-1a, "STOP AHEAD," and R1-1, "STOP," signs in each direction to direct traffic through the intersection. For 2-lane approaches, place 2 R1-1 signs.

W3-1a and R1-1 signs must comply with Section 12-3.06, "Construction Area Signs." Use a minimum size of 30 inches for the R1-1 sign.

Cover signal faces when the system is shut down overnight. Cover temporary W3-1a and R1-1 signs when the system is turned on.

86-1.07 SCHEDULING OF WORK

Except service installation and service equipment enclosure, do not work above ground until all materials are on hand to complete electrical work at each location. Schedule work to allow each system to be completed and ready for operation before opening the corresponding section of the roadway to traffic.

If street lighting exists or is installed in conjunction with traffic signals, do not turn on the signals until the street lighting is energized.

Traffic signals will not be placed in operation until the roadways to be controlled are open to public traffic.

Lighting and traffic signals, including flashing operation, will not be placed in operation before starting the functional test period specified in Section 86-2.14, "Testing."

Do not pull conductors into conduit until:

1. Pull boxes are set to grade
2. Metallic conduit is bonded

In vehicular undercrossings, soffit lights must be in operation as soon as practicable after falsework has been removed from the structure. Lighting for pedestrian structures must be in operation before opening the structure to pedestrian traffic.

If the Engineer orders soffit lights or lighting for pedestrian structures to be activated before permanent power service is available, the cost of installing and removing temporary power service will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

The initial traffic signal turn-on must be made between 9:00 a.m. and 2:00 p.m. Before the initial turn-on, all equipment, including pedestrian signals, pedestrian push buttons, vehicle detectors, lighting, signs, and pavement delineation must be installed and in working order. Direct louvers, visors, and signal faces to maximize visibility.

Start functional tests on any working day except Friday or the day before a legal holiday. You must notify the Engineer 48 hours before the start of functional test.

86-1.08 (BLANK)

86-2 MATERIALS AND INSTALLATION

86-2.01 EXCAVATING AND BACKFILLING

Dispose of surplus excavated material under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."

Backfill as specified in Section 19-3, "Structure Excavation and Backfill." Compact backfill in conduit trenches outside the hinge point of slopes and not under pavement to a minimum relative compaction of 90 percent. Compact backfill within hinge points and in areas where pavement is to be constructed to a minimum relative compaction of 95 percent.

Backfill trenches and restore sidewalk, pavement, and landscaping at one intersection before starting excavation at another intersection.

If excavating on a street or highway, restrict closure to 1 lane at a time.

86-2.02 REMOVING AND REPLACING IMPROVEMENTS

Replace or reconstruct sidewalk, curb, gutter, concrete pavement, asphalt concrete pavement, underlying material, lawn, plant, and other facilities damaged by your activities. Replacement material must be of equal or better quality than the material replaced. Work must be in a serviceable condition.

If a part of a square or slab of concrete sidewalk, curb, gutter, or driveway is broken or damaged, the entire square or slab must be removed and reconstructed.

Cut outline of PCC sidewalk or driveway to be removed:

1. Using a power-driven saw
2. On a neat line
3. To a 0.17-foot minimum depth

86-2.03 FOUNDATIONS

Except for concrete for cast-in-drilled-hole concrete pile foundation, PCC must comply with Section 90-10, "Minor Concrete."

Construct concrete foundation on firm ground.

After each post, standard, and pedestal is properly positioned, place mortar under the base plate. Finish exposed portion to present a neat appearance. Mortar must comply with Section 51-1.135, "Mortar," except mortar must have:

1. 1 part by volume of cementitious material
2. 3 parts by volume of clean sand

Reinforced cast-in-drilled-hole concrete pile foundation must comply with Section 49, "Piling," except:

1. Material resulting from drilling holes must be disposed of as specified in Section 86-2.01, "Excavating and Backfilling"

2. Concrete for cast-in-drilled-hole concrete pile will not be considered as designated by compressive strength

Form exposed portion of the foundation to present a neat appearance and true to line and grade. The top of a foundation for post and standard must be finished to curb or sidewalk grade. Forms must be rigid and securely braced in place. Conduit ends and anchor bolts must be placed at proper height and position. Anchor bolts must be installed a maximum of 1:40 from vertical and held in place by rigid top and bottom templates. Use a steel bottom template at least 1/2 inch thick that provides proper spacing and alignment of anchor bolts near the embedded bottom end. Install bottom template before placing footing concrete.

Provide new foundation and anchor bolts of the proper type and size for relocated standards.

Steel parts must be galvanized as specified in Section 75-1.05, "Galvanizing."

Provide 2 nuts and washers for the upper threaded part of each anchor bolt. Provide 3 nuts and washers for each anchor bar or stud.

Do not weld high-strength steel used for anchor bolt, anchor bar, or stud.

Before placing concrete, moisten forms and ground. Keep forms in place until the concrete sets for at least 24 hours and is strong enough to prevent damage to surface.

Except if located on a structure, construct foundation for post, standard, and pedestal monolithically.

Apply ordinary surface finish as specified in Section 51-1.18A, "Ordinary Surface Finish."

If a foundation must be extended for additional depth, the extension work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

Do not erect post, pole, standard, pedestal, or cabinet until the foundation is set for a minimum of 7 days.

The Engineer will choose the plumbing or raking technique for posts, standards, and pedestals. Plumb or rake by adjusting the leveling nuts before tightening nuts. Do not use shims or similar devices. After final adjustments of both top nuts and leveling nuts on anchorage assemblies have been made, and each post, standard, and pedestal on structure is properly positioned, tighten nuts as follows:

1. Tighten leveling nuts and top nuts, following a crisscross pattern, until bearing surfaces of all nuts, washers, and base plates are in firm contact.
2. Use an indelible marker to mark the top nuts and base plate with lines showing relative alignment of the nut to the base plate.
3. Tighten top nuts, following a crisscross pattern, an additional 1/6th of a turn.

In unpaved areas, construct a raised PCC pad in front of each controller cabinet.

Completely remove foundations not to be reused or abandoned.

If abandoning a foundation, remove the top of foundation, anchor bolts, and conduits to a minimum depth of 0.5 foot below sidewalk surface or original ground. Backfill the resulting hole with material equivalent to the surrounding material.

86-2.04 STANDARDS, STEEL PEDESTALS AND POSTS

Bolts, including anchor bolts, nuts, and washers for signal and lighting support structures must comply with Section 55-2, "Materials." Except for bearing-type connection or slip-base, high-strength bolted connection must comply with Section 55-3.14, "Bolted Connections." Welding, nondestructive testing of welds, and acceptance and repair criteria for steel member nondestructive testing must comply with American Welding Society (AWS) D1.1.

Using stainless steel rivets, attach rectangular corrosion-resistant metal identification tag on all standards and poles, except Type 1:

1. Above the hand hole, near the base of standards and poles
2. On the underside of mast arms near the arm plate

The lettering on each identification tag must be depressed or raised, 1/4 inch tall, legible, and include the following information:

1. Name of the manufacturer
2. Date of manufacture
3. Identification number
4. Contract number
5. Unique identification code that is:

    5.1. Assigned by the manufacturer
    5.2. Traceable to a particular contract and the welds on that component

5.3. Readable after the support structure is coated and installed

Type 1 standard and steel pedestal for controller cabinet must be manufactured of one of the following:

1. 0.12-inch or thicker galvanized steel
2. 4-inch standard weight galvanized steel pipe as specified in ASTM A 53
3. 4-inch Type 1 conduit with the top designed for post-top slip-fitter

Ferrous metal parts of a standard that has a shaft length of 15 feet or longer must comply with the provisions in Section 55-2, "Materials," and the following:

1. Standard must be manufactured from sheet steel of weldable grade having a minimum yield strength of 40,000 psi after manufacturing.
2. Certified test report verifying compliance with minimum yield strength requirements must be submitted. Test report may be the mill test report for the as-received steel or if the as-received steel has a lower yield strength than required you must provide test data assuring that your method of cold forming will consistently increase the tensile properties of the steel to meet the specified minimum yield strength. Test data must include tensile properties of the steel after cold forming for specific heats and thicknesses.
3. If a single-ply 5/16-inch thick pole is specified, a 2-ply pole with equivalent section modulus may be substituted.
4. Standard may be manufactured of full-length sheets or shorter sections. Each section must be manufactured from 1 or 2 pieces of sheet steel. If 2 pieces are used, the longitudinal welded seams must be directly opposite from one another. If the sections are butt-welded together, the longitudinal welded seams of adjacent sections must be placed to form continuous straight seams from base to top of standard.
5. Butt-welded circumferential joints of tubular sections requiring CJP groove welds must be made using a metal sleeve backing ring inside each joint. The sleeve must be 1/8 inch nominal thickness, or thicker, and manufactured from steel having the same chemical composition as the steel in the tubular sections to be joined. If the sections to be joined have different specified minimum yield strengths, the steel in the sleeve must have the same chemical composition as the tubular section having the higher minimum yield strength. The width of the metal sleeve must be consistent with the type of nondestructive testing selected and must be a minimum width of 1 inch. At fitting time, the sleeve must be centered at the joint and in contact with the tubular section at the point of the weld.
6. Welds must be continuous.
7. Weld metal at the transverse joint must extend to the sleeve, making the sleeve an integral part of the joint.
8. During manufacturing, longitudinal seams on vertical tubular members of cantilevered support structures must be centered on and along the side of the pole that the pole plate is located. Longitudinal seams on horizontal tubular members, including signal and luminaire arms, must be within ±45 degrees of the bottom of the arm.
9. Longitudinal seam weld in steel tubular section may be made by the electric resistance welding process.
10. Longitudinal seam weld must have 60 percent minimum penetration, except:

    10.1. Within 6 inches of circumferential weld, longitudinal seam weld must be CJP groove weld.
    10.2. Longitudinal seam weld on lighting support structure having telescopic pole segment splice must be CJP groove weld on the female end for a length on each end equal to the designated slip-fit splice length plus 6 inches.

11. Exposed circumferential weld, except fillet and fatigue-resistant weld, must be ground flush with the base metal before galvanizing or painting. Ground flush is specified as -0, +0.08-inch.
12. Circumferential weld and base plate-to-pole weld may be repaired only one time.
13. Exposed edges of the plates that make up the base assembly must be finished smooth and exposed corners of the plates must be broken. Provide shafts with slip-fitter shaft caps.
14. Surface flatness requirements of ASTM A 6 apply to plates:

    14.1. In contact with concrete, grout, or washers and leveling nuts
    14.2. In high-strength bolted connections
    14.3. In joints, where cap screws are used to secure luminaire and signal arms
    14.4. Used for breakaway slip-base assemblies

15. Standard must be straight with a maximum variation of:

15.1. 1 inch measured at the midpoint of a 30-foot to 35-foot standard
15.2. 3/4 inch measured at the midpoint of a 17-foot to 20-foot standard
15.3. 1 inch measured 15 feet above the base plate for Type 35 and Type 36 standards

16. Zinc-coated nuts used on fastener assemblies having a specified preload obtained by specifying a prescribed tension, torque value, or degree of turn must be provided with a colored lubricant, clean and dry to the touch. The lubricant color must contrast the zinc coating color on the nut so the presence of the lubricant is visually obvious. Lubricant must be insoluble in water or the fastener components must be shipped to the job site in a sealed container.
17. Do not make additional holes in structural members.
18. Standard with an outside diameter of 12 inches or less must be round. Standard with an outside diameter greater than 12 inches must be round or multisided. Multisided standard must be convex with a minimum of 12 sides and have a minimum bend radius of 4 inches.
19. Manufacture mast arm from material specified for standard.
20. Manufacture cast steel option for slip base from material of Grade 70-40, as specified in ASTM A 27/A 27M. Other comparable material may be used if approved by the Engineer. The casting tolerances must comply with the Steel Founders' Society of America's recommendations for green sand molding.
21. One casting from each lot of a maximum of 50 castings must be radiographed as specified in ASTM E 94. Casting must comply with the acceptance criteria for severity level 3 or better for the types and categories of discontinuities in ASTM E 186 and E 446. If the casting fails the inspection, 2 additional castings must be radiographed. If the 2 additional castings fail the inspection, the entire lot will be rejected.
22. Material certification, consisting of physical and chemical properties, and radiographic film of the casting must be filed at the manufacturer's office. Certification and film must be available for inspection.
23. High-strength bolts, nuts, and flat washers used to connect slip-base plate must comply with ASTM A 325 or A 325M and be galvanized as specified in Section 75-1.05, "Galvanizing."
24. Plate washers must be manufactured by saw cutting and drilling steel plate. Steel plate must comply with AISI 1018 and be galvanized as specified in Section 75-1.05, "Galvanizing." Before galvanizing, remove burrs and sharp edges and chamfer both sides of holes to allow the bolt head to make full contact with the washer without tension.
25. High-strength cap screws for attaching arms to standards must comply with ASTM A 325, A 325M, or A 449, and the mechanical requirements in ASTM A 325 or A 325M after galvanizing. Cap screws must be galvanized as specified in Section 75-1.05, "Galvanizing." Coat threads of cap screws with a colored lubricant, clean and dry to the touch. Lubricant color must contrast the zinc-coating color on the cap screw so the presence of the lubricant is visually obvious. Lubricant must be insoluble in water or the fastener components must be shipped to the job site in a sealed container.
26. Bolted connection attaching signal or luminaire arm to pole must be considered slip critical. Galvanized faying surfaces of plates on luminaire, signal arm, and pole must be roughened by hand using a wire brush before assembly and must comply with requirements for Class C surface conditions for slip-critical connections in "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts," a specification approved by the Research Council on Structural Connections (RCSC). Paint for faying surfaces must be as specified in the RCSC specification for Class B coating.
27. The Engineer will randomly take samples of fastener components from each production lot and submit to the Transportation Laboratory with test reports as specified in ASTM fastener specifications for QA testing and evaluation. The Engineer will determine sample sizes for each fastener component.

Change in mast arm configuration is allowed as long as the mounting height and stability are maintained.

Before manufacturing, details must be adjusted to ensure that cap screw heads can be turned using conventional installation tools. During manufacturing process, to avoid interference with the cap screw heads, the position of the luminaire arm on the arm plate must be properly located.

Configure mast arm as a smooth curving arm.

Push button post, pedestrian barricade, and guard post must comply with ASTM A 53.

Assemble and tighten slip base when pole is on the ground. Threads of heavy hex nuts for each slip-base bolt must be coated with additional lubricant that is clean and dry to the touch. Tighten high strength slip-base bolts to within ±10 foot-pounds of the following:

Slip-Base Bolt-Tightening Requirements

Standard Type	Torque (foot-pounds)
15-SB	150
30	150
31	200
36-20A	165

Hole in shaft of existing standard, due to removal of equipment or mast arms, must be sealed by fastening a galvanized steel disk to cover the hole. Fasten using a single central galvanized steel fastener. Seal edges of disk and hole with polysulfide or polyurethane sealing compound of Type S, Grade NS, Class 25, and Use O, as specified in ASTM C 920.

If existing standard is ordered to be relocated or reused, remove large dents, straighten shafts, and replace parts that are in poor condition. You must furnish anchor bolts or bars and nuts required for relocating or reusing standard. Repair and replacement work will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

New nuts, bolts, cap screws, and washers must be provided if:

1. Standard or mast arm is relocated
2. Used standard or mast arm is State furnished

If the standard has a slip base, a new keeper plate must be provided.

86-2.05 CONDUIT

Run conductors in conduit except for overhead and where conductors are run inside poles.

You may use a larger size conduit than specified as long as you use it for the entire length between outlets. Do not use reducing coupling.

New conduit must not pass through existing foundations for standards.

86-2.05A Material

Conduit and conduit fitting must be UL or NRTL listed and comply with the following:

Conduit and Conduit Fitting Requirements

Type 1	Hot-dip galvanized rigid steel conduit and conduit couplings must comply with UL 6 and ANSI C80.1. Zinc coating testing must comply with copper sulfate test requirements in UL 6. Conduit couplings for rigid steel conduit must be electrogalvanized.
Type 2	Hot-dip galvanized rigid steel conduit must comply with requirements for Type 1conduit and be coated with polyvinyl chloride (PVC) or polyethylene. Exterior thermoplastic coating must have a minimum thickness of 35 mils. Internal coating must have a minimum thickness of 2 mils. Coated conduit must comply with UL 6; NEMA RN 1; or NRTL PVC-001.
Type 3	Rigid nonmetallic PVC conduit must comply with UL 651. Type A extruded rigid PVC conduit and extruded rigid HDPE conduit must comply with UL 651A. Coilable, smooth-wall, continuous length HDPE conduits must comply with UL 651B. Install at underground locations only.
Type 4	Waterproof flexible metal conduit must consist of conduit with a waterproof non-metallic sunlight-resistant jacket over an inner flexible metal core. Type4 conduit must be UL listed for use as the grounding conductor.
Type 5	Intermediate steel conduit and conduit couplings must comply with UL 1242 and ANSI C80.6. Zinc coating testing must comply with copper sulfate test requirements in UL 1242. Conduit couplings for intermediate rigid steel conduit must be electrogalvanized. Type 5 conduit must only be used if specified.

Bonding bushings to be installed on metal conduit must be insulated and either galvanized or zinc alloy type.

Fittings for steel conduit and for watertight flexible metal conduit must be UL listed at UL 514B.

86-2.05B Use

Install Type 1 conduit on all exposed surfaces and at the following locations:

1. In concrete structures
2. Between a structure and nearest pull box

Exposed conduit installed on painted structure must be painted the same color as the structure.

Change or extend existing conduit runs using the same material. Install pull box if an underground conduit changes from the metallic type to Type 3.

Minimum trade size of conduit must be:

1. 1-1/2 inches from electrolier to adjacent pull box
2. 1 inch from pedestrian push button post to adjacent pull box
3. 2 inches from signal standard to adjacent pull box
4. 3 inches from controller cabinet to adjacent pull box
5. 2 inches from overhead sign to adjacent pull box
6. 2 inches from service equipment enclosure to adjacent pull box
7. 1-1/2 inches if unspecified

Two conduits must be installed between controller cabinet and adjacent pull box.

86-2.05C Installation

Whether shop or field cut, ream ends of conduit to remove burrs and rough edges. Make cuts square and true. Slip joints and running threads are not allowed for coupling conduit. If a standard coupling cannot be used for coupling metal type conduit, use a threaded union coupling that is UL or NRTL listed. Tighten couplings for metal conduit to maintain a good electrical connection through conduit run.

Cut Type 3 conduit with tools that will not deform the conduit. Use solvent weld for connections.

Cut Type 2 conduit with pipe cutters; do not use hacksaws. Coated conduit must be threaded with standard conduit-threading dies. Tighten conduit into couplings or fittings using strap wrenches or approved groove-joint pliers.

Protect shop-cut threads from corrosion as follows:

Shop-Cut Thread Protection

Steel conduit and conduit couplings	ANSI C80.1
Electrical intermediate metal conduit and conduit couplings	ANSI C80.6

Paint conduits as specified in Section 91, "Paint." Apply 2 coats of approved unthinned zinc-rich primer of organic vehicle type. Do not use aerosol cans. Paint the following parts of conduits:

1. All exposed threads
2. Field-cut threads before installing conduit couplings to steel conduit
3. Damaged surfaces on metal conduit

Do not remove shop-installed conduit couplings.

Damaged Type 2 conduit or conduit coupling must be wrapped with at least 1 layer of 2 inch wide, 20 mil minimum thickness PVC tape, as specified in ASTM D 1000, with a minimum tape overlap of 1/2 inch. Before applying the tape, conduit or fitting must be cleaned and painted with 1 coat of rubber-resin based adhesive as recommended by the tape manufacturer. You may repair damaged spots in the thermoplastic coating by painting over with a brushing type compound supplied by the conduit manufacturer instead of the tape wrap.

The ends of Types 1, 2, or 5 conduit must be threaded and capped with standard pipe caps until wiring is started. The ends of Types 3 and 4 conduit must be capped until wiring is started. If caps are removed, replace with conduit bushings. Fit insulated bonding bushings on the end of metal conduit ending in pull box or foundation. Bell or end bushings for Type 3 conduit must be non-metallic type.

Conduit bends, except factory bends, must have a radius of not less than 6 times the inside diameter of the conduit. If factory bends are not used, bend the conduit without crimping or flattening using the longest radius practicable. Bend conduits as follows:

Conduit-Bending Requirements

Type 1	By methods recommended by the conduit manufacturer and with equipment approved for the purpose.
Type 2	Use standard bending tool designed for use on thermoplastic coated conduit. Conduit must be free of burrs and pits.
Type 3	By methods recommended by the conduit manufacturer and with equipment approved for the purpose. Do not expose conduit to direct flame.
Type 4	--
Type 5	By methods recommended by the conduit manufacturer and with equipment approved for the purpose.

Install pull tape in conduit that is to receive future conductors. The pull tape must be a flat woven lubricated soft-fiber polyester tape with a minimum tensile strength of 1,800 pounds and have printed sequential measurement markings every 3 feet. At least 2 feet of pull tape must be doubled back into the conduit at each end.

Existing underground conduit to be incorporated into a new system must be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air.

Install conduit to a depth of not less than 30 inches below finished grade, except in sidewalk and curbed paved median areas, where it must be at least 18 inches below grade. You may lay conduit on existing pavement within new curbed median.

Conduit coupling must be a minimum of 6 inches from face of foundation.

Place a minimum of 2 inches of sand bedding in the trench before installing Type 2 or Type 3 conduit. Place a minimum of 4 inches of same material over conduit before placing additional backfill material.

Obtain approval from the Engineer before disturbing pavement. If obstruction is encountered, obtain approval from Engineer to cut small holes in the pavement to locate or remove obstruction If jacking or drilling method is used, keep jacking or drilling pit 2 feet away from edge of pavement. Pavement must not be weakened or subgrade softened from excess water use.

Conduit used for drilling or jacking must be removed; install new conduit for completed work. If a hole larger than the conduit is pre-drilled and you install conduit by hand or by method recommended by the conduit manufacturer with equipment approved for purpose, you may install Type 2 or Type 3 conduit under pavement.

If trenching in pavement method is specified, conduit installation under pavement that is not a freeway lane or freeway to freeway connector ramp, must comply with the following:

1. Use Type 3 conduit. Place conduit under pavement in a trench approximately 2 inches wider than the outside diameter of conduit, but not exceeding 6 inches in width. Trench depth must not exceed the greater of 12 inches or conduit trade size plus 10 inches, except that at pull boxes the trench may be hand dug to required depth. The top of the installed conduit must be a minimum of 9 inches below finished grade.
2. Trenching installation must be completed before placing final pavement layer.
3. Cut pavement to be removed with a rock cutting excavator. Minimize shatter outside the removal area.
4. Place conduit in bottom of trench and backfill with minor concrete as specified in Section 90-10, "Minor Concrete.". Minor concrete must contain a minimum of 590 pounds of cementitious material per cubic yard. If the trench is in asphalt concrete pavement and pavement overlay is not placed, backfill the top 0.10 foot of trench with minor HMA.
5. Before spreading HMA, apply tack coat as specified in Section 39, "Hot Mix Asphalt."
6. Backfill trenches, except for the top 0.10 foot, by the end of each day. The top 0.10 foot must be filled within 3 days after trenching.

Conduit installed beneath railroad tracks must be:

1. Type 1 or 2
2. 1-1/2-inch minimum diameter
3. Placed a minimum depth of 42 inches below bottom of the rail

If jacking or drilling method is used, construct jacking pit to a minimum of 13 feet from the centerline of track at the near side of jacking pit. Cover jacking pit with substantial planking if left overnight.

Conduit ending in standard or pedestal must not extend more than 3 inches vertically above the foundation and must be sloped toward the handhole opening. Conduit entering through the side of non-metallic pull box must end inside the box within 2 inches of the wall and 2 inches above the bottom and be sloped toward the top of box to facilitate pulling of conductors. Conduit entering through the bottom of a pull box must end 2 inches above the bottom and be located near the end walls to leave the major portion of the box clear. At outlet, conduit must enter from the direction of the run.

Underground conduit runs, including under sidewalks, that are adjacent to gasoline service stations or other underground gasoline or diesel storage, piping, or pumps and that lead to a controller cabinet, circuit breaker panel, service, or enclosure where an arc may occur during normal operations must be sealed if the conduit is within the limits specified in the NEC for Class 1, Division 1. Use Type 1 or Type 2 conduit for these runs.

Conduit for future use in structures must be threaded and capped. Conduit leading to soffit, wall, or other lights or fixtures below pull box grade must be sealed and made watertight, except where conduit ends in a No. 9 or No. 9A pull box.

Support for conduit in or on wall or bridge superstructure must comply with the following:

1. Steel hangers, steel brackets, and other fittings must comply with Section 75-1.03, "Miscellaneous Bridge Metal."
2. Construct precast concrete conduit cradles using minor concrete and commercial quality welded wire fabric. Minor concrete must comply with Section 90-10, "Minor Concrete," and contain a minimum of 590 pounds of cementitious material per cubic yard.. The cradles must be moist cured for a minimum of 3 days. Bond precast concrete cradles to structure with epoxy adhesives specified in one of the following:

    2.1. Section 95-2.03, "Epoxy Resin Adhesive for Bonding New Concrete to Old Concrete"
    2.2. Section 95-2.04, "Rapid Set Epoxy Adhesive for Pavement Markers"
    2.3. Section 95-2.05, "Standard Set Epoxy Adhesive for Pavement Markers"

3. Use pipe sleeve or form opening for conduit through bridge superstructure concrete. Sleeve or opening through either prestressed member or conventionally reinforced precast member must be:

    3.1. Transverse to the member
    3.2. Through the web
    3.3. Not more than 3 inches maximum gross opening in concrete

4. Where conduits pass through the abutment concrete, wrap conduit with 2 layers of asphalt-felt building paper securely taped or wired in place. Fill space around conduit that runs through bridge abutment wall with mortar as specified in Section 51-1.135, "Mortar," except the proportion of cementitious material to sand must be 1 to 3. Fill the space around conduits that run through abutments after prestressing is completed.
5. Run surface-mounted conduit straight and true, horizontal or vertical on the wall, and parallel to wall on ceiling or other similar surfaces. Support conduit at a maximum of 5-foot intervals or closer where necessary to prevent vibration or unsightly deflection. The supports must include galvanized malleable iron conduit clamps and clamp backs secured with expansion anchorage devices as specified for concrete anchorage devices in Section 75-1.03, "Miscellaneous Bridge Metal." Threaded studs must be galvanized and be of the largest diameter that will pass through the mounting hole in conduit clamp.
6. Where pull boxes are placed in conduit runs, conduit must be fitted with threaded bushings and bonded.
7. Mark location of conduit end in structure, curb, or wall with a "Y" that is a minimum of 3 inches tall, directly above conduit.

86-2.05D Expansion Fittings

Install expansion fitting where the conduit crosses an expansion joint in structure. Each expansion fitting for metal conduit must include a copper bonding jumper having the ampacity specified in NEC.

Each expansion-deflection fitting for expansion joints of 1-1/2-inch movement rating must be watertight and include a molded neoprene sleeve, a bonding jumper, and 2 silicon bronze or zinc-plated iron hubs. Each fitting must allow a minimum of 3/4-inch expansion, contraction, and lateral deflection.

86-2.06 PULL BOXES

86-2.06A (Blank)

86-2.06B Cover Marking

Marking must be clearly defined, uniform in depth, and parallel to either the long or short sides of cover.
Marking letters must be 1 inch to 3 inches high.
Before galvanizing steel or cast iron cover, apply marking by one of the following methods:

1. Use cast iron strip at least 1/4 inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover with 1/4 inch flathead stainless steel machine bolts and nuts. Peen bolts after tightening.
2. Use sheet steel strip at least 0.027-inch thick with letters raised a minimum of 1/16 inch. Fasten strip to cover by spot welding, tack welding, or brazing, with 1/4 inch stainless steel rivets or 1/4 inch roundhead stainless steel machine bolts and nuts. Peen bolts after tightening.
3. Bead weld the letters on cover so that letters are raised a minimum of 3/32 inch.

86-2.06C Installation and Use

Space pull boxes no more than 200 feet apart. You may install additional pull boxes to facilitate the work.
You may use a larger standard size pull box than that shown on the plans or specified.
A pull box in ground or sidewalk area must be installed as follows:

1. Embed bottom of pull box in crushed rock.
2. Place a layer of roofing paper on the crushed rock.
3. Place mortar over the layer of roofing paper. Mortar must be 0.50 inch to 1 inch thick and sloped toward the drain hole.
4. Make a 1-inch drain hole in center of pull box through mortar and roofing paper.
5. Place mortar between pull box and pull box extension, and around conduits.

The top of the pull box must be flush with the surrounding grade or the top of an adjacent curb, except in unpaved areas where the pull box is not immediately adjacent to and protected by a concrete foundation, pole, or other protective construction. Place the pull box 1-1/4 inches above the surrounding grade. Where practical, place a pull box shown in the vicinity of curbs or adjacent to a standard on the side of the foundation facing away from traffic, unless otherwise directed. If a pull box is installed in a sidewalk area, adjust the depth of the pull box so that the top of the pull box is flush with the sidewalk.

Reconstruct the sump of an existing pull box if it is disturbed by your operations. Remove old grout and replace with new if the sump was grouted.

86-2.07 TRAFFIC PULL BOXES

Comply with Sections 86-2.06B, "Cover Marking," and 86-2.06C, "Installation and Use."

Traffic pull box and cover must comply with ASTM C857, "Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures," for HS20-44 loading. You must be able to place the load anywhere on box and cover for 1 minute without causing cracks or permanent deformations.

Frame must be anchored to the box with 1/4" x 2-1/4" concrete anchors. Four concrete anchors must be included for No. 3-1/2(T) pull box; one placed in each corner. Six concrete anchors for must be included for No. 5(T) and No. 6(T) pull boxes; one placed in each corner and one near the middle of each of the longer sides.

Nuts must be zinc plated carbon steel, vibration resistant, and have a wedge ramp at the root of the thread.

After installation of traffic pull box, install steel cover and keep bolted down when your activities are not in progress at the pull box. When steel cover is placed for final time, cover and Z bar frame must be cleaned of debris and tightened securely.

Steel cover must be countersunk approximately 1/4 inch to accommodate bolt head. When tightened, bolt head must not exceed more than 1/8 inch above the top of cover.

Concrete placed around and under traffic pull box must be minor concrete as specified in Section 90-10, "Minor Concrete."

86-2.08 CONDUCTORS AND CABLES

Conductor must be copper wire that complies with ASTM B 3 and B 8.
Wire size must comply with the following:

Wire Size Requirements

Conductor usage	Requirement
In loop detector lead-in cable	ASTM B 286
Everywhere except in loop detector lead-in cable	American Wire Gage (AWG)[a]

[a]Except conductor diameter must not be less than 98 percent of specified AWG diameter.

Single conductor and cable, except detector lead-in cable, must have clear, distinctive, and permanent markings on the outer surface throughout its length. The markings must include the manufacturer's name or trademark, insulation type letter designation, conductor size, voltage, and temperature rating, and for cables, it must also include number of conductors.

86-2.08A Conductor Identification

Conductor insulation must be a solid color with a permanent stripe as specified below. The solid color must be homogeneous through the full depth of insulation. Identification stripe must be continuous throughout the length of conductor. For conductor sizes No. 2 and larger, the insulation may be black and the ends of the conductors must be taped for a minimum length of 20 inches with electrical insulating tape of the required color.

Conductor Identification

Circuit	Signal Phase or Function	Identification			Size
		Insulation Color[i]			
		Base	Stripe[a]	Band Symbols[f]	
Vehicle Signals[a,b,d]	2,6	Red, Yel, Brn	Blk	2,6	14
	4,8	Red, Yel, Brn	Ora	4,8	14
	1,5	Red, Yel, Brn	None	1,5	14
	3,7	Red, Yel, Brn	Pur	3,7	14
	Ramp Meter 1	Red, Yel, Brn	None	NBR	14
	Ramp Meter 2	Red, Yel, Brn	Blk	NBR	14
Pedestrian Signals[d]	2p,6p	Red, Brn	Blk	2p,6p	14
	4p,8p	Red, Brn	Ora	4p,8p	14
	1p,5p	Red, Brn	None	1p,5p	14
	3p,7p	Red, Brn	Pur	3p,7p	14
Pedestrian Push Buttons[d]	2p,6p	Blu	Blk	P-2,P-6	14
	4p,8p	Blu	Ora	P-4,P-8	14
	1p,5p	Blu	None	P-1,P-5	14
	3p,7p	Blu	Pur	P-3,P-7	14
Traffic Signal Controller Cabinet	Ungrounded Circuit Conductor	Blk	None	CON-1	6
	Grounded Circuit Conductor	Wht	None	CON-2	6
Highway Lighting Pull Box to Luminaire	Ungrounded-Line 1	Blk	None	NBR	14
	Ungrounded-Line 2	Red	None	NBR	14
	Grounded	Wht	None	NBR	14
Multiple Highway Lighting	Ungrounded-Line 1	Blk	None	ML1	10
	Ungrounded-Line 2	Red	None	ML2	10
Lighting Control	Ungrounded to PEU	Blk	None	C1	14
	Switching leg from PEU unit or SM transformer	Red	None	C2	14

Service	Ungrounded-Line 1 (Signals)	Blk	None	NBR[e]	6
	Ungrounded-Line 2 (Lighting)	Red[h]	None	NBR[e]	8
Sign Lighting	Ungrounded-Line 1	Blk	None	SL-1	10
	Ungrounded-Line 2	Red	None	SL-2	10
Flashing Beacons[g]	Ungrounded between Flasher and Beacons	Red or Yel	None	F-Loc.[c]	14
Grounded and Common	Pedestrian Push Buttons	Wht	Blk	NBR	14
	Signals and Multiple Lighting	Wht	None	NBR	10
	Flashing Beacons and Sign Lighting	Wht	None	NBR	12
	Lighting Control	Wht	None	C-3	14
	Multiple Service	Wht	None	NBR	14
Railroad Preemption		Blk	None	R	14
Spares		Blk	None	NBR	14

NBR = No Band Required PEU=Photoelectric unit

[a]On overlaps, insulation is striped for 1st phase in designation. e.g., phase (2+3) conductor is striped as for phase 2.

[b]Band for overlap and special phases as required.

[c]Flashing beacons having separate service do not require banding.

[d]These requirements do not apply to signal cable.

[e]"S" if circuit is switched on line side of service equipment by utility.

[f]Band conductors in each pull box and near ends of termination points. On signal light circuits, a single band may be placed around 2 or 3 ungrounded conductors comprising a phase.

[g]Ungrounded conductors between service switch and flasher mechanism must be black and banded.

[h]Black acceptable for size No. 2 and larger. Tape ends for 20 inches with indicated color.

[i]Color Code: Yel-Yellow, Brn-Brown, Blu-Blue, Blk-Black, Wht-White, Ora-Orange, Pur-Purple.

86-2.08B Multiple Circuit Conductors

Conductor for multiple circuit must be UL or NRTL listed and rated for 600 V(ac) operation. Insulation for No. 14 to No. 4 conductors must be one of the following:

1. Type TW PVC as specified in ASTM D 2219
2. Type THW PVC
3. Type USE, RHH, or RHW cross-linked polyethylene

Minimum insulation thickness must comply with the following:

Insulation Thickness

Insulation Type	Conductor Size	Insulation Thickness (mils)
USE, RHH, or RHW	No. 14 to No. 10	39
	No. 8 to No. 2	51
THW or TW	No. 14 to No. 10	27
	No. 8	40
	No. 6 to No. 2	54

Insulation for No. 2 and larger conductor must be one of the types listed above or Type THWN.

Conductor for wiring wall and soffit luminaire must be stranded copper with insulation rated for use at temperatures up to 125 °C.

86-2.08C Signal Cable

Signal cable, except for the 28-conductor type, must:

1. Not be spliced

2. Be marked in each pull box with the signal standard information it is connecting to

Signal cable must comply with the following:

1. Cable jacket must be:

    1.1. Black polyethylene with an inner polyester binder sheath
    1.2. Rated for 600 V(ac) and 75 °C

2. Filler material, if used, must be polyethylene material.
3. Conductor must be solid copper with Type THWN insulation as specified in Section 86-2.08, "Conductors and Cables," and ASTM B 286. The minimum thickness of Type THWN insulation must be 12 mils for conductor sizes No. 14 to No. 12 and 16 mils for conductor size No. 10. The minimum thickness of nylon jacket must be 4 mils.

Conductor Signal Cable Requirements

Cable Type[a]	Conductor Quantity and Type	Cable Jacket Thickness (mils)		Maximum Nominal Outside Diameter (inch)	Conductor Color Code	Remarks
		Average	Minimum			
3CSC	3 - No. 14	44	36	0.40	blue/black, blue/orange, white/black stripe	Use for pedestrian push buttons and spare
5CSC	5 - No. 14	44	36	0.50	red, yellow, brown, black, white	
9CSC	8 - No. 14 1 - No. 12	60	48	0.65	No. 12 - white No. 14 - red, yellow, brown, black, and red/black, yellow/black, brown/black, white/black stripe	
12CSC	11 - No. 14 1 - No. 12	60	48	0.80	No. 12 - white No. 14 - see "12CSC Color Code and Functional Connection" table	Use for vehicle signals, pedestrian signals, spares, and signal common
28CSC	27 - No. 14 1 - No. 10	80	64	0.90	No. 10 - white No. 14 - see "28CSC Color Code and Functional Connection" table	Keep signal commons in each cable separate except at the signal controller. Label each cable as "C1" or "C2" in pull box. Use "C1" for signal phases 1, 2, 3, and 4. Use "C2" for phases 5, 6, 7, and 8.

[a]Conductor signal cable description starts with the number of conductors, followed by "CSC". (e.g., a signal cable with 3 conductors is labeled "3CSC.")

12CSC Color Code and Functional Connection

Color Code	Termination	Phase
Red	Vehicle signal red	2, 4, 6, or 8
Yellow	Vehicle signal yellow	2, 4, 6, or 8
Brown	Vehicle signal green	2, 4, 6, or 8
Red/black stripe	Vehicle signal red	1, 3, 5, or 7
Yellow/black stripe	Vehicle signal yellow	1, 3, 5, or 7
Brown/black stripe	Vehicle signal green	1, 3, 5, or 7
Black/red stripe	Spare, or use as required for red or DONT WALK	
Black/white stripe	Spare, or use as required for yellow	
Black	Spare, or use as required for green or WALK	
Red/white stripe	Ped signal DONT WALK	
Brown/white stripe	Ped signal WALK	

28CSC Color Code and Functional Connection

Color Code	Termination	Phase
Red/black stripe	Vehicle signal red	2 or 6
Yellow/black stripe	Vehicle signal yellow	2 or 6
Brown/black stripe	Vehicle signal green	2 or 6
Red/orange stripe	Vehicle signal red	4 or 8
Yellow/orange stripe	Vehicle signal yellow	4 or 8
Brown/orange stripe	Vehicle signal green	4 or 8
Red/silver stripe	Vehicle signal red	1 or 5
Yellow/silver stripe	Vehicle signal yellow	1 or 5
Brown/silver stripe	Vehicle signal green	1 or 5
Red/purple stripe	Vehicle signal red	3 or 7
Yellow/purple stripe	Vehicle signal yellow	3 or 7
Brown/purple stripe	Vehicle signal green	3 or 7
Red/2 black stripes	Ped signal DONT WALK	2 or 6
Brown/2 black stripes	Ped signal WALK	2 or 6
Red/2 orange stripes	Ped signal DONT WALK	4 or 8
Brown/2 orange stripes	Ped signal WALK	4 or 8
Red/2 silver stripes	Overlap A, C red	OLA, OLC
Brown/2 silver stripes	Overlap A, C green	OLA, OLC
Red/2 purple stripes	Overlap B, D red	OLB, OLD
Brown/2 purple stripes	Overlap B, D green	OLB, OLD
Blue/black stripe	Ped push button	2 or 6
Blue/orange stripe	Ped push button	4 or 8
Blue/silver stripe	Overlap A, C yellow	OLA(y), OLC(y)
Blue/purple stripe	Overlap B, D yellow	OLB(y), OLD(y)
White/black stripe	Ped push button common	
Black/red stripe	Railroad preemption	
Black	Spare	

86-2.08D Signal Interconnect Cable (SIC)

Signal interconnect cable must be a 3-pair or 6-pair type with stranded tinned copper No. 20 conductors. Each conductor insulation must be 13 mils minimum nominal thickness, color-coded, polypropylene material. Conductors must be in twisted pairs. Color coding distinguishes each pair. Each pair must be wrapped with an aluminum polyester shield and must have a No. 22 or larger stranded tinned copper drain wire inside the shielded pair.

Cable jacket must be black, high density polyethylene, rated for a minimum of 300 V(ac) and 60 °C, and must have a minimum nominal wall thickness of 40 mils. Cable jacket or moisture-resistant tape directly under the outer jacket must be marked as specified in Section 86-2.08.

You must have a minimum of 6 feet of slack at each controller cabinet. Splicing is allowed only if shown on the plans.

Insulate conductor splice with heat-shrink tubing and overlap at least 0.6 inch. Cover overall cable splice with heat-shrink tubing and overlap the cable jacket at least 1-1/2 inch.

86-2.09 WIRING

Run conductors in conduit, except for overhead and temporary installations and where conductors are run inside poles.

Solder by hot iron, pouring, or dipping method, connectors and terminal lugs for conductor sizes No. 8 and smaller. Do not perform open-flame soldering.

86-2.09A Circuitry

Do not run traffic signal indication conductors to a terminal block on a standard unless connected to a mounted signal head.

Use only 1 conductor to connect to each terminal of a pedestrian push button.

The common for pedestrian push button circuit must be separate from traffic signal circuit grounded conductor.

86-2.09B Installation

Use a UL- or NRTL-listed inert lubricant for placing conductors in conduit.

Pull conductors into conduit by hand using pull tape specified in Section 86-2.05C, "Installation." Do not use winches or other power-actuated pulling equipment.

If adding new conductors or removing existing conductors, remove all conductors, clean conduit as specified in Section 86-2.05C, "Installation," and pull all conductors in conduit as 1 unit.

If traffic signal conductors are run in lighting standard containing street lighting conductors from a different service point, you must encase the traffic signal conductors or the lighting conductors with a flexible or rigid metal conduit for a length until the 2 types of conductors are no longer in the same raceway.

If less than 10 feet above grade, enclose temporary conductors in flexible or rigid metal conduit.

Leave slack for each conductor as follows:

Conductor Slack Requirements

Location	Slack (feet)
Signal standard	1
Lighting standard	1
Signal and lighting standard	1
Pull box	3
Splice	3
Standards with slip base	0

After conductors are installed, seal ends of conduits with an approved sealing compound.

To form a watertight seal, tape ends of spare conductors and conductors ending in pull boxes.

Conductors and cables inside fixture or cabinet must be neatly arranged and tied together by function with self-clinching nylon cable ties or enclosed in plastic tubing or raceway.

Identify conductors for signal overlap phase as specified for vehicle signals in the table titled "Conductor Identification."

Permanently identify conductors by function. Place identification on each conductor, or each group of conductors forming a signal phase, at each pull box and near the end of conductors.

Label, tag, or band conductors by mechanical methods. Identification must not move along the conductors.

86-2.09C Connectors and Terminals

Connectors and terminals must be UL- or NRTL-listed crimp type. Use manufacturer-recommended tool for connectors and terminals to join conductors. Comply with MIL-T-7928.

Terminate stranded conductors smaller than No. 14 in crimp style terminal lugs.

86-2.09D Splicing and Terminations

Splices are allowed for:

1. Grounded conductors in pull box.
2. Pedestrian push button conductors in pull box.
3. Conductors in pull box adjacent to each electrolier or luminaire.
4. Ungrounded traffic signal conductors in pull box, if traffic signals are modified.

5. Ungrounded traffic signal conductors to a terminal compartment or signal head on a standard with conductors of the same phase in the pull box adjacent to the standard.
6. Ungrounded lighting circuit conductors in pull box, if lighting circuits are modified.

86-2.09E Splice Insulation

Splice must function under continuous submersion in water.

Multi-conductor cable must be spliced and insulated to form a watertight joint and to prevent moisture absorption by the cable.

Low-voltage tape must be:

1. UL or NRTL listed
2. Self-fusing, oil and flame-resistant, synthetic rubber
3. PVC, pressure-sensitive adhesive of 6 mils minimum thickness

Insulating pad must be a combination of an 80-mils thick electrical grade PVC laminate and a 120-mils thick butyl splicing compound with removable liner.

Heat-shrink tubing must comply with the following:

1. Be medium or heavy wall thickness, irradiated polyolefin tubing with an adhesive mastic inner wall.
2. Before contraction, minimum wall thickness must be 40 mils.
3. Heating must be as recommended by the manufacturer. Do not perform open-flame heating.
4. When heated, the inner wall must melt and fill crevices and interstices of the covered object and the outer wall must shrink to form a waterproof insulation.
5. After contraction, each end of the heat-shrink tubing or the open end of end cap of heat-shrink tubing must overlap the conductor insulation at least 1-1/2 inches. Coat ends and seams with electrical insulation coating.
6. Comply with requirements for extruded insulated tubing at 600 V(ac) in UL Standard 468D and ANSI C119.1, and the following requirements:

Heat-Shrink Tubing Requirements

Shrinkage Ratio	33 percent, maximum, of supplied diameter when heated to 125 °C and allowed to cool to 25 °C
Dielectric Strength	350 kV per inch, minimum
Resistivity	25^{13} Ω per inch, minimum
Tensile Strength	2,000 psi, minimum
Operating Temperature	-40 °C to 90 °C (135 °C in emergency)
Water Absorption	0.5 percent, maximum

7. If 3 or more conductors are to be enclosed in 1 splice, place mastic around each conductor before placing inside tubing. Use mastic type recommended by heat-shrink tubing manufacturer.

You may use "Method B" as an alternative method for splice insulation. Use at least 2 thicknesses of electrical insulating pad. Apply pad to splice as recommended by manufacturer.

86-2.095 FUSED SPLICE CONNECTORS

Install a fused disconnect splice connector in each ungrounded conductor, between the line and the ballast, in the pull box adjacent to each luminaire. Connector must be accessible in the pull box.

For 240 and 480 V(ac) circuits, each connector must simultaneously disconnect both ungrounded conductors. Connector must not have exposed metal parts, except for the head of stainless steel assembly screw. Recess head of stainless steel assembly screw a minimum of 1/32 inch below top of plastic boss that surrounds the head.

Splice connector must protect fuse from water or weather damage. Contact between fuse and fuseholder must be spring loaded. Splice connector terminals must be:

1. Rigidly crimped, using a tool recommended by manufacturer of fused splice connector, onto ungrounded conductors
2. Insulated
3. Watertight

Fuses must be standard midget ferrule type, with "Non-Time-Delay" feature, and 13/32" x 1-1/2".

86-2.10 BONDING AND GROUNDING

Secure all metallic components, mechanically and electrically, to form a continuous system that is effectively grounded.

Bonding jumper must be copper wire or copper braid of the same cross sectional area as a No. 8 or larger to match the load. Equipment grounding conductors must be color coded as specified in NEC or be bare.

Attach bonding jumper to standard as follows:

Bonding Jumper Attachment

Standard type	Requirements
Standard with handhole and traffic pull box lid cover	Use UL-listed lug and 3/16-inch diameter or larger brass or bronze bolt. Run jumper to conduit or bonding wire in adjacent pull box. Grounding jumper must be visible after the standard is installed and mortar pad is placed on foundation.
Standard without handhole	Use UL-listed ground clamp on each anchor bolt.
Slip-base standard	Use UL-listed ground clamp on each anchor bolt or attach UL-listed lug to bottom slip-base plate with 3/16-inch diameter or larger brass or bronze bolt.

Ground one side of secondary circuit of step-down transformer.

Ground metal conduit, service equipment, and grounded conductor at service point as specified by NEC and service utility, except grounding electrode conductor must be No. 6 or larger.

Equipment bonding and grounding conductors are required in conduit. Run a No. 8 minimum bare copper wire continuously in conduit system. The bonding wire must be sized as specified in the NEC.

Ground electrode must be:

1. 1 piece
2. 10-foot minimum length of one of the following:

    2.1. Galvanized steel rod or pipe not less than 3/4 inch in diameter
    2.2. Copper clad steel rod not less than 5/8 inch in diameter

3. Installed as specified in NEC
4. Bonded to service equipment using one of the following:

    4.1. Ground clamp
    4.2. Exothermic weld
    4.3. No. 6 or larger copper conductor

On wood pole, metallic equipment mounted less than 8 feet above ground surface must be grounded.

Bond metallic conduit in non-metallic pull box using bonding bushing or bonding jumper.

Bond metallic conduit in metal pull box using bonding bushings and bonding jumpers connected to bonding wire running in the conduit system.

86-2.11 SERVICE

Electrical service installation and materials must comply with service utility requirements.

If service equipment is to be installed on utility-owned pole, you must furnish and install conduit, conductors, and other necessary material to complete service installation. Service utility will decide riser and equipment position.

Install service equipment early on to allow service utility to schedule its work before project completion.

Furnish each service with a circuit breaker that simultaneously disconnects all ungrounded service entrance conductors.

Circuit breakers must:

1. Be quick-break on either automatic or manual operation.
2. Have operating mechanism that is enclosed and trip-free from operating handle on overload.

3. Be trip indicating.
4. Have frame size plainly marked.
5. Have trip rating clearly marked on operating handle.
6. Have overload tripping of breakers not influenced by ambient temperature range of -18 °C to 50 °C.
7. Be internal trip type.
8. Be UL or NRTL listed and comply with UL 489 or equal.
9. Have minimum interrupting capacity of 10,000 A, rms, if used as service disconnect.

Service equipment enclosure must be a NEMA 3R enclosure with dead-front panel and a hasp with a 7/16-inch hole for a padlock. Enclosure must be field marked as specified in the NEC to warn qualified persons of potential electric arc flash hazards.

Service equipment enclosure, except Types II and III, must be galvanized or have a factory-applied rust-resistant prime coat and finish coat.

Types II and III service equipment enclosures must be manufactured from one of the following:

1. Galvanized sheet steel
2. Sheet steel plated with zinc or cadmium after manufacturing
3. Aluminum

Manufacture service equipment enclosure as specified in Section 86-3.04A, "Cabinet Construction." Overlapping exterior seams and doors must comply with requirements for NEMA 3R enclosures in the NEMA Enclosure Standards.

If an alternative design is proposed for Type II or III service equipment enclosure, submit plans and shop drawings to the Engineer for approval before manufacturing.

Except for falsework lighting and power for your activities, when you submit a written request, the Engineer will arrange:

1. With the service utility to complete service connections for permanent installations and the Department will pay all costs and fees required by the service utility. Submit request at least 15 days before service connections are required.
2. For furnishing electrical energy. Energy used before contract completion will be charged to you, except cost of energy used for public benefit as ordered by the Engineer will be paid by the Department or local authorities.

Full compensation for furnishing and installing State-owned or permanent service poles, service equipment, conduit, conductors, and pull boxes, including equipment, conduit, and conductors placed on utility-owned poles, is included in the contract item of electrical work involved and no additional compensation will be allowed therefor.

If the service point is indeterminate and is shown on the plans as "approximate location" or "service point not yet established," the labor and materials required for making the connection between the service point, when established, and the nearest pull box shown on the plans will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

86-2.12 WOOD POLES

Wood poles must comply with the following:

1. Class 5 or larger as specified in ANSI O 5.1
2. Less than 180-degree twist in grain over the full length
3. 4-inch or less sweep
4. Beveled top
5. Placed in ground at least 6 feet
6. Length must be:

    6.1. 25 feet for service pole
    6.2. 35 feet for other

After each pole is set in ground, backfill space around pole with selected earth or sand, free of rocks and other deleterious material, placed in 4-inch thick layers. Moisten each layer and thoroughly compact.

Manufacture mast arm from standard pipe, free from burrs. Each mast arm must have an insulated wire inlet and wood pole mounting brackets for mast arm and tie-rod cross arm. Manufacture tie rod from structural steel and pipe.

Mount mast arm for luminaire to provide a 34-foot mounting height for a 200 W high pressure sodium luminaire and 40-foot mounting height for 310 W high pressure sodium luminaire. Traffic signals and flashing beacons on mast arm must provide a minimum vertical clearance of 17 feet from bottom of equipment to pavement.

After manufacturing, pressure-treat pole as specified in Section 58, "Preservative Treatment of Lumber, Timber and Piling," and AWPA Use Category System: UC4B, Commodity Specification D.

If specified, treat pole with waterborne wood preservative.

86-2.13 LIGHTING AND SIGN ILLUMINATION CONTROL

Enclosure for the circuit breaker for lighting and sign illumination control must:

1. Be NEMA 3R
2. Be galvanized, cadmium plated, or powder-coated
3. Include dead front panel and a hasp with a 7/16 inch diameter hole for padlock

86-2.14 TESTING

86-2.14A Materials Testing

Deliver material and equipment to be tested to either the Transportation Laboratory or a testing location ordered by the Engineer.

Allow 30 days for acceptance testing from the time material or equipment is delivered to test site. You must pay for all shipping, handling, and related transportation costs associated with testing. If equipment is rejected, you must allow 30 days for retesting. Retesting period starts when corrected equipment is delivered to test site. You must pay for all retesting costs. Delays resulting from submittal of non-compliant materials do not relieve you from executing the contract within the allotted time.

If equipment submitted for testing does not comply with specifications, remove the equipment within 5 business days after notification that the equipment is rejected. If equipment is not removed within that period, it may be shipped to you at your expense.

When testing is complete, you will be notified. You must pick up the equipment at the test site and deliver it to the job site.

Testing and quality control procedures for all other traffic signal controller assemblies must comply with NEMA TS Standards for Traffic Control Systems.

86-2.14B Field Testing

Before starting functional testing, perform the following tests in the presence of the Engineer:

86-2.14B(1) Continuity

Test each circuit for continuity.

86-2.14B(2) Ground

Test each circuit for grounds.

86-2.14B(3) Insulation Resistance

Perform insulation resistance test at 500 V(dc) on each circuit between the circuit and a ground. Insulation resistance must be 10 MΩ minimum on all circuits, except for inductive loop detector circuits that must have an insulation resistance value at least 100 MΩ.

86-2.14C Functional Testing

Test periods must comply with Section 86-1.07, "Scheduling of Work."

Acceptance of new or modified traffic signal will be made only after all traffic signal circuits have been thoroughly tested.

Perform functional test to show that each part of the system functions as specified.

Functional test for each new or modified system must include at least 5 business days of continuous, satisfactory operation. If unsatisfactory performance of the system occurs, the condition must be corrected and the system retested until the 5 business days of continuous, satisfactory operation is obtained.

Except for new or modified parts of existing lighting circuit and sign illumination system, the State or local agency will maintain the system during test period and pay the electrical energy cost. Except for electrical energy, you must pay the cost of necessary maintenance performed by the State or local agency on new circuits or on the portions of existing circuits modified under the contract.

Shutdown of electrical system caused by traffic from a power interruption or from unsatisfactory performance of State-furnished materials does not constitute discontinuity of the functional test.

86-2.15 GALVANIZING

Galvanize as specified in Section 75-1.05, "Galvanizing." Cabinet material may be galvanized before manufacturing as specified in ASTM A 653/653M, Coating Designation G 90.

Steel pipe standard and pipe mast arm must be hot-dip galvanized after manufacturing and must comply with Section 75-1.05, "Galvanizing." . Remove spikes from galvanized surfaces.

A minimum of 10 inches of upper end of anchor bolts, anchor bars or studs, and nuts and washers must be galvanized as specified in Section 75-1.05, "Galvanizing."

After galvanizing, bolt threads must accept galvanized standard nuts without requiring tools or causing removal of protective coatings.

Galvanizing existing materials in an electrical installation will not be required.

86-2.16 PAINTING

Paint electrical equipment and material as specified in Section 59, "Painting," and the following:

1. Use paint material specified in Section 91, "Paint."
2. Factory or shop cleaning methods for metals are acceptable if equal to the methods specified.
3. Instead of temperature and seasonal restrictions for painting as specified in Section 59, "Painting," paint may be applied to equipment and materials for electrical installations if ordered by the Engineer.
4. Ungalvanized ferrous surface to be painted must be cleaned before applying prime coat. Blast cleaning is not required.
5. If an approved prime coat is applied by manufacturer, and in good condition, the 1st primer application is not required.
6. Existing equipment to be painted in the field, including State-furnished equipment, must be washed with a stiff bristle brush using a solution of water containing 2 tablespoons of heavy duty detergent powder per gallon. After rinsing, surface must be wire-brushed with a coarse, cup-shaped, power-driven brush to remove badly bonded paint, rust, scale, corrosion, grease, or dirt. Dust or residue remaining after wire brushing must be removed before priming.
7. Do not paint galvanized metal guard post, galvanized equipment, State-furnished controller cabinet, and wood poles for traffic signal or flashing beacon.
8. New galvanized metal surface to be painted in the field must be cleaned as specified for existing equipment before applying the prime coat. Do not wire brush new galvanized surface.
9. After erection, examine exterior surface for damaged primer, clean, and spot coat with primer.
10. Paint Types II and III steel service equipment enclosures with a polymeric or an enamel coating system matching Color No. 14672, light green, of Federal Standard 595B. Coating must be commercially smooth and free of flow lines, paint washout, streaks, blisters, and other defects that would impair serviceability or detract from general appearance. Coating must comply with the following:

    10.1. Coating hardness - Finish must have pencil lead hardness of HB, minimum, using an Eagle Turquoise pencil.
    10.2. Salt spray resistance - Undercutting coating system's film must not exceed 1/8-inch average, from lines scored diagonally and deep enough to expose the base metal, after 336 hours of exposure in a salt spray cabinet complying with ASTM B 117.
    10.3. Adherence - Must not have coating loss when tested as specified in California Test 645. Perform testing by applying coating to 4" x 8" x 0.024" test specimens of the same material as the cabinet, using the same application method.

11. Finish interior of metal signal visor, louver, and front face of back plates with 2 applications of lusterless black exterior grade latex paint formulated for application to properly prepared metal surface. Good condition factory finish will be acceptable.
12. Finish metal signal section, signal head mounting, brackets and fittings, outside of visor, pedestrian push button housing, pedestrian signal section and visor, and back face of back plate with 2 applications of

lusterless black or dark olive green exterior grade latex paint formulated for application to properly prepared metal surface. Match dark olive green color to Color Chip No. 68 filed at the Transportation Laboratory.

13. Prepare and finish conduit and conduit fitting above ground the same as adjacent standard or post.
14. Relocated, reset or modified equipment previously finished as specified in this section, except for previously-finished galvanized standard with traffic signal yellow enamel, must be given a spot finishing application on newly primed areas and 1 finishing application over the entire surface. If signal face or mounting brackets are required to be painted under this section, all signal faces and mounting brackets on the same mounting must be repainted.
15. Small rusted or repaired areas of relocated or reset galvanized equipment must be cleaned and painted as specified in Section 75-1.05, "Galvanizing," for repairing damaged galvanized surfaces.
16. Stencil equipment number neatly on the standard or adjacent structure. Obtain number from the Engineer.
17. Perform painting neatly. The Engineer reserves the right to require use of brushes if the work performed by paint spraying machine is unsatisfactory.

86-3 CONTROLLER ASSEMBLIES

86-3.01 CONTROLLER ASSEMBLIES

A controller assembly houses a complete mechanism for controlling the operation of traffic signals or other systems.

Model 170 and Model 2070, specified as a Model 170/2070 controller assembly, includes a Model 170, 170E or 2070 controller unit, a wired cabinet, and all auxiliary equipment required to control the system.

86-3.02 (BLANK)

86-3.03 (BLANK)

86-3.04 CONTROLLER CABINETS

Controller cabinets for controller assemblies other than Model 170/2070 must comply with the following:

86-3.04A Cabinet Construction

Cabinet must be rainproof and the top crowned 1/2 inch or slanted toward the back to prevent standing water.
Cabinet and door must be manufactured from one of the following:

1. 0.073-inch minimum thickness cold-rolled steel with continuously-welded exterior seams
2. 0.073-inch minimum thickness stainless steel with overlapping exterior seams complying with Type 4 enclosures of the NEMA Enclosure Standards
3. 0.125-inch minimum thickness aluminum with continuously-welded exterior seams

Exterior welds must be ground smooth and edges filed to a radius of at least 0.03 inch.
Cabinet manufactured from cold-rolled steel must comply with Section 86-2.16, "Painting," and the following:

1. Cabinet manufactured from cold-rolled steel must be finished with a polymeric or an enamel coating system conforming to Color No. 14672 of Federal Standard 595B.
2. Cabinet must not have coating loss when 2 test specimens, 4" x 8", of the same material and coating as the cabinet are tested. Two 9-inch-diagonal scratches exposing bare metal will be made on a specimen. Soak specimen in demineralized water for 192 hours. Tightly affix a 1-inch wide strip of masking tape to the surface and remove with one quick motion. Specimen showing evidence of blistering, softening, or peeling of paint or coating from the base metal will be rejected. Testing must comply with California Test 645, except passing 180 Degree Bend Test is not required.
3. Metal must be prepared by the 3-step, iron phosphate conversion coating bonderizing technique.
4. Inside walls, doors, and ceiling of the housing must be the same as the outside finish.

Cabinet manufactured from stainless steel must comply with the following:

1. Use annealed or quarter-hard stainless steel that complies with ASTM A 666 for Type 304, Grades A or B.
2. Use gas tungsten arc welding (GTAW) process with bare stainless steel welding electrodes. Electrodes must comply with AWS A5.9 for ER308 chromium-nickel bare arc welding electrodes.

3. Procedures, welder, and welding operator must comply with requirements and practices recommended in AWS C5.5.
4. Ground or brush exposed, exterior surfaces of stainless steel cabinet to a 25 to 50-microinch finish using iron-free abrasives or stainless steel brushes.
5. After grinding or brushing, cabinet must not show rust discoloration when:

    5.1. Exposed for 48 hours in a salt spray cabinet as specified in ASTM B 117
    5.2. Exposed 24 hours in a tap water spray cabinet with the water temperature between 38 °C and 45 °C

6. After the test, cabinet showing rust discoloration anywhere on its surface will be rejected. Rejected cabinets may be cleaned, passivated, and resubmitted for testing.

Cabinet manufactured from aluminum sheet must comply with ASTM B 209 or B 209M for 5052-H32 aluminum sheet, and the following:

1. Use gas metal arc welding (GMAW) process with bare aluminum welding electrodes. Electrodes must comply with AWS A5.10 for ER5356 aluminum alloy bare welding electrodes.
2. Procedures, welder, and welding operator for welding must comply with requirements in AWS B3.0, "Welding Procedure and Performance Qualification," and to practices recommended in AWS C5.6.
3. Surface finish of each aluminum cabinet must comply with MIL-A-8625 for a Type II, Class I coating, except anodic coating must have a minimum thickness of 0.0007 inch and a minimum coating weight of 0.001 ounce per square inch. The anodic coating must be sealed in a 5 percent aqueous solution of nickel acetate, pH 5.0 to 6.5, for 15 minutes at 97 °C. Before applying anodic coating, clean and etch cabinets using the steps below:

    3.1. Clean by immersing into inhibited alkaline cleaner, Oakite 61A, Diversey 909, or equal, 6 to 8 ounces per gallon at 71 °C for 5 minutes.
    3.2. Rinse in cold water.
    3.3. Etch in solution of 1-1/2 ounce of sodium fluoride and 4 to 6 ounces of sodium hydroxide per gallon of distilled water at 60 °C to 65 °C for 5 minutes.
    3.4. Rinse in cold water.
    3.5. Immerse in 50 percent by volume nitric acid solution at room temperature for 2 minutes.
    3.6. Rinse in cold water.

Cabinet must have:

1. Single front door with:

    1.1. 44-inch maximum door width.
    1.2. Lock, when closed and latched, that is locked.
    1.3. Police panel mounted on door, equipped with a keyed lock and 2 police keys. Each police key must have a shaft at least 1-3/4 inch in length.

2. Dust-tight gasketing on all door openings, permanently bonded to the metal. Mating surface of the gasketing must be covered with silicone lubricant to prevent sticking.
3. Handle that:

    3.1. Allows padlocking in closed position
    3.2. Has a minimum length of 7 inches
    3.3. Has a 5/8-inch, minimum, steel shank
    3.4. Is manufactured of cast aluminum, or zinc-plated or cadmium-plated steel

4. Cabinet door frame with:

    4.1. Latching mechanism that:

        4.1.1. Holds tension on and forms a firm seal between door gasketing and frame.
        4.1.2. Is a 3-point cabinet latch with nylon rollers that have a minimum diameter of 3/4 inch and equipped with ball bearings.

4.1.3. Has a center catch and a pushrod made of zinc-plated or cadmium-plated steel. Pushrod must be at least 1/4" x 3/4" and turned edgewise at outer supports. Cadmium plating must comply with MIL-QQ-416. Zinc plating must comply with MIL-QQ-325.

4.2. Hinging that:

4.2.1. Has 3-bolt butt hinges, each having a stainless steel fixed pin. Hinges must be stainless steel or may be aluminum for aluminum cabinet.
4.2.2. Is bolted or welded to the cabinet. Hinge pins and bolts must not be accessible when door is closed.
4.2.3. Has a catch to hold the door open at 90 degrees and 180 degrees, ± 10 degrees, if a door is larger than 22 inches in width or 6 square feet in area. Catch must be at least 3/8-inch diameter, stainless steel plated rod capable of holding door open at 90 degrees in a 60 mph wind at an angle perpendicular to the plane of the door.

5. Lock that:

5.1. Is solid brass, 6-pin tumbler, rim type
5.2. Has rectangular, spring-loaded bolts
5.3. Is left hand and rigidly mounted with stainless steel machine screws approximately 2 inches apart
5.4. Extends 1/8 to 3/8 inch beyond the outside surface of door

6. 2 keys that are removable in the locked and unlocked positions.

Submit alternative design details for review and approval before manufacturing cabinet.
Use metal shelves or brackets that will support controller unit and auxiliary equipment.
Machine screws and bolts must not protrude outside the cabinet wall.

86-3.04B Cabinet Ventilation

Each controller cabinet must have:

1. 8 screened, 1/2-inch diameter or larger, raintight vent holes, in lower side or bottom of cabinet. You may use louvered vents with a permanent metal mesh or 4-ply woven polypropylene air filter held firmly in place, instead.
2. Electric fan with ball or roller bearings and capacity of at least 100 cubic feet per minute. Fan must be thermostatically controlled and manually adjustable to turn on between 32 °C and 65 °C with a differential of not more than 6 °C between automatic turn on and turn off. Fan circuit must be fused at 125 percent of ampacity of installed fan motor.

Fan and cabinet vent holes must be positioned to direct bulk of airflow over controller unit or through ventilating holes of controller unit.

86-3.04C Cabinet Wiring

Conductors used in controller cabinet wiring must:

1. Be neatly arranged and laced, or enclosed in plastic tubing or raceway.
2. End with properly sized captive or spring-spade terminal or be soldered to a through-panel solder lug on the back side of the terminal block. Apply crimp-style connector with proper tool to prevent opening of handle until crimp is completed.

Controller cabinet must have an equipment grounding conductor bus that is grounded to the cabinet and connected to metal conduit system or other approved ground with a No. 8, or larger, grounding conductor.

With all cabinet equipment in place and connected, resistance between grounded conductor terminal bus and equipment grounding conductor bus must be 50 MΩ, minimum, when measured with an applied voltage of 150 V(dc).

If direct current is to be grounded, connect to equipment ground only.

Use two or more terminal blocks for field connection. Install field terminal within 22 inches from front of cabinet and orient for screwdriver operation. Terminal must be a minimum of 5 inches above foundation.

No more than 3 conductors per terminal are allowed. Two flat metal jumpers, straight or U shaped, may be placed under terminal screw. At least 2 full threads of terminal screws must be fully engaged when screw is tightened. Live parts must not extend beyond the barrier.

86-3.05 CABINET ACCESSORIES

86-3.05A Labels

Include permanently printed, engraved, or silk-screened label for equipment and removable items of equipment.

Labeling must match cabinet wiring diagram. Label for shelf-mounted equipment must be on shelf face below item. Label for wall-mounted equipment must be below item.

86-3.05B Convenience Receptacle

Mount convenience receptacle in a readily accessible location inside the cabinet.

Convenience receptacle must be a duplex, 3-prong, NEMA 5-15R grounding type outlet that complies with UL Standard 943.

86-3.05C Surge Arrestor

Surge arrestor must reduce effects of power line voltage transients and have ratings as follows:

Surge Arrestor Requirements

Recurrent peak voltage	184 V(ac)
Energy rating, maximum	20 J
Power dissipation, average	0.85 W
Peak current for pulses less than 7 μs	1,250 A

Standby current must be 1 mA or less for 120 V(ac), 60 Hz sinusoidal input.

86-3.05D Terminal Blocks

Terminal block must be rated 600 V(ac), minimum, and have nickel-, silver-, or cadmium-plated brass binder head screw terminal.

Heavy duty terminal block must be rated at 20 A and have 12 position with No. 10 x 5/16-inch nickel-plated brass binder head screws and nickel-plated brass inserts. Each position must have 2 screw-type terminals. Terminal block must be barrier type with shorting bars in each of the 12 positions, and must have integral type marking strips.

Light duty terminal block must be rated at 5 A and have 12 positions with No. 6 x 1/8 inch binder head screws. Each position must have 1 screw-type terminal.

86-3.06 COMPONENTS

86-3.06A Toggle Switches

Toggle switch must:

1. Have poles as required
2. Be rated at 200 percent of circuit current for circuits of 10 A or less and 125 percent of circuit current for circuits over 10 A

86-3.06B Cartridge Fuses

Install cartridge fuse in panel-mounted fuseholder. Fuse type and rating must be as recommended by the fuse manufacturer for protecting the load.

86-3.06C Circuit Breakers

Circuit breaker must comply with Section 86-2.11, "Service," except breaker must have a minimum interrupting capacity of 5,000 A, rms.

86-3.06D Connectors

Use connector designed to interconnect various parts of circuit together and constructed for the application involved. Design connector for positive connection of circuit and easy insertion and removal of mating contacts. Connector must be permanently keyed to prevent improper connection of circuit.

Connector, or device plugging into connector, must have positive connection to prevent a circuit from breaking due to vibration, a pull on connecting cable, or similar disruptive force.

86-4 TRAFFIC SIGNAL FACES AND FITTINGS

86-4.01 VEHICLE SIGNAL FACES

Each vehicle signal face must:

1. Be adjustable and allow for 360-degree rotation about vertical axis
2. Comply with ITE publication ST-017B, "Vehicle Traffic Control Signal Heads"
3. Comply with California Test 604, except for arrow and "X" faces
4. Have 3 sections arranged vertically: red at top, yellow at center, and green at bottom
5. Be of the same manufacturer and material, if more than 1 is installed at an intersection, except for programmed visibility type
6. Be sealed with neoprene gasket at top opening
7. Be LED modules

86-4.01A Signal Sections

Each signal section must comply with the following:

1. Maximum height must be 10-1/4 inches for an 8-inch section and 14-3/4 inches for a 12-inch section.
2. Housing must:

    2.1. Be either die-cast or permanent mold-cast aluminum, or if specified, be structural plastic.
    2.2. Comply with ITE publication ST-017B if die-cast or permanent mold-cast aluminum is used.
    2.3. Have a 1-piece, hinged, square-shaped door designed to allow access for relamping without the use of tools. Door must be secured to hold the door closed during loading tests. Module or lens must be watertight and mounted in the door.

3. Hinge pins, door latching devices, and other exposed hardware must be Type 304 or 305 stainless steel. Interior screws and fittings must be stainless steel, or steel with a corrosion resistant plating or coating.
4. Opening must be placed on top and bottom to receive 1-1/2-inch pipe. The 8-inch and 12-inch sections of an individual manufacturer must be capable of joining to form a signal face in any combination. This interchangeability is not required between metal and plastic sections.
5. Gaskets must be made of a material that is not affected if installed in a section with metal or plastic housing that is continuously operated for 336 hours.

Structural failure is described as follows:

Signal Section Structural Failure

Signal Section Type	Requirements	Description of Structural Failure
Metal	California Test 666	Fracture within housing assembly or deflection of more than half the lens diameter of signal section during wind load test
Plastic	California Test 605	Fracture within housing assembly or deflection of more than 10 degrees in either the vertical or horizontal plane after wind load has been removed from front of signal face, or deflection of more than 6 degrees in either the vertical or horizontal plane after wind load has been removed from back of signal face

86-4.01A(1) Metal Signal Sections

Each metal signal section must have a metal visor. Metal signal faces requiring backplates must have metal backplates.

86-4.01A(2) Plastic Signal Sections

Housing must be molded in 1 piece, or fabricated from 2 or more pieces and joined into a single piece. Plastic must have ultraviolet stability, be unaffected by lamp heat, and be self-extinguishing. Housing and door must be colored throughout and be black, matching Color No. 17038, 27038, or 37038 of Federal Standard 595B.

Each face section must be joined to adjacent section by one of the following:

1. Minimum of 3 machine screws for 8-inch sections and 4 machine screws for 12-inch sections, installed through holes near front and back of housing. Each screw must be a No. 10 and have a nut, flat washer, and lock washer.
2. Two machine screws, each with a nut, flat washer, and lock washer, installed through holes near the front of the housing, and a fastening through the 1-1/2-inch pipe opening. Fastening must have 2 large flat washers to distribute the load around the pipe opening and 3 carriage bolts, each with a nut and lock washer. Minimum screw size must be No. 10. Minimum carriage bolt size must be 1/4 inch.

Supporting section of each signal face supported only at top or bottom must have reinforcement.

Reinforcement plate must be either sheet aluminum, galvanized steel, or cast aluminum. Each plate must be a minimum of 0.11-inch thick and have a hole concentric with 1-1/2-inch pipe-mounting hole in the housing. Place reinforcement plate as follows:

Reinforcement Plate Placement

Type of Reinforcement Plate	Placement
Sheet aluminum	Inside and outside of housing
Galvanized steel	Inside of housing
Cast aluminum	Outside of housing

Reinforcement plates placed outside of the housing must be finished to match signal housing color and be designed to allow proper serrated coupling between signal face and mounting hardware. Minimum of 3 No. 10 machine screws must be installed through holes in each plate and matching holes in the housing. Each screw must have a round or binder head, a nut, and lock washer.

If signal face is supported by a Type MAS side attachment slip-fitter inserted between 2 sections, place spacers between the 2 sections. Vertical dimension of spacers must allow proper seating of serrations between the slip-fitter and the 2 sections. In addition to the fastening through the large openings in housing, the 2 sections must join with at least 2 machine screws through holes near the front of housing and the spacers, and through matching holes in a reinforcing plate installed in housing. Machine screws must be No. 10 minimum size. Spacers must be made of same material as signal housing.

If reinforcing webs are used to connect back of housing to top, bottom, and sides, reinforcing plates are not required.

Holes for machine screws must be either cast or drilled during signal section manufacturing. Surround each hole with a 1/8-inch minimum width boss to allow contact between signal sections about axis of hole.

Each plastic signal section must have a plastic or metal visor. Plastic signal faces requiring backplates must have plastic backplates.

Serrated nylon washer must be inserted between each plastic signal section and metal mounting assembly. Each washer must be between 3/16- and 1/4-inch thick. Serrations must match those on signal section and mounting assembly.

86-4.01B Electrical Components

Conductors must be connected to a terminal block mounted inside, at the back of housing. Terminal block must have enough screw type terminals or NEMA type tab connectors to end all field and module or lamp conductors independently. Permanently identify terminal with field conductors attached or color code conductors to facilitate field wiring.

86-4.01C Visors

Include removable visor with each signal section. Comply with ITE publication ST-017B. Visors are classified by lens enclosure as full circle, tunnel or cap. Bottom opens for tunnel type and both, bottom and lower sides open for cap type. Visors must be tunnel type.

Visor must have a downward tilt between 3 and 7 degrees with a length of:

1. 9-1/2-inch minimum for nominal 12-inch round lenses
2. 7 inch for nominal 8-inch round lenses

Metal visor must be formed from 0.050-inch, minimum thickness, aluminum alloy sheet.

Plastic visor must be either formed from sheet plastic or assembled from one or more injection, rotational, or blow-molded plastic sections. Material must be of a black homogeneous color with lusterless finish. Sections must be joined using thermal, chemical, or ultrasonic bonding, or with aluminum rivets and washers permanently colored to match visor.

Secure each visor to its door and prevent removal or permanent deformation when wind load specified in California Test 605 for plastic visors or 666 for metal visors is applied to its side for 24 hours.

If directional louvers are used, fit louvers snuggly into full-circular signal visors. Outside cylinder must be constructed of 0.030-inch nominal thickness, or thicker, sheet steel and vanes must be constructed of 0.016-inch nominal thickness, or thicker, sheet steel, or the cylinder and vanes must be constructed of 5052-H32 aluminum alloy of equal thickness.

86-4.02 (BLANK)

86-4.03 (BLANK)

86-4.04 BACKPLATES

Background light must not be visible between backplate and signal face or between sections.

Plastic backplates must be either formed from sheet plastic or assembled from extruded, molded, or cast sections. Sections must be factory joined using one of the following:

1. Appropriate solvent cement
2. Aluminum rivets and washers painted or permanently colored to match backplate
3. No. 10 machine screws with washers, lock washers, and nuts, painted to match backplate

Backplate material must be of black homogeneous color with a lusterless finish. Secure each plastic backplate to the plastic signal face in a manner that prevents its removal or permanent deformation when the wind-load test is applied to either the front or back of signal face. Permanent deformation of any portion of backplate must not exceed 5 degrees forward or backward after wind loading is applied for 24 hours.

If plastic backplate requires field assembly, join with at least 4 No. 10 machine screws at each field-assembled joint. Each machine screw must have an integral or captive flat washer, a hexagonal head slotted for a standard screwdriver, and either a locking nut or a nut and lockwasher. Machine screws, nuts, and washers must be stainless steel or steel with a zinc or black-oxide finish.

If a metal backplate has 2 or more sections, fasten sections with rivets or aluminum bolts peened after assembly to avoid loosening.

Instead of the screws shown on the plans, you may use self-threading No. 10 steel screws to fasten plastic backplates to plastic signal face. Each screw must have an integral or captive flat washer, a hexagonal head slotted for a standard screwdriver, and is stainless steel or steel with a zinc or black-oxide finish.

86-4.05 PROGRAMMED VISIBILITY VEHICLE SIGNAL FACES

Programmed visibility signal face and its installation must comply with Section 86-4.01, "Vehicle Signal Faces," Section 86-4.04, "Backplates," and Section 86-4.08, "Signal Mounting Assemblies."

Each programmed visibility signal section must:

1. Have a nominal 12-inch diameter circular or arrow indication
2. Comply with ITE publication ST-017B for color and arrow configuration
3. Have a cap visor
4. Have an adjustable connection that provides incremental tilting from 0 to 10 degrees above or below horizontal while maintaining a common vertical axis through couplers and mountings

Terminal connection must allow external adjustment about the mounting axis in 5-degree increments.

Signal must be mountable with ordinary tools and capable of servicing without tools. Preset adjustment at 4 degrees below horizontal.

Visibility of each programmed visibility signal face must be capable of adjustment or programming, within the face. When programmed, each signal face's indication must be visible only in those areas or lanes to be controlled, except that during dusk and darkness a faint glow to each side is allowed.

You must program the head as recommended by the manufacturer.

86-4.06 PEDESTRIAN SIGNAL FACES

Message symbols for pedestrian signal faces must be white "WALKING PERSON" and Portland orange "UPRAISED HAND." Comply with ITE Standards: "Pedestrian Traffic Control Signal Indications" and California MUTCD. Each symbol's height must be at least 10 inches and width must be at least 6-1/2 inches.

Luminance of "UPRAISED HAND" symbol must be 1,100 foot-lamberts, minimum, and luminance of "WALKING PERSON" symbol must be 1,550 foot-lamberts, minimum, when tested as specified in California Test 606.

Uniformity ratio of an illuminated symbol must not exceed 4 to 1 between the highest luminance area and the lowest luminance area.

Luminance difference between a nonilluminated symbol and the background around the symbol must be less than 30 percent when viewed with the visor and front screen in place and at a low sun angle.

Each housing, including front screen, must have maximum overall dimensions of 18-1/2-inch width, 19-inch height, and 11-1/2-inch depth.

All new pedestrian signal faces installed at an intersection must be the same make and type.

86-4.06A Type A

Each Type A pedestrian signal face must include a housing, 1 LED pedestrian signal combo module and a front screen.

86-4.06B Front Screen

Front screen installation for each Type A signal must comply with one of the following:

1. Install, tilting downward, at an angle of 15±2 degrees out from the top, an aluminum honeycomb screen with 0.2-inch cells, 3/8-inch thick, or a plastic screen of 3/8-inch squares, 1/2-inch thick with wall thickness of 1/16-inch. Completely cover message plate. Include a clear front cover of 1/8-inch minimum thickness acrylic plastic sheet or 1/16-inch minimum thickness polycarbonate plastic. Hold screen and cover firmly in place with stainless steel or aluminum clips or stainless steel metal screws.
2. Install a 1-1/2-inch deep eggcrate or Z crate type screen of 1/32-inch nominal thickness polycarbonate. Mount screening in a frame constructed of 0.040-inch minimum thickness aluminum alloy or polycarbonate. Install screen parallel to face of message plate and hold in place with stainless steel screws.

The Department will test screens in a horizontal position with its edges supported. When a 3-inch diameter, 4-pound steel ball is dropped on the screen from a height of 4 feet above, the front screen must not fracture, separate at the welds, or compress more than 1/8-inch. When pedestrian housing is used to support front screen during test, remove message plate from pedestrian signal housing, so there is no back support for the screen.

Screen and frame must be one of the following:

1. Manufactured from aluminum anodized flat black
2. Finished with lusterless black exterior grade latex paint formulated for application to properly prepared metal surfaces
3. Manufactured from flat black plastic

86-4.06C Housing

Pedestrian signal housing must comply with Section 86-4.01A, "Signal Sections."

86-4.06D Finish

Paint exterior of each housing as specified in Section 86-2.16, "Painting."

86-4.06E Control

Pedestrian signals must be controllable by solid-state switching devices specified for traffic signal controller assemblies.

86-4.06F Terminal Blocks

Include light duty terminal block, as specified in Section 86-4.01B, "Electrical Components," with each pedestrian signal face.

86-4.07 (BLANK)

86-4.08 SIGNAL MOUNTING ASSEMBLIES

Signal mounting assembly must include:

1. 1-1/2-inch standard steel pipe or galvanized conduit
2. Pipe fitting made of ductile iron, galvanized steel, aluminum alloy Type AC-84B No. 380, or bronze
3. Mast arm and post top slip-fitters, and terminal compartments made of cast bronze or hot-dip galvanized ductile iron

After installation, clean and paint exposed threads of galvanized conduit brackets and bracket areas damaged by wrench or vise jaws. Use wire brush to clean and apply 2 coats of approved unthinned zinc-rich primer, organic vehicle type, as specified in Section 91, "Paint." Do not use aerosol can.

Fit each terminal compartment with a terminal block having a minimum of 12 positions, each with 2 screw-type terminals. Each terminal must accommodate at least five No. 14 conductors. Include a cover on compartment for ready access to terminal block. Terminal compartment used to bracket mount signals must be bolted securely to pole or standard.

Horizontal dimension of mounting assembly members between vertical centerline of terminal compartment or slip-fitter, and the vertical centerline of each signal face must not exceed 11 inches, except where required for proper signal face alignment or to allow programming of programmed visibility signal faces.

Mounting assembly members must be plumb or level, symmetrically arranged, and securely assembled.

Mounting assembly must be watertight, and free of sharp edges or protrusions that might damage conductor insulation. Include positive locking serrated fittings that, if mated with similar fittings on signal faces, will prevent faces from rotating.

Orient each mounting assembly to allow maximum horizontal clearance to adjacent roadway.

Use slip-fitter for post-top mounting of signals. Fit slip-fitter over a 4-1/2-inch outside diameter pipe or tapered standard end. Include cadmium-plated steel set screws. Include an integral terminal compartment for each slip-fitter used to post-top mount signals with brackets.

Do not install signal faces at an intersection until all other signal equipment, including complete controller assembly, is in place and ready for operation. You may mount signal faces if covered or not directed toward traffic.

86-4.09 FLASHING BEACONS

Flashing beacon must include:

1. Single section traffic signal face with yellow or red LED module indications
2. Backplate
3. Tunnel visor
4. Flashing beacon control assembly

Beacon flasher unit must be independent of intersection flasher unit.

86-4.09A Flashing Beacon Control Assembly

86-4.09A(1) Enclosure

Enclosure must be:

1. NEMA 3R with a dead front panel and a hasp with a 7/16-inch hole for a padlock
2. Powder coated, hot-dip galvanized, or factory-applied rust resistant prime coat and finish coat

86-4.09A(2) Circuit Breakers and Switches

Circuit breakers must comply with Section 86-2.11, "Service."

Switch for manually operating sign lighting circuit must be a single-hole-mounting toggle type with a single pole and throw and rated at 12 A, 120 V(ac). Furnish switch with an indicating nameplate reading "Auto-Test."

86-4.09A(3) Flasher

Comply with Section 8, "Solid-State Flashers," of NEMA Standards publication No. TS 1.

Flasher must be a solid-state device with no contact points or moving parts.

Include 2 output circuits to allow alternate flashing of signal faces. Flasher must be able to carry a minimum of 10 A per circuit at 120 V(ac).

86-4.09A(4) Wiring

Conductors and wiring in the enclosure must comply with Section 86-2.09B(1), "Cabinet and Enclosure Installation."

86-4.09A(5) Terminal Blocks

Terminal blocks must be:

1. Rated 25 A, 600 V(ac)
2. Molded phenolic or nylon material
3. Barrier type with plated brass screw terminals and integral marking strips

86-5 DETECTORS

86-5.01 VEHICLE DETECTORS

Sensor unit and isolator must comply with TEES.

86-5.01A Inductive Loop Detectors

86-5.01A(1) General

Inductive loop detector includes a completely installed loop or group of loops, in the roadway, lead-in cable, and a sensor unit, with power supply installed in a controller cabinet.

86-5.01A(2) (Blank)

86-5.01A(3) Construction Materials

Conductor for each inductive loop detector must be continuous, unspliced, and one of the following:

Conductor Options for Inductive Loop Detector

Option	Specifications
Type 1 loop wire	Type RHW-USE neoprene-jacketed or Type USE cross-linked polyethylene insulated, No. 12, stranded copper wire with a 40 mils minimum thickness at any point.
Type 2 loop wire	Type THWN or Type XHHW, No. 14, stranded copper wire in a plastic tubing. Plastic tubing must be polyethylene or vinyl, rated for use at 105 °C, and resistant to oil and gasoline. Outside diameter of tubing must be 0.27 inch maximum with a wall thickness of 0.028 inch minimum.

Conductor for loop detector lead-in cable must be two No. 16, 19 x 29, stranded, tinned copper wires, comply with the calculated cross sectional area of ASTM B 286, Table 1, and be one of the following:

Conductor Options for Loop Detector Lead-In Cable

Option	Specifications
Type B lead-in cable	Insulated with 20 mils of high-density polyethylene. Conductors must be twisted together with at least 2 turns per foot and the twisted pair must be protected with a copper or aluminum polyester shield. A No. 20, minimum, copper drain wire must be connected to equipment ground within cabinet. Cable must have a high-density polyethylene or high-density polypropylene outer jacket with a nominal thickness of 32 mils. Include an amorphous interior moisture penetration barrier of nonhydroscopic polyethylene or polypropylene fillers.
Type C lead-in cable	Comply with International Municipal Signal Association (IMSA) Specification No. 50-2. A No. 20, minimum, copper drain wire must be connected to equipment ground within cabinet.

86-5.01A(4) Installation Details

Install loop conductors without splices and end in nearest pull box. Seal open end of cable jacket or tubing similar to splicing requirements to prevent water from entering. Do not make final splices between loops and lead-in cable until loop operations under actual traffic conditions is approved.

Splice all loop conductors for each direction of travel for same phase of a traffic signal system, in same pull box, to a detector lead-in cable that runs from pull box adjacent to loop detector to a sensor unit mounted in controller cabinet.

End all loop conductors in a pull box or terminal strip in the cabinet.

Identify and band conductors for inductive loop installations. Band, in pairs, by lane, in the pull box adjacent to the loops and near the end of conductors in the cabinet. Bands must comply with Section 86-2.09, "Wiring."

If HMA surfacing is to be placed, install loop conductors before placing uppermost layer of HMA. Install conductors in compacted layer of HMA immediately below the uppermost layer. Install conductors as shown on the plans, except fill slot with sealant flush to the surface.

When cutting loops:

1. Residue from slot cutting activities must not be allowed to flow across shoulders or lanes occupied by public traffic and must be removed from the pavement surface before residue flows off. Dispose of residue from slot cutting activities under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."
2. Surplus sealant must be removed from adjacent road surface without using solvents before setting.

Sealant for filling slots must comply with one of the following:

Elastomeric Sealant

Polyurethane material that will, within stated shelf life, cure only in the presence of moisture. Sealant must be suitable for use in both HMA and PCC.

The cured sealant must have the following performance characteristics:

Performance Characteristics of Cured Sealant

Specification	ASTM	Requirement
Hardness (indentation) at 25 °C and 50% relative humidity. (Type A, Model 1700 only)	D 2240 Rex.	65-85
Tensile Strength: Pulled at 508 mm per minute	D 412 Die C	3.45 MPa, min.
Elongation: Pulled at 508 mm per minute	D 412 Die C	400%, min.
Flex at -40 °C: 0.6-mm free film bend (180°) over 13-mm mandrel	--	No cracks
Weathering Resistance: Weatherometer 350 h, cured 7 days at 25 °C @ 50% relative humidity	D 822	Slight chalking
Salt Spray Resistance: 28 days at 38 °C with 5% NaCl, Die C & pulled at 508 mm per minute	B 117	3.45 MPa, min. tensile 400%, min. elongation
Dielectric Constant over a temperature range of -30 °C to 50 °C	D 150	Less than 25% change

Asphaltic Emulsion Sealant

Comply with State Specification 8040-41A-15. Use for filling slots in HMA pavement that are a maximum of 5/8 inch in width. Do not use where the slope causes the material to run from the slot. Material must not be thinned beyond manufacturer's recommendations. Place material when air temperature is at least 7 °C.

Hot-Melt Rubberized Asphalt Sealant

Hot-melt rubberized asphalt must be:

1. In solid form at room temperature and fluid at application temperature of 190 °C to 205 °C. Fumes must be non-toxic.

2. Suitable for use in both HMA and PCC.
3. Melted in a jacketed, double-boiler type melting unit. Temperature of heat transfer medium must not exceed 245 °C.
4. Applied with a pressure feed applicator or pour pot, when the pavement surface temperature is greater than 4 °C.
5. Packaged in containers clearly marked "Detector Loop Sealant" and specifying manufacturer's batch and lot number.

The cured sealant must have the following performance characteristics:

Performance Characteristics of Cured Sealant

Specification	ASTM	Requirement
Cone Penetration, 25 °C, 150 g, 5 s	D 5329, Sec. 6	3.5 mm, max
Flow, 60 °C	D 5329, Sec. 8	5 mm, max
Resilience, 25 °C	D 5329, Sec. 12	25%, min
Softening Point	D 36	82 °C, min
Ductility, 25 °C, 50 mm/min	D 113	300 mm, min
Flash Point, COC, °C	D 92	288 °C, min
Viscosity, Brookfield Thermosel, No. 27 Spindle, 20 rpm, 190 °C	D 150	Less than 25% change

86-5.01B Magnetic Detectors

Cable from pull box, adjacent to magnetic detector sensing element, to the field terminals in the controller cabinet must be the type specified for inductive loop detectors.

86-5.02 PEDESTRIAN PUSH BUTTON ASSEMBLIES

Housing must be either die-cast or permanent mold-cast aluminum, or ultraviolet stabilized, self-extinguishing structural plastic, if specified. Plastic housing must be black matching Color No. 17038, 27038 or 37038 of Federal Standard 595B, and colored throughout. Assembly must be rainproof and shockproof in any weather condition.

Switch must be a single-pole, double-throw, switching unit, with screw type terminals, rated 15 A at 125 V(ac), and must have:

1. Plunger actuator and a U frame to allow recessed mounting in push button housing
2. Operating force of 3.5 pounds
3. 1/64-inch maximum pretravel
4. 7/32-inch minimum overtravel
5. 0.0004- to 0.002-inch differential travel
6. 2-inch minimum diameter actuator

Where pedestrian push button is attached to a pole, shape housing to fit the pole curvature and secure. Include saddles to make a neat fit if needed.

Where a pedestrian push button is mounted on top of a 2-1/2-inch diameter post, fit housing with a slip-fitter and use screws for securing rigidly to post.

Pedestrian push button signs must be porcelain enameled metal or structural plastic.

Install push button and sign on crosswalk side of pole.

Point arrows on push button signs in the same direction as the corresponding crosswalk.

Attach sign on Type B push button assembly.

For Type C pedestrian push button assembly, mount instruction sign on the same standard as the push button assembly, using 2 straps and saddle brackets. Straps and saddle brackets must be corrosion-resisting chromium nickel steel and comply with ASTM A 167, Type 302B. Theft-proof bolts must be stainless steel with a chromium content of at least 17 percent and a nickel content of at least 8 percent.

86-6 LIGHTING

86-6.01 HIGH PRESSURE SODIUM LUMINAIRES

High pressure sodium luminaires must be the enclosed cutoff type.

Housing must be manufactured from aluminum. Painted or powder-coated housing must withstand a 1,000-hour salt spray test as specified in ASTM B 117.

Other metal parts must be corrosion resistant.

Each housing must include a slip-fitter that can be mounted on a 2-inch pipe tenon and can be adjusted 5 degrees from the axis of the tenon. Clamping brackets of slip-fitter must not bottom out on housing bosses when adjusted within the ±5 degree range.

The slip-fitter mounting bracket must not permanently set in excess of 0.020-inch when the 3/8-inch diameter cap screw used for mounting is tightened to 10 foot-pounds.

Luminaire to be mounted horizontally on mast arm, when tested as specified in California Test 611, must be capable of withstanding cyclic loading for a minimum of 2 million cycles without failure of any luminaire parts as follows:

Cyclic Loading

Plane	Internal Ballast	Minimum Peak Acceleration Level[a]
Vertical	Removed	3.0 G peak-to-peak sinusoidal loading (same as 1.5 G peak)
Horizontal[b]	Installed	1.5 G peak-to-peak sinusoidal loading (same as 0.75 G peak)
Vertical	Installed	1.0 G peak-to-peak sinusoidal loading (same as 0.5 G peak)

[a]G = Acceleration of gravity

[b]Perpendicular to direction of mast arm

If a photoelectric unit receptacle is included, a raintight shorting cap must be installed. If luminaire housing has a hole for the receptacle, hole must be permanently closed, covered, and sealed with weatherproof material.

Optical system must be in a sealed chamber and include:

1. Reflector shaped so that a minimum of light is reflected through the arc tube of the lamp. Reflector surface must be specular and protected by either an anodized finish or a silicate film on its specular surface.
2. Refractor or lens mounted in a door frame that is hinged to the housing and secured with a spring-loaded latch. Refractor must be made of glass or polycarbonate plastic. Lens must be made of heat- and impact-resistant glass.
3. Lamp socket that is a porcelain enclosed mogul-multiple type. Shell must include integral lamp grips to assure electrical contact under conditions of normal vibration. Socket must be mounted in the luminaire to allow presetting a variety of specified light distribution patterns. Socket must be rated for 1,500 W and 600 V(ac), and a 4 kV pulse.
4. Lamp.

Sealing must be provided by a gasket between the reflector and:

1. Refractor or lens
2. Lamp socket

Chamber must allow for filtered flow of air in and out of the chamber from lamp heat. Filtering must be accomplished by either a separate filter or a filtering gasket.

If components are mounted on a down-opening door, door must be hinged and secured to luminaire housing separately from refractor or flat lens frame. Door must be easily removable and replaceable, and secured to housing to prevent accidental opening when refractor or flat lens frame is opened.

Field wires connected to luminaire must terminate on a barrier-type terminal block secured to the housing. Terminal screws must be captive and equipped with wire grips for conductors up to No. 6. Each terminal positions must be clearly identified.

Minimum light distribution for each luminaire must meet the isolux diagrams.

Maximum brightness of each cutoff luminaire, with the lamp indicated, must be as follows:

Cutoff Type

Lamp ANSI Code No.	Lamp Wattage	Maximum Brightness foot-lamberts
S55	150	40
S66	200	40
S50	250	50
S67	310	60
S51	400	75

Brightness readings will be taken using a brightness meter with an acceptance angle of 1.5 degrees. When measured on the 90-degree and 270-degree lateral angle line, maximum brightness must not exceed above specified brightness when meter is located at a horizontal distance of 120 feet and a vertical distance of 7.5 feet between luminaire and meter, or at an angle of 3 degrees 35 minutes from the horizontal to the line between luminaire and meter. Measurements must be made from 90-degree line and 270-degree line, and averaged. Lamp used for each test must operate at wattage necessary to produce the following light output:

Light Output

Lamp Wattage	Lumens
150	16,000
200	22,000
250	27,000
310	37,000
400	50,000

86-6.01A High Pressure Sodium Lamp Ballasts

Each ballast must:

1. Operate the lamp for its rated characteristics and wattage
2. Continuously operate at ambient air temperatures from -20 °C to 25 °C without reduction in ballast life
3. Operate for at least 180 cycles of 12 hours on and 12 hours off, with the lamp circuit in an open or short-circuited condition and without measurable reduction in operating requirements
4. Have a design life of not less than 60,000 hours
5. Provide proper starting and operating waveforms, voltage, and current
6. Provide reliable lamp starting and operation at ambient temperature down to -20 °C for the rated life of lamp

Ballast must be tested as specified in ANSI C82.6-1980, "Methods of Measurement of High-Intensity-Discharge Lamp Ballasts."

Starting aids for ballast of a given lamp wattage must be interchangeable between ballasts of same wattage and manufacturer, without adjustment.

Each integral ballast must consist of separate components that can be easily replaced. An encapsulated starting aid will be counted as a single component. Each component must include screw terminals, NEMA tab connectors, or a single multi-circuit connector. Conductors and terminals must be identified.

Mount heat-generating component so as to use the portion of the luminaire it is mounted to as a heat sink. Place capacitor a maximum practicable distance from heat-generating components or thermally shield to limit the case temperature to 75 °C.

Transformer and inductor must be resin-impregnated for protection against moisture. Capacitors, except those in starting aids, must be metal cased and hermetically sealed.

The Department will test high-pressure sodium lamp ballast. High-pressure sodium lamp ballast must have a characteristic curve that will intersect both of the lamp-voltage limit lines between the wattage limit lines and remain between the wattage limit lines throughout the full range of lamp voltage. This requirement must be met at the rated input voltage of the ballast and at the lowest and highest rated input voltage of the ballast.

Throughout the lifetime of the lamp, ballast curve must fall within the specified limits of the lamp voltage and wattage.

Ballast for luminaires must be located in the luminaire housing.

86-6.01A(1) Regulator Type Ballasts

Regulator type ballast must comply with the following:

1. For nominal input voltage and lamp voltage, ballast design center must not vary more than 7.5 percent from rated lamp wattage.
2. Ballast must be designed for a capacitance variance of ±6 percent that will not cause more than ±8 percent variation in lamp wattage regulation during rated lamp life.
3. Lamp current crest factor must not exceed 1.8 for input voltage variation of ±10 percent at any lamp voltage during lamp life.

Regulator-type ballast must be one of the following:

Regulator-Type Ballast

Ballast Type	Power Factor	Lamp Regulation
Lag-type[a]	Not less than 90 percent throughout the life of lamp when ballast is operated at nominal line voltage with a nominally-rated reference lamp	Lamp wattage regulation spread does not vary by more than 18 percent for ±10 percent input voltage variation from nominal through life
Lead-type[b]	Not less than 90 percent throughout the life of lamp when ballast is operated at nominal line voltage with a nominally-rated reference lamp	Lamp wattage regulation spread does not vary by more than 30 percent for ±10 percent input voltage variation from nominal through life

[a]Primary and secondary windings must be electrically isolated
[b]Constant wattage autoregulator (CWA)

86-6.01A(2) Nonregulator Type Ballasts

Each nonregulator type ballast must comply with the following:

1. For nominal input voltage and lamp voltage, ballast design center must not vary more than 7.5 percent from rated lamp wattage.
2. Lamp current crest factor must not exceed 1.8 for input voltage variation of ±5 percent at any lamp voltage during lamp life.

Nonregulator-Type Ballast

Ballast Type	Power Factor	Lamp Regulation
Autotransformer or High-Reactance	Not less than 90 percent throughout the life of lamp when ballast is operated at nominal line voltage with a nominally-rated reference lamp	Lamp wattage regulation spread does not vary by more than 25 percent for ±5 percent input voltage variation from nominal through life

86-6.01B High Pressure Sodium Lamps

High pressure sodium lamps must comply with ANSI C 78.42, "High Pressure Sodium Lamps," when tested as specified in ANSI C 78.389, "American National Standard for Electric Lamps - High Intensity Discharge-Methods of Measuring Characteristics." High pressure sodium lamps must have a minimum average rated life of 24,000 hours.

86-6.02 LOW PRESSURE SODIUM LUMINAIRES

Each low pressure sodium luminaire must be completely assembled with a lamp and ballast, and must:

1. Be the enclosed type, either semi-cutoff or cutoff type.
2. Include housing, reflector, refractor or lens, lamp socket, integral ballast, removable ballast tray, lamp support, terminal strip, capacitor, and slip fitter. Reflector may be an integral part of the housing.

Luminaire housing must be minimum 1/16-inch thick, corrosion resistant die cast aluminum sheet and plate with concealed continuous welds, or minimum nominal wall thickness of 3/32-thick acrylonitrile-butadiene-styrene sheet material, on a cast aluminum frame that provides mounting for all electrical components and slip fitter.

Housing must be divided into optical and power compartments that are individually accessible for service and maintenance. Position and clamp luminaire to pipe tenon by tightening mounting bolts.

Painted exterior surface of luminaire must be finished with a fused coating of electrostatically applied polyester powder paint or other ultraviolet inhibiting film. Color must be aluminum gray.

High temperature neoprene, or equal, sealing ring must be installed in pipe tenon opening to prevent entry of water and insects into power and optical compartments.

Access to power unit assembly must be through a weathertight hinged cover, secured with spring type latches or captive screws, to luminaire housing.

Hardware must be stainless steel or cadmium plated. Use machine screws or bolts to secure removable components. Do not use sheet metal screws.

Semi-cutoff luminaires and molded refractor style cutoff luminaires must include a refractor. Other cutoff luminaires must include a flat lens.

Refractor must be 1-piece injection molded polycarbonate of 3/32 inch minimum thickness, or 1-piece injection molded acrylic of 1/8 inch minimum thickness. Flat lens must be 1-piece polycarbonate of 3/32 inch minimum thickness, mounted to metal frame. Refractor assembly and flat lens assembly must be constructed to rigidly maintain its shape, and hinged and secured with spring type latches to luminaire housing. Alternate methods of manufacturing refractor may be approved provided minimum specified thicknesses are maintained.

Lamp socket must be high temperature, flame retardant thermoset material with self-wiping contacts or equivalent. Socket must be rated for 660 W and 1,000 V(ac). Position of socket and support must maintain the lamp in correct relationship with reflector and refractor for designed distribution pattern.

Isofootcandle distribution must be ANSI Type III, short or Type IV, medium distribution, for cutoff or semi-cutoff luminaires.

With a 40-foot mounting height, each type of luminaire must maintain a minimum of 0.2 footcandle at least 60 feet each side, along the longitudinal roadway line below the luminaire, and a minimum of 0.35 footcandle at a transverse roadway distance from luminaire location equal to 1.5 times the luminaire mounting height.

Certified luminaire performance data must be provided. This data must include complete photometric test data in isofootcandle charts at a scale of 1 inch equals 20 feet, for the luminaire and lamp sizes shown on the plans.

Alternate data may be in horizontal footcandle values recorded on a 15' x 15' area extending 90 feet longitudinally each side of the light source, and 15 feet behind and 90 feet in front of the light source, for luminaire and lamp sizes, and mounting height shown on the plans. Horizontal footcandle levels in data submitted must equal or exceed levels specified. Failure to meet referenced values will be justification for rejection of the luminaires.

Photometric testing must be performed and certified by an independent and recognized testing laboratory.

Low pressure sodium lamps must:

1. Be 180 W, single-ended, bayonet base, tubular gas discharge lamp
2. Maintain a minimum of 93 percent of initial lumens during rated life and must comply with the following minimum performance requirements:

Performance Requirements

Lamp Designation	ANSI L74-RF-180
Initial Lumens	33,000 lumens
Rated Ave. Life (@ 10 hrs/Start)	18,000 hours
Operating Position	Horizontal ±20 degrees

3. Reach 80 percent of light output within 10 minutes and must restrike within 1 minute after an outage due to power interruption or voltage drop at the lamp socket
4. Identify the month and year of installation.
5. Have an autotransformer or high-reactance type ballast. The ballast must comply with the following:

    5.1. Lamp current crest factor must not exceed 1.8 at nominal line voltage
    5.2. Ballast loss must not exceed 24 percent for 180 W ballast at nominal line voltage

Autotransformer or High-Reactance Type Ballast

Ballast Type	Power Factor	Lamp Operation
Autotransformer or High-Reactance	Not less than 90 percent when ballast is operated at nominal line voltage with a nominally-rated reference lamp	Lamp wattage regulation spread does not vary by more than ±6 percent for ±10 percent input voltage variation from nominal through life

A multi-circuit connector must be included for quick disconnection of ballast tray.

86-6.03 SOFFIT AND WALL LUMINAIRES

Soffit and wall luminaire must be weatherproof and corrosion resistant.
Each flush-mounted soffit luminaire must consist of:

1. Metal body with two 1-inch minimum conduit hubs and provisions for anchoring into concrete
2. Prismatic refractor made of heat-resistant polycarbonate mounted in a door frame and clearly identified as to street side
3. Specular anodized aluminum reflector
4. Ballast located either within housing or in a ceiling pull box as shown on the plans
5. Lamp socket

The door frame assembly must be hinged, gasketed, and secured to body by at least 3 machine screws.
Each pendant soffit luminaire must be enclosed and gasketed, have an aluminum finish, and include:

1. Reflector with a specular anodized aluminum finish
2. Refractor made of heat-resistant polycarbonate
3. Optical assembly hinged and latched for lamp access and a device to prevent dropping
4. Ballast designed for operation in a raintight enclosure
5. Galvanized metal box with a gasketed cover, 2 captive screws, and 2 chains to prevent dropping and for luminaire mounting

Each wall-mounted luminaire must consist of:

1. Cast metal body
2. Prismatic refractor, made of glass, mounted in a door frame
3. Aluminum reflector with a specular anodized finish
4. Integral ballast
5. Lamp socket
6. Gasket between refractor and body
7. At least two 5/16-inch minimum diameter mounting bolts

Cast-aluminum bodies to be cast into or mounted against concrete must have a thick application of alkali-resistant bituminous paint on all surfaces to be in contact with concrete.

Each soffit luminaire and wall luminaire must include a 70 W high-pressure sodium lamp with a minimum average rated life of 24,000 hours. Each lamp socket must be positioned to locate the light center of the lamp within 1/2 inch of light center location of the luminaire design.

Ballast must comply with Section 86-6.01A, "High Pressure Sodium Lamp Ballasts." Wall luminaire ballast must be located in luminaire housing or, if shown on the plans, in a pull box adjacent to luminaire.

86-6.04 PEDESTRIAN CROSSING FIXTURES

Before starting fixture manufacturing, submit fixture design for approval. If requested, submit 1 complete prototype fixture for approval at least 30 days before manufacturing the fixtures. The prototype fixture will be returned to you, and if permitted, the fixture may be installed in the work.

Lens unit in door section must be formed of 1-1/2-inch methyl methacrylate rod cut and fire-glazed for a clear finish or a cast unit with equivalent tolerances and finish.

Lens must be secured to door section with an extruded lens retainer of 6063-T5 aluminum alloy that fits the lens shape. Lens retainer must fit the full length of lens on both sides. Continuous lens retainer for the full length of 3 lenses is allowed. Z bars of 5052-H32 or 5005-H14 aluminum alloy, 1/16 inch minimum thickness may be substituted for extruded lens retainer.

A captive positive-keyed screw-type latching device requiring a special socket wrench must be installed at upper edge to secure door in the closed position as shown on the plans. Furnish 2 special wrenches to the Engineer.

Each fixture must include a F48T12/CW rapid start fluorescent lamp with recessed, double contact base installed on back side of door directly behind lens.

Each lampholder must be UL listed for outdoor use without an enclosure and with 1,500 mA rapid start fluorescent lamp. Lampholder must be spring-loaded type.

For each lamp, the distance from face of lampholder to the lamp must be designed to provide a compression of at least 0.10-inch on the spring-type lampholder when lamp is in place. Lamp must have positive mechanical and electrical contact when lamp is in place. Socket on spring-type lampholder must have enough travel to allow lamp installation. Spring must not be a part of current-carrying circuit.

Ballast must be high-power-factor type with weatherproof leads for operation of one 48-inch rapid-start lamp. Ballast must be UL listed for outdoor operation on 110 to 125 V(ac) 60 Hz circuit and rated at 1,500 mA.

Conductors from ballast leads to lampholder must be minimum size of No. 16, stranded, and UL-listed copper AWM. Splicing of lampholder conductors to ballast leads must be performed by using mechanically secure connectors.

Conductors in fixture except ballast leads and entrance line conductors, must be UL-listed AWM.

Provide sufficient slack in the conductors to allow the fixture door to fully open.

Circuit conductors entering the fixture must be terminated on molded phenolic barrier-type terminal blocks rated at 15 A and 600 V(ac) and must have integral-type white waterproof-marking strips. Current-carrying parts of terminal blocks must be insulated from fixture with integral plugs or strips to provide protection from line-to-ground flashover voltage. Terminal blocks must be attached to wireway cover in top section. If you use sectionalized terminal blocks, each section must include an integral barrier on each side and be capable of rigid mounting and alignment.

Exposed surfaces of fixture must be uniform in appearance and free from significant defects, including improper fit, dents, deep scratches and abrasions, burrs, roughness, off-square ends, holes off-center or jagged, and surface irregularities. Screws for attaching components to fixture door, including Z bars, ballasts, and terminal block, must be tapped into door from the inside only. Screwheads, nuts, or other fasteners must not be removable from the outside.

86-6.04A Pedestrian Undercrossing Fixtures

Fixture shell must be cast aluminum alloy, industrial type or Federal Class 18 aluminum of 1/4 inch minimum thickness.

Door must be 1 piece of 6061-T6 aluminum alloy of 1/8 inch minimum thickness.

Continuous piano hinge must be Type 1100 aluminum alloy. The piano hinge must be welded or riveted to door section with 1/8 inch aluminum rivets. Matching holes must be drilled in the hinge and lower edge of fixture. After shell is in place, door assembly must be attached by minimum 3/8-inch No. 8 stainless steel self-tapping screws.

A neoprene gasket must be attached to frame to provide a cushion between the shell and the door.

Chain or other device must be included to prevent the door, when fully opened, from coming in contact with the undercrossing wall.

Fixture must be held in place by three 3/8" x 8" anchor bolts with 2 nuts each.

Fixture surfaces in contact with concrete, and with anchor bolts and nuts must be painted with a thick application of alkali-resistant bituminous paint. Paint must comply with MIL-P-6883.

Circuit conductor entering the fixture must be terminated on 2-position terminal blocks.

Both ends of fixture must have holes for 1-inch conduit. Unused holes must be plugged with pressed metal closures.

86-6.04B Pedestrian Overcrossing Fixtures

Fixture shell must consist of:

1. Top section and a door section of extruded 6063-T5 aluminum alloy, each with a nominal 1/8 inch wall thickness
2. 2 cast-end sections of 319 aluminum alloy
3. Internal wireway cover of 505-H32 aluminum alloy

Top section and door section must be joined together on one side by a continuous hinge formed as part of the 2 extrusions and must overlay to allow locking on the other side. Hinge must be treated with a silicone grease that will prevent the entrance of water by capillary action.

Wireway cover with 3/16 inch hemmed ends up and terminal blocks and circuit conductors must be inserted before welding end sections and must provide clearance at both ends for conductors. Cover must be fastened by at least two 1/4 inch No. 4 self-threading sheet metal screws with binding head and blunt point. You may substitute blind rivets of equivalent strength.

One or more bronze sash chains or other device must be included to prevent door from opening to an extent that will damage the hinge.

Lampholder must include heat-resistant circular cross section neoprene sealing gasket, silver-coated contacts, and waterproofed lead entrance for use with a 1,500 mA rapid start fluorescent lamp.

Ballast must be at most 13-1/4 inches long.

Circuit conductors entering the fixture must be terminated on 3-position terminal blocks.

Electrical system of pedestrian overcrossing must be grounded by a No. 8 copper wire installed in conduit from fixture to fixture, from end fixture to conduit fitting on end post and from conduit fitting on end post to grounding bushing in nearest pull box.

Ground wire must be secured to inside of telescoping sleeve end casting where conductors are carried and to the inside of Type LB conduit fitting on end post by a connecting lug and a No. 8 self-threading pan screw.

Lamp, lampholder, ballast, and fixture wire, must be attached to door section. Terminal blocks must be attached to top section or wireway cover.

Three No. 10, solid copper circuit conductors must be installed between terminal blocks as part of each completed fixture.

Before shipment to job site, fixture must be completely manufactured and assembled in the shop.

86-6.05 INDUCTION SIGN LIGHTING FIXTURES

Each induction sign lighting fixture must include housing with door, reflector, refractor or lens, lamp, power coupler, high frequency generator, socket assembly, fuse block, and fuses.

Each induction sign lighting fixture must:

1. Be designed for mounting near the bottom of sign panel on an overhead sign structure.
2. Be an enclosed design and be raintight and corrosion resistant.
3. Have a minimum average rating of 60,000 hours.
4. Be for a wattage of 87 W, 120/240 V(ac).
5. Have a power factor greater than 90 percent and total harmonic distortion less than 10 percent.
6. Be UL approved for wet locations and be FCC Class A-listed.
7. Not exceed 44 pounds in weight.
8. Include the manufacturer's brand name, trademark, model number, serial number, and date of manufacture on packaged assembly. Same information must be permanently marked on the outside and inside of housing.
9. Comply with minimum horizontal footcandle requirement shown on the plans.
10. Be a maximum height of 12 inches above the top of the mounting rails.

If fixture is located so that the light center of the lamp is 55 inches in front of, 1 foot below, and centered on a 10-foot high by 20-foot wide sign panel, the ratio of maximum to minimum illuminance level on the panel must not exceed 12 to 1 in 95 percent of the points measured. Illuminance gradient must not exceed 2 to 1 and is defined as the ratio of minimum illuminance on a 1-foot square of panel to that on an adjacent 1-foot square of panel.

Each fixture must have a mounting assembly that will allow fixture to be mounted on continuous slot channels. Mounting assembly must be either cast aluminum, hot-dip galvanized steel plate, or steel plate that has been galvanized and finished with a polymeric coating system or same finish that is used for housing.

Housing must have a door designed to hold a refractor or lens, and to open without the use of special tools. Housing and door must be manufactured of sheet or cast aluminum, and have a powder coat or polyester paint finish of a gray color resembling unfinished manufacturing. Sheet aluminum must comply with ASTM B 209 or B 209M for 5052-H32 aluminum sheet. External bolts, screws, hinges, hinge pins, and door closure devices must be corrosion resistant.

Housing must include weep holes.

Door must be hinged to housing on side of fixture away from the sign panel and include 2 captive latch bolts or other latching device. Door must be designed to lock in the open position, 50 degrees minimum from the plane of the door opening, with an 85-mph 3-second-wind-gust load striking the door from either side.

Door and housing must be gasketed to be raintight and dusttight. Thickness of gasket must be 1/4 inch, minimum.

Fixture height must be less than 12 inches above the top of mounting rails.

Reflector must be 1 piece, made from specularly finished aluminum protected with an electrochemically applied anodized finish or a chemically applied silicate film, and designed so deposited water due to condensation will drain away. Reflector must be secured to housing with a minimum of 2 screws and removable without removing any fixture parts. Do not attach reflectors to outside of housing.

Refractor or lens must have a smooth exterior and must be manufactured from the material as follows:

Refractor and Lens Material Requirements

Component	Manufactured From
Flat lens	Heat-resistant glass
Convex lens	Heat resistant, high-impact resistant tempered glass
Refractor	Borosilicate heat resistant glass

Refractor and convex lens must be designed or shielded so no fixture luminance is visible if fixture is approached directly from the rear and viewing level is the bottom of the fixture. If a shield is used, it must be an integral part of the door casting.

Each fixture must include an 85 W induction lamp with an interior wall that is fluorescent phosphor-coated. Light output must be at least 70 percent at 60,000 hours. Lamp must have a minimum color-rendering index of 80, be rated at a color temperature of 4,000K and be removable without the use of tools.

Lamp socket must be a porcelain enclosed mogul type with a shell that contains integral lamp grips to assure electrical contact under normal vibration conditions. Center contact must be spring-loaded. Shell and center contact must be nickel-plated brass. Socket must be rated for 1,500 W and 600 V(ac).

Power coupler must include a construction base with antenna, heat sink, and electrical connection cable, and be designed so it can be removed with common hand tools.

High frequency generator must:

1. Start and operate lamps at an ambient temperature of -25 °C or greater for the rated life of the lamp
2. Operate continuously at ambient air temperatures from -25 °C to 25 °C without reduction in generator life
3. Have a design life of at least 100,000 hours at 55 °C
4. Have an output frequency of 2.65 MHz ± 10 percent
5. Have radio frequency interference that complies with FCC Title 47, Part 18, regulations regarding harmful interference
6. Be replaceable with common hand tools
7. Mounted so the fixture can be used as a heat sink

Conductor terminal must be identified by the component terminal the conductor connects to.

Submit a copy of the high frequency generator test methods and results from the manufacturer with each lot of fixtures.

Each fixture must include a barrier-type fuse block for terminating field connections. Fuse block must:

1. Be secured to housing and be accessible without removal of any fixture parts
2. Be mounted to leave a minimum of 1/2 inch air space from sidewalls of housing
3. Be designed for easy removal of fuses with a fuse puller, be rated at 600 V(ac), and have box terminals.

Fuses must be 13/32-inch diameter, 1-1/2 inch long ferrule type and UL or NRTL listed. For 120 V(ac) input fixture, only the ungrounded conductor must be fused and there must be a solid link between the neutral and the high frequency generator.

If shown on the plans, include a wire guard to prevent damage to the refractor or lens. Guard must be constructed of 1/4-inch minimum diameter galvanized steel wire, and either hot-dip galvanized or electroplated-zinc coated as specified in ASTM B 633, Service Condition SC4 with a clear chromate dip treatment. Guard elements must be spaced to prevent rocks larger than 1-1/2-inch diameter from passing through.

86-6.06 SIGN LIGHTING FIXTURES FOR FLASHING BEACON

Sign lighting fixture must:

1. Be UL or NRTL listed for outdoor installation

2. Include a hood with side outlet tapped for conduit, a symmetrical 10-inch steel reflector with a white porcelain-enamel finish, and a medium base socket
3. Be rated at 150 W minimum

86-6.07 INTERNALLY ILLUMINATED STREET NAME SIGNS

Sign fixture must be:

1. Designed and constructed to prevent deformation or failure when subjected to an 85 mph 3-second-wind-gust load as specified in AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaires and Traffic Signals," and its interim revisions
2. Manufactured from all new material and all ferrous parts must be galvanized or cadmium-plated
3. Type A or B signs

Top and bottom must be formed or extruded aluminum and must be attached to formed or cast aluminum end fittings. Housing must be designed for continuous sealing between top and bottom assemblies, and end fittings, and be constructed to resist torsional twist and warp. Opening or removing 1 panel must allow access to the interior of the sign for lamp, ballast, and fuse replacement.

Photoelectric unit sockets are not allowed.

For Type A sign, both sides must be hinged at the top to allow installation or removal of sign panel, and to allow access to interior of sign.

For Type B sign, sign panel must be slide-mounted into housing.

Reflectors may be used to obtain required sign brightness. Reflectors must be formed aluminum with acrylic baked white enamel surface having a minimum reflectance of 0.85.

Sign panel must be slide-mounted or rigid-mounted in a frame, with white legend, symbols, arrows, and border on each face. Background must be green.

Sign panels surface must be evenly illuminated. Average of brightness readings for letters must be 150 foot-lamberts, minimum. Light transmission factor of sign panel must provide a letter to background brightness ratio between 10 to 1 and 20 to 1. Background luminance must not vary by more than 40 percent from the average background brightness reading. Luminance of letters, symbols, and arrows must not vary by more than 20 percent from their average brightness readings.

Sign panels must be translucent, high impact, resistant plastic panels of one of the following:

1. Glass fiber reinforced acrylated resin
2. Polycarbonate resin
3. Cellulose acetate butyrate plastic

Paint on the outside of plastic must be protected by a plastic film that seals the front surface of panel and filters out ultraviolet radiation. Paint must be acrylic plastic type.

Surface must be free of blemishes in the plastic or coating that may impair the serviceability or detract from the general appearance and color matching of sign.

White or green color must not fade or darken when sign is exposed to an accelerated test of ultraviolet light equivalent to 2 years of outdoor exposure. Green color of sign, when not illuminated, must match Color No. 14109 of Federal Standard 595B.

Sign panel must not crack or shatter when a 1-inch diameter, steel ball with a weight of 2.4 ounces is dropped from a height of 8.5 feet above the sign panel to any point of sign panel. For this test, sign panel must be lying in a horizontal position and supported within its frame.

For Type A sign, gasket must be installed between sign panel frame and fixture housing to prevent water entry between frame and fixture housing. Gasket must be uniform and even-textured, and be the closed-cell, sponge-neoprene type, designed for use at temperatures between -20 °C and +74 °C.

Gasket must be neatly applied to thoroughly degreased, clean surface with a suitable heat-resistant adhesive that will not allow the gasket to slip at temperatures between -20 °C and +74 °C.

Ballast must be high power factor type and capable of starting the lamp at -20 °C and above.

Ballast for Type A sign must be rated at 200 mA. Ballasts for Type B sign must be rated at 430 mA. Ballast must be UL or NRTL listed for operation on 110 to 125 V(ac), 60 Hz circuits, and comply with ANSI C 82.1 and ANSI C 82.2.

Lampholder must be UL or NRTL listed for outdoor use and of the spring-loaded type. Lampholder must have silver-coated contacts and waterproofed entrance leads for use with a rapid-start fluorescent lamp. Removal of lamp from socket must de-energize the primary of ballast. Each lampholder must include heat-resistant, circular cross

section, partially-recessed neoprene ring to seal against lamp ends and protect electrical contacts from moisture, dirt or other injurious elements.

Distance between face of lampholders must be designed to provide compression of at least 0.10 inch on the spring-type lampholder when lamp is in place. Lamp must have positive mechanical and electrical contact when lamp is in place. Socket on spring-type lampholder must have sufficient travel to allow lamp installation. Spring must not be a part of current carrying circuit. Lampholder must match lamp requirements and must not increase cathode filament circuit resistance by more than 0.10 Ω.

Lamp must comply with ANSI C 78.

Wiring connections in fixture must be terminated on molded, phenolic, barrier-type, terminal blocks rated at 15 A, 1,000 V(ac), and must have integral-type white waterproof-marking strips. Current carrying parts of terminal blocks must be insulated from fixture with integral plugs or strips to provide protection from line-to-ground flashover voltage. If you choose to use sectionalized terminal blocks, each section must include an integral barrier on each side and be capable of rigid mounting and alignment. Terminal screws must be No. 10, minimum.

Fuses must be Type 3AG, miniature, slow-blowing type with appropriate current and voltage ratings.

Fuseholder must be a panel-mounting type with threaded or bayonet-type knob that grips the fuse tightly for extraction. Use a separate fuse for each ballast.

Screened weep holes must be constructed at strategic locations in members subject to moisture collection.

Fasteners, screws, and hardware must be passive stainless steel, Type 302 or 304, or aluminum Type 6060-T6.

Top of fixture housing must have 2 free-swinging mounting brackets. Each bracket must be adjustable vertically for leveling the sign to either a straight or curved mast arm. Bracket assembly must allow fixture to swing perpendicular to the sign panel.

Hinge pins for the free-swinging brackets must have a minimum diameter of 1/4 inch.

Message, as shown on the plans, must be displayed on both sign panels.

If not shown on the plans, the message and the size of symbols or arrows will be given by the Engineer at your request. Letters must be 8-inch upper case and 6-inch lower case, Series E.

Fixture conductors must be UL- or NRTL-listed AWM stranded copper wire with 28 mils, minimum, thermoplastic insulation, rated at 1,000 V(ac) and rated for use at 90 °C. Conductors must be No. 16 minimum and must match color coding of ballast leads.

Conductors within the fixture must be secured with easily removable spring cross straps, not clamped, in the chassis or fixture. Straps must be installed 12 inches apart or less.

Stranded copper conductors connected to screw-type terminals must terminate in approved crimp-type ring connectors.

Splices are not allowed within fixture.

Submit shop drawings showing the message for each sign, including size of letters, symbols or arrows, as shown on the plans. If requested, you must supply, without cost to the State, sufficient samples of materials to be used in the manufacturing of the sign or a complete sign assembly, to allow adequate testing and evaluation of compliance to specified requirements.

86-6.08 PHOTOELECTRIC CONTROLS

Photoelectric controls must be capable of directly switching multiple lighting systems.

86-6.08A Types

Photoelectric control type must comply with the following:

Photoelectric Control Types

Type I	Includes a remote photoelectric unit and a test switch housed in an enclosure.
Type II	Includes a remote photoelectric unit, a separate contactor located in a service equipment enclosure, and a test switch located in service equipment enclosure.
Type III	Includes a remote photoelectric unit, a separate contactor, and a test switch housed in an enclosure.
Type IV	Includes a photoelectric unit that plugs into an EEI-NEMA twist-lock receptacle integral with the luminaire.
Type V	Includes a photoelectric unit, contactor, and test switch located in service equipment enclosure.

A switch to allow manual operation of lighting circuit must be included for each Type I, Type II, Type III, and Type V photoelectric control. Switches must be single-hole mounting toggle type, single-pole, single-throw, rated at 12 A with a voltage rating that matches the circuit. Switches must have an indicating nameplate reading "Auto-

Test" and be connected in parallel with the load contacts of the photoelectric unit. Test switches must not have an "OFF" position.

Photoelectric unit for Types I, II, and III photoelectric controls, must be pole-top mounted.

86-6.08B Equipment Details

86-6.08B(1) Photoelectric Unit

Photoelectric unit must:

1. Have an output in response to changing light levels. Response level must remain stable throughout life of control unit.
2. Have a "turn-on" between 1 and 5 footcandles, and a "turn-off" between 1.5 and 5 times "turn-on." Measurements must be made by procedures in EEI-NEMA standards for physical and electrical interchangeability of light-sensitive control devices used in the control of roadway lighting.
3. Have a EEI-NEMA type receptacle. Mounting brackets must be used where pole-top mounting is not possible. Photoelectric controls must be installed at locations show on the plans and oriented.
4. Be screened to prevent artificial light from causing cycling.
5. Have a supply voltage rating of 60 Hz, 105-130 V(ac), 210-240 V(ac), or 105-240 V(ac), as specified.
6. Have a load rating of 800 W minimum, incandescent, high intensity discharge, or fluorescent.
7. Operate at a temperature range of -20 °C to 55 °C.
8. Have a power consumption less than 10 W.
9. Be housed in a weatherproof enclosure.
10. Have a base with a 3-prong, EEI-NEMA standard, twist-lock plug mounting.
11. Have a "fail-on" feature.

Unit components must not require periodic replacement.

Photoelectric controls, except Type IV and Type V, must include a 4-inch minimum inside diameter, pole-top mounting adaptor containing a terminal block, and cable supports or clamps to support pole wires.

For switching 480 V(ac), 60 Hz circuits, a 100 VA, minimum, 480/120 V(ac) transformer must be installed in the contactor enclosure to allow 120 V(ac) for the photoelectric control unit. If more than 1 photoelectric unit is to be installed at a location, a single transformer with a volt-ampere rating capable of handling the total controlled load, may be used.

86-6.08B(2) Contactor

Contactor must:

1. Have contacts rated to switch the specified lighting load
2. Be normally open
3. Be the mechanical armature type with contacts of fine silver, silver alloy, or superior alternative material

86-6.08B(3) Enclosure

Enclosure for Type I and Type III photoelectric controls must be NEMA 3R. Enclosure must be supplied with a factory-applied rust-resistant prime coat and finish coat. Two applications of paint to match the color of the standard must be applied as specified in Section 86-2.16, "Painting." Enclosure may be hot-dip galvanized instead of painting. A minimum of 2-1/2 inches must be provided between contactor terminals and end of enclosure for wiring connections. Enclosure must be mounted on the same standard as the photoelectric unit at a height of about 6 feet above finished grade.

86-6.08B(4) Terminal Blocks

Terminal blocks must be rated at 25 A, 600 V(ac), molded from phenolic or nylon material, and of the barrier type with plated-brass screw terminals and integral-type marking strips.

86-6.09 TRANSFORMERS

Multiple-to-multiple transformers must be single-phase dry type designed for operation on a 60 Hz supply.

86-6.09A Electrical Requirements

Transformers must have a decal showing a connection diagram. Diagram must show either color-coding or wire-tagging with primary (H1, H2) or secondary (X1, X2) markers, and the primary and secondary voltage and volt-ampere rating. Transformers must comply with the following:

Transformer Electrical Requirements

Transformer Characteristic	Multiple-to-Multiple Unit
Rating	120/480 V(ac), 240/480 V(ac), or 480/120 V(ac)
Efficiency	Exceed 95 percent
Secondary Voltage Regulation and Tolerance	±3 percent from half load to full load

Secondary 480 V(ac) windings must be center-tapped.

86-6.09B Physical Requirements

External leads for multiple-to-multiple secondary connections must be Type USE, No. 10, rated 600 V(ac).

Transformer leads must extend a minimum of 12 inches from the case.

Transformer insulation must be NEMA 185 C or better.

Multiple-to-multiple transformers must withstand the application of 2,200 V(ac) from core to coils and from coil to coil for a 1-minute period.

The above tests must be made immediately after operation of transformer at full load for 24 hours.

Non-submersible transformers must include metal half-shell coil protection, have moisture resistant synthetic varnish impregnated windings, and be suitable for outdoor operation in a raintight enclosure.

Each transformer to be installed in a pull box must be the submersible type and include a handle and a hanger.

86-6.09C Submersible Type Transformers

Submersible type transformers must be securely encased in a rugged corrosion resistant, watertight case and must withstand a 5-day test submerged in 2 feet of salt water, 2 percent salt by weight, with 12-hour on and off periods. The operating periods must be at full load.

Leads of submersible transformers must be brought out through one or more sealed hubs and secured to withstand a 100 pound static pull without loosening or leaking.

86-6.10 (BLANK)

86-6.11 FALSEWORK LIGHTING

86-6.11A General

Falsework lighting must include lighting to illuminate the pavement, portals, and pedestrian walkways at or under openings in the falsework required for traffic.

Lighting for pedestrian walkway illumination must be installed at all pedestrian openings through or under falsework.

Before starting falsework opening construction, you must submit a plan of proposed lighting installations for review and obtain approval. Approval will be made as specified in Section 5-1.02, "Plans and Working Drawings."

You must design falsework lighting so that required maintenance can be performed with a minimum of inconvenience to public traffic. Closing of traffic lanes for routine maintenance will not be permitted on roadways with posted speed limits greater than 25 mph.

Pavement under falsework with portals less than 150 feet apart and falsework portals must be illuminated only during the hours of darkness as defined in Division 1, Section 280, of the California Vehicle Code. Photoelectric switches must be used to control falsework lighting systems. Pavement under falsework with portals 150 feet or more apart and all pedestrian openings through falsework must be illuminated 24 hours per day.

Lighting fixtures must be aimed to avoid glare to oncoming motorists.

Type NMC cable with No. 12 minimum conductors, with ground wire, must be used. Fasten cable to supporting structure at sufficient intervals to adequately support cable and within 12 inches from every box or fitting. Conductors within 8 feet of ground must be enclosed in a 1/2 inch or larger metal conduit.

Each illumination system must be on a minimum of 1 separate branch circuit at each bridge location. Each branch circuit must be fused, not to exceed 20 A.

For falsework lighting, you must arrange with the serving utility to complete service connections. You must pay for energy, line extension, service, and service hookup costs.

At completion of project or when ordered by the Engineer, falsework lighting equipment will become your property and you must remove it from the job site.

You may propose a lighting plan that fulfills light intensity requirements to the systems specified herein. You must supply sufficient data to allow evaluation of alternative methods.

86-6.11B Pavement Illumination

Illumination of pavement at vehicular openings through falsework must comply with the following:

1. Fixture must include R/FL commercial type floodlamp holder with protective covers.
2. Fixture must be fully adjustable with brackets and locking screws, and allow mounting directly to a standard metal junction box.
3. Lamp must be medium-base 120 V(ac), 120 W, minimum, PAR-38 quartz-halogen floodlamp.
4. A continuous row of fixture types required must be installed at locations and spacing specified. Fixtures must be installed beneath falsework structure, with the end fixtures not further than 10 feet inside portal faces. Fixtures must be installed and energized immediately after the members supporting them have been erected.
5. Fixtures along the sides of the opening must be placed not more than 4 feet behind or 2 feet in front of the roadway face of the temporary railing. Mounting heights of fixtures must be between 12 and 16 feet above the roadway surface and must present an unobstructed light pattern on the pavement.

86-6.11C Portal Illumination

Illumination of falsework portals must comply with the following:

1. On each side of each entrance portal, plywood sheet clearance guides, 4 feet wide by 8 feet high, must be fastened vertically, facing traffic, with the bottom of the panel 3 feet to 4 feet above the roadway. The center of the panel must be located approximately 3 feet horizontally behind the roadway face of the railing. Panels must be freshly painted for each installation with not less than 2 applications of flat white paint. Paint testing will not be required.
2. If ordered by the Engineer, in order to improve the general appearance of the painted surfaces, you must repaint designated areas and that painting will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."
3. Falsework portals must be illuminated on the side facing traffic with 150 W, minimum, PAR reflector floodlamps mounted on the structure directly over each vertical support adjacent to the traveled way, as needed to uniformly illuminate the exterior falsework beam, the clearance guides, and the overhead clearance sign. Each lamp must be supported approximately 16 feet above the pavement and approximately 6 feet in front of the portal face.
4. Portal lighting and clearance guides must be installed on the day that vertical members are erected.

86-6.11D Pedestrian Walkway Illumination

Illumination of pedestrian openings through or under falsework must comply with the following:

1. Fixtures must be flush-mounted in the overhead protection shield and equipped with a damage-resistant clear polycarbonate diffuser lens. Lamps must be standard incandescent 100 W, 120 V(ac).
2. Fixtures must be centered over the passageway at intervals of not more than 15 feet with the end fixtures not more than 7 feet inside the end of the pedestrian openings.
3. Pedestrian passageway light systems must be installed immediately after the overhead protection shield is erected.

86-7 REMOVING, REINSTALLING OR SALVAGING ELECTRICAL EQUIPMENT

86-7.01 REMOVING ELECTRICAL EQUIPMENT

Existing electrical equipment, pull boxes, and conduits, to be removed and not reused or salvaged, become your property and you must dispose of it under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way." Unused underground conduit may be abandoned in place after all conductors have been removed, except that conduit terminations from conduit to be abandoned must be removed from pull boxes to remain.

Exercise care in salvaging equipment so that it will not be damaged or destroyed. Mast arms must be removed from standards. Luminaires, signal heads, and signal mounting assemblies must be removed from standards and mast arms.

Holes resulting from removing pull boxes must be filled with material equivalent to the surrounding material.

86-7.02 REINSTALLING REMOVED ELECTRICAL EQUIPMENT

If removed electrical equipment is to be reinstalled, you must supply all necessary materials and equipment, including signal mounting assemblies, anchor bolts, nuts, washers, and concrete as required to complete the new installation.

Luminaires to be reinstalled must be cleaned and relamped.

Existing materials required to be reused and found to be unsatisfactory by the Engineer must be replaced with new material and the replacement cost will be paid for as extra work as specified in Section 4-1.03D, "Extra Work."

86-8 PAYMENT

86-8.01 PAYMENT

The contract lump sum price or prices paid for signal, ramp metering, flashing beacon, lighting, sign illumination, traffic monitoring station, highway advisory radio systems, closed circuit television systems, or combinations thereof; for modifying or removing those systems; for temporary systems; or the lump sum or unit prices paid for various units of those systems; or the lump sum or per foot price paid for conduit of the various sizes, types, and installation methods listed in the Engineer's Estimate include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and installing, modifying, or removing the systems, combinations or units thereof, including any necessary pull boxes (except if the type required is shown as a separate contract item); excavation and backfill; concrete foundations (except if shown as a separate contract item); pedestrian barricades; furnishing and installing illuminated street name signs; installing sign panels on pedestrian barricades, on flashing beacon standards, and on traffic signal mast arms; restoring sidewalk, pavement and appurtenances damaged or destroyed during construction; salvaging existing materials; and making all required tests, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

If poles for electrical systems are manufactured from a source located more than 300 air-line miles from Sacramento and Los Angeles, the Department will deduct $5,000 for inspection costs for each inspection site. If poles for electrical systems are manufactured from a source located more than 3,000 air-line miles from Sacramento and Los Angeles, the Department will deduct $8,000 for inspection costs for each inspection site.

Full compensation for all additional materials and labor, not shown on the plans or specified, that are necessary to complete the installation of the various systems, is included in the prices paid for the systems, or units thereof, except as provided in Section 86-1.06, "Maintaining Existing and Temporary Electrical Systems," and no additional compensation will be allowed therefor.

If shown as a contract item, the contract price paid per foot for cast-in-drilled-hole concrete pile (signal foundation) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing reinforced concrete pile foundations of the size shown on the Engineer's Estimate, including drilling holes, disposing of the material resulting from drilling holes, furnishing and placing anchor bolt assemblies and reinforcing steel, complete in place, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

If shown as a contract item, non-reinforced PCC foundations will be measured and paid for by the cubic yard for foundation concrete in the same manner as specified for minor concrete (minor structure) in Section 51, "Concrete Structures."

If shown as a separate contract item by the lump sum or per foot, interconnection conduit and cable includes all interconnection conductors, and conduit and pull boxes containing interconnection cable and no other conductors. The quantity of interconnection conduit and cable to be paid for by the foot is the length of that conduit. Compensation for conduit containing interconnection cable and other conductors is included in the contract price paid for the item requiring the other conductors.

Full compensation for furnishing, installing, maintaining, and removing falsework lighting equipment is included in the contract prices paid for the items of work involved in the structure that requires the falsework lighting and no additional compensation will be allowed therefor.

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SECTION 88 ENGINEERING FABRICS
(Issued 01-20-12)

Replace Section 88 with:

SECTION 88 GEOSYNTHETICS

88-1.01 GENERAL

88-1.01A Summary

Section 88 includes specifications for geosynthetics. Geosynthetics are used for:

1. Filtration
2. Drainage
3. Reinforcement
4. Water pollution control
5. Channel and shore protection
6. Pavement interlayer
7. Separation and stabilization

88-1.01B Submittals

Submit:

1. Certificate of Compliance under Section 6-1.07, "Certificates of Compliance"
2. Samples representing each lot
3. Minimum average roll values (MARV)

Label submittals with the manufacturer's name and product information.

88-1.01C Quality Control and Assurance

Treat geosynthetics to resist degradation from exposure to sunlight. Using covers, protect geosynthetics from moisture, sunlight, and shipping and storage damage.

88-1.02 FILTRATION

88-1.02A Filter Fabric

Geosynthetics used for filter fabric must be permeable and nonwoven. Filter fabric must consist of 1 of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Filter fabric must comply with:

Filter Fabric

Property	ASTM	Specification		
		Class A	Class B	Class C
Grab breaking load, 1-inch grip, lb minimum in each direction	D 4632	157		
Apparent elongation, percent minimum in each direction	D 4632	50		
Puncture strength, lb minimum	D 6241	600		
Ultraviolet resistance, percent minimum retained grab breaking load, 500 hr	D 4355	70		
Permittivity, sec^{-1} minimum	D 4491	0.5	0.2	0.1
Apparent opening size, average roll value, U.S. Standard sieve size maximum	D 4751	40	60	70

88-1.03 DRAINAGE

88-1.03A Geocomposite Wall Drain

Geocomposite wall drain must consist of a polymeric core with filter fabric integrally bonded to 1 or both sides of the core creating a stable drainage void.

Filter fabric must comply with Section 88-1.02, "Filtration."

Geocomposite wall drain must comply with:

Geocomposite Wall Drain

Property	ASTM	Specification
Thickness with fabric, inches maximum	--	2
Transmissivity, gradient = 1.0, normal stress = 5,000 psf, gal/min/ft	D 4716	4

88-1.04 REINFORCEMENT

88-1.04A Geotechnical Subsurface Reinforcement

General

Geosynthetic used for geotechnical subsurface reinforcement must be either of the following:

1. Geotextile
2. Geogrid

Geotextile permittivity must be at least 0.05 sec^{-1} determined under ASTM D 4491.

Geogrid must have a regular and defined open area. The open area must be from 50 to 90 percent of the total grid area.

Long Term Design Strength

Long Term Design Strength (LTDS) of geosynthetic reinforcement is the ultimate tensile strength in the primary strength direction divided by reduction factors. Calculate the LTDS from the guidelines in Geosynthetic Research Institute (GRI) Standard Practice GG4a, GRI GG4b, or GRI GT7.

The product of the appropriate reduction factors must be at least 1.30. Determine the reduction factor for creep using a 75-year design life for permanent applications and a 5-year design life for temporary applications. Determine the installation damage reduction factor based on the characteristics of the backfill materials used.

If test data is not available, use default values of reduction factors in the GRI Standard Practice to calculate LTDS.

Submit the LTDS and its supporting calculations at least 15 days before placing geosynthetic reinforcement. Do not install before the Engineer's approval. The LTDS must be signed by an engineer who is registered as a civil engineer in the State.

88-1.05 WATER POLLUTION CONTROL

Geosynthetics used for water pollution control must comply with:

Water Pollution Control Geosynthetics

Property	ASTM	Application						
		Silt Fence		Sediment Filter Bag		Gravel-Filled Bags	Temporary Cover	
		Woven	Non-woven	Woven	Non-woven		Woven	Non-woven
Grab breaking load, 1-inch grip, lb minimum in each direction	D 4632	120	120	200	250	205	200	200
Apparent elongation, percent minimum, in each direction	D 4632	15	50	10	50	--	15	50
Water flow rate, gallons per minute/square foot minimum and maximum average roll value	D 4491	10 - 100	100 - 150	100 - 200	75 - 200	80 - 150	4 - 10	80 - 120
Permittivity, sec^{-1} minimum	D 4491	0.05	1.1	1.0	1.0	0.2	0.05	1.0
Apparent opening size, inches maximum average roll value	D 4751	0.023	0.012	0.023	0.012	0.016	0.023	0.012
Ultraviolet resistance, percent minimum retained grab breaking load, 500 hr.	D 4355	70	70	70	70	70	70	70

88-1.06 CHANNEL AND SHORE PROTECTION

88-1.06A Rock Slope Protection

Rock slope protection (RSP) fabric must be a permeable, nonwoven, needle-punched geotextile. RSP fabric consists of 1 of the following:

1. Polyester
2. Polypropylene
3. Combined polyester and polypropylene

Polymers must be either virgin compounds or clean reworked material. Do not subject virgin compounds to use or processing other than required for initial manufacture. Clean reworked material must be previously processed material from the processor's own production that has been reground, pelletized, or solvated. RSP fabric must not consist of more than 20 percent by weight of clean reworked material. Do not use recycled materials from either post-consumer or post-industrial sources.

Class 8 or Class 10 RSP fabric must comply with:

Rock Slope Protection Fabric

Property	ASTM	Specification	
		Class 8	Class 10
Weight, oz/yd^2 minimum	D 5261	7.5	9.5
Grab breaking load, lb 1-inch grip, min. in each direction	D 4632	200	250
Apparent elongation, percent min., in each direction	D 4632	50	50
Permittivity, sec^{-1}, minimum	D 4491	1.0	0.70
Apparent opening size, U.S. Standard sieve size minimum and maximum	D 4751	70 - 100	70 - 100
Ultraviolet resistance, percent minimum retained grab breaking load, 500 hr.	D4355	70	70

88-1.07 PAVEMENT INTERLAYER

88-1.07A Paving Fabric

Geosynthetics used for paving fabric must be nonwoven. Paving fabric must comply with:

Geosynthetic Paving Fabric

Property	ASTM	Specification
Mass per unit area, oz/yd^2 minimum	D 5261	4.1
Grab breaking load, lb 1-inch grip, minimum, in each direction	D 4632	100
Apparent elongation, percent minimum in each direction	D 4632	50
Hydraulic bursting strength, psi minimum	D 3786	200
Melting point, °F minimum	D 276	325
Asphalt retention, gal/yd^2 minimum	D 6140	0.2

88-1.07B Paving Mat

Geosynthetics used for paving mat must be a nonwoven fiberglass and polyester hybrid material. Paving mat must comply with:

Geosynthetic Paving Mat

Property	ASTM	Specification
Breaking force, lb/2 inches minimum	D 5035	45
Ultimate elongation, percent maximum	D 5035	5
Mass per unit area, oz/ sq yd minimum	D 5261	3.7
Melting point, °F minimum	D 276	400
Asphalt retention, gal/yd^2 minimum	D 6140	0.10

88-1.07C Paving Grid

Geosynthetics used for paving grid must be a geopolymer material formed into a grid of integrally connected elements with openings. Paving grid must comply with:

Geosynthetic Paving Grid

Property	Test	Specification		
		Class I	Class II	Class III
Tensile strength at ultimate, lb/in [a] minimum	ASTM D 6637	560 x 1,120	560	280
Aperture size, inch minimum	Calipered	0.5	0.5	0.5
Elongation, % maximum	ASTM D 6637	12	12	12
Mass per area, oz / sqyd minimum	ASTM D 5261	16	10	5.5
Melting point, °F minimum	ASTM D 276	325	325	325

Note:
[a] For Class I, machine direction x cross direction. For Class II and Class III, both directions.

88-1.07D Paving Geocomposite Grid

Paving geocomposite grid consists of paving grid specified under Section 88-1.07C, "Paving Grid," bonded or integrated with paving fabric specified under Section 88-1.07A, "Paving Fabric."

Paving geocomposite grid must have a peel strength of at least 10 pounds per foot determined under ASTM D 413.

88-1.07E Geocomposite Strip Membrane

Geocomposite strip membrane must consist of various widths of strips manufactured from of asphaltic rubber and geosynthetics. Geocomposite strip membrane must comply with:

Geocomposite Strip Membrane

Property	ASTM	Specification
Strip tensile strength, lbs/inch minimum	D 882	50
Elongation at break, % minimum	D 882	50
Resistance to puncture, lbs. minimum	E 154	200
Permeance, perms maximum	E 96/E 96M	0.10
Pliability, 1/4 inch mandrel with sample conditioned at 25 °F	D 146	No cracks in fabric or bitumen
Melting point, °F	D 276	325

88-1.08 SEPARATION AND STABILIZATION

88-1.08A Subgrade Enhancement Geotextile

Subgrade enhancement geotextile must consist of either of the following:

1. Polyester
2. Polypropylene

Subgrade enhancement geotextile must comply with:

Subgrade Enhancement Geotextile

Property	ASTM	Specification [a]				
		Class A1	Class A2	Class B1	Class B2	Class B3
Elongation at break, %	D 4632	<50	≥50	<50	<50	≥50
Grab tensile strength, lb minimum	D4632	250	160	--	320	200
Wide width tensile strength at 5% strain, lb/ft minimum	D 4595	--	--	2,000	--	--
Wide width tensile strength at ultimate strength, lb/ft minimum	D 4595	--	--	4,800	--	--
Tear strength, lb minimum	D 4533	90	60	--	120	80
Puncture strength, lb minimum	D 6241	500	310	620	620	430
Permittivity, sec^{-1} minimum	D 4491	0.05	0.05	0.20	0.20	0.20
Apparent opening size, inches maximum	D 4751	0.012	0.012	0.024	0.012	0.012
Ultraviolet stability (retained strength after 500 hrs exposure), % minimum	D 4355	70	70	70	70	70

Notes:
[a] Specifications are based on minimum average roll value in the weaker principle direction except apparent opening size is based on maximum average roll value.

88-1.09 PAYMENT

The Department measures and pays for geosynthetics under the specifications requiring their use.

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SECTION 90 PORTLAND CEMENT CONCRETE
(Issued 08-05-11)

Replace Section 90 with:

SECTION 90 PORTLAND CEMENT CONCRETE

90-1 GENERAL

90-1.01 DESCRIPTION

Portland cement concrete shall be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.

The Contractor shall determine the mix proportions for concrete in conformance with these specifications.

Minor concrete shall contain not less than 505 pounds of cementitious material per cubic yard unless otherwise specified in these specifications or the special provisions.

Unless otherwise designated on the plans or specified in these specifications or the special provisions, the amount of cementitious material used per cubic yard of concrete in structures or portions of structures shall conform to the following:

Use	Cementitious Material Content (Pounds/CY)
Concrete designated by compressive strength:	
Deck slabs and slab spans of bridges	675 min., 800 max.
Roof sections of exposed top box culverts	675 min., 800 max.
Other portions of structures	590 min., 800 max.
Concrete not designated by compressive strength:	
Deck slabs and slab spans of bridges	675 min.
Roof sections of exposed top box culverts	675 min.
Prestressed members	675 min.
Seal courses	675 min.
Other portions of structures	590 min.
Concrete for precast members	590 min., 925 max.

Except for minor structures, the minimum required compressive strength for concrete in structures or portions of structures shall be the strength specified, or 3600 pounds per square inch at 28 days, whichever is greater.

Except for when a modulus of rupture is specified, the minimum required compressive strength for concrete shall be the strength specified, or 2,500 pounds per square inch, whichever is greater. Concrete shall be proportioned such that the concrete will attain the minimum required compressive strength.

If the specified 28-day compressive strength is 3,600 pounds per square inch or greater, the concrete is designated by compressive strength. For concrete with a 28-day compressive strength greater than 3,600 pounds per square inch, 42 days will be allowed to obtain the specified strength.

For concrete not designated by compressive strength, the Engineer may test the concrete for compressive strength. The concrete will be accepted if the compressive strength at 28 days attains 85 percent or more of the minimum required compressive strength.

Concrete shall be proportioned to conform to the following shrinkage limitations when tested in conformance with the requirements of AASHTO Designation: T 160, modified as follows:

Condition	Maximum Shrinkage of Laboratory Cast Specimens at 28 days Drying (average of 3, %)
Paving and approach slab concrete	0.050
Bridge deck concrete	0.045

Note: Shrinkage requirement is waived for concrete that is used for precast elements.

Shrinkage tests shall be either:

A. Performed by a laboratory accredited to perform AASHTO Designation: T 160, or
B. Performed by a laboratory that maintains a current rating of 3 or better for the Cement and Concrete Reference Laboratory (CCRL) concrete proficiency sample program.

Laboratory cast specimens shall have a 4" x 4" cross section. Specimens shall be removed from the molds 23 ± 1 hours after mixing the concrete and placed in lime water at 73 ± 3 °F to 7 days age. A comparator reading shall be taken at 7 days age and recorded as the initial reading. Specimens then shall be stored in a humidity controlled room maintained at 73 ± 3 °F and 50 ± 4 percent relative humidity for the remainder of the test. Subsequent readings shall be taken at 7, 14, 21, and 28 days drying.

Test data verifying conformance to the shrinkage limitations shall be submitted with the mix design. Shrinkage testing data accepted by the Engineer no more than 3 years prior to the first working day of this contract will be acceptable for this entire contract, provided the data was for concrete with similar proportions and the same materials and material sources to be used on this contract. Concrete shall be considered to have similar proportions if, when compared to concrete to be used on this project, no more than 2 mix design elements are varied. Varied mix design elements shall fall within the tolerances in the following table:

Mix Design Element	Tolerance (±)
Water to cementitious material ratio	0.03
Total water content	5 %
Coarse aggregate (weight per cubic yard)	10 %
Fine aggregate (weight per cubic yard)	10 %
Supplementary cementitious material content	5 %
Admixture (as originally dosed)	25 %

Note: Admixtures must be of the same brand.

Before using concrete or in advance of revising the mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.

Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, supplementary cementitious material (SCM) shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.

If any concrete has a cementitious material, portland cement, or SCM content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State $0.25 for each pound of cementitious material, portland cement, or SCM that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.

The requirements of the preceding paragraph shall not apply to minor concrete.

90-2 MATERIALS

90-2.01 CEMENTITIOUS MATERIALS

Unless otherwise specified, cementitious material shall be either a combination of Type II or Type V portland cement and SCM, or a blended cement. No cementitious material shall be used in the work unless it is on the Department's Pre-Qualified Products List at the time of mix design submittal. Information regarding cementitious material qualification and placement on the Department's approved list can be obtained at the Transportation Laboratory.

Cementitious materials used in cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same sources and of the same proportions.

Cementitious materials shall be protected from moisture until used. Sacked cementitious materials shall be piled to permit access for tallying, inspecting, and identifying each shipment.

Facilities shall be provided to ensure that the various cementitious materials meeting this Section 90-2.01 are kept separate from each other and from other cementitious materials. A storage silo containing a cementitous material shall be emptied before using that silo for a different cementitious material. Blended cements with a percentage of SCM differing by more than 2 percentage points are considered different cementitious materials. Sampling cementitious materials shall be in conformance with California Test 125.

The Contractor shall furnish a Certificate of Compliance for cementitious materials in conformance with the provisions in Section 6-1.07, "Certificates of Compliance." The Certificate of Compliance shall indicate the source by name and location (including country, state, and city). If cementitious material is delivered directly to the job site, the Certificate of Compliance shall be signed by the cementitious material supplier. If the cementitious material is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product. If blended cement is used, the Certificate of Compliance shall include a statement signed by the blended cement supplier that indicates the actual percentage, by weight, of SCM in the blend. Weight of SCM shall be by weighing device conforming to Section 9-1.01, "Measurement of Quantities," or as determined by chemical analysis.

90-2.01A Cement

Portland cement shall conform to the requirements in ASTM Designation: C 150 except the C_3S content of Type II cement shall not exceed 65 percent.

Blended cement shall conform to the requirements for Portland Blast-Furnace Slag Cement, Type IS (MS) or Portland-Pozzolan Cement, Type IP (MS) in AASHTO Designation: M 240, except that the maximum limits on the pozzolan content shall not apply. Blended cement shall be comprised of Type II or Type V cement and SCM produced by intergrinding portland cement clinker and granulated blast furnace slag, ground granulated blast furnace

slag (GGBFS), or pozzolan; by blending portland cement and either GGBFS or finely divided pozzolan; or by a combination of intergrinding and blending.

In addition, Type II portland cement and Type V portland cement shall conform to the following requirements:

A. The cement shall not contain more than 0.60-percent by mass of alkalies, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O, when determined by methods as required in AASHTO Designation: T 105; and
B. The autoclave expansion shall not exceed 0.50-percent

Type III portland cement shall be used only as specified or with the approval of the Engineer. Type III portland cement shall conform to the additional requirements listed above for Type II portland cement. The Contractor may use Type III portland cement in the manufacturing of precast concrete.

90-2.01B Supplementary Cementitious Materials

Each supplementary cementitious material shall conform to one of the following:

A. Fly ash conforming to the requirements in AASHTO Designation: M 295, Class F, and these specifications. The available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311 or the total alkali, as sodium oxide equivalent, shall not exceed 5.0 percent when determined in conformance with the requirements in AASHTO Designation: T 105.
B. Ultra fine fly ash (UFFA) conforming to the requirements in AASHTO Designation: M 295, Class F, and the following chemical and physical requirements:

Chemical Requirements	Percent
Sulfur Trioxide (SO_3)	1.5 max.
Loss on ignition	1.2 max.
Available Alkalies (as Na_2O) equivalent	1.5 max.

Physical Requirements	Percent
Particle size distribution	
Less than 3.5 microns	50
Less than 9.0 microns	90
Strength Activity Index with portland cement	
7 days	95 (minimum % of control)
28 days	110 (minimum % of control)
Expansion at 16 days when testing job materials in conformance with ASTM C 1567*	0.10 max.

* In the test mix, Type II or Type V portland cement shall be replaced with at least 12% UFFA by weight.

C. Raw or calcined natural pozzolans conforming to the requirements in AASHTO Designation: M 295, Class N. and the following requirements and these specifications. The available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311 or the total alkali, as sodium oxide equivalent, shall not exceed 5.0 percent when determined in conformance with the requirements in AASHTO Designation: T 105.
D. Metakaolin conforming to the requirements in AASHTO Designation: M 295, Class N, and the following chemical and physical requirements:

Chemical Requirements	Percent
Silicon Dioxide (SiO_2) + Aluminum Oxide (Al_2O_3)	92.0 min.
Calcium Oxide (CaO)	1.0 max
Sulfur Trioxide (SO_3)	1.0 max.
Loss on ignition	1.2 max.
Available Alkalies (as Na_2O) equivalent	1.0 max.

Physical Requirements	Percent
Particle size distribution Less than 45 microns	95
Strength Activity Index with portland cement 7 days 28 days	 100 (minimum % of control) 100 (minimum % of control)

E. Ground Granulated Blast Furnace Slag (GGBFS) conforming to the requirements in AASHTO Designation: M 302, Grade 100 or Grade 120.
F. Silica Fume conforming to the requirements of AASHTO Designation: M 307, with reduction in mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

Commingling of fly ash from different sources at uncontrolled ratios is permissible only if the following criteria are satisfied:

A. Sources of fly ash to be commingled shall each produce fly ash that conforms to the requirements in AASHTO Designation: M 295, Class F.
B. Testing of the commingled product is the responsibility of the fly ash supplier.
C. Each fly ash's running average of relative density shall not differ from any other by more than 0.25 at the time of commingling.
D. Each fly ash's running average of loss on ignition shall not differ from any other by more than one percent at the time of commingling.
E. The final product of commingled fly ash shall conform to the requirements in AASHTO Designation: M 295, Class F.

90-2.01C Required Use Of Supplementary Cementitious Materials

General

The amount of portland cement and SCM used in portland cement concrete shall conform to the minimum cementitious material content provisions in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and these specifications.

The SCM content in portland cement concrete shall conform to one of the following:

A. Any combination of portland cement and at least one SCM, satisfying Equations (1) and (2):

Equation (1)

$$\frac{(25 \times UF) + (12 \times FA) + (10 \times FB) + (6 \times SL)}{MC} \geq X$$

Where:

UF = Silica fume, metakaolin, or UFFA, including the amount in blended cement, pounds per cubic yard.
FA = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N with a CaO content up to 10 percent, including the amount in blended cement, pounds per cubic yard.
FB = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N with a CaO content greater than 10 percent and up to 15 percent, including the amount in blended cement, pounds per cubic yard.
SL = GGBFS, including the amount in blended cement, pounds per cubic yard.
MC = Minimum amount of cementitious material specified, pounds per cubic yard.
X = 1.8 for innocuous aggregate, 3.0 for all other aggregate.

Equation (2)

$MC - MSCM - PC \geq 0$

Where:

MC = Minimum amount of cementitious material specified, pounds per cubic yard.
MSCM = The minimum sum of SCMs that satisfies Equation (1) above, pounds per cubic yard.
PC = The amount of portland cement, including the amount in blended cement, pounds per cubic yard.

B. 15 percent of Class F fly ash with at least 48 ounces of $LiNO_3$ solution added per 100 pounds of portland cement. CaO content of the fly ash shall not exceed 15 percent.

Precast Concrete

The SCM content in precast portland cement concrete shall conform to one of the following:

A. Any combination of portland cement and SCM, satisfying the following equation:

Equation (3)

$$\frac{(25 \times UF) + (12 \times FA) + (10 \times FB) + (6 \times SL)}{TC} \geq X$$

Where:

UF = Silica fume, metakaolin, or UFFA, including the amount in blended cement, pounds per cubic yard.
FA = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N with a CaO content up to 10 percent, including the amount in blended cement, pounds per cubic yard.
FB = Fly ash or natural pozzolan conforming to the requirements in AASHTO Designation: M 295, Class F or N with a CaO content greater than 10 percent and up to 15 percent, including the amount in blended cement, pounds per cubic yard.
SL = GGBFS, including the amount in blended cement, pounds per cubic yard.
TC = Total amount of cementitious material used in the mix, pounds per cubic yard.
X = 0.0 if precast members are constructed with portland cement concrete using aggregate that is "innocuous" in conformance with the provisions in Section 90-2.02, "Aggregates."
X = 3.0 for all other aggregate.

B. 15 percent of Class F fly ash with at least 48 ounces of $LiNO_3$ solution added per 100 pounds of portland cement. CaO content of the fly ash shall not exceed 15 percent.
C. Any combination of supplementary cementitious material and portland cement may be used if the expansion of cementitious material and aggregate does not exceed 0.10 percent when tested in conformance with the requirements in ASTM C 1567. Test data shall be submitted with each mix design. Test data accepted by the Engineer no more than 3 years prior to the first working day of this contract will be acceptable for this entire contract, provided the data was for the same concrete mix and the same materials and material sources to be used on this contract.

90-2.02 AGGREGATES

To be considered innocuous, aggregate must be on the Department's approved list, "Innocuous Aggregates for use in Concrete." Information regarding aggregate qualification and placement on the Department's approved list can be obtained at the Transportation Laboratory.

Both coarse and fine aggregate must be on the approved list for the aggregate used in concrete to be considered innocuous.

Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.

The Contractor shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.

Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."

Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, D_f, of the fine aggregate is 60 or greater when tested for durability in conformance with California Test 229.

If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."

If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $3.50 per cubic yard for paving concrete and $5.50 per cubic yard for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $3.50 per cubic yard for paving concrete and $5.50 per cubic yard for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs are in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."

No single Cleanness Value, Sand Equivalent, or aggregate grading test shall represent more than 300 cubic yards of concrete or one day's pour, whichever is smaller.

When the source of an aggregate is changed, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates.

90-2.02A Coarse Aggregate

Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, reclaimed aggregate, crushed air-cooled iron blast furnace slag or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in reinforced or prestressed concrete.

Reclaimed aggregate is aggregate that has been recovered from plastic concrete by washing away the cementitious material. Reclaimed aggregate shall conform to all aggregate requirements.

Coarse aggregate shall conform to the following quality requirements:

Tests	California Test	Requirements
Loss in Los Angeles Rattler (after 500 revolutions)	211	45% max.
Cleanness Value		
Operating Range	227	75 min.
Contract Compliance	227	71 min.

In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71, minimum, and a Cleanness Value "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

A. Coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested in conformance with the requirements in California Test 227; and

B. Prequalification tests performed in conformance with the requirements in California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.02B Fine Aggregate

Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.

Fine aggregate shall conform to the following quality requirements:

Test	California Test	Requirements
Organic Impurities	213	Satisfactory[a]
Sand Equivalent:		
Operating Range	217	75, min.
Contract Compliance	217	71, min.

[a] Fine aggregate developing a color darker than the reference standard color may be accepted if 95% relative mortar strength is achieved when tested in conformance with ASTM C87.

In lieu of the above Sand Equivalent requirements, a Sand Equivalent "Operating Range" limit of 71, minimum, and a Sand Equivalent "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the fine aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

A. Fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217; and
B. Prequalification tests performed in conformance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.03 WATER

In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1,000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1,300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1,300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either of the following results when compared to the same test using distilled or deionized water: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109.

In nonreinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2,000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1,500 parts per million of sulfates as SO_4, when tested in conformance with California Test 417.

In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis ($Na_2O + 0.658\ K_2O$) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

90-2.04 Admixture Materials

Admixture materials shall be stored and dispensed in liquid form and conform to the following requirements:

A. Chemical Admixtures—ASTM Designation: C 494.
B. Air-entraining Admixtures—ASTM Designation: C 260.
C. Lithium Nitrate shall be in an aqueous solution conforming to the following:

1. Lithium Nitrate ($LiNO_3$) must be 30 percent +/- 0.5 percent by weight
2. Sulfate (SO_4) must be less than 1000 ppm
3. Chloride (Cl) must be less than 1000 ppm
4. Alkalis ($Na_2O + 0.658\ K_2O$) must be less than 1000 ppm

90-3 AGGREGATE GRADINGS

90-3.01 GENERAL

Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

Gradations proposed by the Contractor shall be within the following percentage passing limits:

Primary Aggregate Nominal Size	Sieve Size	Limits of Proposed Gradation
1-1/2" x 3/4"	1"	19 - 41
1" x No. 4	3/4"	52 - 85
1" x No. 4	3/8"	15 - 38
1/2" x No. 4	3/8"	40 - 78
3/8" x No. 8	3/8"	50 - 85
Fine Aggregate	No. 16	55 - 75
Fine Aggregate	No. 30	34 - 46
Fine Aggregate	No. 50	16 - 29

Should the Contractor change the source of supply, the Contractor shall submit in writing to the Engineer the new gradations before their intended use.

90-3.02 COARSE AGGREGATE GRADING

The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

	Percentage Passing Primary Aggregate Nominal Sizes							
	1-1/2" x 3/4"		1" x No. 4		1/2" x No. 4		3/8" x No. 8	
Sieve Sizes	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2"	100	100	—	—	—	—	—	—
1-1/2"	88 - 100	85 - 100	100	100	—	—	—	—
1"	X ±18	X ±25	88 - 100	86 - 100	—	—	—	—
3/4"	0 - 17	0 - 20	X ±15	X ±22	100	100	—	—
1/2"	—	—	—	—	82 - 100	80 - 100	100	100
3/8"	0 - 7	0 - 9	X ±15	X ±22	X ±15	X ±22	X ±15	X ±20
No. 4	—	—	0 - 16	0 - 18	0 - 15	0 - 18	0 - 25	0 - 28
No. 8	—	—	0 - 6	0 - 7	0 - 6	0 - 7	0 - 6	0 - 7

In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

Coarse aggregate for the 1-1/2 inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.

When the one inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 1" x No. 4 primary aggregate nominal size.

90-3.03 FINE AGGREGATE GRADING

Fine aggregate shall be graded within the following limits:

Sieve Sizes	Percentage Passing	
	Operating Range	Contract Compliance
3/8"	100	100
No. 4	95 - 100	93 - 100
No. 8	65 - 95	61 - 99
No. 16	X ±10	X ±13
No. 30	X ±9	X ±12
No. 50	X ±6	X ±9
No. 100	2 - 12	1 - 15
No. 200	0 - 8	0 - 10

In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the No. 16 sieve and the total percentage passing the No. 30 sieve shall be between 10 and 40, and the difference between the percentage passing the No. 30 and No. 50 sieves shall be between 10 and 40.

Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

90-3.04 COMBINED AGGREGATE GRADINGS

Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein.

The combined aggregate grading, except when otherwise specified in these specifications or the special provisions, shall be either the 1-1/2 inch, maximum grading, or the 1 inch, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

Sieve Sizes	Percentage Passing			
	1-1/2" Max.	1" Max.	1/2" Max.	3/8" Max.
2"	100	—	—	—
1-1/2"	90 - 100	100	—	—
1"	50 - 86	90 - 100	—	—
3/4"	45 - 75	55 - 100	100	—
1/2"	—	—	90 - 100	100
3/8"	38 - 55	45 - 75	55 - 86	50 - 100
No. 4	30 - 45	35 - 60	45 - 63	45 - 63
No. 8	23 - 38	27 - 45	35 - 49	35 - 49
No. 16	17 - 33	20 - 35	25 - 37	25 - 37
No. 30	10 - 22	12 - 25	15 - 25	15 - 25
No. 50	4 - 10	5 - 15	5 - 15	5 - 15
No. 100	1 - 6	1 - 8	1 - 8	1 - 8
No. 200	0 - 3	0 - 4	0 - 4	0 - 4

Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

90-4 ADMIXTURES

90-4.01 GENERAL

Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.

Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by weight of admixture, as determined by California Test 415, shall not be used.

Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.

If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

Chemical admixtures shall be used in conformance with the manufacturer's written recommendations. The manufacturer's written recommendations shall include a statement that the admixtures are compatible with the types and amounts of SCMs used.

90-4.02 MATERIALS

Admixture materials shall conform to the provisions in Section 90-2.04, "Admixture Materials."

90-4.03 ADMIXTURE APPROVAL

No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved. Information regarding admixture qualification and placement on the Department's list can be obtained at the Transportation Laboratory.

If the Contractor proposes to use an admixture of a brand and type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.

90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES

If the use of a chemical admixture is specified, the admixture shall be used at the dosage specified, except that if no dosage is specified, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

The Contractor may use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate any concrete construction application subject to the following conditions:

A. If a water-reducing admixture or a water-reducing and retarding admixture is used, the cementitious material content specified or ordered may be reduced by a maximum of 5 percent by weight, except that the resultant cementitious material content shall be not less than 505 pounds per cubic yard; and
B. When a reduction in cementitious material content is made, the dosage of admixture used shall be no less than the dosage used in determining approval of the admixture.

The Contractor may use Type S admixtures conforming to the requirements in ASTM Designation: C 494.

Unless otherwise specified, a Type C accelerating chemical admixture conforming to the requirements in ASTM Designation: C 494, may be used in portland cement concrete. Inclusion in the mix design submitted for approval will not be required provided that the admixture is added to counteract changing conditions that contribute to delayed setting of the portland cement concrete, and the use or change in dosage of the admixture is approved in writing by the Engineer.

90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

When air-entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content, as determined by California Test 504, of 3 successive tests does not exceed 4 percent, and no single test value exceeds 5.5 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, the Contractor shall so indicate at the time the Contractor designates the source of aggregate.

90-4.08 BLANK

90-4.09 BLANK

90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES

Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers for liquid admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within ±5 percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.

Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.

If more than one liquid admixture is used in the concrete mix, each liquid admixture shall have a separate measuring unit and shall be dispensed by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix, unless it is demonstrated that a different sequence improves performance.

When automatic proportioning devices are used, dispensers for liquid admixtures shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system in good operating condition that will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent, or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of concrete.

Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

Liquid admixtures requiring dosages greater than one-half gallon per cubic yard shall be considered to be water when determining the total amount of free water as specified in Section 90-6.06, "Amount of Water and Penetration."

90-4.11 BLANK

90-5 PROPORTIONING

90-5.01 STORAGE OF AGGREGATES

Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and the various sizes shall not become intermixed before proportioning.

Aggregates shall be stored or stockpiled and handled in a manner that prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:

A. Intermingling of the different sizes of aggregates shall be positively prevented. The Contractor shall take the necessary measures to prevent intermingling. The preventive measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height; and
B. Contamination of aggregates by contact with the ground shall be positively prevented. The Contractor shall take the necessary measures to prevent contamination. The preventive measures shall include, but are

not necessarily limited to, placing aggregates on wooden platforms or on hardened surfaces consisting of portland cement concrete, asphalt concrete, or cement treated material.

In placing aggregates in storage or in moving the aggregates from storage to the weigh hopper of the batching plant, any method that may cause segregation, degradation, or the combining of materials of different gradings that will result in any size of aggregate at the weigh hopper failing to meet the grading requirements, shall be discontinued. Any method of handling aggregates that results in excessive breakage of particles shall be discontinued. The use of suitable devices to reduce impact of falling aggregates may be required by the Engineer.

90-5.02 PROPORTIONING DEVICES

Weighing, measuring, or metering devices used for proportioning materials shall conform to the requirements in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Automatic Proportioning." Automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and SCM for one batch of concrete is a single operation of a switch or starter.

For concrete pavement, aggregate and bulk cementitious material must be proportioned by weight by means of automatic proportioning devices.

Proportioning devices shall be tested as frequently as the Engineer may deem necessary to ensure their accuracy.

Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the weight of each batch of material shall not vary from the weight designated by the Engineer by more than the tolerances specified herein.

Equipment for cumulative weighing of aggregate shall have a zero tolerance of ±0.5 percent of the designated total batch weight of the aggregate. For systems with individual weigh hoppers for the various sizes of aggregate, the zero tolerance shall be ±0.5 percent of the individual batch weight designated for each size of aggregate. Equipment for cumulative weighing of cement and SCM shall have a zero tolerance of ±0.5 percent of the designated total batch weight of the cement and SCM. Equipment for weighing cement or SCM separately shall have a zero tolerance of ±0.5 percent of their designated individual batch weights. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated weight or volume.

The weight indicated for any batch of material shall not vary from the preselected scale setting by more than the following:

A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch weight of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch weights; and
B. Cement shall be 99 to 102 percent of its designated batch weight. When weighed individually, SCM shall be 99 to 102 percent of its designated batch weight. When SCM and cement are permitted to be weighed cumulatively, cement shall be weighed first to 99 to 102 percent of its designated batch weight, and the total for cement and SCM shall be 99 to 102 percent of the sum of their designated batch weights When a blended cement is used, the percentages of cement and SCM used for calculating batch weights shall be based on the percentage of SCM indicated in the Certificate of Compliance from the blended cement supplier; and
C. Water shall be within 1.5 percent of its designated weight or volume.

Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, SCM, or cement plus SCM and aggregates shall not exceed that of commercially available scales having single graduations indicating a weight not exceeding the maximum permissible weight variation above, except that no scale shall be required having a capacity of less than 1,000 pounds, with one pound graduations.

90-5.03 PROPORTIONING

Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cementitious material and water as provided in these specifications. Aggregates shall be proportioned by weight.

At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry weight.

Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.

Bulk Type IP (MS) or Type IS (MS) cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.

Bulk cement and SCM may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and SCM are weighed cumulatively, the cement shall be weighed first.

If cement and SCM are weighed in separate weigh hoppers, the weigh systems for the proportioning of the aggregate, the cement, and the SCM shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material-weighing device. The cement and the SCM shall be discharged into the mixer simultaneously with the aggregate.

The scales and weigh hoppers for bulk weighing cement, SCM, or cement plus SCM shall be separate and distinct from the aggregate weighing equipment.

For batches of one cubic yard or more, the batching equipment shall conform to one of the following combinations:

A. Separate boxes and separate scale and indicator for weighing each size of aggregate.
B. Single box and scale indicator for all aggregates.
C. Single box or separate boxes and automatic weighing mechanism for all aggregates.

In order to check the accuracy of batch weights, the gross weight and tare weight of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined when ordered by the Engineer. The equipment shall be weighed on scales designated by the Engineer.

90-5.03A Automatic Proportioning

Automatic proportioning devices shall be authorized by the Department.

For concrete pavement, the Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by weight of the fine aggregate.

The batching of cement, SCM, or cement plus SCM and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and SCM hoppers or the cement plus SCM hopper are charged with weights that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."

If interlocks are required for cement and SCM charging mechanisms and cement and SCM are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of SCM until the weight of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."

If concrete is completely mixed in stationary mixers, the SCMs shall be weighed in a separate weigh hopper and the SCM and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the Contractor provides certification that the stationary mixer is capable of mixing the cement, SCM, aggregates, and water uniformly before discharge, weighing the SCM cumulatively with the cement is permitted. Certification shall contain the following:

A. Test results for 2 compressive strength test cylinders of concrete taken within the first one-third and 2 compressive strength test cylinders of concrete taken within the last one-third of the concrete discharged from a single batch from the stationary mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength";
B. Calculations demonstrating that the difference in the averages of 2 compressive strengths taken in the first one-third is no greater than 7.5 percent different than the averages of 2 compressive strengths taken in the last one-third of the concrete discharged from a single batch from the stationary mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;" and
C. The mixer rotation speed and time of mixing before discharge that are required to produce a mix that meets the requirements above.

The discharge gate on the cement and SCM hoppers or the cement plus SCM hopper shall be designed to permit regulating the flow of cement, SCM, or cement plus SCM into the aggregate as directed by the Engineer.

If separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.

Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.

If the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required weight is discharged into the weigh box, after which the gate shall automatically close and lock.

The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

90-6 MIXING AND TRANSPORTING

90-6.01 GENERAL

Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."

Equipment having components made of aluminum or magnesium alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.

Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cementitious material.

Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.

When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 1/2 inch. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 170 pounds per cubic yard of concrete.

Average Slump	Maximum Permissible Difference
Less than 4"	1"
4" to 6"	1-1/2"
Greater than 6" to 9"	2"

The Contractor shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

90-6.02 MACHINE MIXING

Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.

The temperature of mixed concrete, immediately before placing, shall be not less than 50 °F or more than 90 °F. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 150 °F. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one-fourth of the specified mixing time. When concrete is delivered in a truck mixer, a portion of the mixing water may be withheld and, if allowed by the Engineer, may be added at the point of delivery as specified under Section 90-6.03, "Transporting Mixed Concrete."

Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

Stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.

The size of batch shall not exceed the manufacturer's guaranteed capacity.

When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at job site batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

Concrete shall be mixed and delivered to the job site by means of one of the following combinations of operations:

A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in nonagitating hauling equipment (central-mixed concrete).
B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).
C. Mixed completely in a truck mixer (transit-mixed concrete).

Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.

When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed will be allowed for partial mixing in a central plant.

90-6.03 TRANSPORTING MIXED CONCRETE

Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."

Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

Bodies of nonagitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.

Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 75 °F.

No water in excess of that in the approved mix design shall be incorporated into the concrete. If approved by the Engineer, water withheld during batching may be added to the concrete at the delivery point in one operation before the discharge of more than 1/4 cubic yard. Equipment for supplying the water shall conform to Section 90-6.06, "Amount of Water and Penetration." When water is added at the point of delivery, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharged is commenced.

The rate of discharge of mixed concrete from a truck mixer or agitator shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

If a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cementitious materials to the aggregates. Under conditions contributing to quick stiffening of the concrete, or if the temperature of the concrete is 85 °F or above, the time allowed may be less than 1.5 hours. If an admixture is used to retard the set time, the temperature of the concrete shall not exceed 85 °F, the time limit shall be 2 hours, and the revolution limitation shall be 300.

If nonagitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cementitious materials to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 °F or above, the time between the introduction of cementitious materials to the aggregates and discharge shall not exceed 45 minutes.

Each load of concrete delivered at the job site shall be accompanied by a weighmaster certificate showing the mix identification number, nonrepeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time

the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale weights (pounds) for the ingredients batched. Theoretical or target batch weights shall not be used as a substitute for actual scale weights.

Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a CD or DVD. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.

The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch weights or measurements for a load of concrete provided that both certificates are imprinted with the same nonrepeating load number that is unique to the contract and delivered to the jobsite with the load.

Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

90-6.04 TIME OR AMOUNT OF MIXING

Mixing of concrete in stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.

The required mixing time, in stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.

The required mixing time in stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.

The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

When a high range water-reducing admixture is added to the concrete at the job site, the total number of revolutions shall not exceed 300.

90-6.05 HAND-MIXING

Hand-mixed concrete shall be made in batches of not more than 1/3 cubic yard and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than one foot in total depth. On this mixture shall be spread the dry cementitious materials and the whole mass turned no fewer than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned no fewer than 3 times, not including placing in the carriers or forms.

90-6.06 AMOUNT OF WATER AND PENETRATION

The amount of water used in concrete mixes shall be regulated so that the penetration of the concrete as determined by California Test 533 or the slump of the concrete as determined by ASTM Designation: C 143 is within the nominal values shown in the following table. When the penetration or slump of the concrete is found to exceed the nominal values listed, the mixture of subsequent batches shall be adjusted to reduce the penetration or slump to a value within the nominal range shown. Batches of concrete with a penetration or slump exceeding the maximum values listed shall not be used in the work. If Type F or Type G chemical admixtures are added to the mix, the penetration requirements shall not apply and the slump shall not exceed 9 inches after the chemical admixtures are added.

Type of Work	Nominal		Maximum	
	Penetration (inches)	Slump (inches)	Penetration (inches)	Slump (inches)
Concrete Pavement	0 - 1	—	1-1/2	—
Non-reinforced concrete facilities	0 – 1-1/2	—	2	—
Reinforced concrete structures				
Sections over 12 inches thick	0 – 1-1/2	—	2-1/2	—
Sections 12 inches thick or less	0 - 2	—	3	—
Concrete placed under water	—	6 - 8	—	9
Cast-in-place concrete piles	2-1/2 – 3-1/2	5 - 7	4	8

The amount of free water used in concrete shall not exceed 310 pounds per cubic yard, plus 20 pounds for each required 100 pounds of cementitious material in excess of 550 pounds per cubic yard.

The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

If there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic yard of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 pounds of water per added 100 pounds of cementitious material per cubic yard. Full compensation for additional cementitious material and water added under these conditions shall be considered as included in the contract price paid for the concrete work involved and no additional compensation will be allowed therefor.

The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

90-7 CURING CONCRETE

90-7.01 METHODS OF CURING

Newly placed concrete shall be cured by the methods specified in this Section 90-7.01 and the special provisions.

90-7.01A Water Method

The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.

Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period.

If a curing medium consisting of cotton mats, rugs, carpets, polyethylene sheeting, polyethylene sheeting on burlap, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing media.

At the option of the Contractor, a curing medium consisting of white opaque polyethylene sheeting extruded onto burlap may be used to cure concrete structures. The polyethylene sheeting shall have a minimum thickness of 4-mil, and shall be extruded onto 10-ounce burlap.

At the option of the Contractor, a curing medium consisting of polyethylene sheeting may be used to cure concrete columns. The polyethylene sheeting shall have a minimum thickness of 10-mil achieved in a single layer of material.

If the Contractor chooses to use polyethylene sheeting or polyethylene sheeting on burlap as a curing medium, these media and any joints therein shall be secured as necessary to provide moisture retention and shall be within 3 inches of the concrete at all points along the surface being cured. When these media are used, the temperature of the concrete shall be monitored during curing. If the temperature of the concrete cannot be maintained below 140° F, use of these curing media shall be disallowed.

When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified above, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

90-7.01B Curing Compound Method

Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.

Curing compounds to be used shall be as follows:

1. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.

2. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B.
3. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A.
4. Nonpigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class B.
5. Nonpigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
6. Nonpigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.

The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.

The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.28 pounds per square yard in 24 hours.

The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.

If the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.

Curing compound shall be applied at a nominal rate of one gallon per 150 square feet, unless otherwise specified.

At any point, the application rate shall be within ±50 square feet per gallon of the nominal rate specified, and the average application rate shall be within ±25 square feet per gallon of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.

Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.

The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.

At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.

Agitation shall not introduce air or other foreign substance into the curing compound.

The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.

Curing compounds shall remain sprayable at temperatures above 40 °F and shall not be diluted or altered after manufacture.

The curing compound shall be packaged in clean 274-gallon totes, 55-gallon barrels or 5-gallon pails shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 274-gallon totes and the 55-gallon barrels shall have removable lids and airtight fasteners. The 5-gallon pails shall be round and have standard full open head and bail. Lids with bungholes will not be permitted. Settling or separation of solids in containers, except tanks, must be completely redispersed with low speed mixing prior to use, in conformance with these specifications and the manufacturer's recommendations. Mixing shall be accomplished either manually by use of a paddle or by use of a mixing blade driven by a drill motor, at low speed. Mixing blades shall be the type used for mixing paint. On-site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.

Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.

Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State.

Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State.

When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.

Curing compound will be sampled by the Engineer at the source of supply, at the job site, or at both locations.

Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.

Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

90-7.01C Waterproof Membrane Method

The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane, shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.

Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.

The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 0.33 foot.

The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.

Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.

Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

90-7.01D Forms-In-Place Method

Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 20 inches in least dimension the forms shall remain in place for a minimum period of 5 days.

Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

90-7.02 BLANK

90-7.03 CURING STRUCTURES

Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."

The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only ordinary surface finish is to be applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1).

Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.

When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Application of water for this purpose will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

90-7.04 CURING PRECAST CONCRETE MEMBERS

Precast concrete members shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing." Curing shall be provided for the minimum time specified for each method or until the concrete reaches its design strength, whichever is less. Steam curing may also be used for precast members and shall conform to the following provisions:

A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 50 °F, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 50 °F and 90 °F.
B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture.
D. Steam at the jets shall be at low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 40 °F per hour. The curing temperature throughout the enclosure shall not exceed 150 °F and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.
E. Temperature recording devices that will provide an accurate, continuous, permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 200 feet of continuous bed length will be required for checking temperature.
F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm, or the temperature under the enclosure shall be maintained above 60 °F until the stress is transferred to the concrete.
G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES

Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles in a corrosive environment shall be cured as follows:

A. Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in conformance with the provisions in Section 90-7.01A, "Water Method."
B. If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 3 days, including the holding and steam curing periods.

90-7.06 CURING SLOPE PROTECTION

Concrete slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

Concreted-rock slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing," with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

90-7.07 CURING MISCELLANEOUS CONCRETE WORK

Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."

Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

Shotcrete shall be cured for at least 72 hours by spraying with water, by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

Mortar and grout shall be cured by keeping the surface damp for 3 days.

After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

90-8 PROTECTING CONCRETE

90-8.01 GENERAL

In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8. If required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

The Contractor shall protect concrete from damage from any cause, which shall include, but not be limited to: rain, heat, cold, wind, Contractor's actions, and actions of others.

Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.

Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

90-8.02 PROTECTING CONCRETE STRUCTURES

Structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 45 °F for 72 hours after placing and at not less than 40 °F for an additional 4 days.

90-9 COMPRESSIVE STRENGTH

90-9.01 GENERAL

Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by compressive strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.

The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of California Test 539. Test cylinders will be molded and initially field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of California Test 521. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.

When concrete is designated by compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State $10 for each in-place cubic yard of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but is 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State $15 for each in-place cubic yard of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the maximum age specified or allowed. Concrete

represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."

If the test result indicates that the compressive strength at the maximum age specified or allowed is below the specified strength, but is 85 percent or more of the specified strength, payments to the State as required above shall be made, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified 28-day compressive strength. If the test result indicates a compressive strength at the maximum age specified or allowed below 85 percent, the concrete represented by that test will be rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work is at least 85 percent of the specified strength. If the evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in conformance with the requirements in ASTM Designation: C 42.

No single compressive strength test shall represent more than 320 cubic yards.

If a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. If the concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.

When concrete has a specified 28-day compressive strength greater than 3,600 pounds per square inch or when prequalification is specified, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.

Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.

Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 600 pounds per square inch greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.

Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

The certified test data and trial batch test reports shall include the following information:

A. Date of mixing.
B. Mixing equipment and procedures used.
C. The size of batch in cubic yards and the weight, type, and source of all ingredients used.
D. Penetration or slump (if the concrete will be placed under water or placed in cast-in-place concrete piles) of the concrete.
E. The air content of the concrete if an air-entraining admixture is used.
F. The age at time of testing and strength of all concrete cylinders tested.

Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.

When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and the concrete will be paid for as the type of concrete required at that location.

After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.

The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.

When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

90-10 MINOR CONCRETE

90-10.01 GENERAL

Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.

The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

Before using minor concrete or in advance of revising the mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design. When required by the following table, the Contractor shall include compressive strength test results verifying the minimum specified compressive strength:

SCM	Test Submittal Required
Fly Ash used alone	When portland cement content<350 lbs/cy
GGBFS used alone	When portland cement content <250 lbs/cy
Natural Pozzolan used alone	When portland cement content <350 lbs/cy
More than 1 SCM	Always

Tests shall be performed by an ACI certified technician.

90-10.02 MATERIALS

Minor concrete shall conform to the following requirements:

90-10.02A Cementitious Material

Cementitious material shall conform to the provisions in Section 90-1.01, "Description," and 90-2, "Materials."

90-10.02B Aggregate

Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.

Use of crushed concrete or reclaimed aggregate is acceptable only if the aggregate satisfies all aggregate requirements.

The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.

The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 1-1/2-inch or smaller than 3/4 inch.

The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

90-10.02C Water

Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the quality of the concrete.

90-10.02D Admixtures

The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

90-10.03 PRODUCTION

Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.

The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."

The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless allowed by the Engineer.

Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 90 °F will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.

The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.

The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.

When a high range water-reducing admixture is added to the concrete at the job site, the total number of revolutions shall not exceed 300.

Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.

A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

90-10.04 CURING MINOR CONCRETE

Curing minor concrete shall conform to the provisions in Section 90-7, "Curing Concrete."

90-10.05 PROTECTING MINOR CONCRETE

Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 40 °F for 72 hours after placing.

90-10.06 MEASUREMENT AND PAYMENT

Minor concrete will be measured and paid for in conformance with the provisions specified in the various sections of these specifications covering concrete construction when minor concrete is specified in the specifications, shown on the plans, or indicated by contract item in the Engineer's Estimate.

90-11 MEASUREMENT AND PAYMENT

90-11.01 MEASUREMENT

Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

For concrete measured at the mixer, the volume in cubic feet shall be computed as the total weight of the batch in pounds divided by the density of the concrete in pounds per cubic foot. The total weight of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

90-11.02 PAYMENT

Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

Full compensation for furnishing and incorporating admixtures required by these specifications or the special provisions will be considered as included in the contract prices paid for the concrete involved and no additional compensation will be allowed therefor.

Should the Engineer order the Contractor to incorporate any admixtures in the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

Should the Contractor use admixtures in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," or Section 90-4.07, "Optional Use of Air-entraining Admixtures," or should the Contractor request and obtain permission to use other admixtures for the Contractor's benefit, the Contractor shall furnish those admixtures and incorporate them into the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

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SECTION 91 PAINT
(Issued 05-1-06)

Replace Section 91-3 with:

91-3 PAINTS FOR TIMBER

91-3.01 WOOD PRIMER, LATEX-BASE

Classification:

This specification covers a ready-mixed priming paint for use on unpainted wood or exterior woodwork. It shall conform with the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for exterior wood primers, and be listed on the Exterior Latex Wood Primer MPI List Number 6.

91-3.02 PAINT; LATEX-BASE FOR EXTERIOR WOOD, WHITE AND TINTS

Classification:

This specification covers a ready-mixed paint for use on wood surfaces subject to outside exposures. This paint shall conform to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for Paint, Latex, Exterior, and shall be listed on the following MPI Approved Products List:

A. Exterior Latex, Flat MPI Gloss Level 1, MPI List Number 10.
B. Exterior Latex, Semi-Gloss, MPI Gloss Level 5, MPI List Number 11.
C. Exterior Latex, Gloss, MPI Gloss Level 6, MPI List Number 119.

Unpainted wood shall first be primed with wood primer conforming to the provisions in Section 91-3.01, "Wood Primer, Latex-Base."

Replace Section 91-4 with:

91-4 MISCELLANEOUS PAINTS

91-4.01 THROUGH 91-4.04 (BLANK)

91-4.05 PAINT; ACRYLIC EMULSION, EXTERIOR WHITE AND LIGHT AND MEDIUM TINTS

Classification:

This specification covers an acrylic emulsion paint designed for use on exterior masonry. This paint shall conform to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for Paint, Latex, Exterior, and shall be listed on the following MPI Approved Products Lists:

A. Exterior Latex, Flat MPI Gloss Level 1, MPI List Number 10.
B. Exterior Latex, Semi-Gloss, MPI Gloss Level 5, MPI List Number 11.
C. Exterior Latex, Gloss, MPI Gloss Level 6, MPI List Number 119.

This paint may be tinted by using "universal" or "all purpose" concentrates.

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SECTION 92 ASPHALTS
(Issued 01-20-12)

Replace Section 92 with:

SECTION 92 ASPHALTS

92-1.01 DESCRIPTION

Asphalt is refined petroleum or a mixture of refined liquid asphalt and refined solid asphalt that are prepared from crude petroleum. Asphalt is:

1. Free from residues caused by the artificial distillation of coal, coal tar, or paraffin
2. Free from water
3. Homogeneous

92-1.02 MATERIALS

GENERAL

Furnish asphalt under the Department's "Certification Program for Suppliers of Asphalt." The Department maintains the program requirements, procedures, and a list of approved suppliers at:

http://www.dot.ca.gov/hq/esc/Translab/fpm/fpmcoc.htm

Transport, store, use, and dispose of asphalt safely.

Prevent the formation of carbonized particles caused by overheating asphalt during manufacturing or construction.

GRADES

Performance graded (PG) asphalt binder is:

Performance Graded Asphalt Binder

Property	AASHTO Test Method	Specification Grade PG 58-22 [a]	PG 64-10	PG 64-16	PG 64-28	PG 70-10
Original Binder						
Flash Point, Minimum °C	T 48	230	230	230	230	230
Solubility, Minimum % [b]	T 44	99	99	99	99	99
Viscosity at 135°C, [c]	T 316					
Maximum, Pa·s		3.0	3.0	3.0	3.0	3.0
Dynamic Shear,	T 315					
Test Temp. at 10 rad/s, °C		58	64	64	64	70
Minimum G*/sin(delta), kPa		1.00	1.00	1.00	1.00	1.00
Maximum G*/sin(delta), kPa		2.00	2.00	2.00	2.00	2.00
RTFO Test, [e]	T 240					
Mass Loss, Maximum, %		1.00	1.00	1.00	1.00	1.00
RTFO Test Aged Binder						
Dynamic Shear,	T 315					
Test Temp. at 10 rad/s, °C		58	64	64	64	70
Minimum G*/sin(delta), kPa		2.20	2.20	2.20	2.20	2.20
Ductility at 25°C	T 51					
Minimum, cm		75	75	75	75	75
PAV [f] Aging,	R 28					
Temperature, °C		100	100	100	100	110
RTFO Test and PAV Aged Binder						
Dynamic Shear,	T 315					
Test Temp. at 10 rad/s, °C		22 [d]	31 [d]	28 [d]	22 [d]	34 [d]
Maximum G*sin(delta), kPa		5000	5000	5000	5000	5000
Creep Stiffness,	T 313					
Test Temperature, °C		-12	0	-6	-18	0
Maximum S-value, Mpa		300	300	300	300	300
Minimum M-value		0.300	0.300	0.300	0.300	0.300

Notes:

a. Use as asphalt rubber base stock for high mountain and high desert area.

b. The Engineer waives this specification if the supplier is a Quality Supplier as defined by the Department's "Certification Program for Suppliers of Asphalt."

c. The Engineer waives this specification if the supplier certifies the asphalt binder can be adequately pumped and mixed at temperatures meeting applicable safety standards.

d. Test the sample at 3°C higher if it fails at the specified test temperature. G*sin(delta) remains 5000 kPa maximum.

e. "RTFO Test" means the asphaltic residue obtained using the Rolling Thin Film Oven Test, AASHTO Test Method T 240 or ASTM Designation: D 2872. The residue from mass change determination may be used for other tests.

f. "PAV" means Pressurized Aging Vessel.

Performance graded polymer modified asphalt binder (PG Polymer Modified) is:

Performance Graded Polymer Modified Asphalt Binder [a]

Property	AASHTO Test Method	Specification Grade		
		PG 58-34 PM	PG 64-28 PM	PG 76-22 PM
Original Binder				
Flash Point, Minimum °C	T 48	230	230	230
Solubility, Minimum % [b]	T 44[c]	98.5	98.5	98.5
Viscosity at 135°C, [d] Maximum, Pa·s	T 316	3.0	3.0	3.0
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T 315	58 1.00	64 1.00	76 1.00
RTFO Test , Mass Loss, Maximum, %	T 240	1.00	1.00	1.00
RTFO Test Aged Binder				
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T 315	58 2.20	64 2.20	76 2.20
Dynamic Shear, Test Temp. at 10 rad/s, °C Maximum (delta), %	T 315	Note e 80	Note e 80	Note e 80
Elastic Recovery[f], Test Temp., °C Minimum recovery, %	T 301	25 75	25 75	25 65
PAV[g] Aging, Temperature, °C	R 28	100	100	110
RTFO Test and PAV Aged Binder				
Dynamic Shear, Test Temp. at 10 rad/s, °C Maximum G*sin(delta), kPa	T 315	16 5000	22 5000	31 5000
Creep Stiffness, Test Temperature, °C Maximum S-value, MPa Minimum M-value	T 313	-24 300 0.300	-18 300 0.300	-12 300 0.300

Notes:

a. Do not modify PG Polymer Modified using acid modification.

b. The Engineer waives this specification if the supplier is a Quality Supplier as defined by the Department's "Certification Program for Suppliers of Asphalt."

c. The Department allows ASTM D 5546 instead of AASHTO T 44

d. The Engineer waives this specification if the supplier certifies the asphalt binder can be adequately pumped and mixed at temperatures meeting applicable safety standards.

e. Test temperature is the temperature at which G*/sin(delta) is 2.2 kPa. A graph of log G*/sin(delta) plotted against temperature may be used to determine the test temperature when G*/sin(delta) is 2.2 kPa. A graph of (delta) versus temperature may be used to determine delta at the temperature when G*/sin(delta) is 2.2 kPa. The Engineer also accepts direct measurement of (delta) at the temperature when G*/sin(delta) is 2.2 kPa.

f. Tests without a force ductility clamp may be performed.

g. "PAV" means Pressurized Aging Vessel.

SAMPLING

Provide a sampling device in the asphalt feed line connecting the plant storage tanks to the asphalt weighing system or spray bar. Make the sampling device accessible between 24 and 30 inches above the platform. Provide a receptacle for flushing the sampling device.

Include with the sampling device a valve:

1. Between 1/2 and 3/4 inch in diameter

2. Manufactured in a manner that a one-quart sample may be taken slowly at any time during plant operations
3. Maintained in good condition

Replace failed valves.

In the Engineer's presence, take 2 one-quart samples per operating day. Provide round, friction top, one-quart containers for storing samples.

92-1.03 EXECUTION

If asphalt is applied, you must comply with the heating and application specifications for liquid asphalt in Section 93, "Liquid Asphalts."

92-1.04 MEASUREMENT

If the contract work item for asphalt is paid by weight, the Department measures asphalt tons by complying with the specifications for weight determination of liquid asphalt in Section 93, "Liquid Asphalts."

The Engineer determines the asphalt weight from volumetric measurements if you:

1. Use a partial asphalt load
2. Use asphalt at a location other than a mixing plant and no scales within 20 miles are available and suitable
3. Deliver asphalt in either of the following:

    3.1. A calibrated truck with each tank accompanied by its measuring stick and calibration card
    3.2. A truck equipped with a calibrated thermometer that determines the asphalt temperature at the delivery time and with a vehicle tank meter complying with the specifications for weighing, measuring, and metering devices in Section 9-1.01, "Measurement of Quantities"

If you furnish hot mix asphalt from a mixing plant producing material for only one project, the Engineer determines the asphalt quantity by measuring the volume in the tank at the project's start and end provided the tank is calibrated and equipped with its measuring stick and calibration card.

The Engineer determines pay quantities from volumetric measurements as follows:

1. Before converting the volume to weight, the Engineer reduces the measured volume to that which the asphalt would occupy at 60 °F.
2. The Engineer uses 235 gallons per ton and 8.51 pounds per gallon for the average weight and volume for PG and PG Polymer Modified asphalt grades at 60 °F.
3. The Engineer uses the Conversion Table in Section 93, "Liquid Asphalts."

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SECTION 93 LIQUID ASPHALTS

(Issued 11-03-06)

In Section 93-1.04 replace the 9th paragraph with:

The following Legend and Conversion Table is to be used for converting volumes of liquid asphalt products, Grades 70 to 3000, inclusive, and paving asphalt Grades PG 58-22, PG 64-10, PG 64-16, PG 64-28, and PG 70-10, and Grades PG 58-34 PM, PG 64-28 PM, and PG 76-22 PM.

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SECTION 95 EPOXY

(Issued 06-05-09)

Replace the table in Section 95-2.11 with:

Characteristics of Adhesive:

Test[a]	California Test	Requirement
Brookfield Viscosity, No. 3 Spindle at 20 rpm, Poise at 77°F	434, Part 4	0.9 max.
Gel time, minutes	434, Part 1	2 to 15
Slant Shear Strength on Dry Concrete, psi, after 4 days of cure in air at 77° F ±2° F	434, Part 5[b]	3,000 min.
Slant Shear Strength on Wet Concrete, psi, after 4 days of cure in air at 77° F ±2° F	434, Part 5[b]	1,700 min.
Tensile Strength, psi	434, Part 7, except test after 4 days of cure at 77° F ±2° F	4,500 min.
Elongation, %	434, Part 7, except test after 4 days of cure at 77° F ±2° F	10 max.

[a] The mixing ratio used will be that recommended by the manufacturer.

[b] For slant shear strength on concrete, delete Sections B-1 and B-5 of California Test 434, Part 5. For dry concrete, use Step "2" below only. For wet concrete, use both Steps "1" & "2":

1. Soak blocks in water for 24 hours at 77° F ±2° F. Remove and wipe off excess water.
2. Mix epoxy as described in California Test 434, Part 1, and apply a coat approximately 0.010-inch thick to each diagonal surface. Place four 0.125-inch square pieces of shim stock 0.012-inch thick on one block to control final film thickness. Before pressing the coated surfaces together, leave the blocks so that the coated surfaces are horizontal until the epoxy reacts slightly to prevent excessive flow.