

FOR CONTRACT NO.: 01-482104

INFORMATION HANDOUT
MATERIALS INFORMATION

GEOTECHNICAL DESIGN REPORT

ROUTE: 01-Men-20-R4.7/R4.9

Memorandum

*Flex your power!
Be energy efficient!*

To: SERGIO COLACEVICH
Project Engineer
District 3

Date: December 14, 2009
File: 01-MEN-20-PM 4.69/4.89
EA: 01-482101
GRAVEL PIT WIDENING

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN - NORTH
BRANCH B - EUREKA

Subject: Geotechnical Design Report, Mechanically Stabilized Earth Wall

This report provides geotechnical design recommendations for the proposed Mechanically Stabilized Earth Wall (MSEW). The wall is needed to widen the traveled way to 24 feet on Route 20 between PM 4.69 and PM 4.89 in Mendocino County (Figure 1). The widening is proposed at this location to reduce the frequency and severity of "Run Off Road" collisions.

The proposed MSEW is approximately 250 feet in length with a maximum wall height of 13 feet (Figure 2 Layout L-1, dated 12/09/09).

Scope of Work

The foundation recommendations contained in this report are based on one geotechnical boring (R-08-001), laboratory testing of soil samples, geotechnical calculations using data obtained from the subsurface investigation and laboratory testing, and Department standards. Subsurface conditions were evaluated only at the boring location and may deviate elsewhere within the project limits.

Pertinent Reports and Investigations

The following documents were reviewed in preparation of this report:

Project Plans

Existing and Proposed Plan Views of Proposed Project, dated August 22, 2009.

Typical Cross Sections of Proposed Project, dated October 12, 2009.

Caltrans Reports

Preliminary Geotechnical Recommendations, 01-MEN-20 PM 4.69/4.89, EA: 01-48210K, Mendocino County, CA, February 9, 2009.

Project Study Report-Project Report, 01-MEN-20 PM 4.69/4.89, EA 01-482100.

Geotechnical Recommendations

A timber faced MSEW approximately 250 feet in length with a maximum wall height of 13 feet and a wall batter of 6V:1H is recommended.

Table 1 summarizes the material properties used for design.

TABLE 1 –MATERIAL PROPERTIES

<u>Layer</u>	<u>Total Unit Weight (pcf)</u>	<u>Angle of Internal Friction (ϕ, degrees)</u>	<u>Cohesion (c, psf)²</u>	<u>Min. Long Term Design Strength (lb/ft)</u>
Reinforced Soil	125	34 ¹	0	
In-Place Soil	120	32 ²	300	
Geogrid	--	--	--	1,450

1. Based on Caltrans Bridge Design Specifications (Chapter 5)
2. Based on correlations with field penetration test data and soil type

We recommend the geogrid be embedded a minimum of 10 feet for wall heights greater than 8 feet and be embedded a minimum of 8 feet for wall heights less than 8 feet. The base of the MSEW (i.e. the lowermost layer of geogrid) shall be underlain by a 1.3 foot thick layer of structural backfill overlain by a 6-inch thick layer of reinforced soil.

A foot thick toe drain constructed with geotextile wrapped Class 1 Type B permeable material backfill behind the wall is recommended (see attached Design Cross Section – Figure 3).

Additional design details will be provided in the Non-Standard Special Provision (NSSP) for the MSEW.

Construction Considerations

Caving conditions and groundwater may be encountered during excavation. Based on the geotechnical investigation the soils in the excavation is classified as a Type B soil in accordance with CALOSHA Standards. The Log of Test Boring for Borehole R-08-001 is included in Appendix A.

There are overhead utilities in the proposed wall construction area.

Project Information

Standard Special Provisions S5-280, "Project Information," discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

A. None

Data and information included in the Information Handout provided to the bidders and Contractors are:

A. Geotechnical Recommendations for MEN 20 PM 4.69/4.89 MSE Wall, dated December 14, 2009

Data and information available for inspection at the District Office:

A. None

Data and information available for inspection at the Eureka Annex:

A. Rock Cores

If any conceptual changes are made during final project design, the Office of Geotechnical Design North should review those changes to determine if these foundation recommendations are still applicable.

If you have any questions or require further assistance, please contact June James at 707 441-4692 or Charlie Narwold at 707 445-6036.

Report by:



M. JUNE JAMES, P.E. #C55009
Transportation Engineer
Office of Geotechnical Design - North
Branch B

Reviewed by:

A handwritten signature in red ink, appearing to be "C. Narwold", written over a circular professional seal.



CHARLIE NARWOLD, C.E.G. #2335
Senior Engineering Geologist
Office of Geotechnical Design - North
Branch B

Attachments:

- | | |
|---------------|--|
| Attachment 1. | Figure 1 – Project Location Map |
| Attachment 2. | Figure 2 –Wall Layout |
| Attachment 3. | Figure 3 – Design Cross-Section |
| Attachment 4. | Appendix A – Log of Test Boring R-08-001 |

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GS File Room
Branch B File
OGDN Project Folder

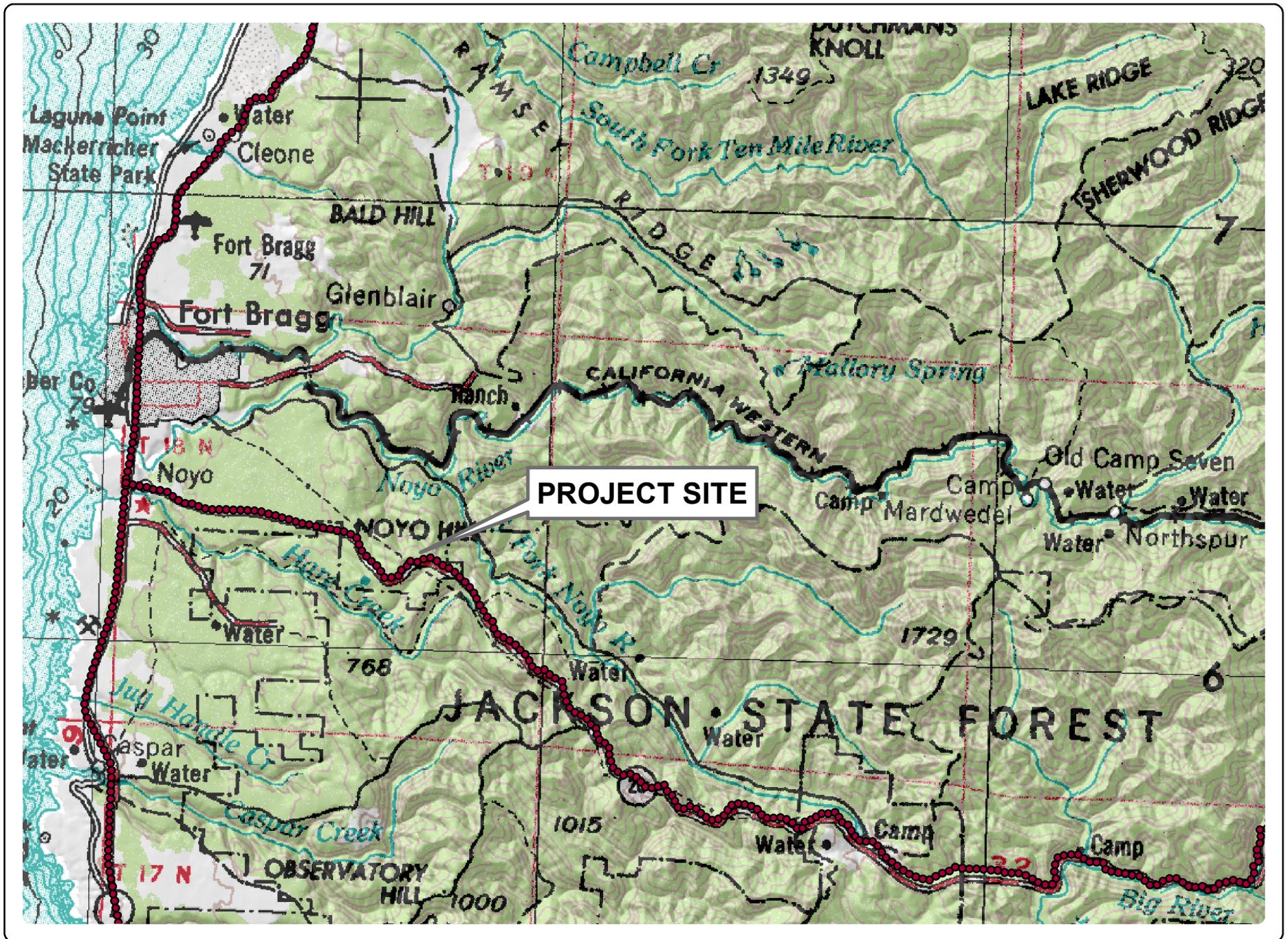
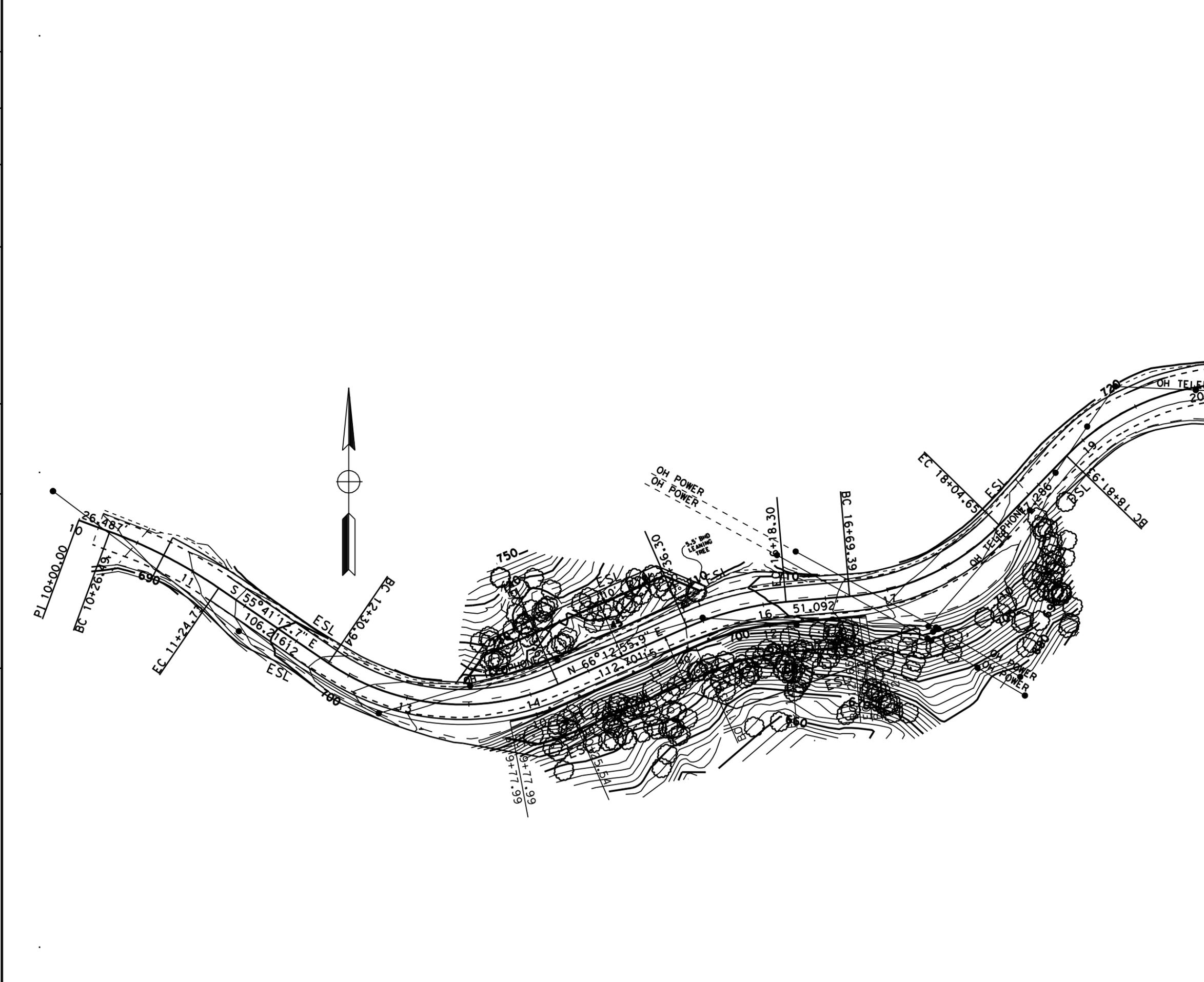


FIGURE 1
Project Location Map
EA: 01-482101 MEN 20 PM 4.69/4.89

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER DATE _____

PLANS APPROVAL DATE _____

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.



**FIGURE 2
 LAYOUT L-1**
 EA: 01- 482101

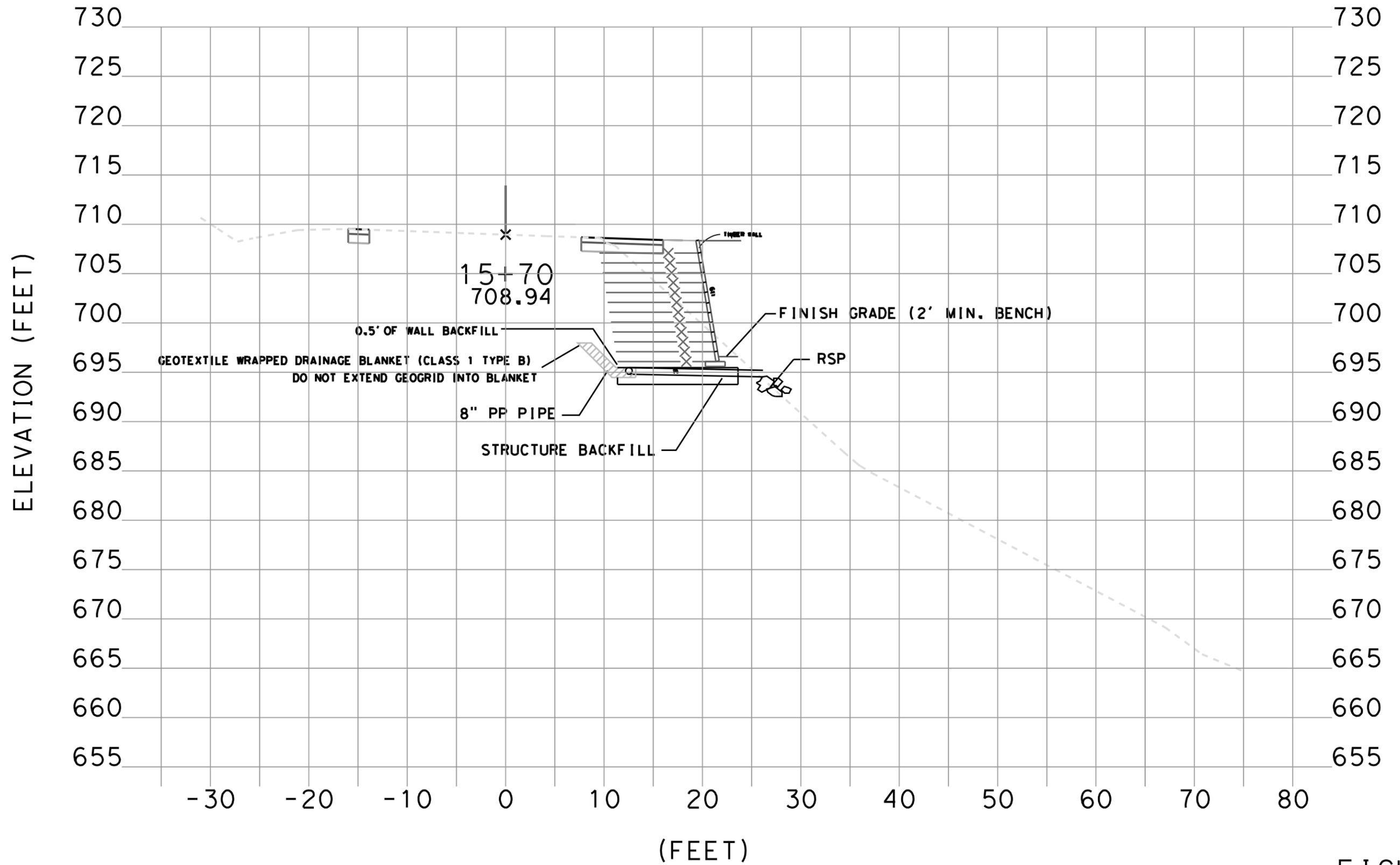


FIGURE 3
 DESIGN CROSS-SECTION
 01-482101 MEN 20 PM 4.69/4.89

APPENDIX A

LOGGED BY KG	BEGIN DATE 11-18-08	COMPLETION DATE 11-18-08	BOREHOLE LOCATION (Lat/Long or North/East and Datum) NAD83	HOLE ID R-08-001
DRILLING CONTRACTOR CT			BOREHOLE LOCATION (Offset, Station, Line) ~5.00' Rt Sta ~15+45 "A"	SURFACE ELEVATION ~707.0 ft NAVD88
DRILLING METHOD Rotary Wire-Line			DRILL RIG Mobile B47	BOREHOLE DIAMETER 4 in
SAMPLER TYPE(S) AND SIZE(S) (ID) SPT (1.4")			SPT HAMMER TYPE Safety Hammer 140#/30 inches	HAMMER EFFICIENCY, ERI 73%
BOREHOLE BACKFILL AND COMPLETION Backfilled with bentonite and/or grout			GROUNDWATER DURING DRILLING AFTER DRILLING (DATE) READINGS	TOTAL DEPTH OF BORING 51.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
0	0		ASPHALT CONCRETE (18").												
705.00	2		SILTY SAND with GRAVEL (SM); AGGREGATE BASE (12").												
703.00	4		SILTY SAND with GRAVEL (SM/SP-SM); reddish brown; dry to moist.												
701.00	6		CLAYEY SAND with GRAVEL (SC); stiff; reddish brown; moist to wet; with small roots.												
	5		At Elev 702.0', observed medium dense, moist; gravel is pea gravel sized.		1	6	14								
	6		At Elev 700.5', becomes wet.			7									
	7					7									
699.00	8														
697.00	10		At Elev 697.5', becomes (CLAYEY GRAVEL) (GC); dark brown; moist to wet; with some wood/charcoal in sample.		2	9	23								
	11		At Elev 697.0', becomes (SANDY lean CLAY) (CL); medium stiff; reddish brown.			11									
	12					12									
695.00	12														
693.00	14														
691.00	16				3	8	25								
	16					9									
	17					16									
689.00	18														
687.00	20		At Elev 687.0', observed (CLAYEY SAND with GRAVEL) (SC); small roots and decomposed wood.		4	34	50								
	21		Poorly graded SAND with SILTY CLAY and GRAVEL (SP-SC); dense; dark brown; moist; angular GRAVEL.			50									
685.00	22					0									
683.00	24														
681.00	26		SILTY, CLAYEY SAND (SC-SM); dense; dark brown; wet; little GRAVEL; coarse to fine SAND.		5	6	36								
	26					14									
	27					22									
679.00	28														
	29														
	30														

SPT Refusal . Blow count for 2nd 6 inches was 50 for 4 inches (R 50/4)

(continued)

S BR - STANDARD MEN 20 PM 4.GPJ CALTRANS LIBRARY_DEC09.GLB 6/3/10



Department of Transportation
 Division of Engineering Services
 Geotechnical Services
 Office of Geotechnical Design - North

REPORT TITLE BORING RECORD				HOLE ID R-08-001	
DIST. 01	COUNTY MEN	ROUTE 20	POSTMILE 4.7/4.8	EA 01-482101	
PROJECT OR BRIDGE NAME Gravel Pit Widening					
BRIDGE NUMBER N/A		PREPARED BY KG		DATE 4-29-10	SHEET 1 of 4

5 BR - STANDARD MEN 20 PM 4.GPJ CALTRANS_LIBRARY_DEC08.GLB 6/3/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
875.00	31		At Elev 677.0', observed (SILTY SAND with GRAVEL) (SM); some larger gravel.	6	9 12 15	27									
673.00	34														
671.00	36		At Elev 671.0', becomes olive brown.	7	19 24 50	74									
669.00	38		At Elev 669.5', observed very dense; gravel is weathered sandstone.												SPT Refusal . Blow count for 3rd 6 inches was 50 for 5 inches (R 50/5)
667.00	40														
665.00	41		At Elev 667.0', becomes reddish brown.	8	42 50 0	50									
665.00	42		At Elev 668.0', becomes olive brown.												
663.00	43														
663.00	44		SILTY, CLAYEY GRAVEL with SAND (GC-GM); very dense; gray; with white and yellow specks (decomposed/weathered shale).												
661.00	46		At Elev 661.0', observed (CLAYEY SAND with GRAVEL) (SC); very dense; dark gray; moist; some GRAVEL; fractured gravel.	9	0 37 50	87									
659.00	48		At Elev 660.0', observed weathered sandstone mixed with soil.												
657.00	49		At Elev 658.5', observed wet.												
657.00	50														
655.00	51		CLAYEY SAND with GRAVEL (SC); very dense; BOH @ 50.5 ft.	10	NA 50 0	50									SPT Refusal . Blow count for 1st 6 inches was 50 for 4 inches (R 50/4)
655.00	52		Bottom of borehole at 51.5 ft bgs												
653.00	54		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007) except as noted on the Soil or Rock Legend or below.												



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DIST. 01	COUNTY MEN	ROUTE 20	POSTMILE 4.714.8	EA 01-482101	
PROJECT OR BRIDGE NAME Gravel Pit Widening					
BRIDGE NUMBER N/A		PREPARED BY KG		DATE 4-29-10	SHEET 2 of 4

GROUP SYMBOLS AND NAMES			
Graphic / Symbol	Group Names	Graphic / Symbol	Group Names
	Well-graded GRAVEL		Lean CLAY
	Well-graded GRAVEL with SAND		Lean CLAY with SAND
	Poorly graded GRAVEL		Lean CLAY with GRAVEL
	Poorly graded GRAVEL with SAND		SANDY lean CLAY
	Well-graded GRAVEL with SILT		SANDY lean CLAY with GRAVEL
	Well-graded GRAVEL with SILT and SAND		GRAVELLY lean CLAY
	Well-graded GRAVEL with CLAY (or SILTY CLAY)		GRAVELLY lean CLAY with SAND
	Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		SILTY CLAY
	Poorly graded GRAVEL with SILT		SILTY CLAY with SAND
	Poorly graded GRAVEL with SILT and SAND		SILTY CLAY with GRAVEL
	Poorly graded GRAVEL with CLAY (or SILTY CLAY)		SANDY SILTY CLAY
	Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		SANDY SILTY CLAY with GRAVEL
	SILTY GRAVEL		GRAVELLY SILTY CLAY
	SILTY GRAVEL with SAND		GRAVELLY SILTY CLAY with SAND
	CLAYEY GRAVEL		ORGANIC lean CLAY
	CLAYEY GRAVEL with SAND		ORGANIC lean CLAY with SAND
	SILTY, CLAYEY GRAVEL		ORGANIC lean CLAY with GRAVEL
	SILTY, CLAYEY GRAVEL with SAND		SANDY ORGANIC lean CLAY
	Well-graded SAND		SANDY ORGANIC lean CLAY with GRAVEL
	Well-graded SAND with GRAVEL		GRAVELLY ORGANIC lean CLAY
	Poorly graded SAND		GRAVELLY ORGANIC lean CLAY with SAND
	Poorly graded SAND with GRAVEL		ORGANIC SILT
	Well-graded SAND with SILT		ORGANIC SILT with SAND
	Well-graded SAND with SILT and GRAVEL		ORGANIC SILT with GRAVEL
	Well-graded SAND with CLAY (or SILTY CLAY)		SANDY ORGANIC SILT
	Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)		SANDY ORGANIC SILT with GRAVEL
	Poorly graded SAND with SILT		GRAVELLY ORGANIC SILT
	Poorly graded SAND with SILT and GRAVEL		GRAVELLY ORGANIC SILT with SAND
	Poorly graded SAND with CLAY (or SILTY CLAY)		ORGANIC fat CLAY
	Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)		ORGANIC fat CLAY with SAND
	SILTY SAND		ORGANIC fat CLAY with GRAVEL
	SILTY SAND with GRAVEL		SANDY fat CLAY
	CLAYEY SAND		SANDY fat CLAY with GRAVEL
	CLAYEY SAND with GRAVEL		GRAVELLY fat CLAY
	SILTY, CLAYEY SAND		GRAVELLY fat CLAY with SAND
	SILTY, CLAYEY SAND with GRAVEL		Elastic SILT
	PEAT		Elastic SILT with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		Elastic SILT with GRAVEL
			SANDY elastic SILT
			GRAVELLY elastic SILT
			GRAVELLY elastic SILT with SAND
			ORGANIC elastic SILT
			ORGANIC elastic SILT with SAND
			ORGANIC elastic SILT with GRAVEL
			SANDY elastic ELASTIC SILT
			SANDY ORGANIC elastic SILT
			GRAVELLY ORGANIC elastic SILT
			GRAVELLY ORGANIC elastic SILT with SAND
			ORGANIC SOIL
			ORGANIC SOIL with SAND
			ORGANIC SOIL with GRAVEL
			SANDY ORGANIC SOIL
			SANDY ORGANIC SOIL with GRAVEL
			GRAVELLY ORGANIC SOIL
			GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS	
C	Consolidation (ASTM D 2436-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 08)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-08)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swail Potential (ASTM D 4548-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06)
	Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS	
	Standard Penetration Test (SPT)
	Standard California Sampler
	Modified California Sampler
	Shelby Tube
	Piston Sampler
	NX Rock Core
	HQ Rock Core
	Bulk Sample
	Other (see remarks)

DRILLING METHOD SYMBOLS			
	Auger Drilling		Rotary Drilling
	Dynamic Cone or Hand Driven		Diamond Core

WATER LEVEL SYMBOLS	
	First Water Level Reading (during drilling)
	Static Water Level Reading (short-term)
	Static Water Level Reading (long-term)



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REPORT TITLE				
BORING RECORD LEGEND				
DIST. 01	COUNTY MEN	ROUTE 20	POSTMILE 4.7/4.8	EA 01-482101
PROJECT OR BRIDGE NAME Gravel Pit Widening				
BRIDGE NUMBER N/A	PREPARED BY KG	DATE 4-29-10	SHEET 3 of 4	

ROCK GRAPHIC SYMBOLS	
	IGNEOUS ROCK
	SEDIMENTARY ROCK
	METAMORPHIC ROCK

BEDDING SPACING	
Descriptor	Thickness or Spacing
Massive	> 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8 inches to 1 ft
Thinly bedded	1-1/4 to 3-5/8 inches
Very thinly bedded	3/8 inch to 1-1/4 inches
Laminated	< 3/8 inch

WEATHERING DESCRIPTORS FOR INTACT ROCK						
Descriptor	Diagnostic Features					General Characteristics
	Chemical Weathering-Discoloration-Oxidation		Mechanical Weathering and Grain Boundary Conditions	Texture and Solutioning		
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (light)	No change	No solutioning	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull	Minor to complete discoloration or oxidation of most surfaces	No visible separation, intact (light)	Preserved	Minor leaching of some soluble minerals may be noted	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty"; feldspar crystals are "cloudy"	All fracture surfaces are discolored or oxidized	Partial separation of boundaries visible	Generally preserved	Soluble minerals may be mostly leached	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in situ disaggregation (refer to grain boundary conditions)	All fracture surfaces are discolored or oxidized; surfaces are friable	Partial separation, rock is friable; in semi-arid conditions, granitics are disaggregated	Altered by chemical disintegration such as via hydration or argillation	Leaching of soluble minerals may be complete	Dull sound when struck with hammer; usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay		Complete separation of grain boundaries (disaggregated)	Resembles a soil; partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes".

Note: Combination descriptors (such as "slightly weathered to fresh") are used where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant identifiable zones can be delineated. Only two adjacent descriptors shall be combined. "Very intensely weathered" is the combination descriptor for "decomposed to intensely weathered".

RELATIVE STRENGTH OF INTACT ROCK	
Descriptor	Uniaxial Compressive Strength (psi)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

ROCK HARDNESS	
Descriptor	Criteria
Extremely Hard	Specimen cannot be scratched with pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows
Very hard	Specimen cannot be scratched with pocket knife or sharp pick; breaks with repeated heavy hammer blows
Hard	Specimen can be scratched with pocket knife or sharp pick with heavy pressure; heavy hammer blows required to break specimen
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure; breaks with moderate hammer blows
Moderately Soft	Specimen can be grooved 1/8 in. with pocket knife or sharp pick with moderate or heavy pressure; breaks with light hammer blow or heavy hand pressure
Soft	Specimen can be grooved or gouged with pocket knife or sharp pick with light pressure, breaks with light to moderate hand pressure
Very Soft	Specimen can be readily indented, grooved, or gouged with fingernail, or carved with pocket knife; breaks with light hand pressure

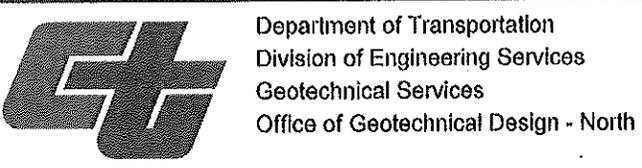
CORE RECOVERY CALCULATION (%)

$$\frac{\sum \text{Length of the recovered core pieces (in.)}}{\text{Total length of core run (in.)}} \times 100$$

RQD CALCULATION (%)

$$\frac{\sum \text{Length of intact core pieces > 4 in.}}{\text{Total length of core run (in.)}} \times 100$$

FRACTURE DENSITY	
Descriptor	Criteria
Unfractured	No fractures
Very Slightly Fractured	Lengths greater 3 ft
Slightly Fractured	Lengths from 1 to 3 ft, few lengths outside that range
Moderately Fractured	Lengths mostly in range of 4 in. to 1 ft, with most lengths about 8 in.
Intensely Fractured	Lengths average from 1 in. to 4 in. with scattered fragmented intervals with lengths less than 4 in.
Very Intensely Fractured	Mostly chips and fragments with few scattered short core lengths



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BRIDGE NUMBER N/A	PREPARED BY KG	DATE 4-29-10	SHEET 4 of 4	