

INFORMATION HANDOUT

FOR CONTRACT NO.: 06-0M2604

Project ID: 0612000095

IN KERN COUNTY, ON ROUTE 58, PM R99.2/R99.8

1) Foundation Report, Sand Canyon UC, Br. No. 50-0345R, April 9, 2014

Validation for the Br. No. 50-0345R

Foundation Report for the Br. No. 50-0345L

2) Alternative Flared Terminal System

Type Fleet-SP-MGS

Type SRT-31

Type 31" X-Tension

3) Alternative Crash Cushion System

Type CAT

Type Brakemaster 350

Type Fleet-MT

Memorandum

*Flex your power!
Be energy efficient!*

To: MR. GUDMUND SETBERG
Chief
Bridge Design Branch 2
Office of Bridge Design North/Central
Division of Engineering Services
Structure Design – MS 9 4/8I
Attn.: Jiffay Lee

Date: April 9, 2014

File: 06-KER-58-R99.4
06-0M2601
Sand Canyon UC
Bridge No. 50-0345R
(replace)

**From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5**

Subject: Foundation Report (FR)

This memorandum is in response to your request for foundation recommendations for the proposed right-side bridge replacement project referenced above.

Foundation Recommendations

A Foundation Report dated January 13, 2012 was prepared for the left bridge.

The foundation recommendation information contained in that report is acceptable for the new right-side structure and should be included in the plans for the right-side structure.

If you have any questions, please contact Christopher Koepke at (916) 227-1040 or Qiang (John) Huang at (916) 227-1037.

Report by:



Christopher Koepke, E.G.
Engineering Geologist
Office of Geotechnical Design North



Benjamin Barnes, P.E.
Transportation Engineer, Civil
Office of Geotechnical Design North

Attachments:
Foundation Report, Sand Canyon Road UC, 50-0345L, 01/13/2012

Memorandum

*Flex your power!
Be energy efficient!*

To: MR. GARY BLAKESLEY
Chief, Design Branch 5
Office of Bridge Design North
Structure Design
Division of Engineering Services

Date: January 13, 2012

File: 06-KER-58
PM R99.3/R99.7
EA 06-0K3901
ID 0600000241
Sand Canyon Rd UC
Br. No. 50-0345L

Attention: Grant Schuster

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: Foundation Report

Introduction

The Office of Geotechnical Design North has prepared this Foundation Report (FR) to provide foundation recommendations for replacement of the Sand Canyon Road Undercrossing (UC), Br. No. 50-0345L along State Route (SR) 58 in Kern County.

Scope of Work

The scope of our work for this FR includes review of the General Plan, Foundation Plan, foundation design loads provided by Structure Design (SD), evaluation of subsurface conditions based on the available geotechnical and geologic data, a field exploration program, and engineering and seismic analyses.

Project Description

The proposed structure type consists of a CIP RC Slab superstructure with diaphragm abutments and two bents with three pile extensions at each bent. The existing pile caps will be left in place. The bents will be supported on 36" diameter CIDH pile extensions which will be constructed outside the existing piles and pile caps. The abutments will be supported on existing 12" driven concrete piles and new 24" diameter CIDH piles.

Foundation design data and foundation design loads provided by Structure Design (SD) are presented in **Table 1** and **Table 2**.

Table 1. Foundation Design Data Sheet

Support No.	Design Method	Pile Type	Finished Grade Elev. (ft)	Cut-off Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement Under Service Load (in)	Number of Piles Per Support
					B	L		
Abut 1	WSD	24" CIDH	3943.5	3940.25	Diaphragm Abut.		1	3
Bent 2	LRFD	36" CIDH	NA	NA	Pile extensions		1	3
Bent 3	LRFD	36" CIDH	NA	NA	Pile extensions		1	3
Abut 4	WSD	24" CIDH	3942.5	3939.25	Diaphragm Abut.		1	3

Table 2. Foundation Design Loads

Support No.	Service-I Limit State (kips)			Strength Limit State (kips)				Extreme Event Limit State (kips)			
	Total Load		Permanent Load	Compression		Tension		Compression		Tension	
	Per Support	Max Per Pile		Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile	Per Support	Max Per Pile
Abut 1	606	90	60	NA	NA	NA	NA	NA	NA	NA	NA
Bent 2	951	519	651	1076	678	0	0	718	369	0	0
Bent 3	951	519	651	1076	678	0	0	718	369	0	0
Abut 4	606	90	60	NA	NA	NA	NA	NA	NA	NA	NA

Field Investigation

The Office of Geotechnical Design North conducted a subsurface investigation in October and November 2011.

The subsurface investigation consisted of two rotary wash borings (No. R-11-001 and R-11-002) and two Cone Penetrometer Tests (CPT-11-001 and CPT-11-002). The borings were advanced using a self-casing wireline drilling method. The maximum depth reached by the borings and CPT was approximately 121.5 feet and 100.1 feet, respectively. Sampling was achieved in the borings utilizing a Standard Penetration Test (SPT) sampler. A summary of the borings and CPT is included in **Table 3**.

**Table 3. Subsurface Exploration Summary for Sand Canyon Rd UC
(Br. No. 50-0345)**

Boring / CPT No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approx. Ground Surface Elevation (ft)	Boring Depth (ft)
R-11-001	10/26/2011	Acker	Auto	74	3937	81.5
R-11-002	10/25/2011	Acker	Auto	74	3940	121.5
CPT-11-001	11/1/2011	CPT	NA	NA	3920	100.0
CPT-11-002	11/1/2011	CPT	NA	NA	3920	100.1

For subsurface data and boring locations, please refer to the Log of Test Borings and the As-Built Log of Test Borings for detailed observations, information and conditions.

Full-sized Logs-of-Test-Borings (LOTB) will be prepared by Geotechnical Services, Office of Geotechnical Support, Branch D, Contracts, Graphics & Records to be incorporated in the project plans.

Site Geology and Subsurface Conditions

Information regarding the regional geology can be found on the Geologic Map of the Bakersfield Quadrangle, published by CDMG dated 1987. According to this map, the proposed bridge site is located in Recent Quaternary Alluvium, which consists of sands, silts and gravels.

The soils underlying the proposed bridge site were classified based on field classification of boring samples and CPT data. The fill embankment is about 20 feet in height and consists of dense to very dense gravelly sand. Below the fill embankment, the soil consists of about 50 feet of interbedded layers of loose to medium dense gravelly, clayey and silty sand, clean sand, and sandy to clayey silt. Below this layer, the soil consists predominantly of dense to very dense silty to gravelly sand to the maximum depth explored of 120 feet.

Topography and Drainage

Regionally, the proposed bridge site is located at the southeast corner of the Great Valley geomorphic province of California, in a transition area from flat to mountainous terrain. Locally, the proposed bridge site is generally flat with elevations ranging from 3940 feet at the top of the approach fills to 3922 feet at the bottom of the approach fills.

Ground Water

The groundwater depth was measured from the top of the approach fill at a stabilized depth of 60 feet below the ground surface (approximate elevation 3880 feet) in boring R-11-002 on November 1, 2011.

Scour

As the bridge structure is not located adjacent to any waterways, scour is not a consideration for this project.

Corrosion

Chemical tests were performed to determine the corrosion potential of the soil. The results from the corrosion testing are included in **Table 4**.

Table 4. Soil Corrosion Test Summary

Location	SIC Number	Minimum Resistivity (ohm-cm)	pH	Chloride Content (ppm)	Sulfate Content (ppm)
Sand Canyon Rd UC	C702986	1359	7.88	NA	NA

The Department currently defines a corrosive area as an area where the soil and/or water contains more than 500 PPM of chlorides, or more than 2000 PPM of sulfates, or has a minimum resistivity of less than 1000 ohm-centimeters, or has a pH of 5.5 or less. With the exception of MSE Walls, chloride and sulfate tests (CTM 422 and CTM 417) are not required (NA) if the minimum resistivity is greater than 1,000 ohm-cm.

The test results are consistent for soils present in the project area and within the non-corrosive limits established by the Department. Consequently, the soil should be considered non-corrosive with respect to pH and resistivity.

Seismic Recommendations

Based on the Caltrans 2009 Seismic Design Procedure, the nearest active fault is the Garlock Fault Zone (Western Section), Fault ID No. 349 with a M_{max} of 7.8. The fault is located southeast of the proposed bridge site. The rupture distance to the fault plane from the bridge site is estimated to be about 1.5 miles. The fault is referred to as a left lateral strike slip (LLSS) fault with a dip angle of 90 degrees.

Based on the log of test borings a V_{s30} (average shear wave velocity for the top 100 feet of soil column) was estimated using the SPT blow counts and the correlation formulas for both cohesive and granular soil. The estimated shear wave velocity is 236 meters per second.

Using the above shear wave velocity, the design Acceleration Response Spectrum, (ARS) curve is controlled by the USGS 5% probability of exceedance in 50 years (return period of 975 years). The design ARS curve was obtained from "USGS 2008 Interactive Deaggregation (Beta)" web site, and is attached. The estimated peak ground acceleration as shown on the ARS curve is 0.46g.

A liquefaction analysis indicates that the granular soil from elevation 3865 to 3870 feet has the potential to liquefy during a seismic event. Liquefaction analysis indicates that seismic induced settlement will be on the order of 2 to 3 inches. Lateral spreading is not anticipated.

The potential for surface rupture at the site due to fault movement is considered insignificant since there are no known faults projecting towards or passing directly through the project site.

The recommended design ARS curve with an estimated peak ground acceleration of 0.46g is attached on **Plate No. 1**.

As-Built Foundation Data

Based on the the As-Built Foundation Plan, General Plan, and Concrete Pile Details for Sand Canyon Road UC, dated August 4, 1970, the existing bridge is supported on Class II 12" driven concrete piles. The design load of the piles is 90 kips. The piles were driven to an average tip elevation of approximately 3870 feet. Pile tip elevations were based on a ground water elevation of 3841 feet.

Foundation Recommendations

Recommendations for 24 inch diameter CIDH piles at Abutments 1 and 2 are presented in **Table 5**.

Table 5. Foundation Recommendations for Abutments

Support	Pile Type	Cut-off Elevation (ft)	Service Limit State Per Support (kips)		LRFD Service-I Limit State Total Load (kips) Per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elev (ft)	Spec Tip Elev (ft)
			Total	Permanent				
Abut 1	24" CIDH	3940.25	606	60	90	180	3886 (a)	3886
Abut 2	24" CIDH	3939.25	606	60	90	180	3886 (a)	3886

Notes:

1. Recommendations are based on Working Stress Design (WSD) for abutments and the loads provided by SD.
2. A factor of safety of 2.0 is used to calculate the available geotechnical resistance in Service Limit State.
3. Design tip elevations are controlled by (a) compression.
4. Design tip elevation controlled by settlement is not applicable.
5. Design tip elevation for lateral load is typically provided by SD.
6. Specified tip elevation shall not be raised if controlled by lateral load.

Recommendations for 36 inch diameter CIDH piles at Bents 2 and 3 are presented in **Table 6**.

Table 6. Foundation Recommendations for Bents

Supp Loc	Pile Type	Cut-off Elev (ft)	Service-I Limit State Load Per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elev (ft)	Spec Tip Elev (ft)
					Strength Limit		Extreme Event			
					Comp $\phi=0.7$	Tension $\phi=0.7$	Comp $\phi=1.0$	Tension $\phi=1.0$		
Bent 2	36" CIDH	NA	951	1	678	0	369	0	3835 (a-II)	3835
Bent 3	36" CIDH	NA	951	1	678	0	369	0	3835 (a-II)	3835

Notes:

1. The design tip elevations recommended herein are controlled by (a-II) compression (Strength Limit State).
2. A resistance factor of 0.7 is used to calculate the available geotechnical resistance in Strength Limit State.
3. Design tip elevation controlled by settlement is not applicable.
4. Design tip elevation for lateral load is typically provided by SD.
5. Specified tip elevation shall not be raised if controlled by lateral load.

Recommendations for 24 inch CIDH piles at the Abutments and 36 inch CIDH piles at the Bents are presented in **Table 7**.

Table 7. Pile Data Table

Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)
		Compression	Tension		
Abut 1	24" CIDH	180	N/A	3886 (a)	3886
Bent 2	36" CIDH	969	0	3835 (a)	3835
Bent 3	36" CIDH	969	0	3835 (a)	3835
Abut 4	24" CIDH	180	N/A	3886 (a)	3886

Notes:

1. Design tip elevations for Abutments and Bents are controlled by (a) compression.

Construction Considerations

Ground water was measured at an approximate elevation of 3880 feet in boring R-11-002 on November 30, 2011. As the specified tip elevation for the 36” diameter CIDH piles are deeper than the measured ground water elevation, ground water may be encountered during pile construction. Specifications for construction of CIDH piles in wet conditions need to be included with the project.

All earthwork shall follow Section 19 of the Caltrans Standard Specifications.

Layers of loose sandy material were encountered within the borings. Temporary casing may be needed during CIDH pile construction to mitigate caving. If temporary casing is used, it shall be removed while the concrete is being placed in order to develop the required pile capacity.

Project Information

Standard Special Provision 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. *Log-of-Test-Borings (LOTB), Sand Canyon Road UC (Replace).*

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

- A. *Foundation Report for EA 06-0K3901, dated 1/13/2012.*

Data and Information available for inspection at the District Office:

- A. *None.*

Data and Information available for inspection at the Transportation Laboratory are:

- A. *None.*

Disclaimer and Contact Information

The foundation recommendations included in this report are based on specific project information regarding structure type, location, and design loads provided by SD. If any changes are made during final project design, OGDN should review the changes to determine if these foundation recommendations are still applicable. Any questions regarding this report should be directed to the attention of Ben Barnes at 916-227-1039.

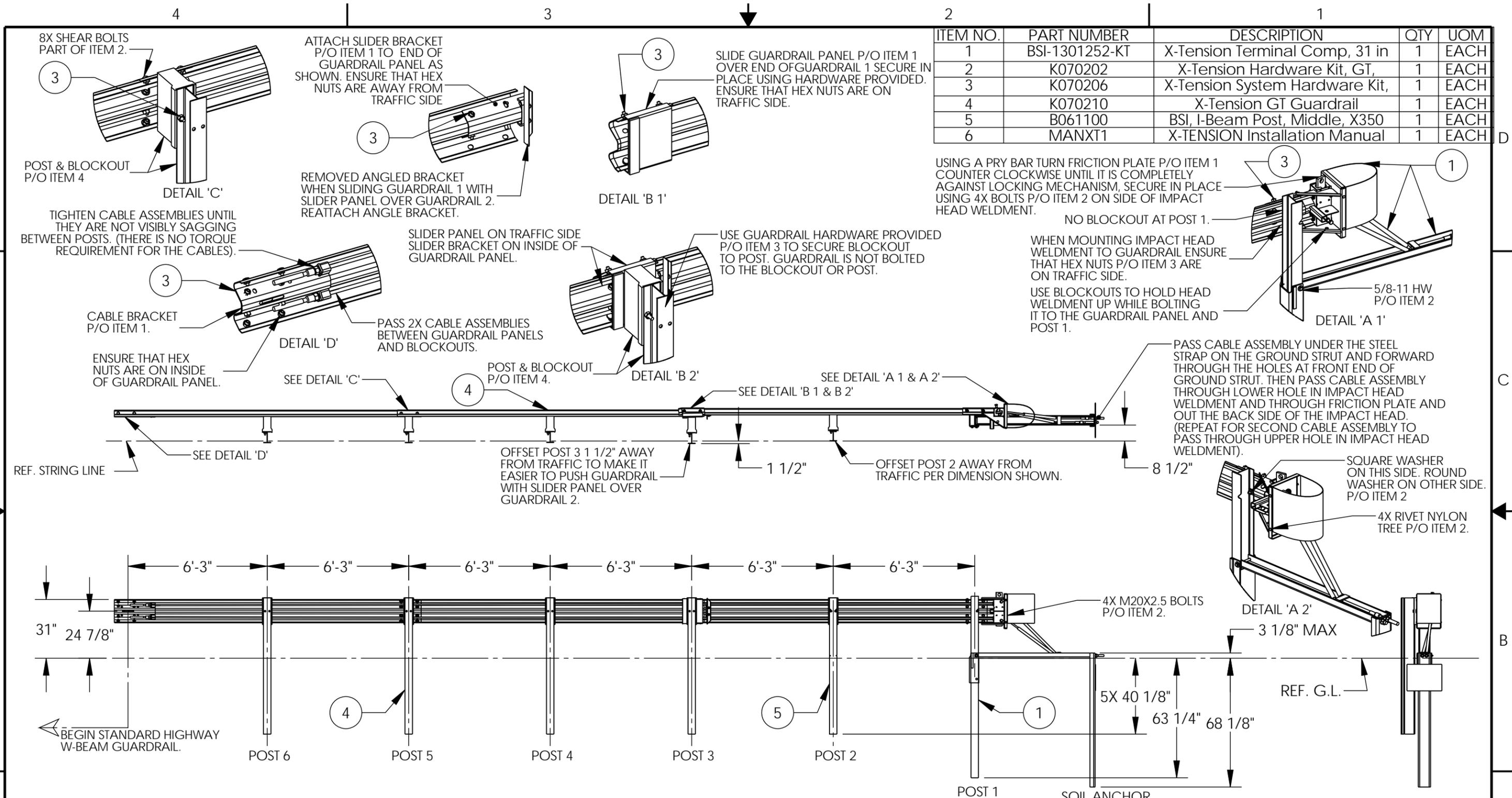


BENJAMIN M. BARNES, P.E.
Transportation Engineer, Civil
Office of Geotechnical Design North
Geotechnical Services



Attachment: Plate No. 1 – Final Design Response Spectrum

- c: Frank Momen (D6 Project Manager)
- Qiang Huang (GS, OGDN-E)
- Shira Rajendra (GS Corporate)
- Structure R.E. Pending File
- Rebecca Harnagel (DES Office Engineer, Office of PS&E)
- Ted Mooradian (D6 DME)



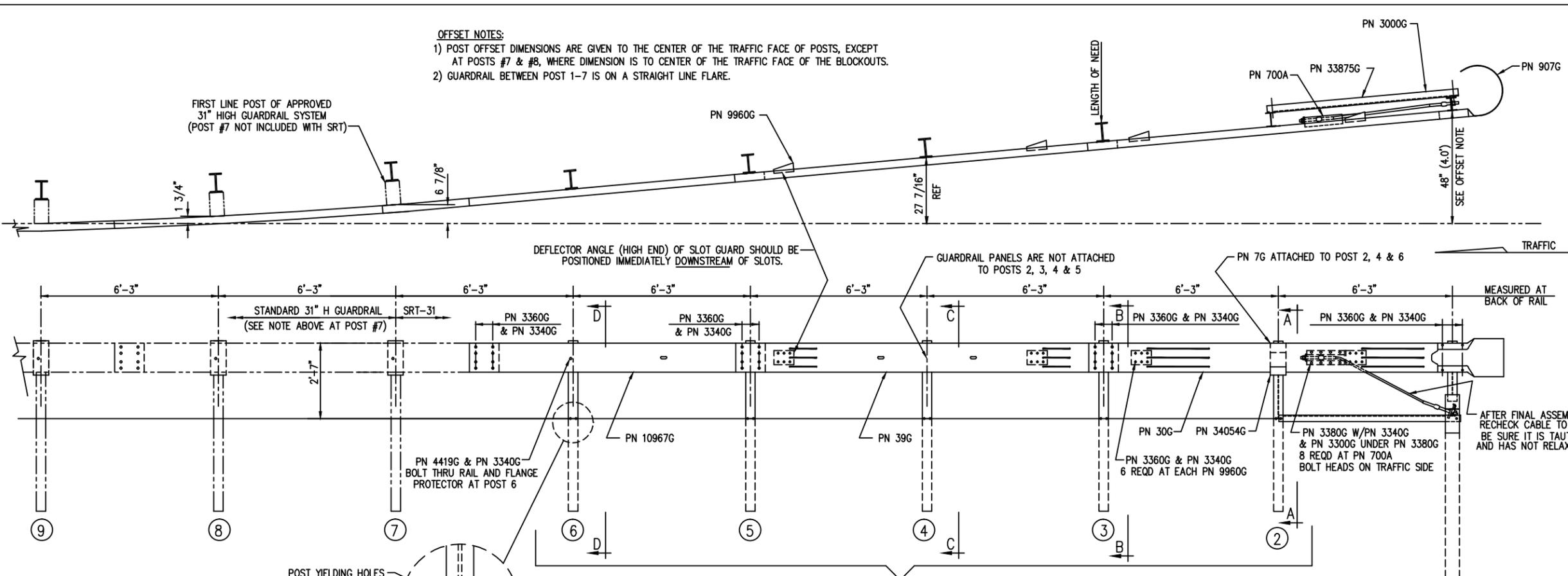
- NOTES: UNLESS OTHERWISE SPECIFIED.
- SYSTEM TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS.
 - ONLY TIGHTEN THE CABLE ASSEMBLIES USING THE NUTS AT THE CABLE BRACKET (SEE DETAIL 'D'). DO NOT TIGHTEN THE CABLES AT THE FRONT OF THE GROUND ANCHOR.
 - WHEN DRIVING STEEL POST, ENSURE THAT A DRIVING CAP WITH TIMBER OR PLASTIC INSERT IS USED TO PREVENT DAMAGE TO THE GALVANIZING TO THE TOP OF THE POST.

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APPROVALS		THIRD ANGLE PROJECTION		TITLE		X-TENSION GUARDRAIL TERMINAL SYSTEM	
DRAWN BY:	NMV			REV		XTGTSS5	
DRAWN DATE:	2/08/13			B	2067	05/02/13	SIZE
APPR'D BY:	JMT	A	2022	2/08/13	B	XTGTSS5	
APPR'D DATE:	2/08/13	REV	ECN#	DATE	SCALE	1:50	SHEET 1 OF 1

OFFSET NOTES:

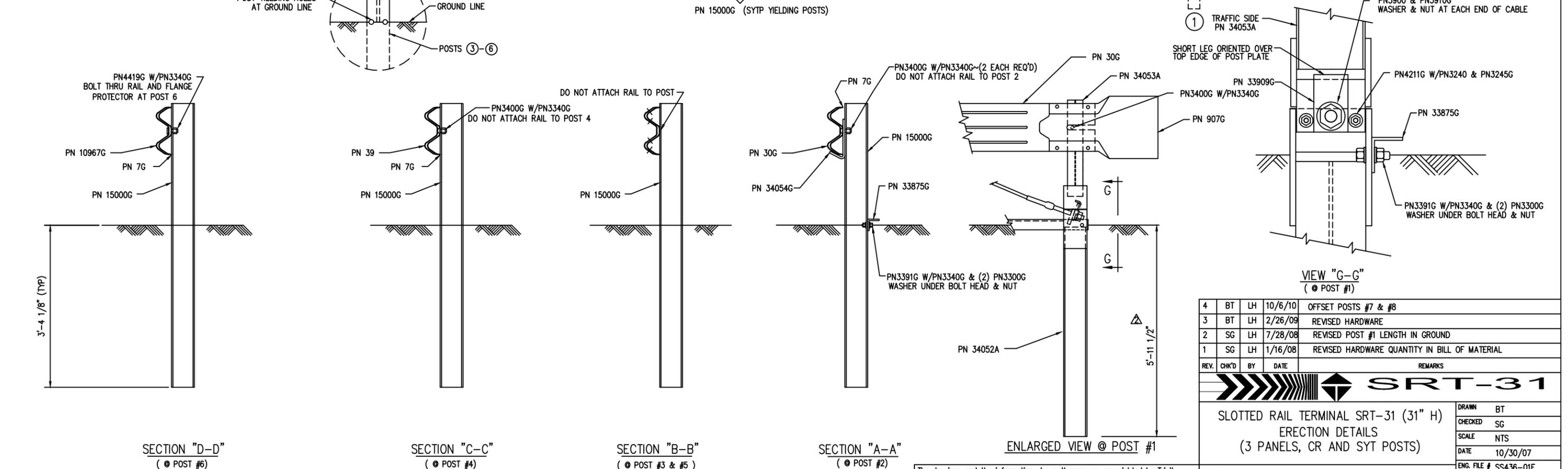
- 1) POST OFFSET DIMENSIONS ARE GIVEN TO THE CENTER OF THE TRAFFIC FACE OF POSTS, EXCEPT AT POSTS #7 & #8, WHERE DIMENSION IS TO CENTER OF THE TRAFFIC FACE OF THE BLOCKOUTS.
- 2) GUARDRAIL BETWEEN POST 1-7 IS ON A STRAIGHT LINE FLARE.

FIRST LINE POST OF APPROVED 31" HIGH GUARDRAIL SYSTEM (POST #7 NOT INCLUDED WITH SRT)



BILL OF MATERIAL

PN	QTY	DESCRIPTION
7G	3	12/6"/FLG PROTECTOR (AT POST 2, 4 & 6)
30G	1	12/12/6"/S SRT-1 (GUARDRAIL)
39G	1	12/12/6"/S SRT-2 (GUARDRAIL)
700A	1	CABLE ANCHOR BRACKET
907G	1	12/BUFFER/ROLLED (TERMINAL)
3000G	1	3/4 x 6'-6" CABLE
HARDWARE		
3240G	2	5/16" WASHER (AT POST 1)
3245G	2	5/16" HEX NUT (AT POST 1)
3300G	12	5/8" WASHER
3340G	67	5/8" HEX HGR NUT
3360G	52	5/8" x 1 1/4" HGR SPLICE BOLT
3380G	8	5/8" x 1 1/2" HEX HD BOLT
3400G	4	5/8" x 2" HGR POST BOLT (AT POSTS 1, 2 & 4)
3391G	2	5/8" x 1 3/4" HEX BOLT (A325) (AT STRUT)
3900G	2	1" WASHER (AT CABLE)
3910G	2	1" HEX NUT (AT CABLE)
4211G	2	5/16" x 1 3/4" HEX BOLT (AT POST 1)
4419G	1	5/8" x 1 3/4" COUNTERSUNK HD BOLT (AT POST 6)
9960G	4	SLOT GUARD BRACKET
10967G	1	12/9/4.5/31.5/S SRT-3 (GUARDRAIL)
15000G	5	6'-0" SYT POST (W6 X 8.5)
33909G	1	CABLE ANCHOR BRACKET (AT POST 1)
33875G	1	ANGLE STRUT 3 x 3 x 1/4
34052A	1	CR POST 1 BOT (W6 X 15)
34053A	1	CR POST 1 TOP (W6 X 8.5)
34054G	1	POST SHELF ANGLE (AT POST 2)



REV.	CHK'D	BY	DATE	REMARKS
4	BT	LH	10/6/10	OFFSET POSTS #7 & #8
3	BT	LH	2/26/09	REVISED HARDWARE
2	SG	LH	7/28/08	REVISED POST #1 LENGTH IN GROUND
1	SG	LH	1/16/08	REVISED HARDWARE QUANTITY IN BILL OF MATERIAL

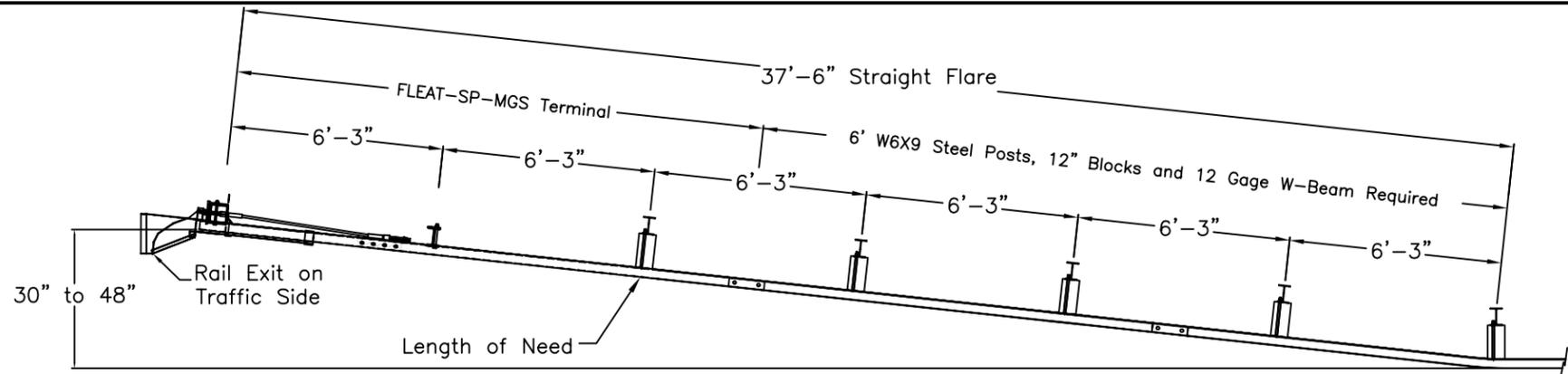
SRT-31

SLOTTED RAIL TERMINAL SRT-31 (31" H)
ERECTION DETAILS
(3 PANELS, CR AND SYT POSTS)

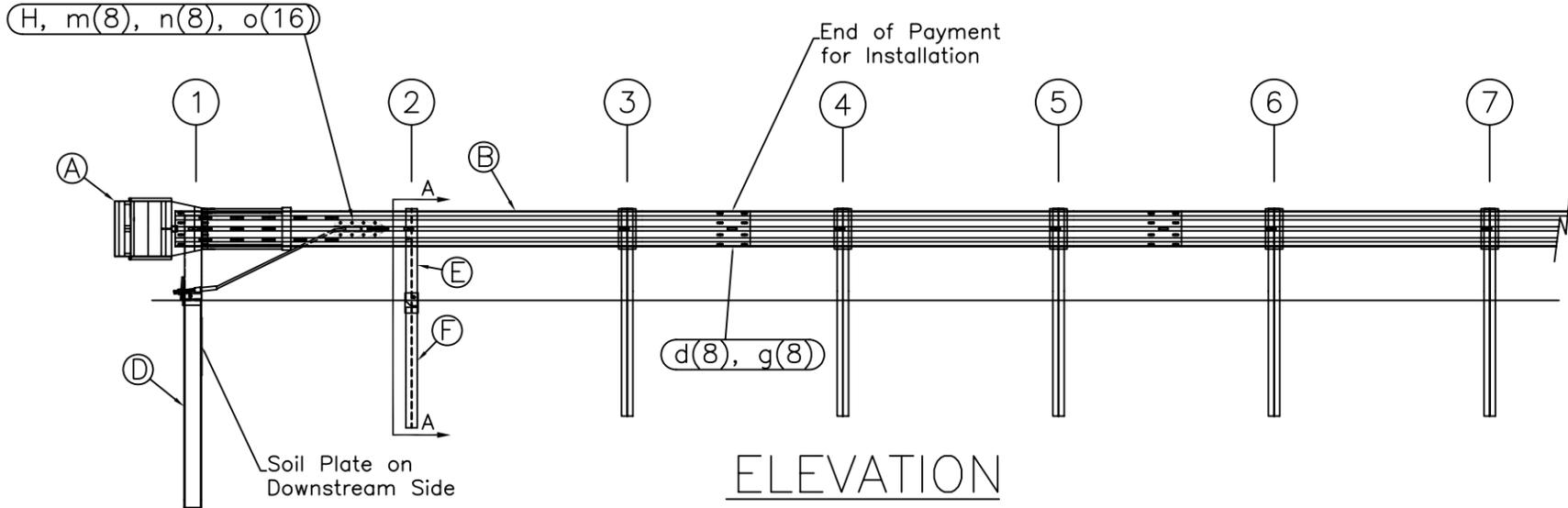
DRAWN	BT
CHECKED	SG
SCALE	NTS
DATE	10/30/07
ENG. FILE #	SS436-01E
SHT.No.	E1 OF 1
DRAWING NO.	SS 436
REV.	4

TRINITY HIGHWAY PRODUCTS, LLC.
2525 STEMMONS FREEWAY
DALLAS, TX 75207

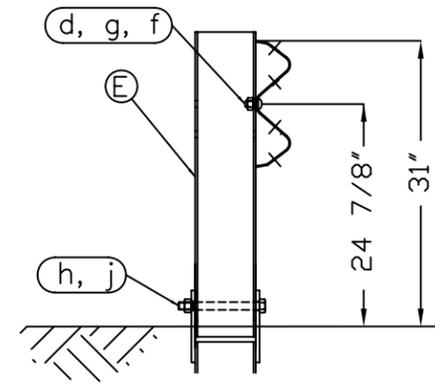
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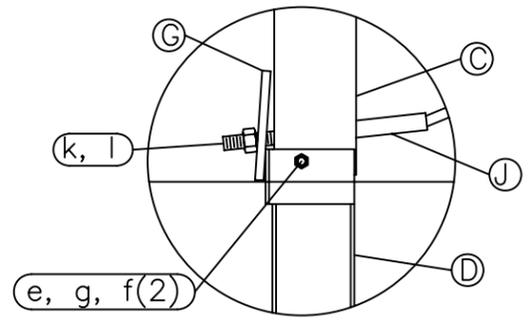
PLAN



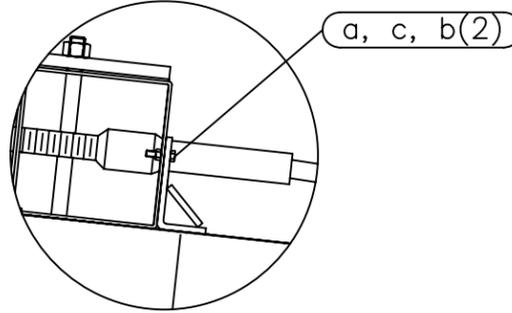
ELEVATION



SECTION A-A
Post #2



Post #1 Connection Detail



Impact Head Connection Detail

ITEM	QTY	BILL OF MATERIALS	ITEM NO.
A	1	IMPACT HEAD	F3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.	MGS-SF1303
C	1	FIRST POST TOP (6X6X $\frac{1}{8}$ " Tube)	TPHP1A
D	1	FIRST POST BOTTOM (6' W6X15)	TPHP1B
E	1	SECOND POST ASSEMBLY TOP	UHP2A
F	1	SECOND POST ASSEMBLY BOTTOM	HP3B
G	1	BEARING PLATE	E750
H	1	CABLE ANCHOR BOX	S760
J	1	BCT CABLE ANCHOR ASSEMBLY	E770

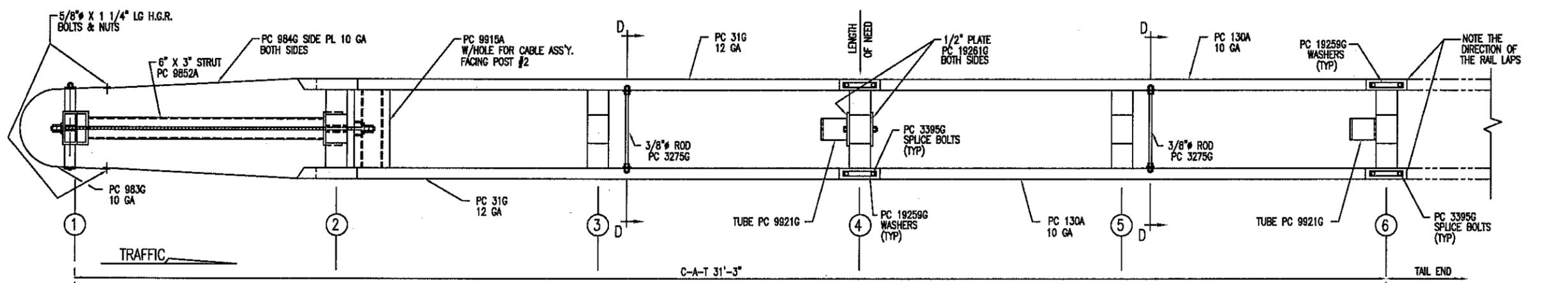
HARDWARE (ALL DIMENSIONS IN INCHES)			
a	2	5/16 x 1 HEX BOLT GRD 5	B5160104A
b	4	5/16 WASHER	W0516
c	2	5/16 HEX NUT	N0516
d	9	5/8 Dia. x 1 1/4 SPLICE BOLT (POST #2)	B580122
e	1	5/8 Dia. x 9 HEX BOLT GRD 5	B580904A
f	3	5/8 WASHER	W050
g	10	5/8 Dia. H.G.R NUT	N050
h	1	3/4 Dia. x 8 1/2 HEX BOLT GRD A449	B340854A
j	1	3/4 Dia. HEX NUT	N030
k	2	1 ANCHOR CABLE HEX NUT	N100
l	2	1 ANCHOR CABLE WASHER	W100
m	8	CABLE ANCHOR BOX SHOULDER BOLT	SB58A
n	8	1/2 A325 STRUCTURAL NUT	N055A
o	16	1 1/16 OD x 9/16 ID A325 STR. WASHER	W050A

GENERAL NOTES:

- All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
- The lower sections of the Posts 1&2 shall not protrude more than 4 in above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
- The lower sections of the hinged posts should not be driven with the upper post attached. If the post is placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
- When competent rock is encountered, a 12" Ø post hole, 20 in. deep cored into the rock surface may be used if approved by the engineer for post 1. Granular material will be placed in the bottom of the hole, approximately 2.5" deep to provide drainage. The first post can be field cut to length, placed in the hole and backfilled with suitable backfill. The soil plate may be trimmed if required.
- The breakaway cable assembly must be taut. A locking device (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening nuts.

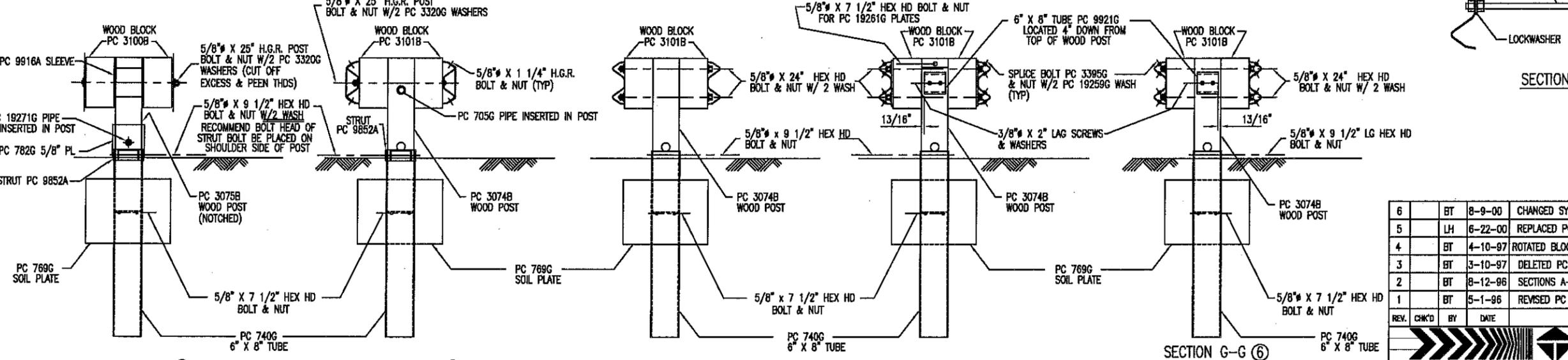
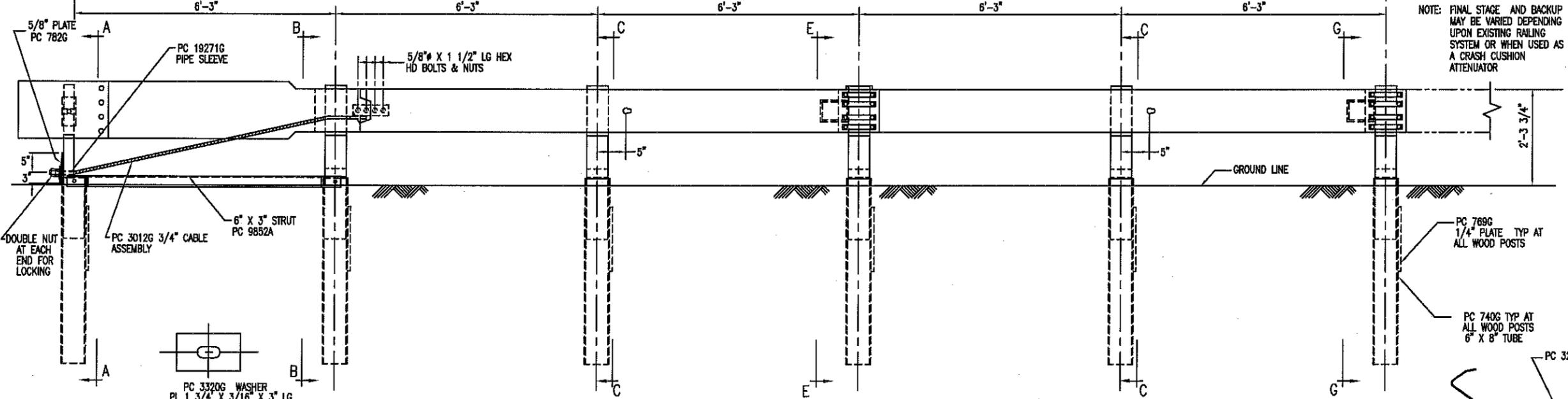
Big Spring, TX
Phone: 432-263-2435
or Phone: 330-346-0721

FLEAT-SP-MGS Terminal Midwest Guardrail System 31" Top of Rail		Sheet:	1
		Date:	02/24/10
Drawing Name: FLT-SP-S-MGS		By:	JRR
		Scale:	None
		Rev:	0



C-A-T BILL OF MATERIAL

PRODUCT CODE	QTY	DESCRIPTION
31G	2	12/12/6/D CAT (GUARDRAIL)
130A	2	10/12/6/8/10/6/8/SP CAT (GUARDRAIL)
705G	1	2' x 5 1/2" PIPE
740G	6	4'6" TUBE SLEEVE
769G	6	1/4 x 18 x 24 SOIL PLATE
782G	1	5/8" x 8" x 8" BEARING PLATE
983G	1	10/NOSE PLATE/CAT/ROLLED
984G	2	10/SIDE PLATE CAT
3012G	1	CABLE 3/4 x 8'0"/DBL SWG
3074B	5	WD 3/6 POST #2, 3, 4, 5, 6 CAT
3075B	1	WD 3/6 POST #1 CAT
3100B	2	WD BLOCK 1'2" #1 CAT
3101B	10	WD BLOCK 1'2" #2-6 CAT
3255G	4	3/8" FLAT WASHER
3263G	4	3/8" x 2" LAG SCREW
3275G	2	3/8" x 24 1/2" RESTRAINT ROD
3300G	20	5/8" FLAT WASHER
3320G	4	3/16" x 1 3/4" x 3" RECT WASHER
3340G	85	5/8" G.R. NUT
3360G	16	5/8" x 1 1/4" G.R. BOLT
3380G	8	5/8" x 1 1/2" HEX BOLT
3395G	32	5/8" x 1 3/4" HEX BOLT CAT
3478G	13	5/8" x 7 1/2" HEX BOLT
3497G	6	5/8" x 9 1/2" HEX BOLT
3650G	2	5/8" x 25" G.R. BOLT
3900G	2	1" FLAT WASHER
3910G	4	1" HEX NUT
4252G	8	3/8" HEX NUT
4258G	4	3/8" LOCK WASHER
4640G	8	5/8" x 24" HEX BOLT
9852A	1	CHANNEL STRUT x 6'-8"
9915A	1	SPACER CHANNEL CAT
9916A	1	10/BENT PLATE SLEEVE
9921G	2	6" SLEEVE 6 x 8
19259G	32	3/16" x 2" x 10" PLATE WASHER
19261G	2	1/2 x 3 x 7 POST PLATE
19271G	1	1" x 2 1/2" PIPE SLEEVE CAT



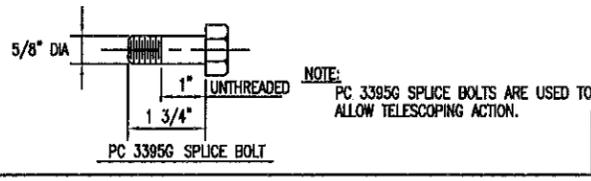
REV.	CHK'D	BY	DATE	REMARKS
6	BT	8-9-00		CHANGED SYSTEM HEIGHT, WAS 2'-3"
5	LH	6-22-00		REPLACED PC 766 WITH PC 769, CHANGED TITLE BLOCK
4	BT	4-10-97		ROTATED BLOCK PC 9921 90° AT POST 4 & 6
3	BT	3-10-97		DELETED PC 3072, 3073, 4470, CHG QTY 3074 & 3478
2	BT	8-12-96		SECTIONS A-A & B-B, CORRECTED PIPE SLEEVE PC No
1	BT	5-1-96		REVISED PC No 31G & 130A

C-A-T

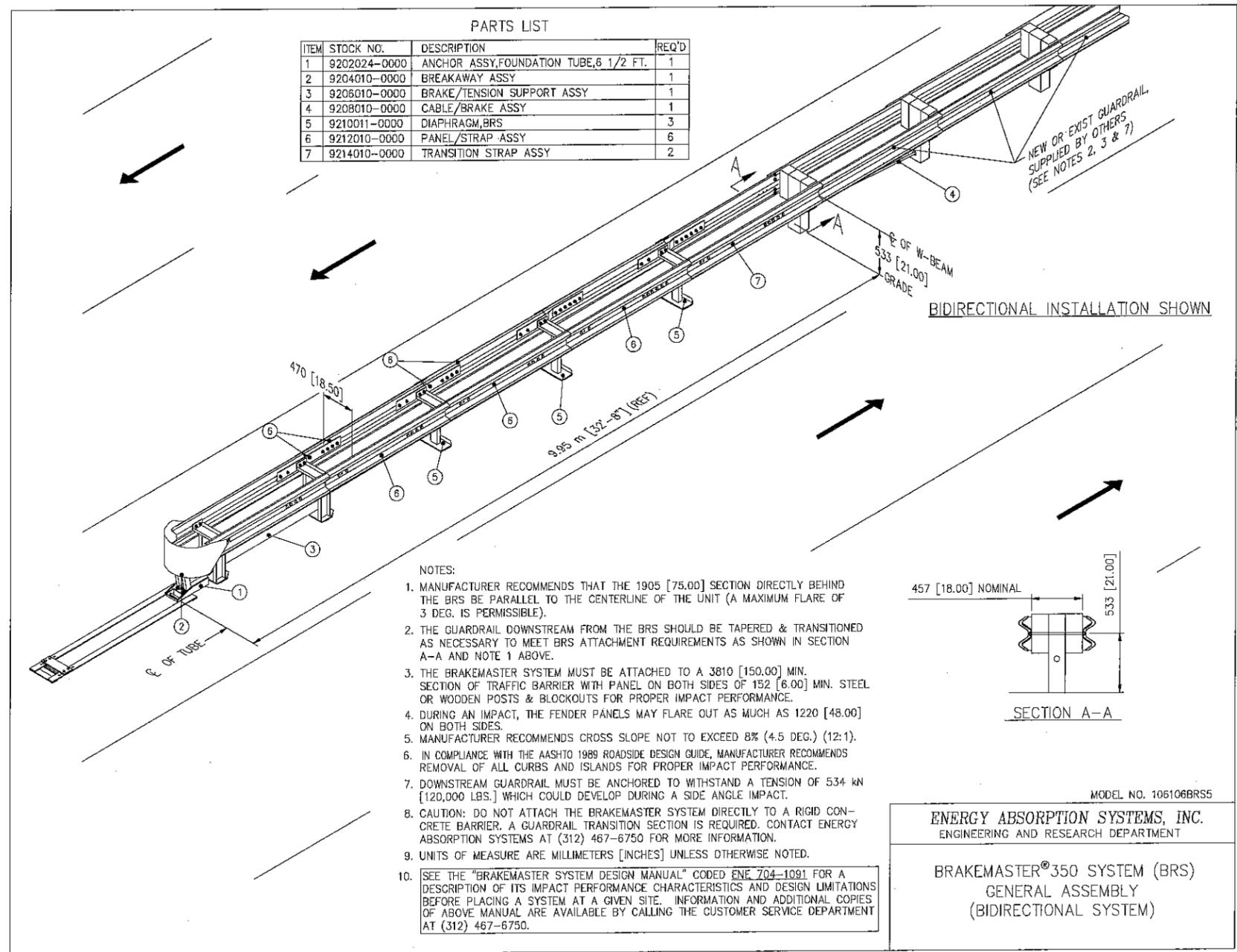
CRASH-CUSHION ATTENUATING TERMINAL PLAN, ELEVATION & SECTIONS FOR USE AS A LONGITUDINAL MEDIAN BARRIER TERMINAL OR CRASH CUSHION ATTENUATOR

TRINITY INDUSTRIES, INC.
HIGHWAY SAFETY PRODUCTS
2525 STEMMONS FREEWAY, DALLAS, TX 75207

DRAWN	BT
CHECKED	EN
SCALE	N.T.S.
DATE	7-15-94
ENG. FILE #	SS245-01E
SHT.No.	E1 OF 1
DRAWING NO.	SS-245
REV.	6



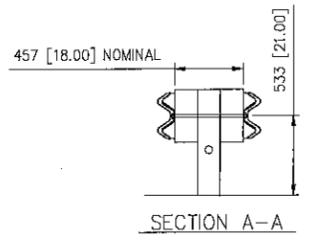
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PARTS LIST

ITEM	STOCK NO.	DESCRIPTION	REQ'D
1	9202024-0000	ANCHOR ASSY, FOUNDATION TUBE, 6 1/2 FT.	1
2	9204010-0000	BREAKAWAY ASSY	1
3	9206010-0000	BRAKE/TENSION SUPPORT ASSY	1
4	9208010-0000	CABLE/BRAKE ASSY	1
5	9210011-0000	DIAPHRAGM, BRS	3
6	9212010-0000	PANEL/STRAP ASSY	6
7	9214010-0000	TRANSITION STRAP ASSY	2

- NOTES:
1. MANUFACTURER RECOMMENDS THAT THE 1905 [75.00] SECTION DIRECTLY BEHIND THE BRS BE PARALLEL TO THE CENTERLINE OF THE UNIT (A MAXIMUM FLARE OF 3 DEG. IS PERMISSIBLE).
 2. THE GUARDRAIL DOWNSTREAM FROM THE BRS SHOULD BE TAPERED & TRANSITIONED AS NECESSARY TO MEET BRS ATTACHMENT REQUIREMENTS AS SHOWN IN SECTION A-A AND NOTE 1 ABOVE.
 3. THE BRAKEMASTER SYSTEM MUST BE ATTACHED TO A 3810 [150.00] MIN. SECTION OF TRAFFIC BARRIER WITH PANEL ON BOTH SIDES OF 152 [6.00] MIN. STEEL OR WOODEN POSTS & BLOCKOUTS FOR PROPER IMPACT PERFORMANCE.
 4. DURING AN IMPACT, THE FENDER PANELS MAY FLARE OUT AS MUCH AS 1220 [48.00] ON BOTH SIDES.
 5. MANUFACTURER RECOMMENDS CROSS SLOPE NOT TO EXCEED 8% (4.5 DEG.) (12:1).
 6. IN COMPLIANCE WITH THE AASHTO 1989 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS FOR PROPER IMPACT PERFORMANCE.
 7. DOWNSTREAM GUARDRAIL MUST BE ANCHORED TO WITHSTAND A TENSION OF 534 kN [120,000 LBS.] WHICH COULD DEVELOP DURING A SIDE ANGLE IMPACT.
 8. CAUTION: DO NOT ATTACH THE BRAKEMASTER SYSTEM DIRECTLY TO A RIGID CONCRETE BARRIER. A GUARDRAIL TRANSITION SECTION IS REQUIRED. CONTACT ENERGY ABSORPTION SYSTEMS AT (312) 467-6750 FOR MORE INFORMATION.
 9. UNITS OF MEASURE ARE MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.
 10. SEE THE "BRAKEMASTER SYSTEM DESIGN MANUAL" CODED ENE 704-1091 FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND ADDITIONAL COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING THE CUSTOMER SERVICE DEPARTMENT AT (312) 467-6750.

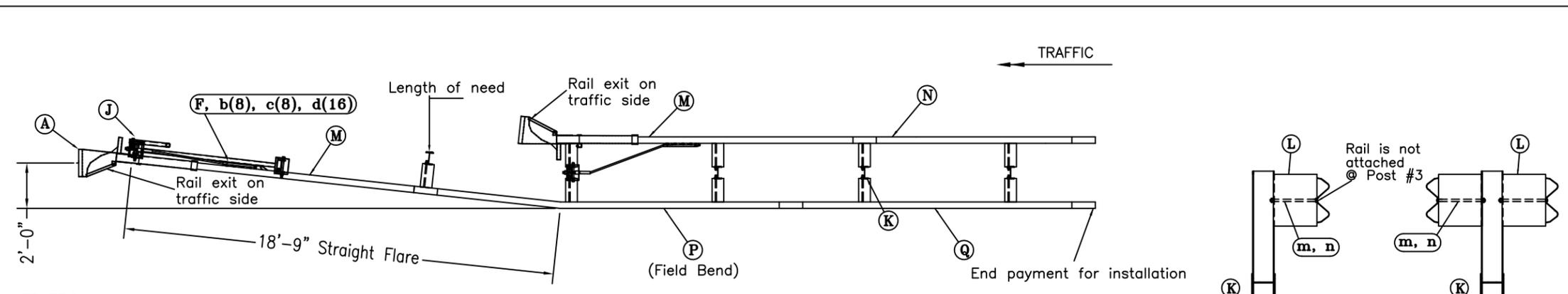


MODEL NO. 106106BRS5

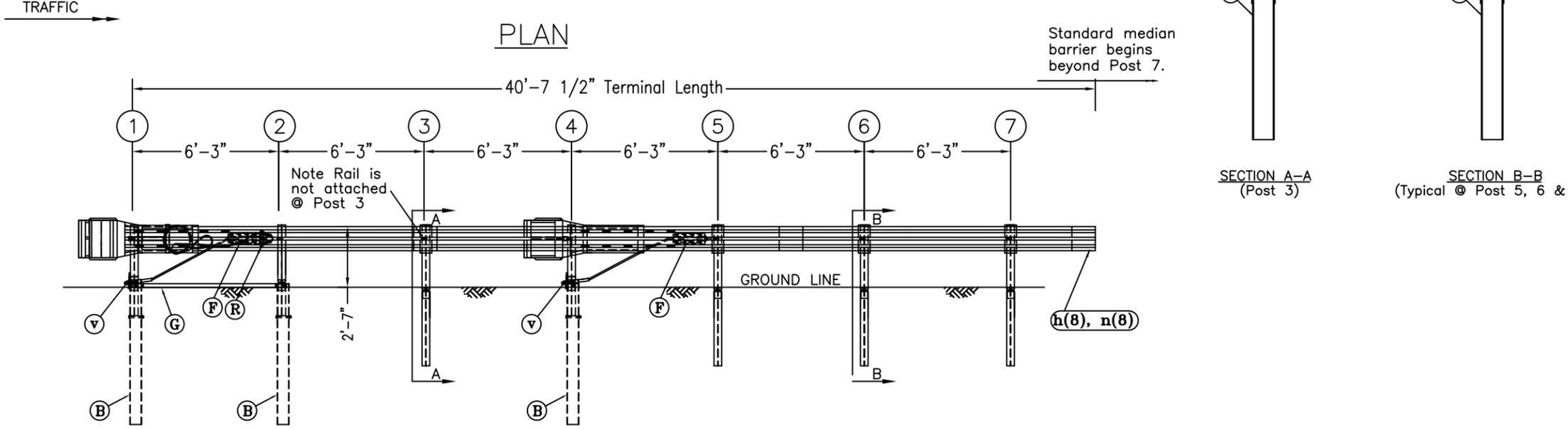
ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

BRAKEMASTER®350 SYSTEM (BRS)
GENERAL ASSEMBLY
(BIDIRECTIONAL SYSTEM)

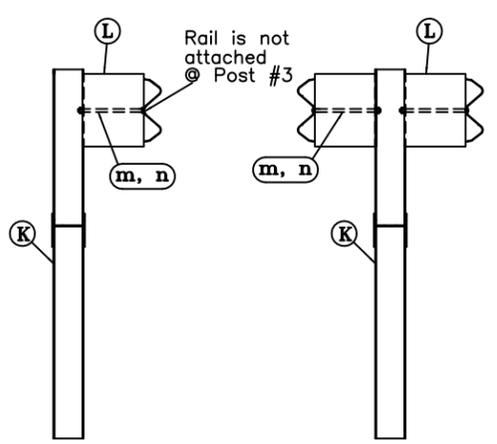
Brakemaster® 350



PLAN

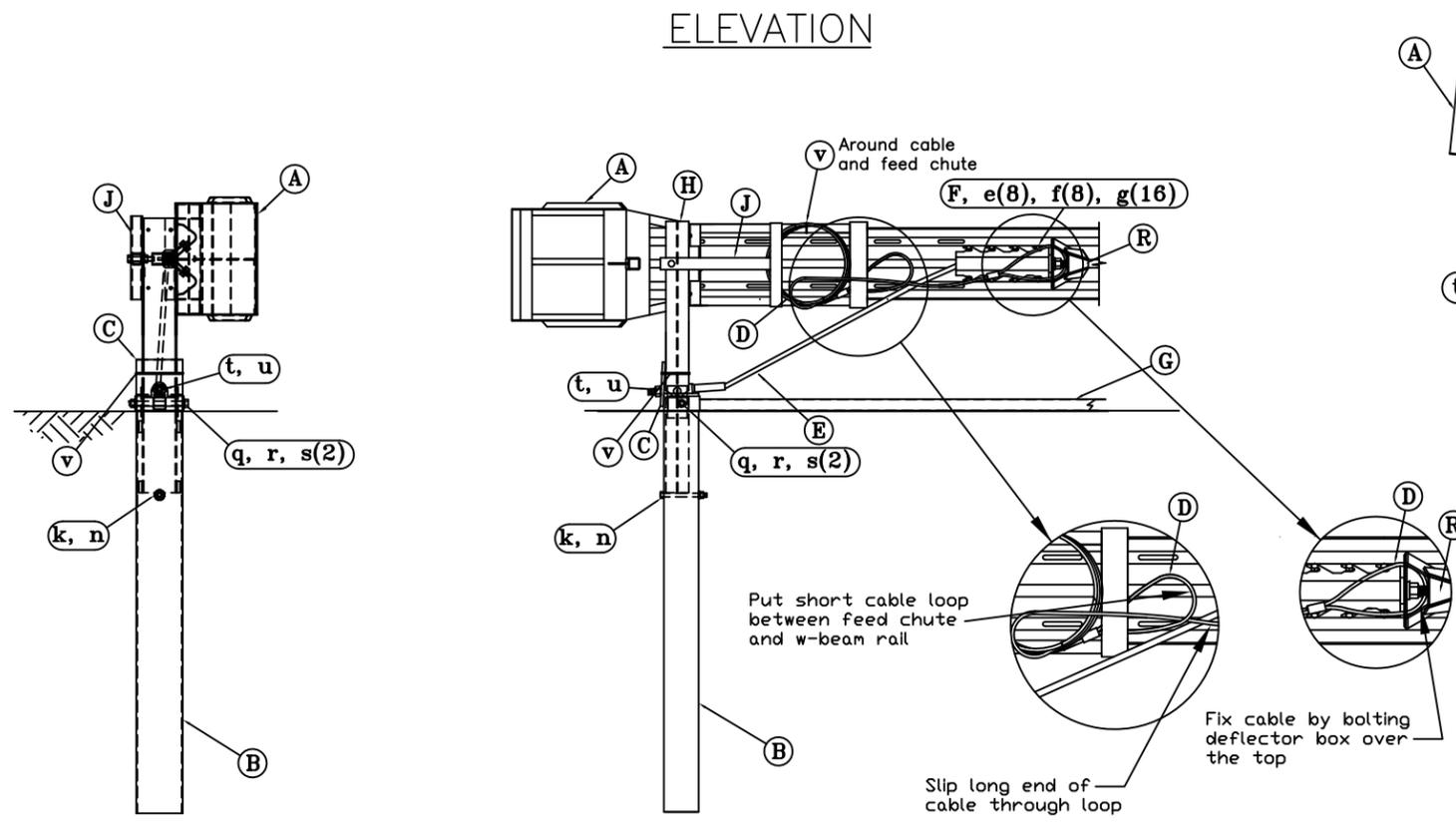


ELEVATION



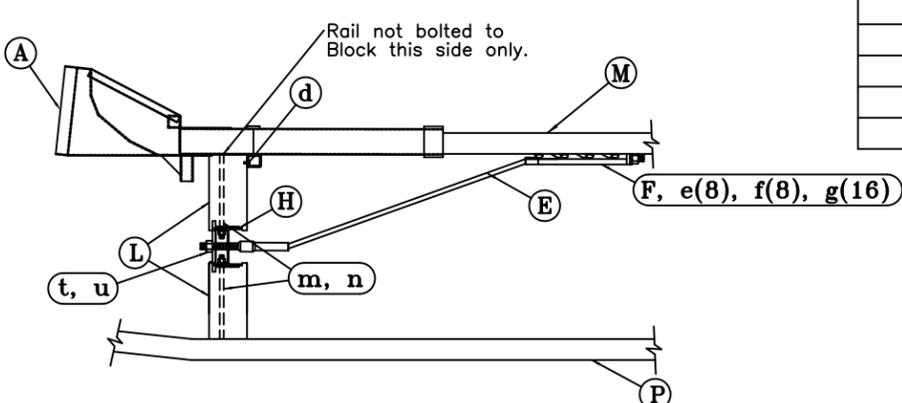
SECTION A-A
(Post 3)

SECTION B-B
(Typical @ Post 5, 6 & 7)

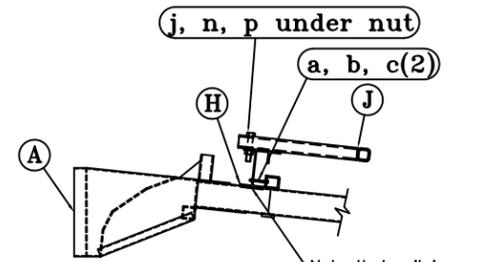


END VIEW OF POST 1

BACK VIEW OF POST 1



SECOND IMPACT HEAD CONNECTING DETAIL
(Post 4)



IMPACT HEAD CONNECTING DETAIL
(Post 1)

ITEM	QTY	DESCRIPTION	PART#
A	2	FLEAT IMPACT HEAD	F3000
B	3	SOIL TUBE, 6" x 8" x 6'-0"	S730
C	2	BEARING PLATE	E750
D	1	3/8" GALV Cable 20'-0"	C3820
E	2	BCT CABLE ANCHOR ASSEMBLY	E770
F	2	CABLE ANCHOR BOX	S760
G	1	GROUND STRUT	E780
H	3	BREAKAWAY END POSTS 1, 2, & 4	MGSPB620
J	1	POST BREAKER	PBMT
K	4	BREAKAWAY LINE POSTS 3, 5, 6 & 7	MGSPB621
L	9	TIMBER BLOCKOUT OR RECYCLED EQUIV	P675
M	2	W-BEAM END SECTION, 12 GA. 12.5'	SF1303
N	1	W-BEAM GUARDRAIL, 12 GA. 9'-4 1/4"	G1202A
P	1	W-BEAM GUARDRAIL, 12 GA. 15'-7 1/2"	G1204A
Q	1	W-BEAM GUARDRAIL, 12 GA. 12'-6"	G1203A
R	1	DEFLECTOR BOX	DBMT
HARDWARE			
a	2	5/16" DIA. x 3" HEX BOLT	B5160304A
b	2	5/16" HEX NUT	N0516
c	4	5/16" WASHER	W0516
d	2	3/8" DIA. x 3" LAG SCREW	E350
e	16	1/2" DIA. SHOULDER BOLT	SB58A
f	16	1/2" A325 NUT	N055A
g	32	1/2" WASHER	W050A
h	41	5/8" DIA. x 1 1/4" SPLICE BOLT	B580122
j	1	5/8" DIA. x 3" HEX BOLT	B580304
k	3	5/8" DIA. x 7 1/2" HEX BOLT	B580754
m	9	5/8" DIA. x 14" H.G.R. BOLT	B581402
n	54	5/8" H.G.R. NUT	N050
p	1	5/8" H.G.R. WASHER	W050
q	3	3/4" DIA. x 10" HEX BOLT	B341004
r	3	3/4" HEX NUT	N030
s	6	3/4" WASHER	W030
t	4	1" ANCHOR CABLE HEX NUT	N100
u	4	1" ANCHOR CABLE WASHER	W100
v	3	CABLE TIE	CT100ST

- GENERAL NOTES:
- Breakaway posts are required with the FLEAT-MT.
 - All bolts, nuts, cable assemblies, cable anchors and plates shall be galvanized.
 - The soil tubes shall not protrude more than 4" above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
 - The soil tubes may be driven with an approved driving head. Soil tubes should not be driven with the post in the tube. If the tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent settlement.
 - When rock is encountered during excavation, a 12" Dia. post hole, 20" deep may be used if approved by the engineer. Granular material will be placed in the bottom of the hole approx. 2 1/2" deep to provide drainage. The soil tubes will be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
 - The breakaway cable assembly must be taut. A locking device (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening nuts.

Median FLEAT Terminal
Midwest Guardrail System
Steel Posts

Sheet: **S1**

Date: 09/20/11

By: JRR

Rev:

Drawing Name: MEDFLT-S-MGS

Scale: NONE