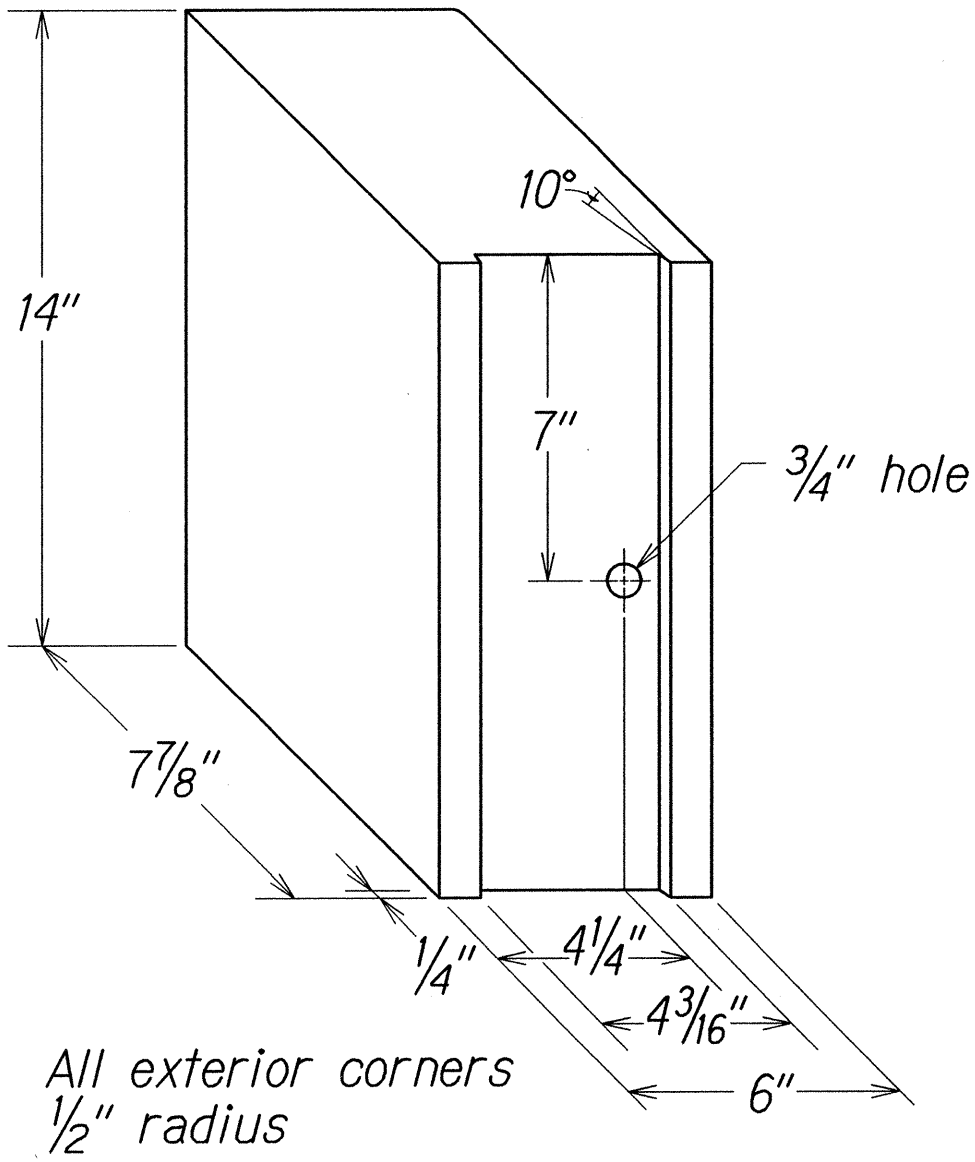


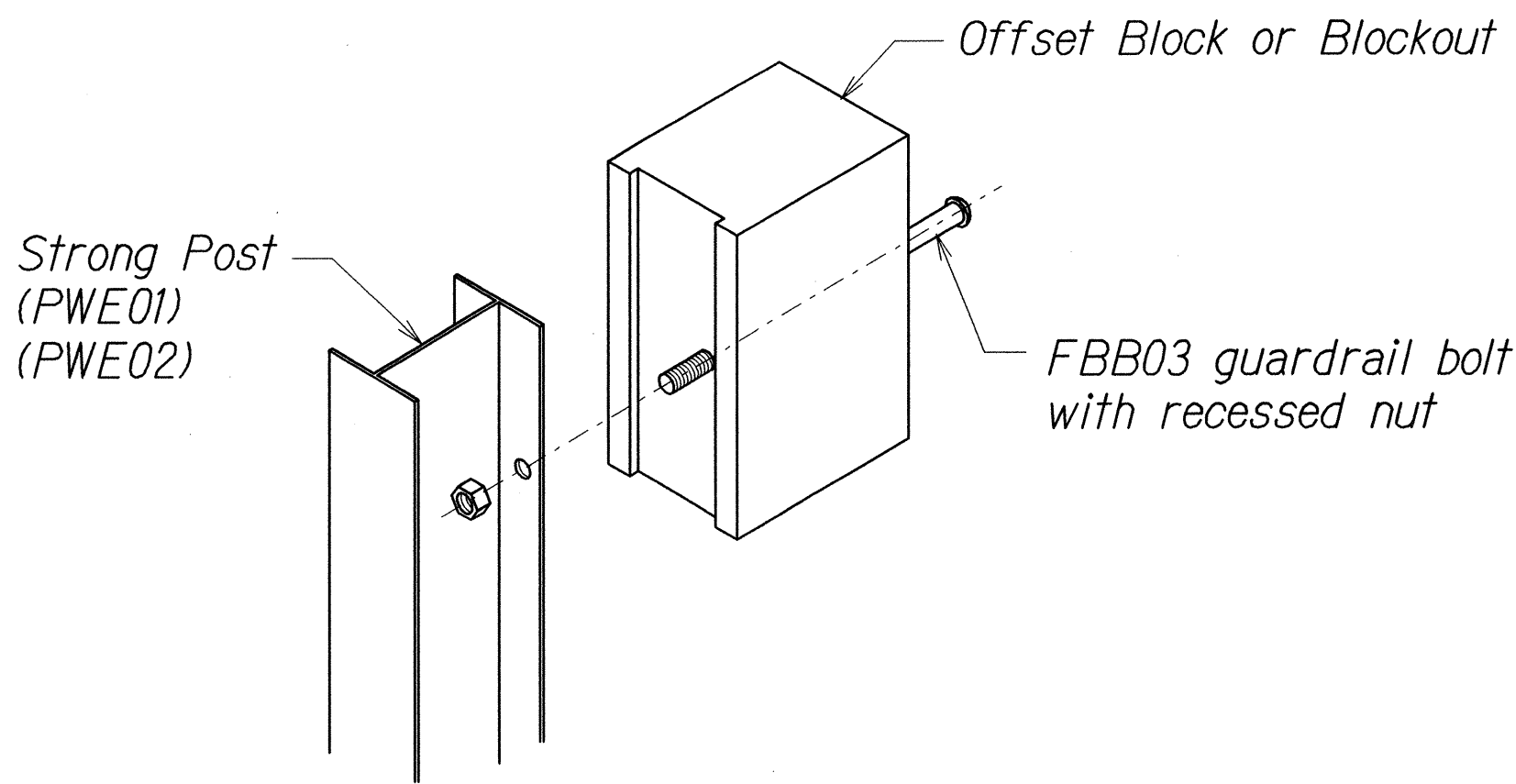
RECYCLED PLASTIC BLOCKOUT (TYPE I)



RECYCLED POLYETHYLENE  
OFFSET BLOCK (TYPE II)

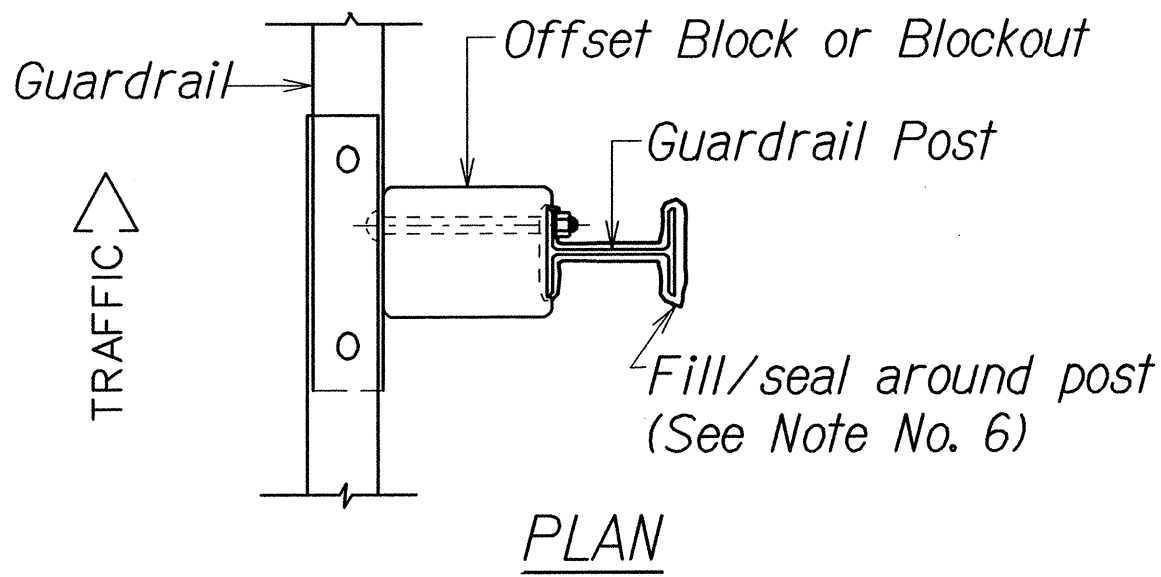
GENERAL NOTES

1. All hardware, posts and fasteners shall be hot-dip zinc coated galvanized after fabrication. No punching, drilling or cutting will be permitted after galvanizing.
2. Where conditions require, special post lengths in increments of 6 inches may be specified.
3. All fasteners, posts, and rail elements (i.e. FBB03, PWE01, RWM02b, etc.) shall conform to the latest edition and amendments of "A Guide to Standardized Highway Barrier Rail Hardware", a report prepared and approved by the AASHTO-AGC-ARTBA Joint Cooperative Committee, Subcommittee On New Highway Materials, Task Force 13 Report. Dimensions of fastners, posts and rail elements have been converted from metric units into their present form.
4. The Recycled Plastic Block or Offset Block shall be approved by the State.
5. All new guardrail systems (system consists of total length of guardrail including both end treatments) shall include the Additional Paved Area.
6. After the guardrail posts are installed in the paved area, the Contractor shall fill/seal around each guardrail post and all cracks in the paved area caused during the guardrail post installation. If required by the inspector/engineer, the Contractor shall tamper the paved area around the guardrail post prior to filling/sealing. All costs associated with this work shall not be paid for separately, but shall be considered incidental to the various guardrail items.
7. When standards for the fill slope area cannot be met, a site specific, engineer approved design may be used.
8. Reflector Markers (RM-5) mounted on guardrails shall be spaced every 25 feet. RM-5's shall not be installed on Terminal Sections. Furnishing and installing of each RM-5 shall be considered incidental to the adjacent guardrail system.

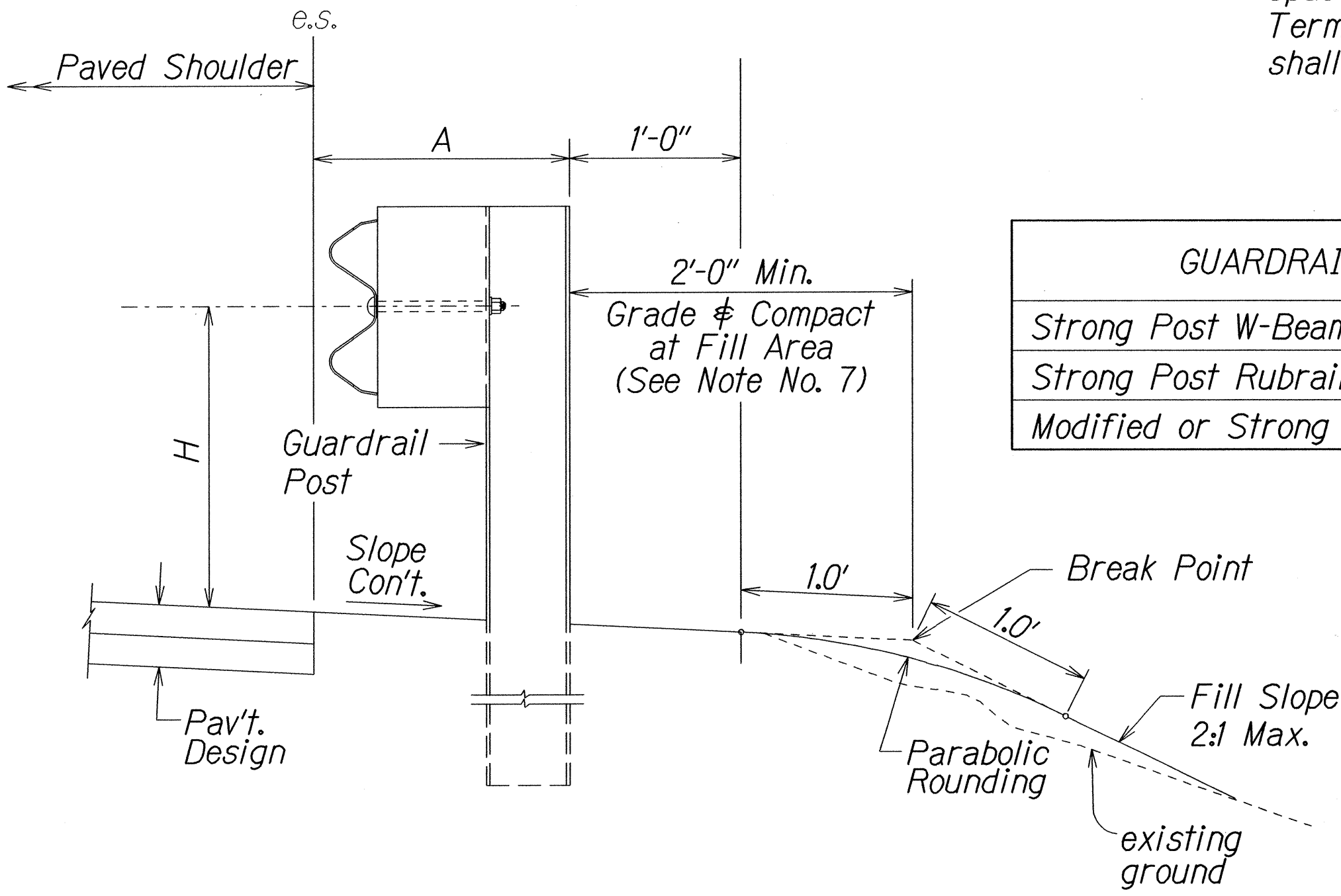


Exploded View  
(Rail and washer not shown)

STEEL POST AND BLOCK DETAIL



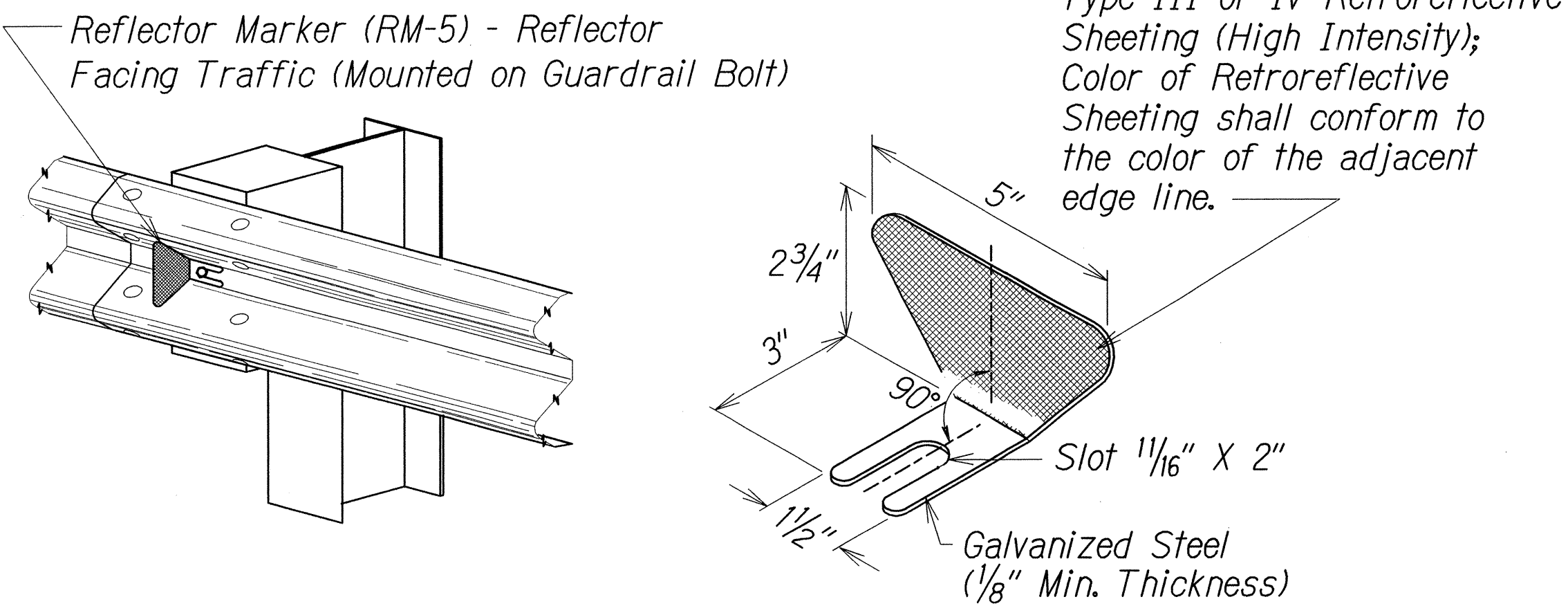
PLAN



ELEVATION

TYPICAL GUARDRAIL INSTALLATION

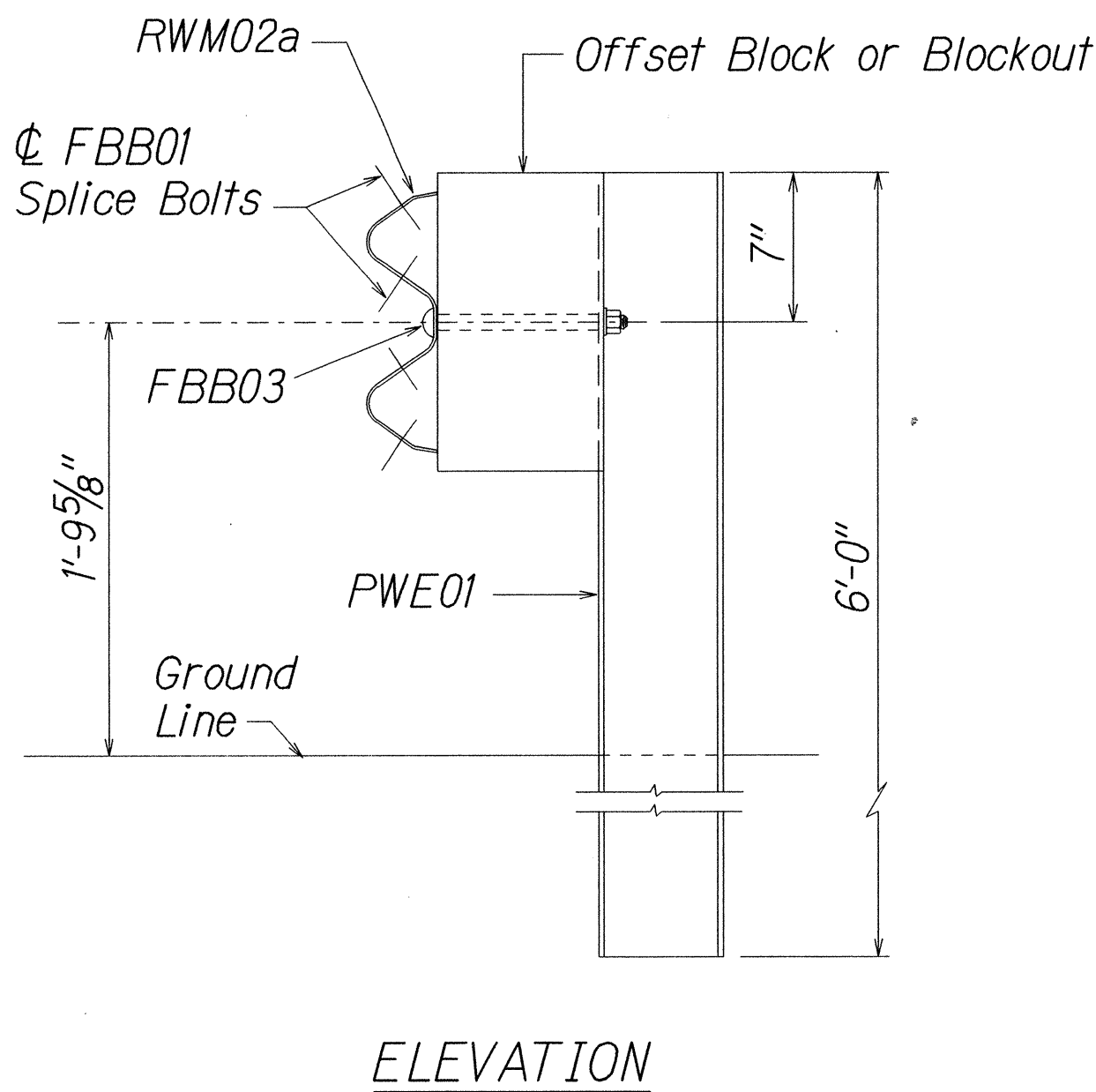
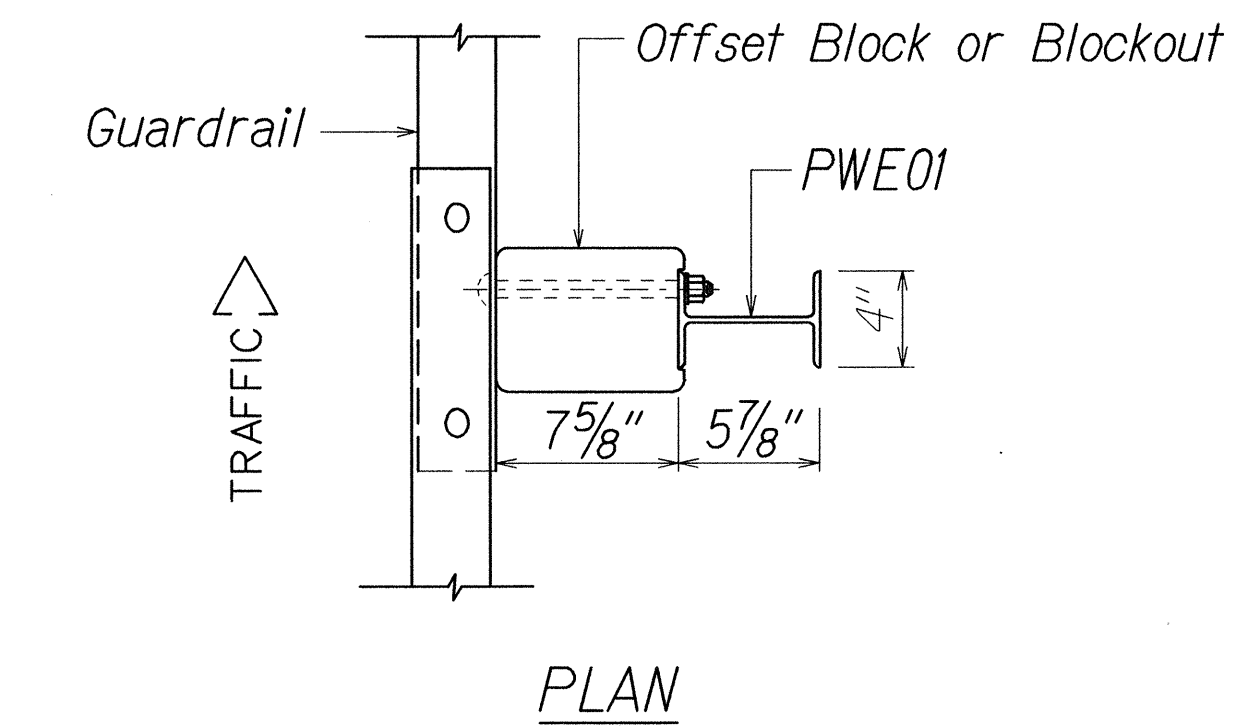
GUARDRAIL TYPE	DIMENSION	
	H	A
Strong Post W-Beam	1'-9 5/8"	1'-6"
Strong Post Rubrail (W-Beam)	2'-0"	1'-6"
Modified or Strong Post Thrie Beam	2'-0"	2'-0"



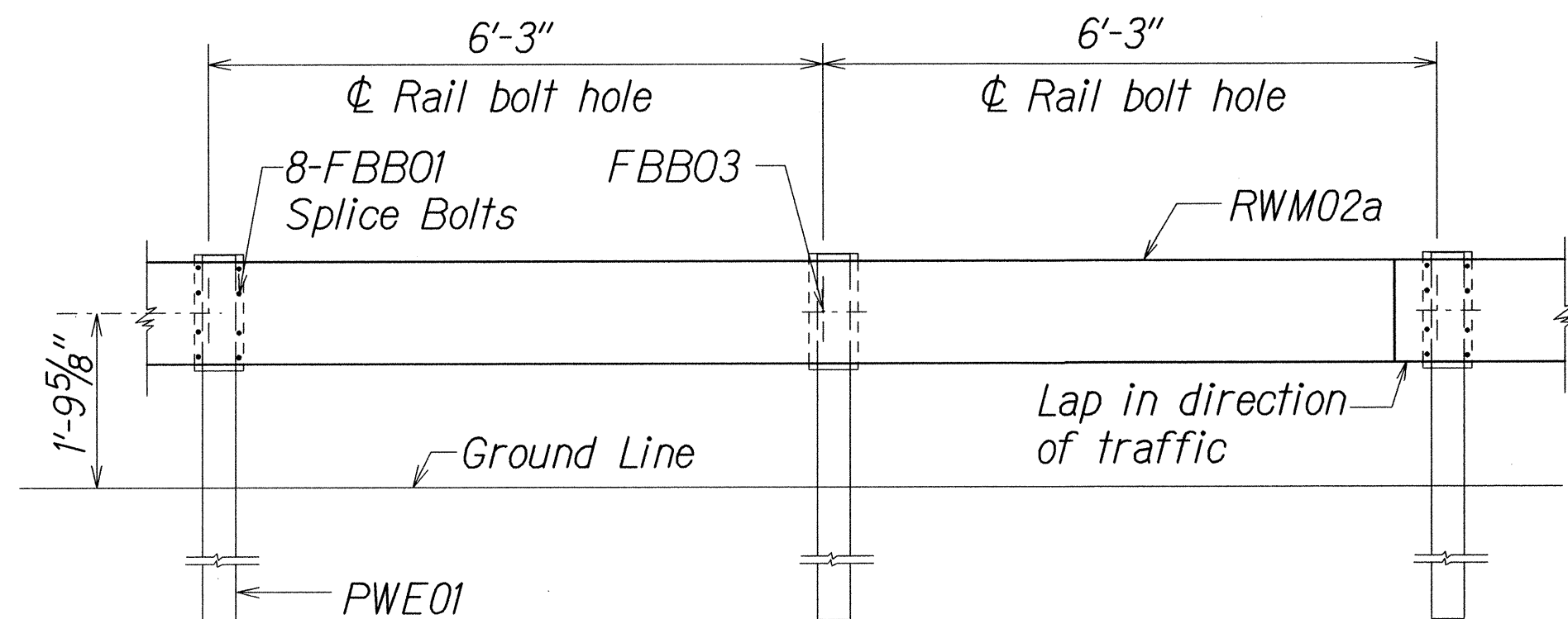
REFLECTOR MARKER (RM-5) DETAIL AND TYPICAL INSTALLATION

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION  
**GUARDRAIL DETAILS & NOTES**  
KAMEHAMEHA HIGHWAY RESURFACING  
Vicinity of Ka Uka Boulevard to  
Vicinity of Waihau Street  
Federal Aid Project No. NH-099-1(029)  
Scale: NTS  
Date: Sept., 2013

SHEET No. 1 OF 12 SHEETS

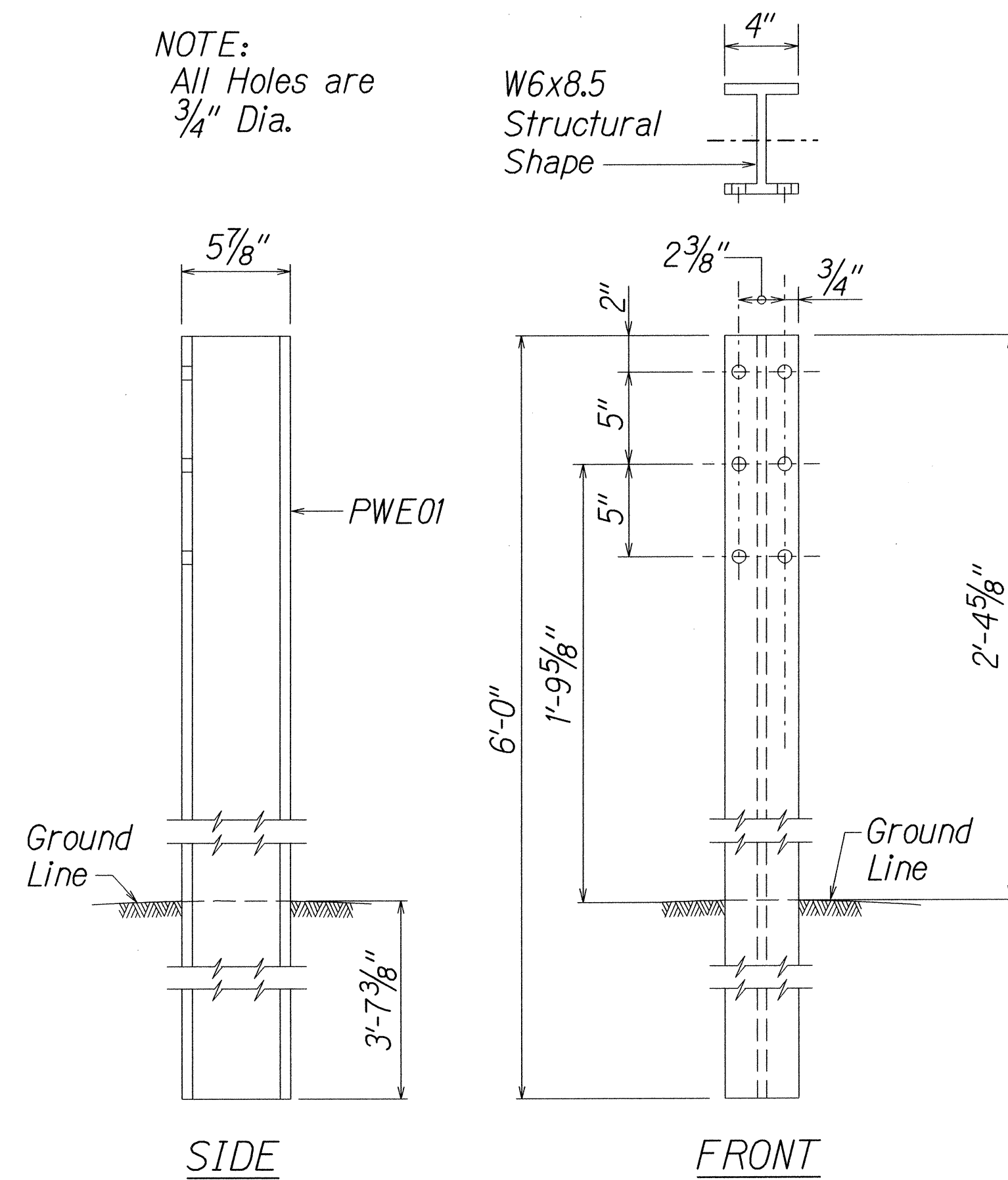


**STRONG POST W-BEAM GUARDRAIL**  
**(SGR04a)**

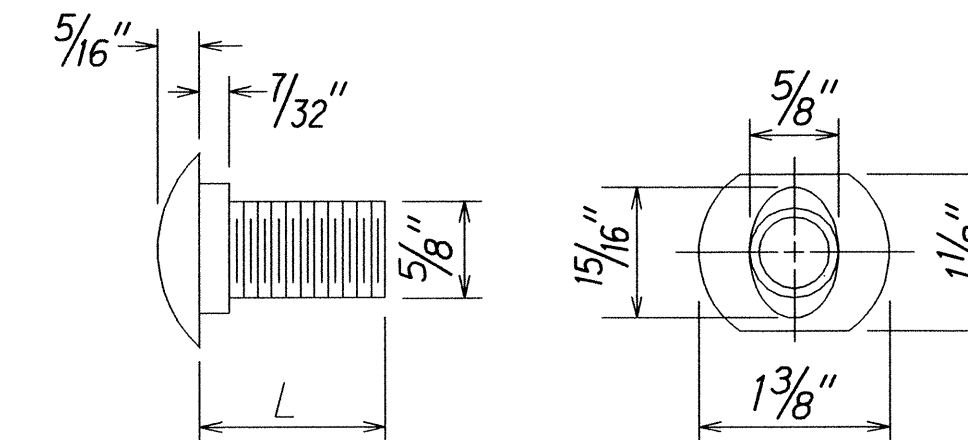


**STRONG POST W-BEAM GUARDRAIL WITH**  
**RECYCLED OFFSET BLOCK OR PLASTIC BLOCKOUT**

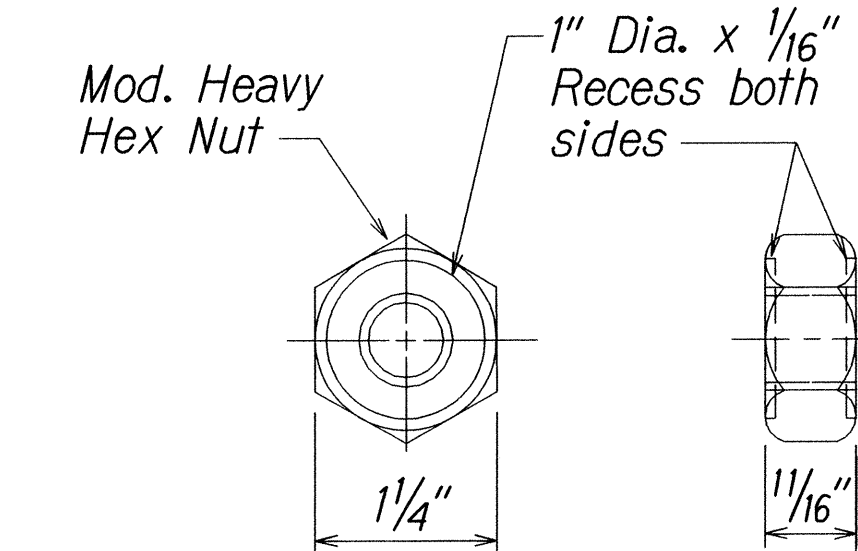
NOTE:  
All Holes are  
3/4" Dia.



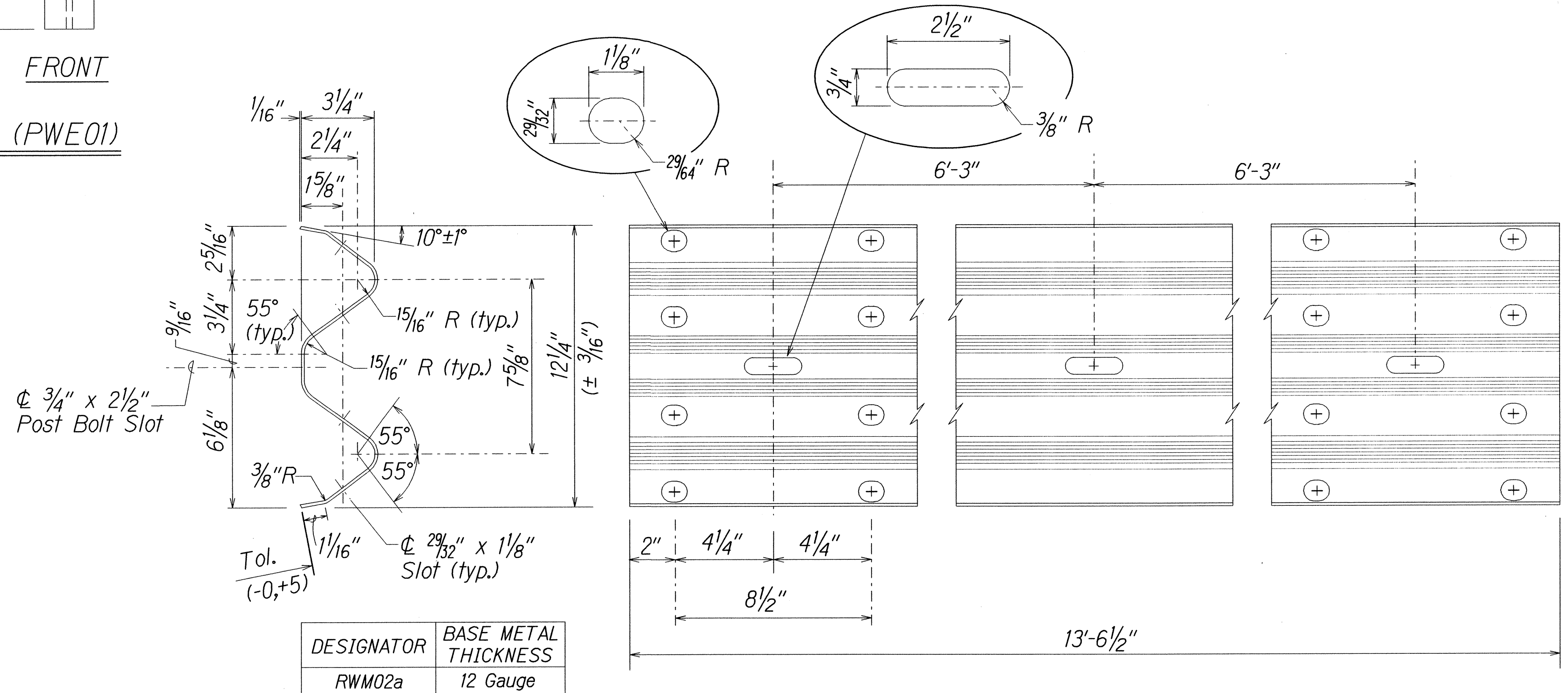
**W-BEAM STRONG POST (PWE01)**



DESIGNATOR	L
FBB01	1 3/8"
FBB02	2"
FBB03	10"



**GUARDRAIL BOLTS AND RECESSED NUT**



DESIGNATOR	BASE METAL THICKNESS
RWM02a	12 Gauge

**2 SPACE W-BEAM GUARDRAIL (RWM02a)**

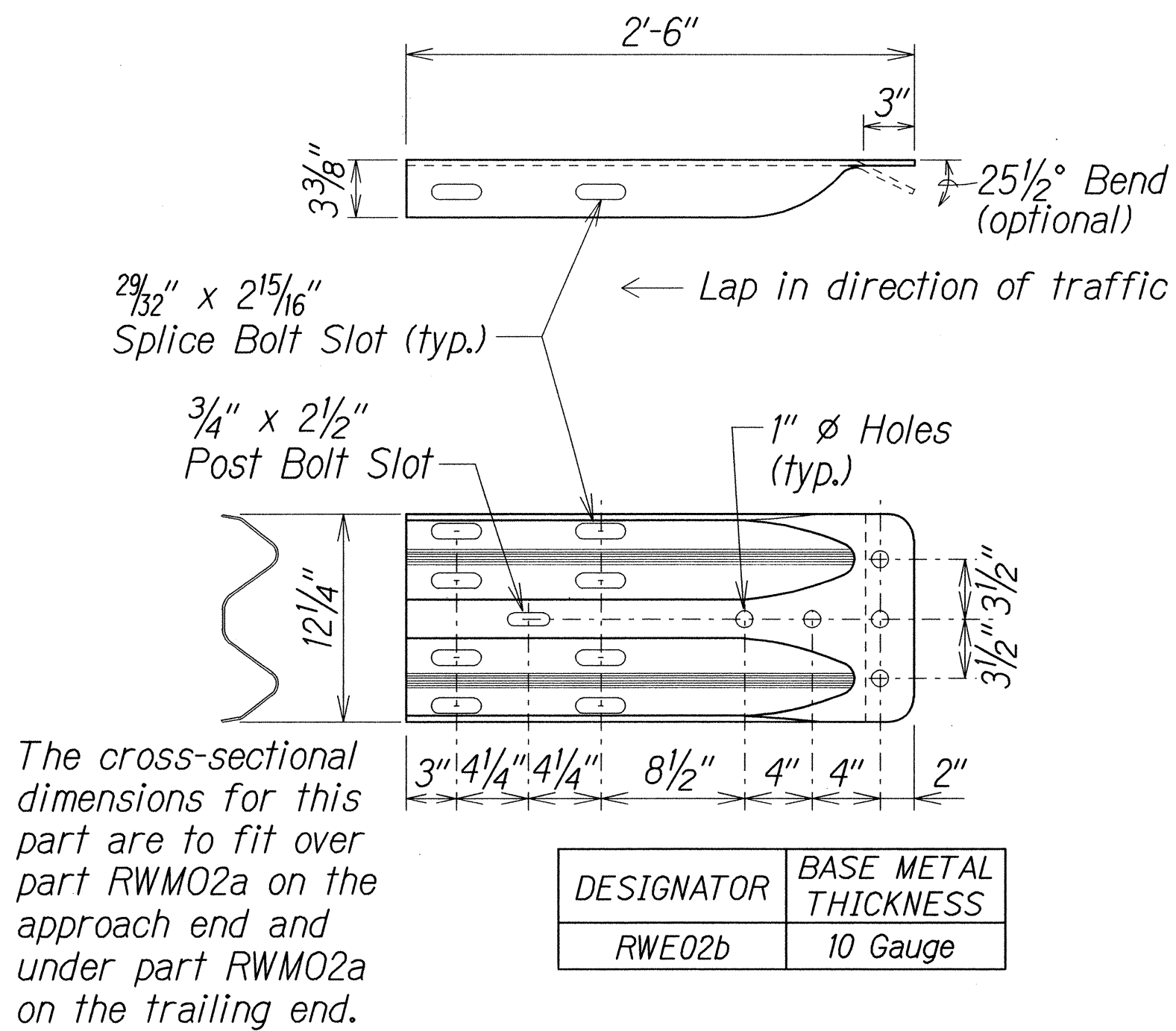
DATE	01/14/14	Inserted updated sheet.
REVISION		

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

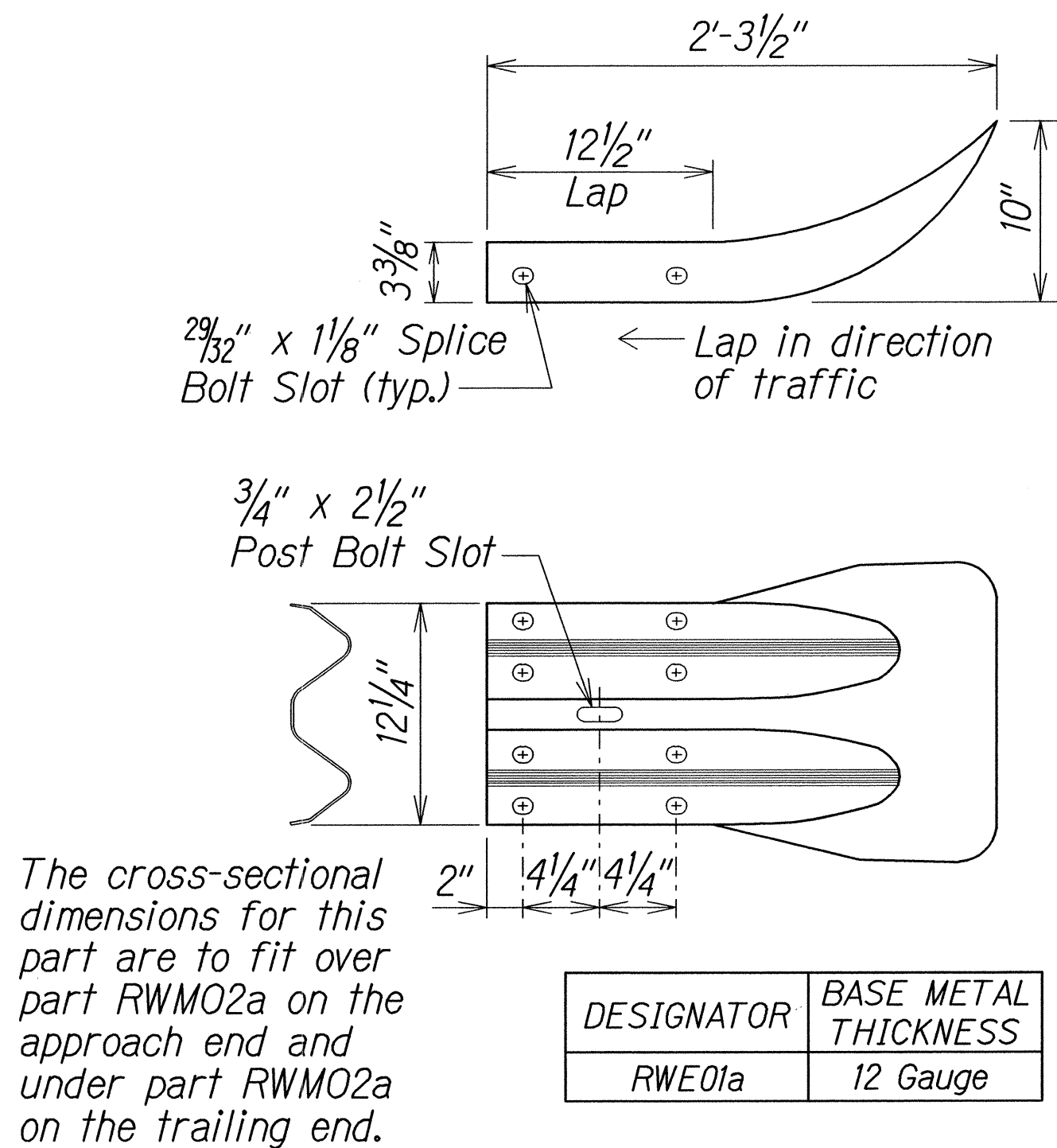
**STRONG POST W-BEAM GUARDRAIL**  
**KAMEHAMEHA HIGHWAY RESURFACING**  
**Vicinity of Ka Uka Boulevard**  
**to Vicinity of Waihau Street**  
**Federal Aid Project No. NH-099-1(029)**  
**Scale: Not to Scale Date: January 14, 2014**



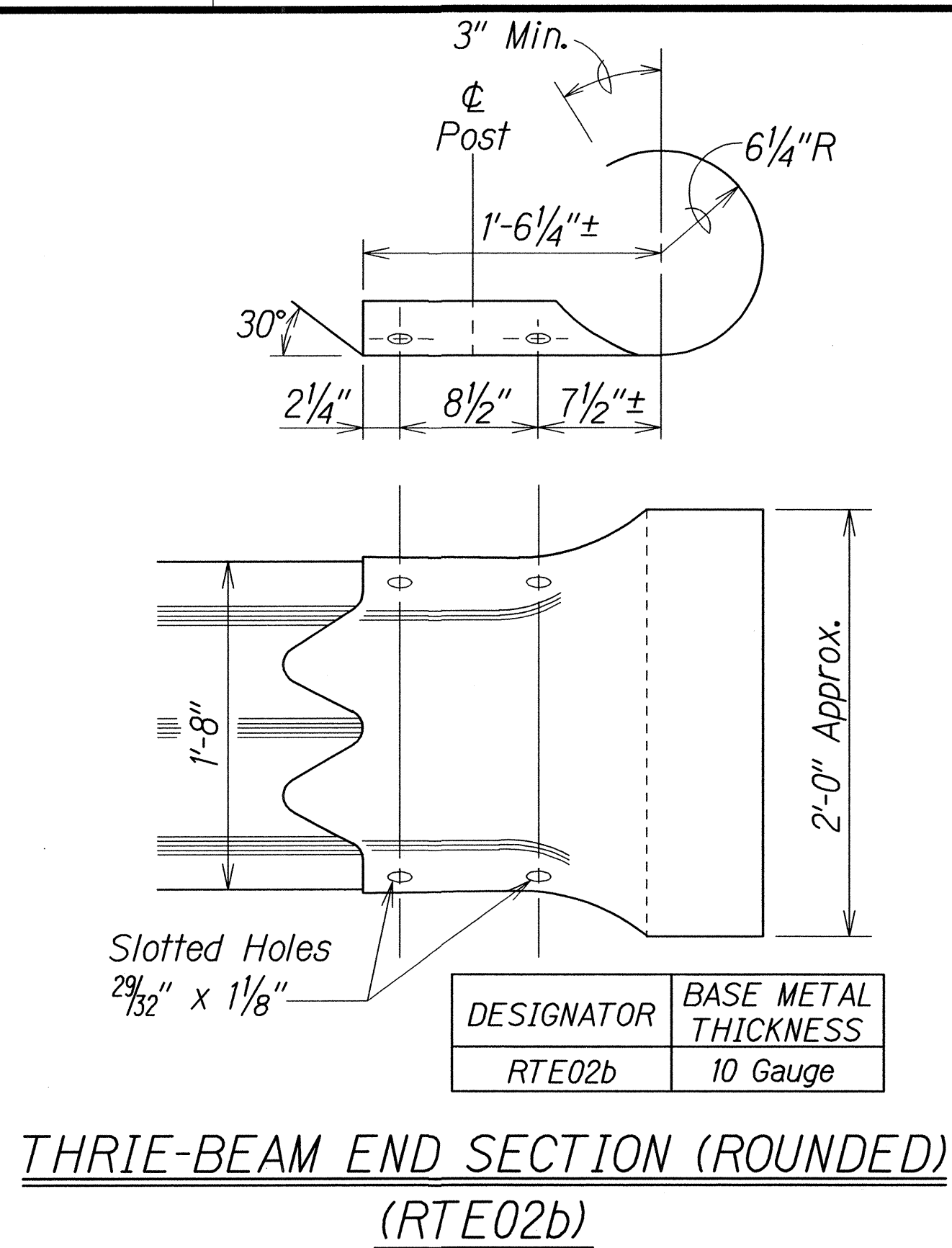
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-099-1(029)	2014	27	84



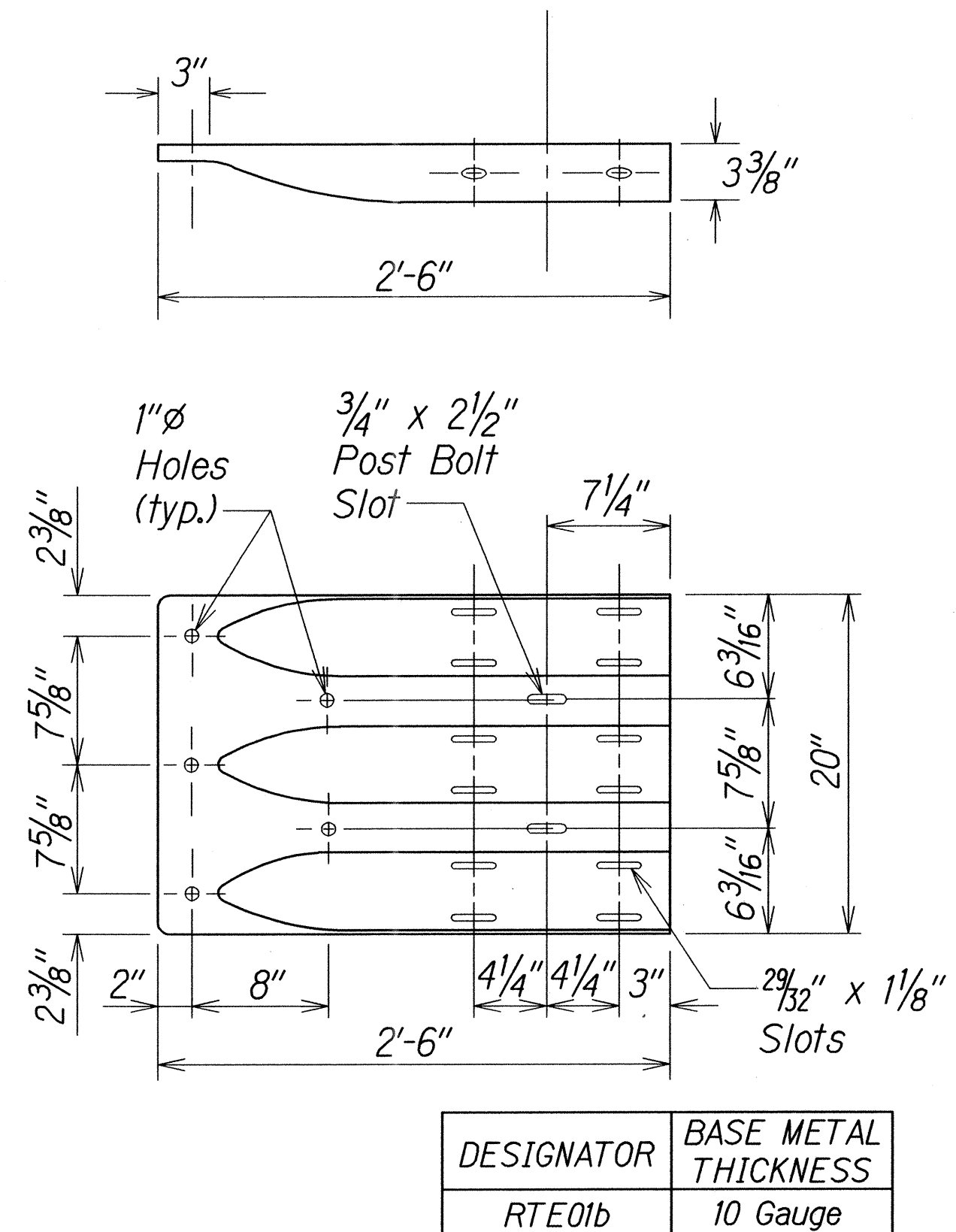
W-BEAM TERMINAL CONNECTOR (RWE02b)



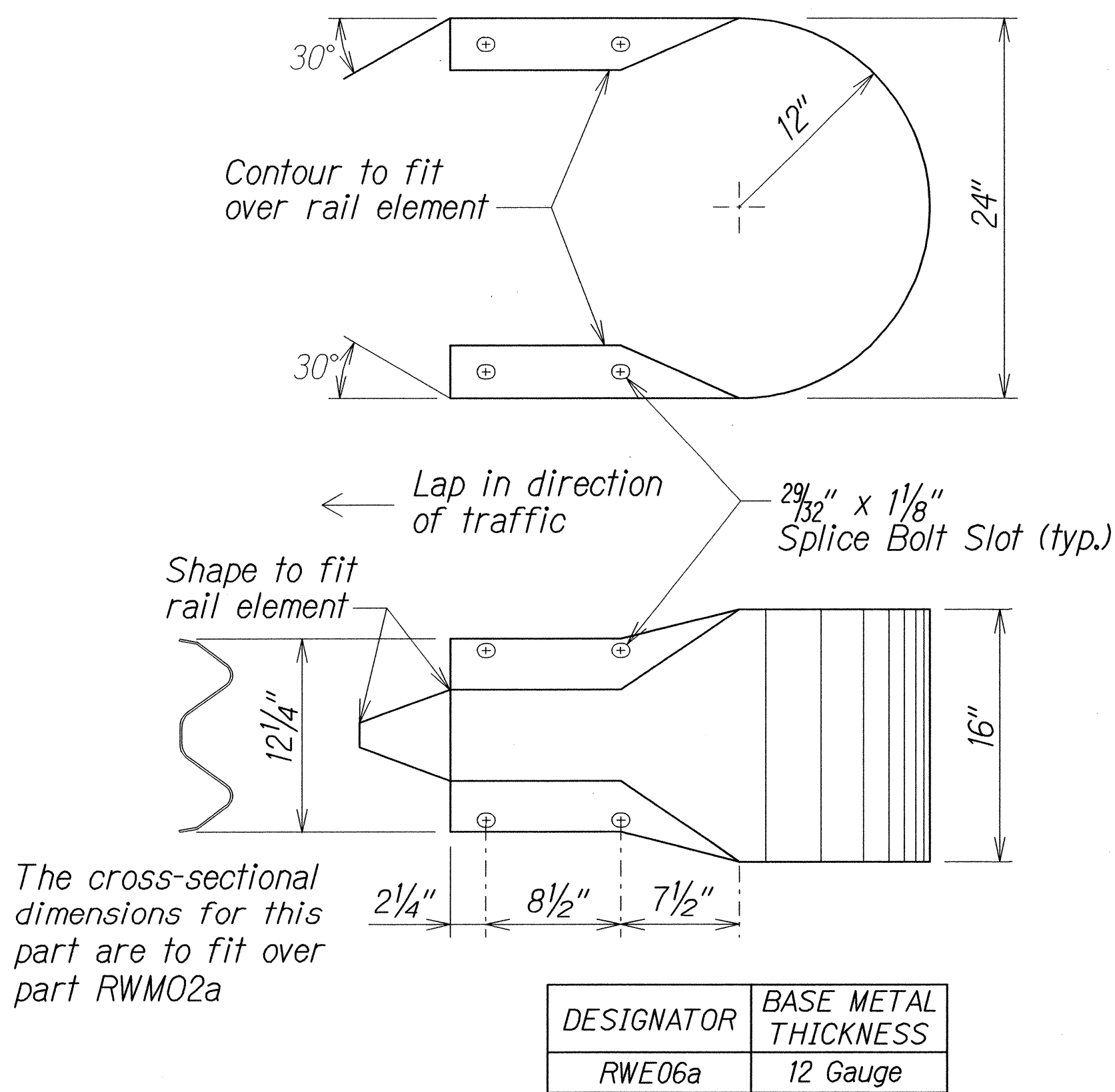
W-BEAM END SECTION (FLARED RWE01a)



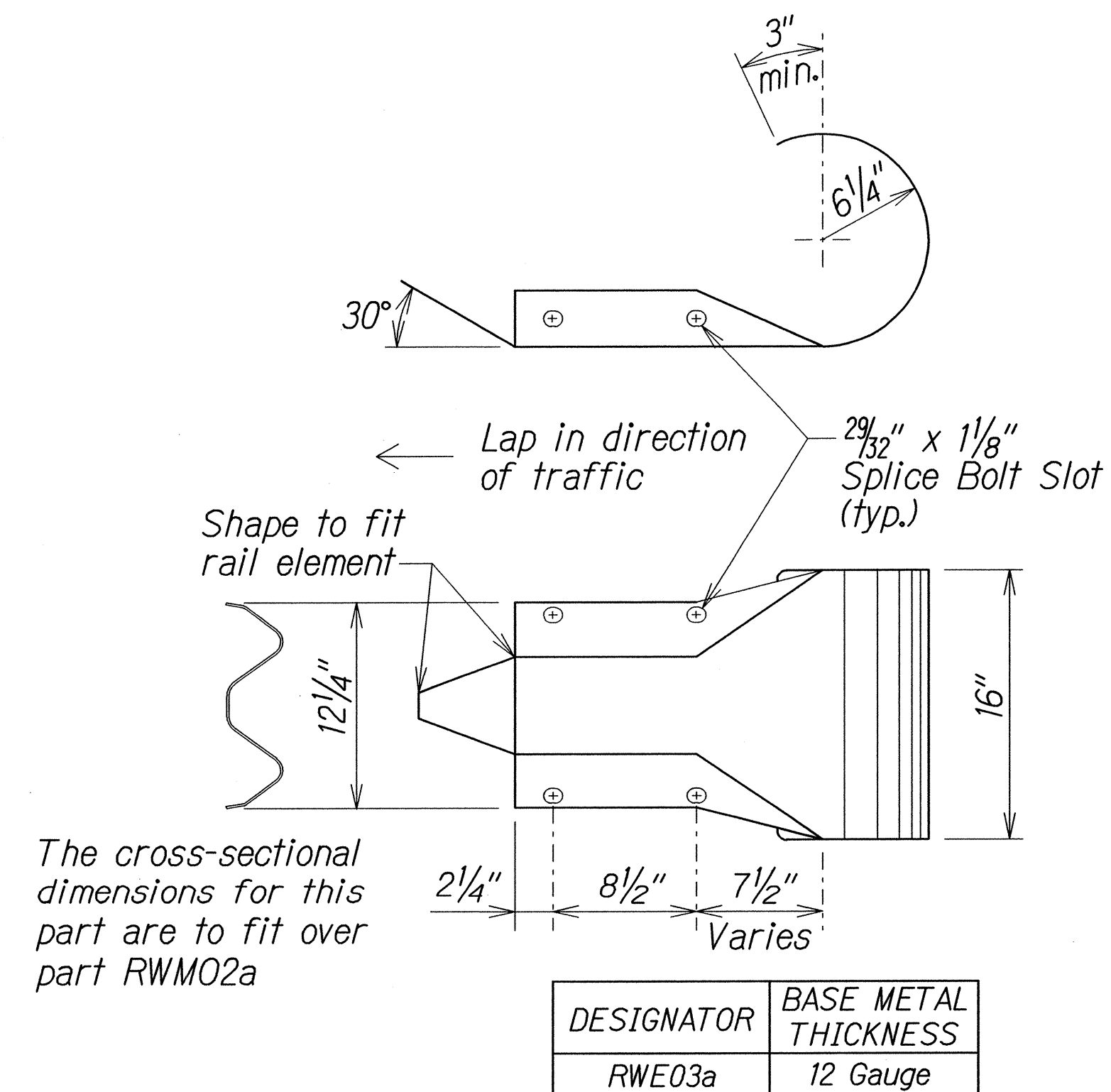
THRIE-BEAM END SECTION (ROUNDED) (RTE02b)



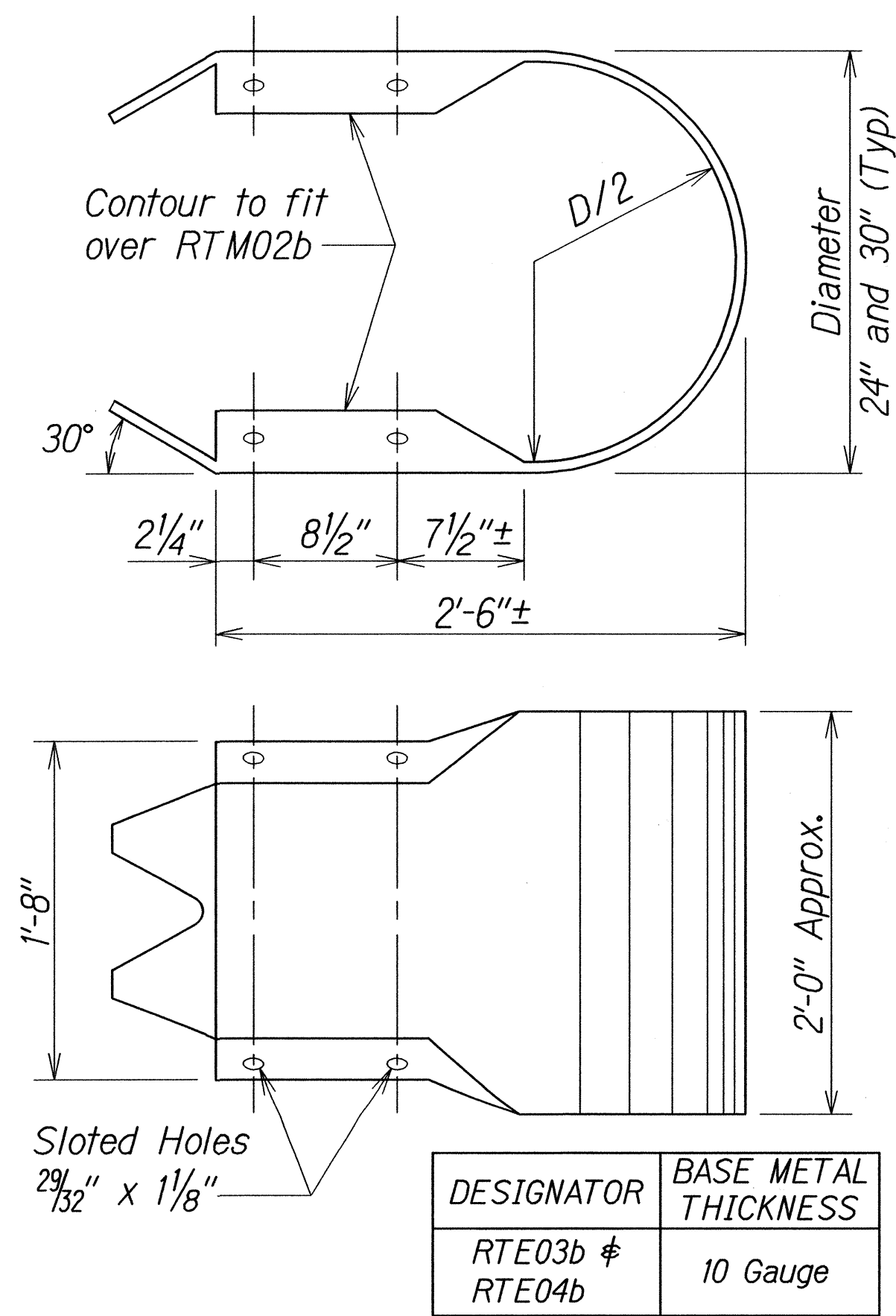
THRIE-BEAM TERMINAL CONNECTOR (RTE01b)



W-BEAM END SECTION (BUFFER RWE06a)

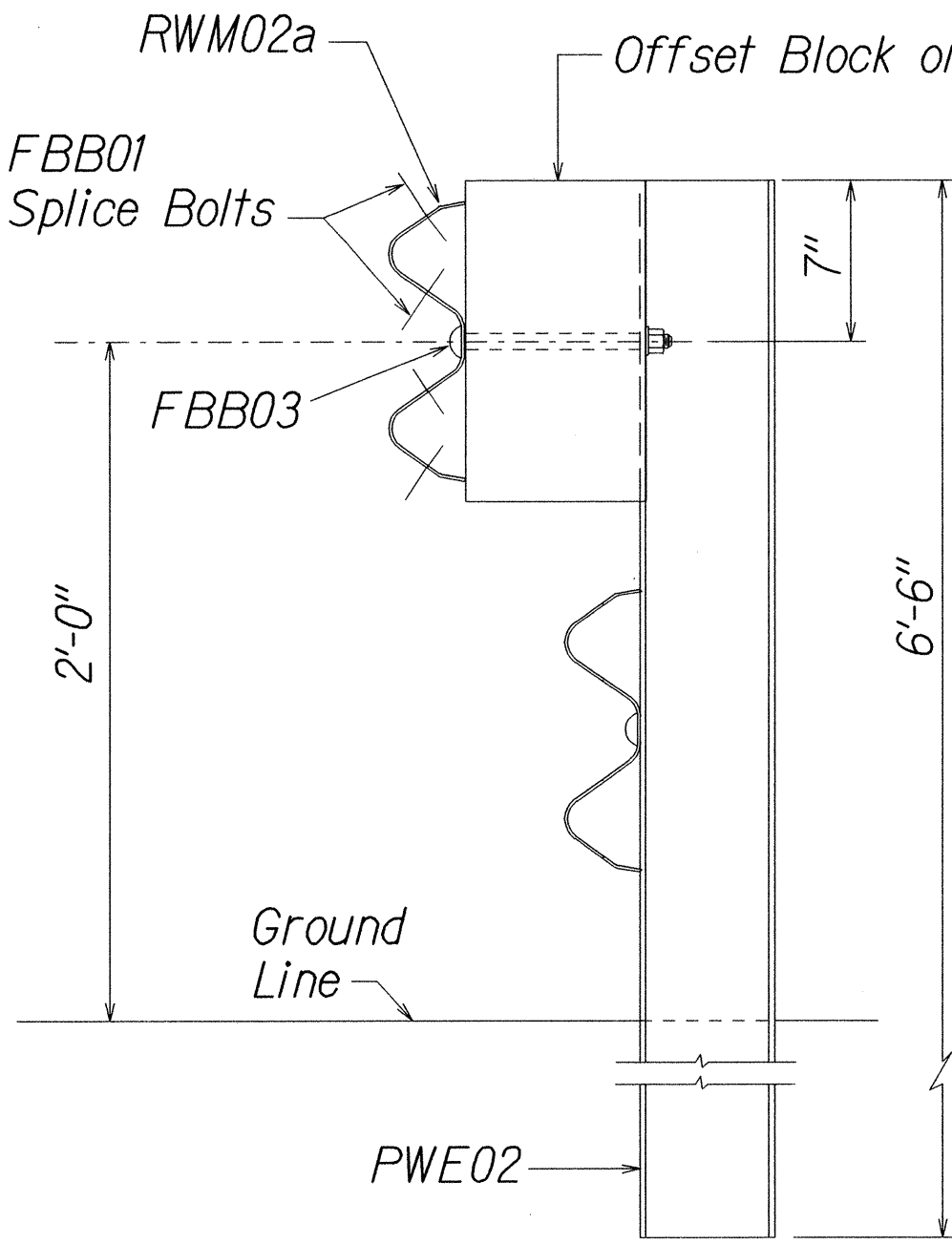


W-BEAM END SECTION (ROUNDED RWE03a)

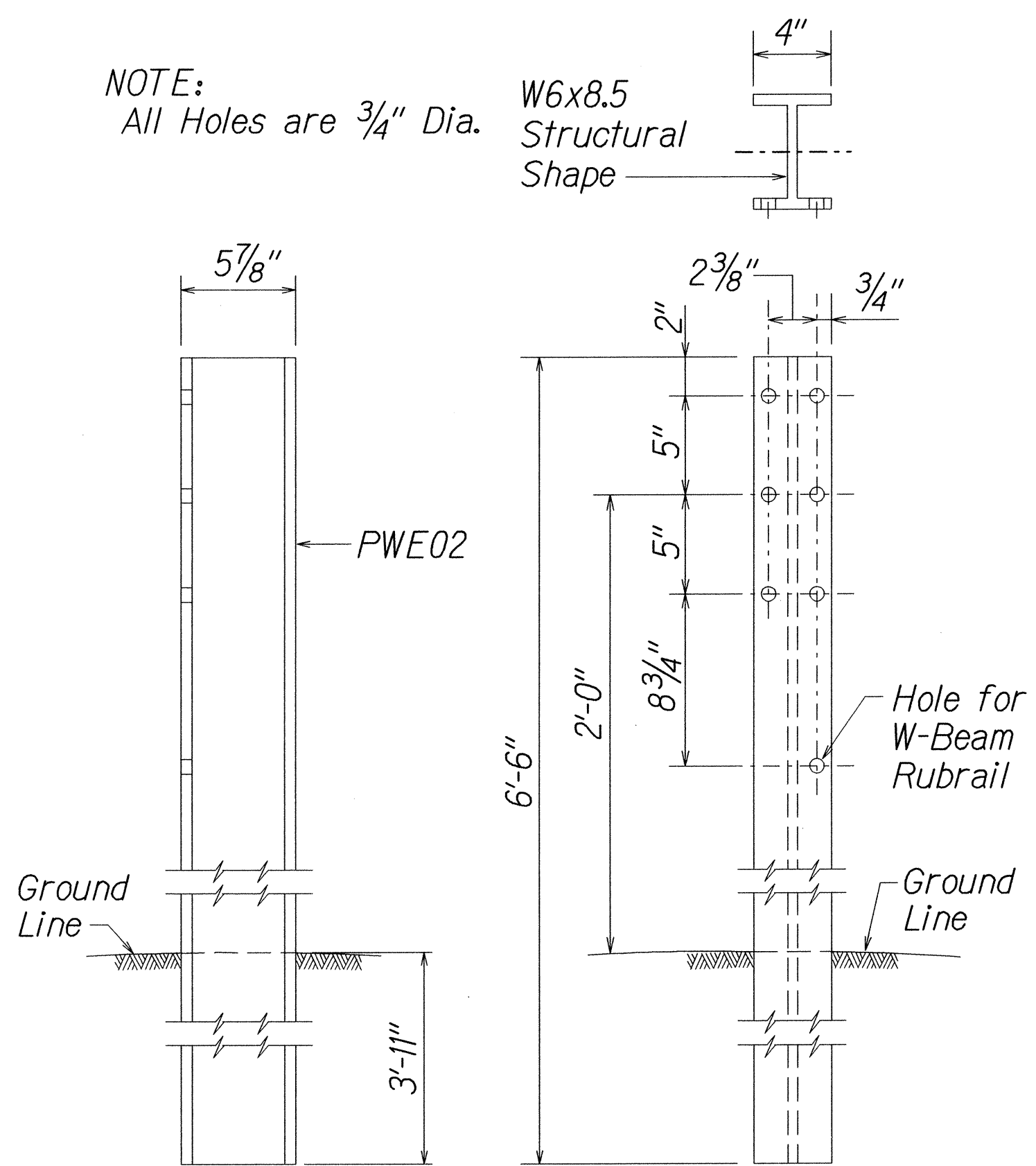


THRIE-BEAM END SECTION (BUFFER RTE03b or RTE04b)

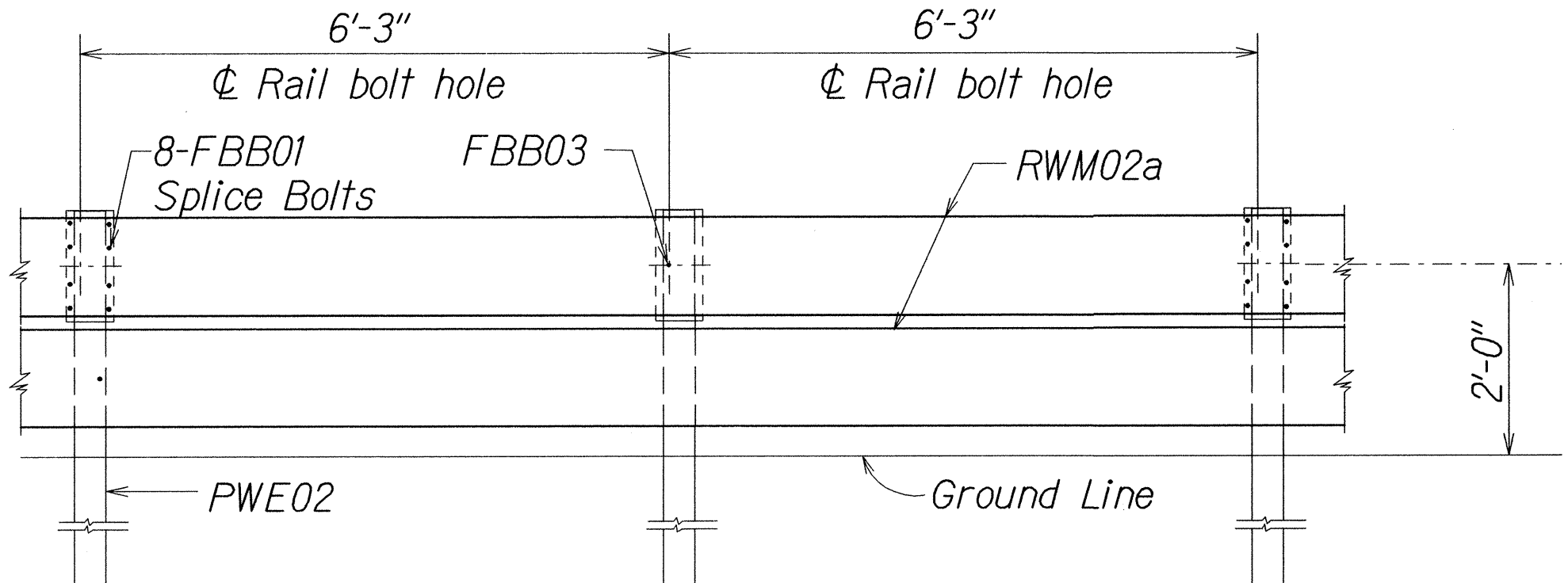
STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION  
**GUARDRAIL TERMINAL CONNECTORS  
AND END SECTIONS**  
KAMEHAMEHA HIGHWAY RESURFACING  
Vicinity of Ka Uka Boulevard to  
Vicinity of Waihau Street  
Federal Aid Project No. NH-099-1(029)  
Scale: NTS Date: Sept., 2013  
SHEET No. 3 OF 12 SHEETS



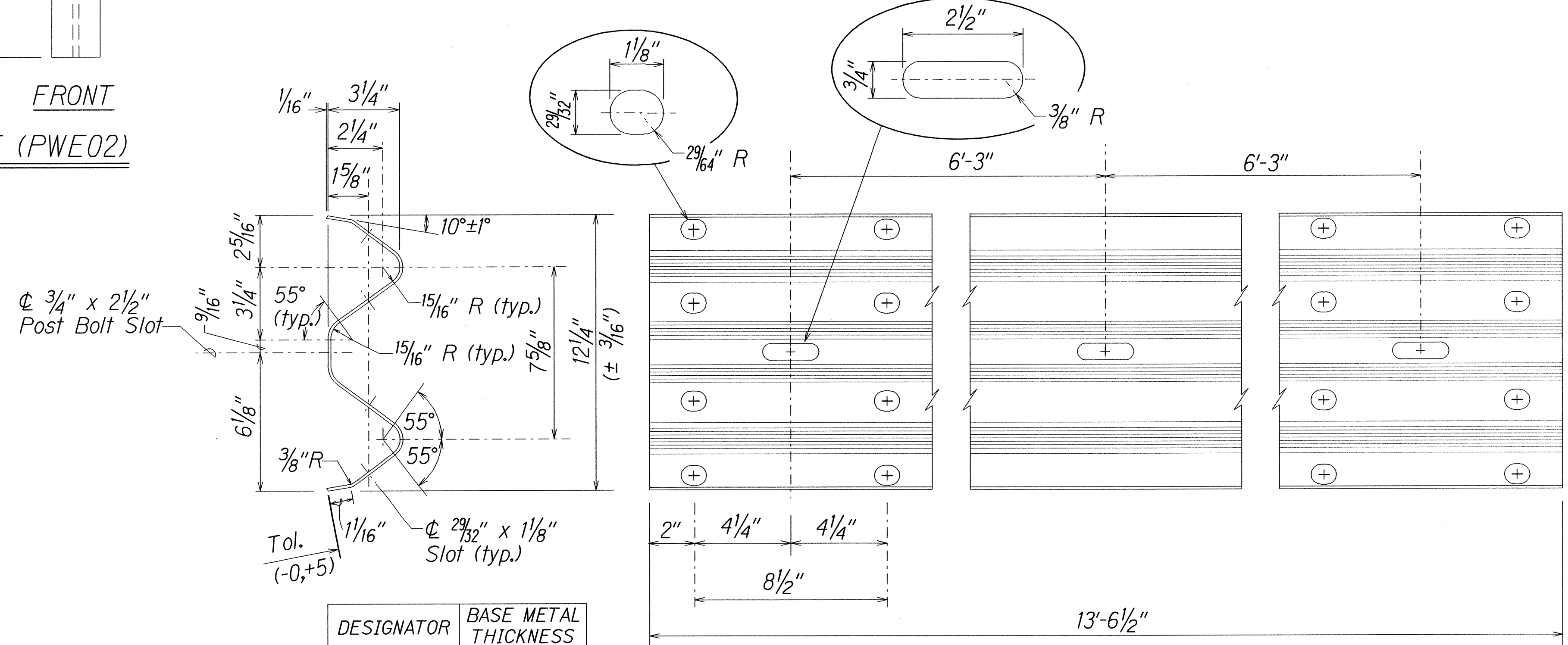
ELEVATION  
STRONG POST RUBRAIL  
(W-BEAM) GUARDRAIL



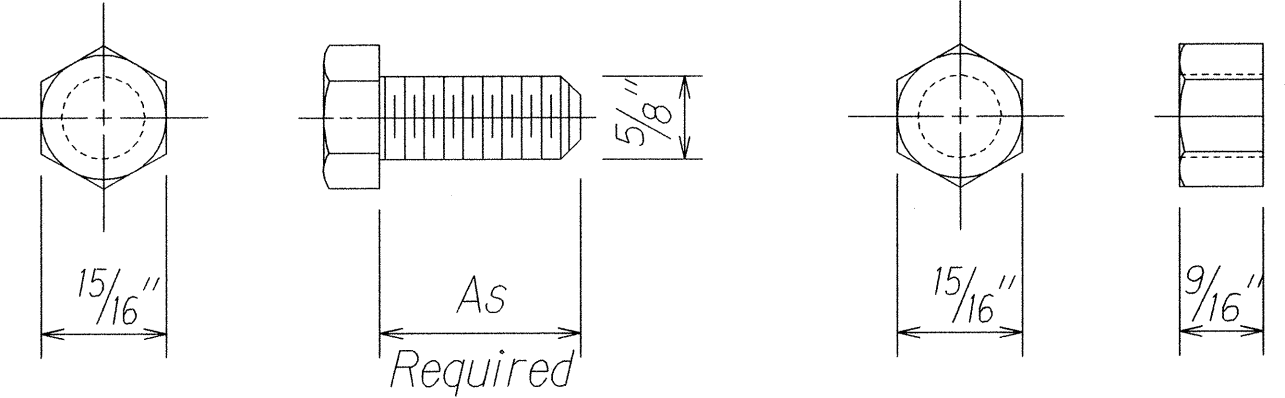
SIDE  
FRONT  
W-BEAM STRONG POST (PWE02)



ELEVATION  
STRONG POST RUBRAIL (W-BEAM) GUARDRAIL WITH  
RECYCLED OFFSET BLOCK OR PLASTIC BLOCKOUT



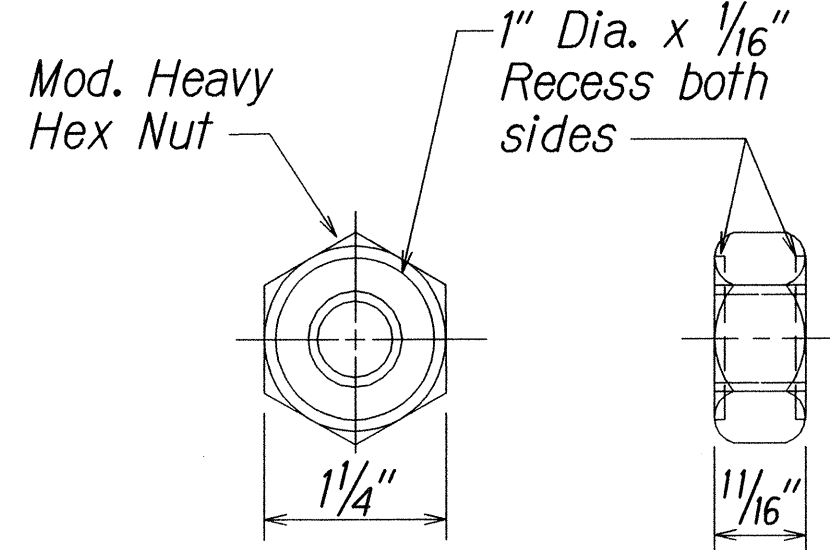
2 SPACE W-BEAM GUARDRAIL (RWM02a)



HEX BOLT & NUT (FBX16a)

DESIGNATOR	L
FBB01	1 3/8"
FBB02	2"
FBB03	10"

GUARDRAIL BOLTS AND RECESSED NUT



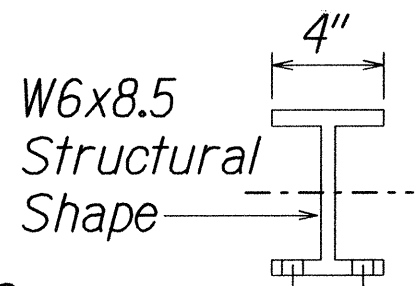
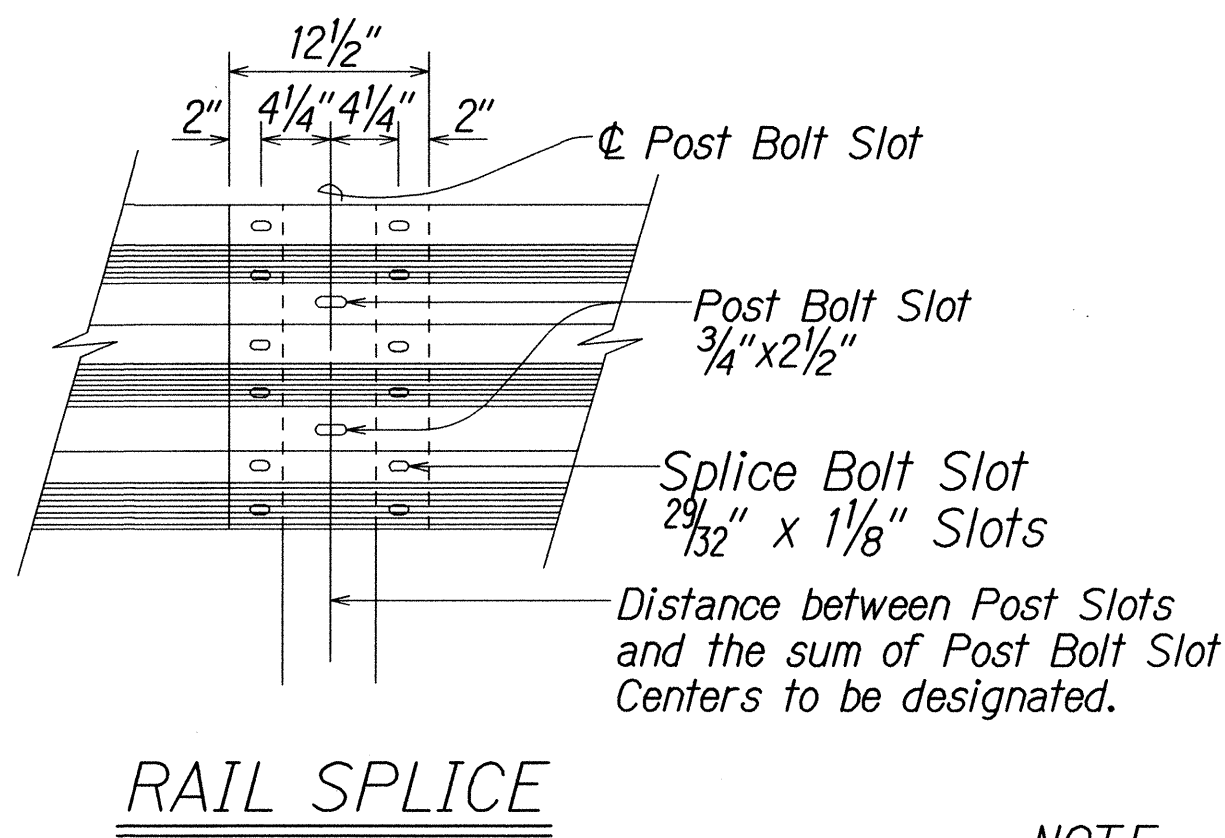
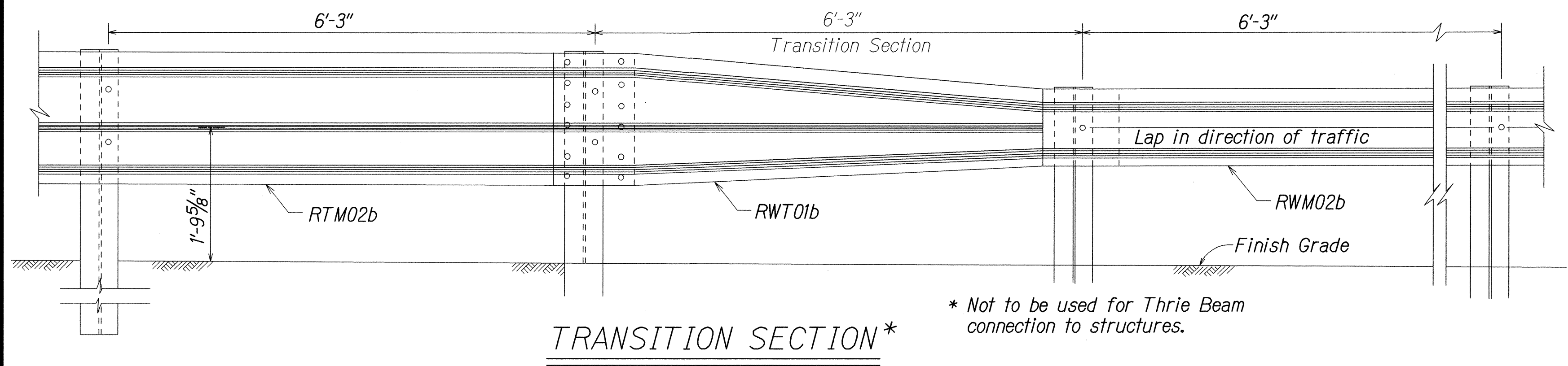
1/14/14 Inserted updated sheet.

DATE REVISION

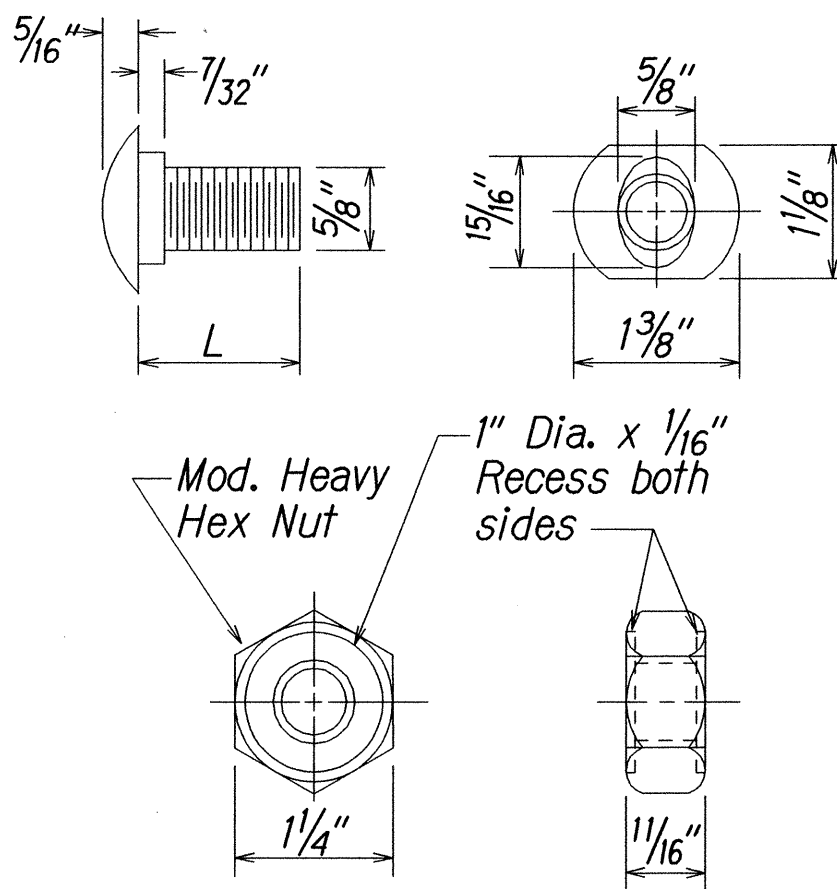
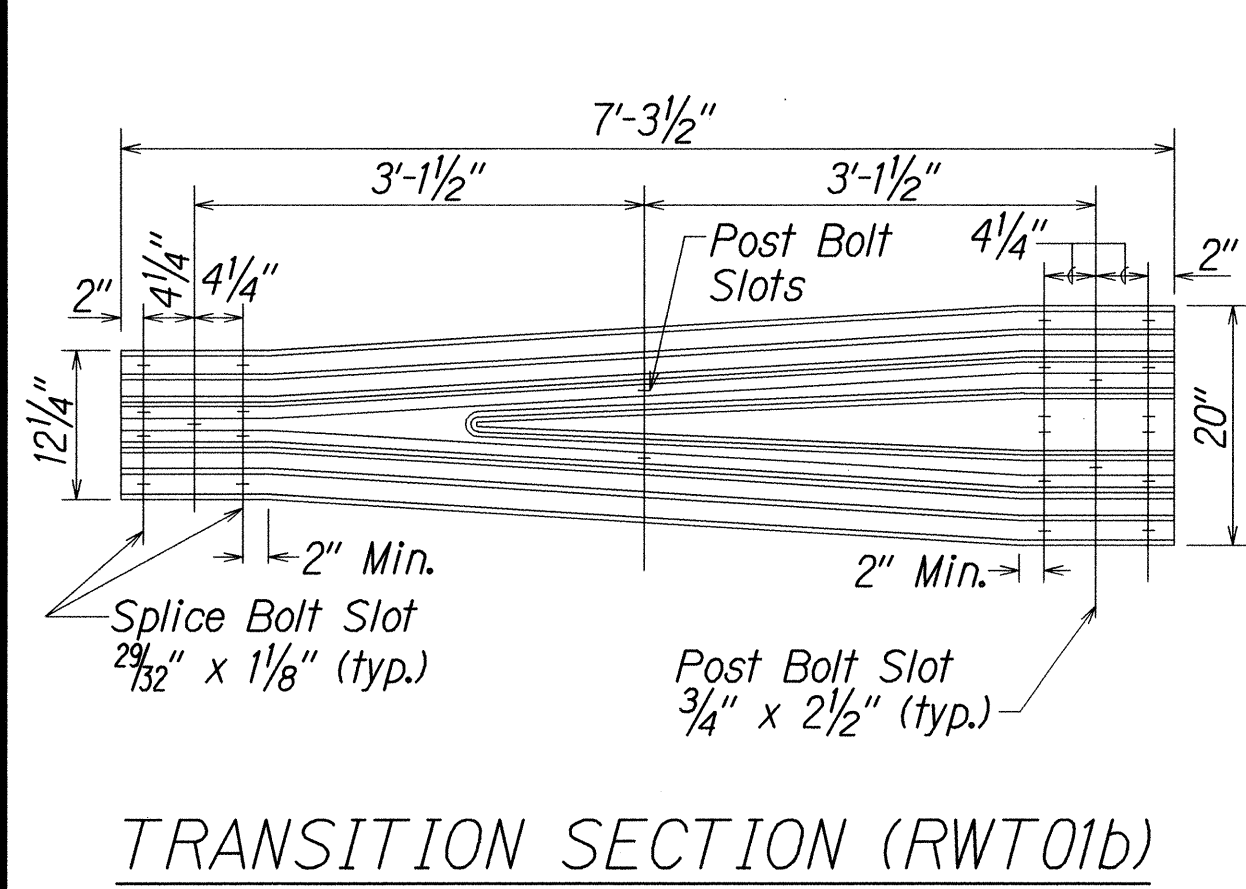
STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION  
**STRONG POST RUBRAIL**  
**(W-BEAM) GUARDRAIL**  
KAMEHAMEHA HIGHWAY RESURFACING  
Vicinity of Ka Uka Boulevard  
to Vicinity of Waihau Street  
Federal Aid Project No. NH-099-1(029)  
Scale: Not to Scale Date: January 14, 2014  
SHEET No. 4 OF 12 SHEETS



FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-099-1(029)	2014	ADD.29	84

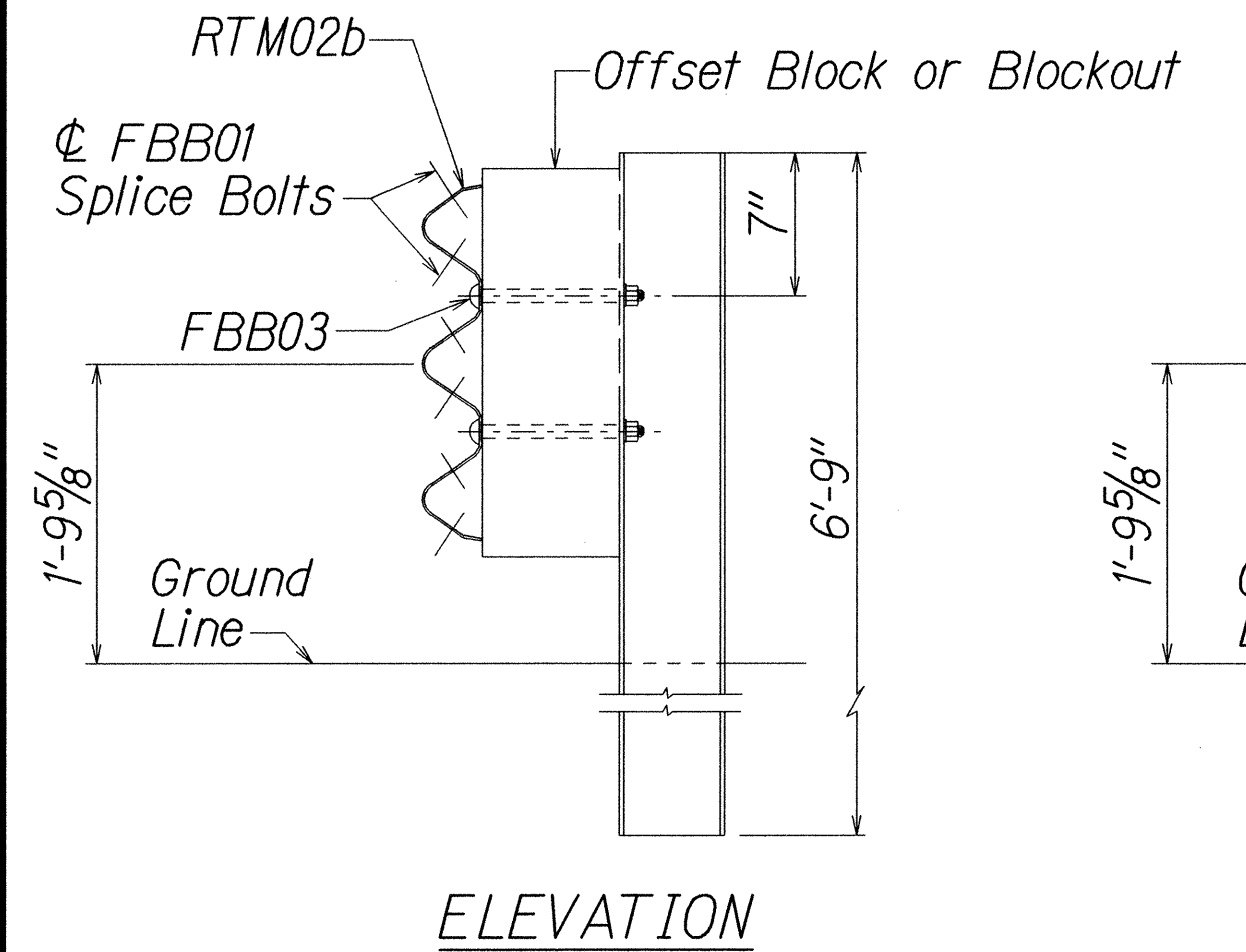
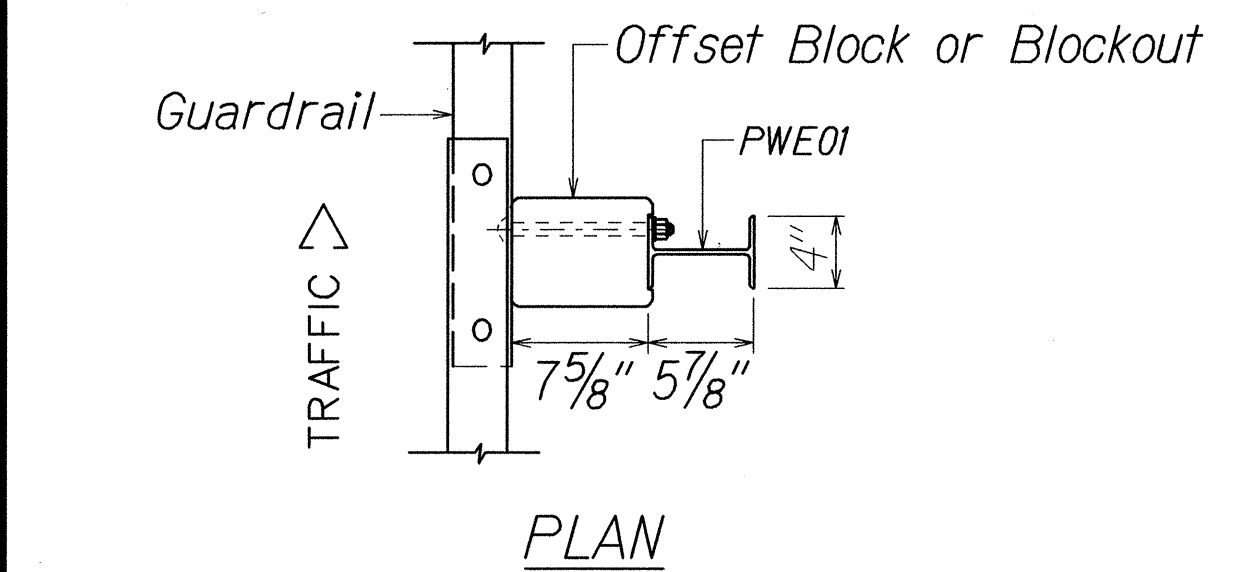
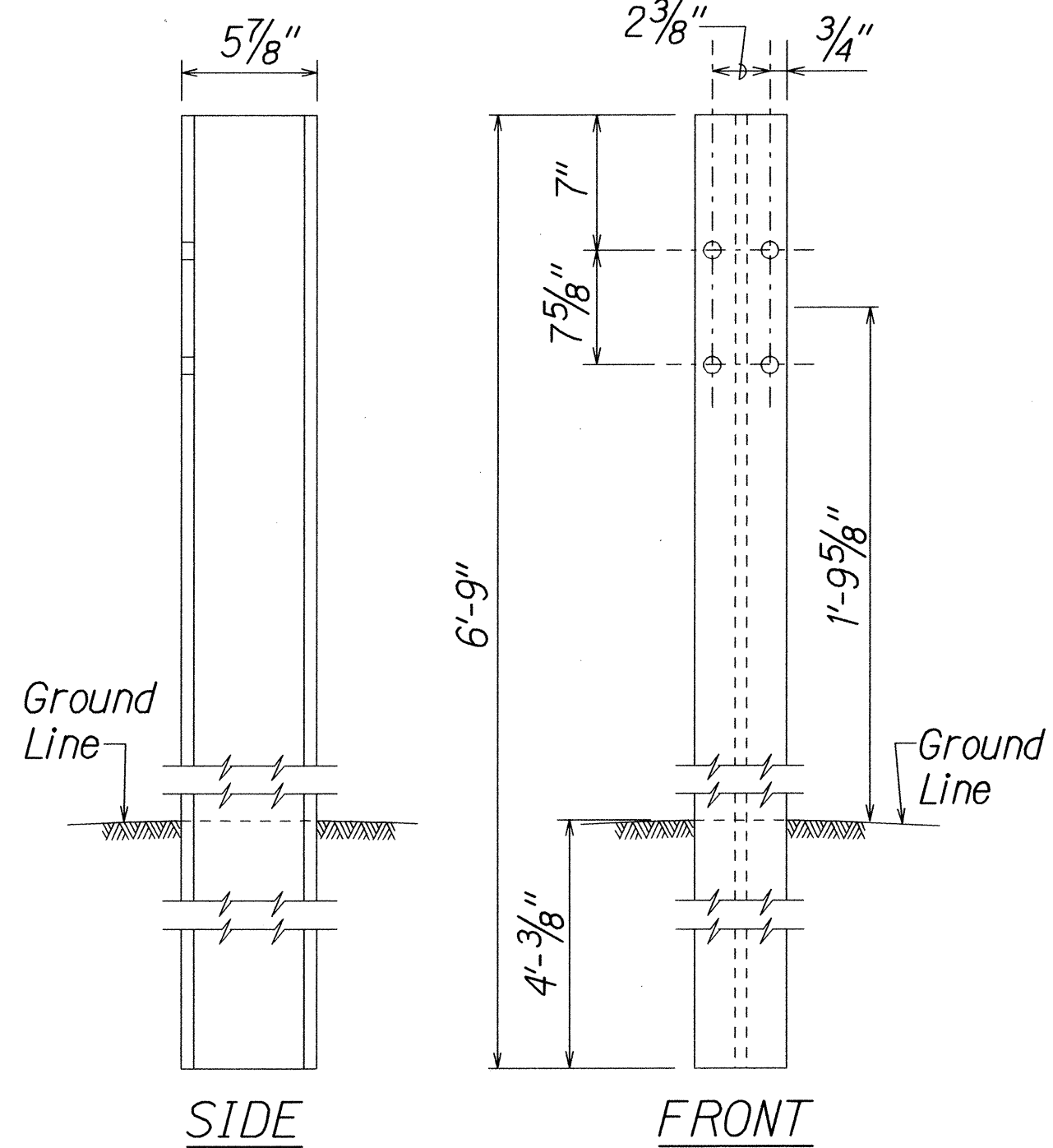
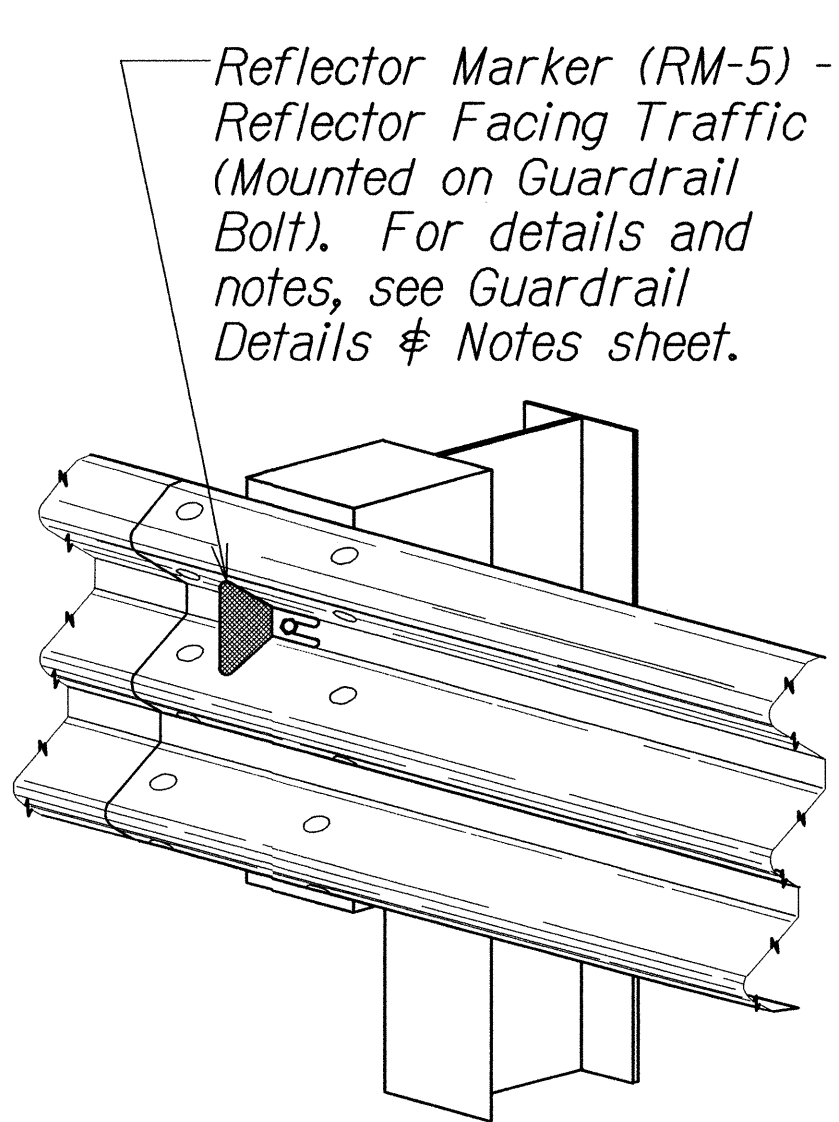
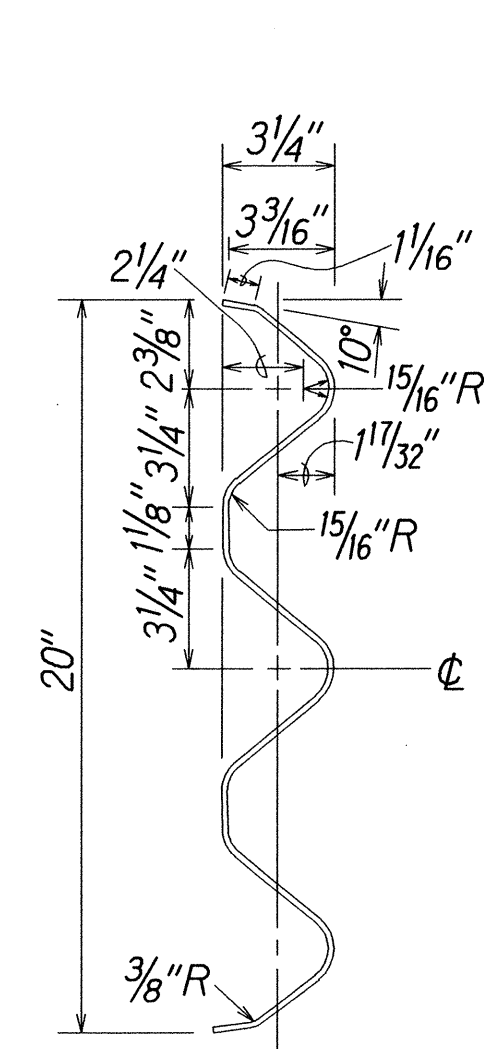


NOTE:  
All Holes are  $\frac{3}{4}$ " Dia.

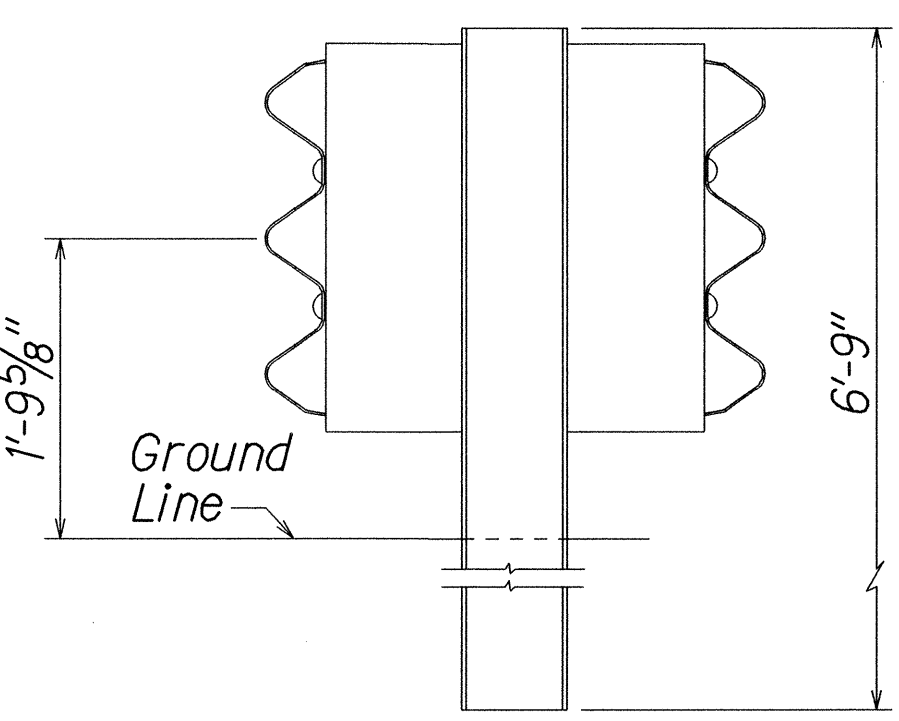


DESIGNATOR	L
FBB01	1 $\frac{3}{8}$ "
FBB02	2"
FBB03	10"

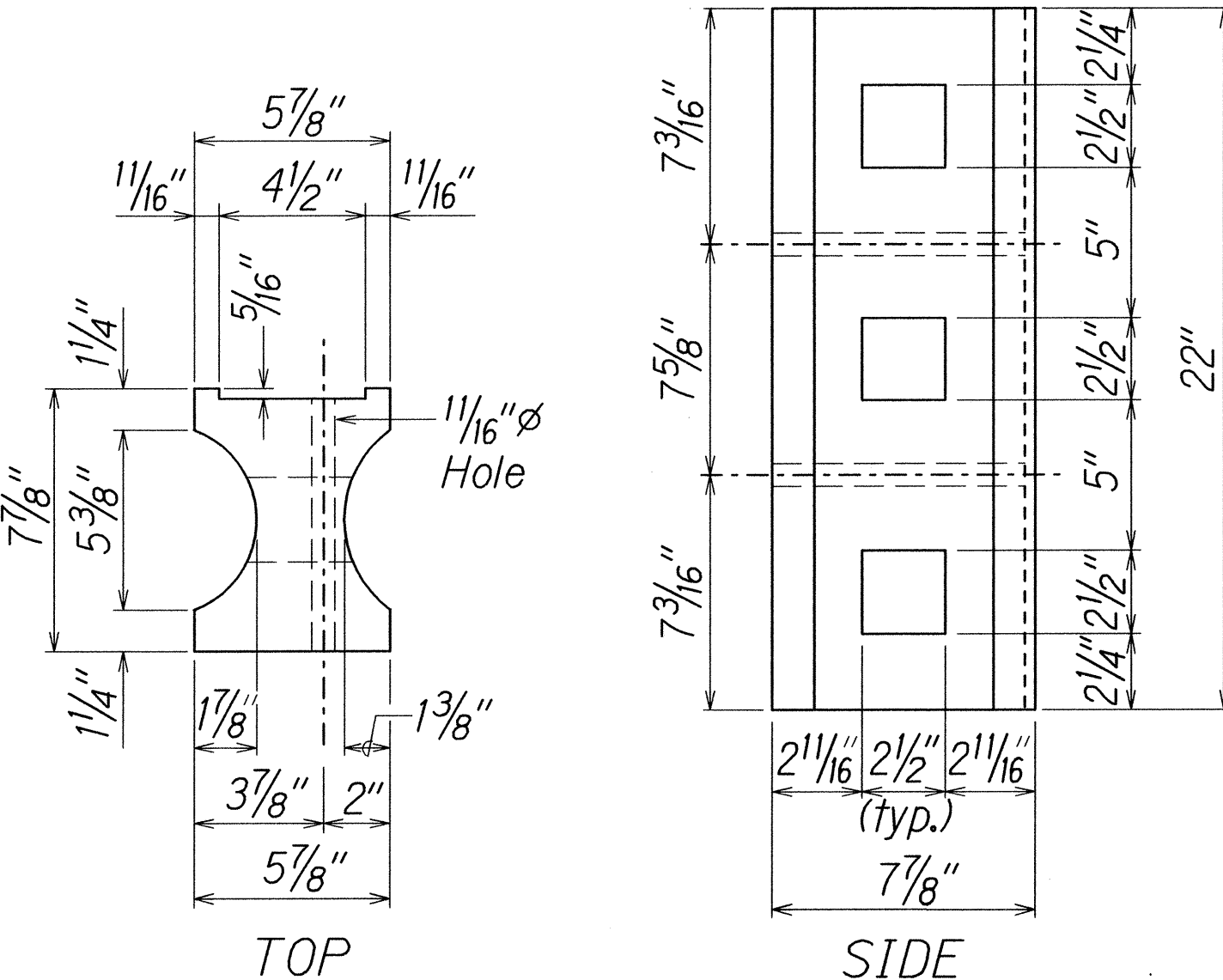
GUARDRAIL BOLTS  
AND RECESSED NUT



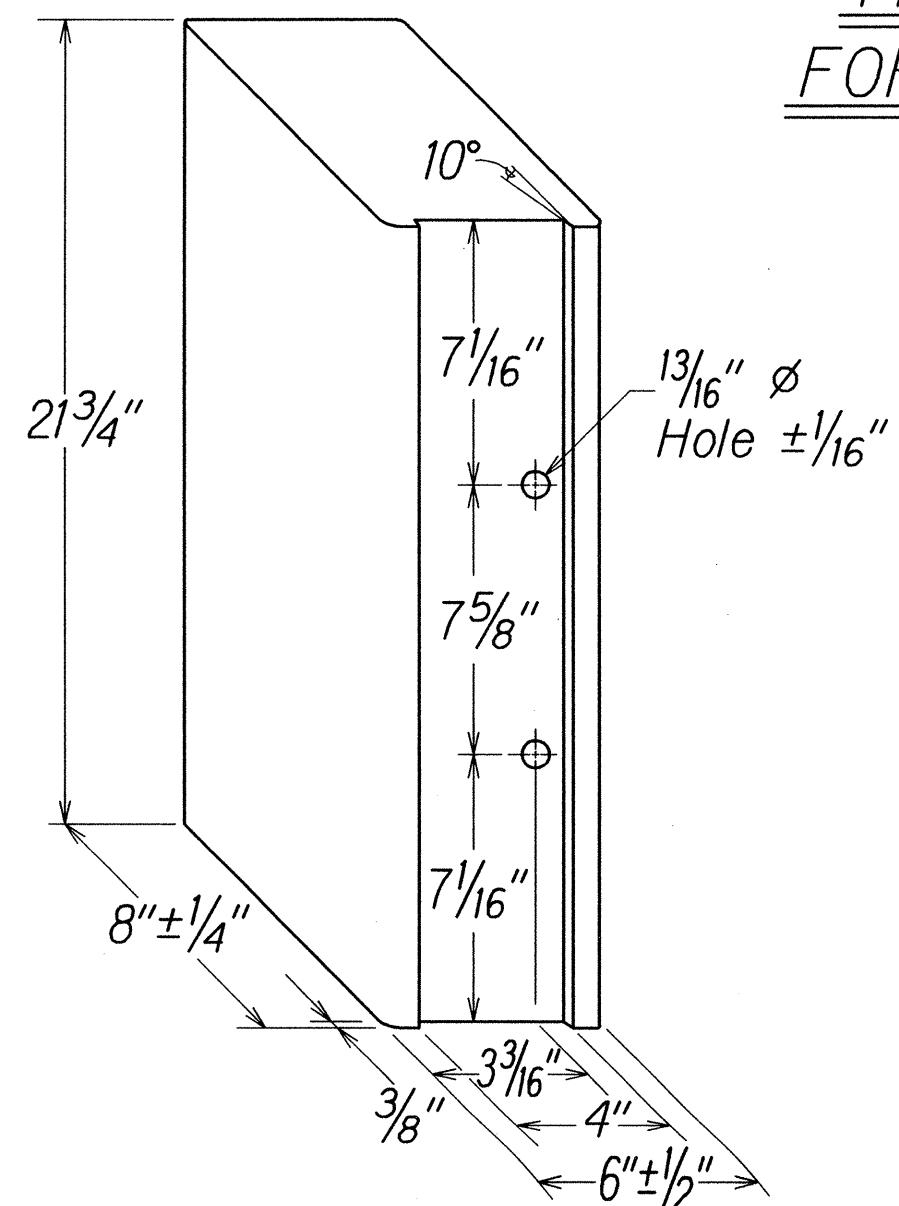
STRONG POST  
THRIE-BEAM GUARDRAIL  
(SGR09a)



STRONG POST THRIE-BEAM  
MEDIAN GUARDRAIL  
(SGM09a)



MODIFIED 6X8X22 PLASTIC BLOCKOUT  
(TYPE I-THRIE)



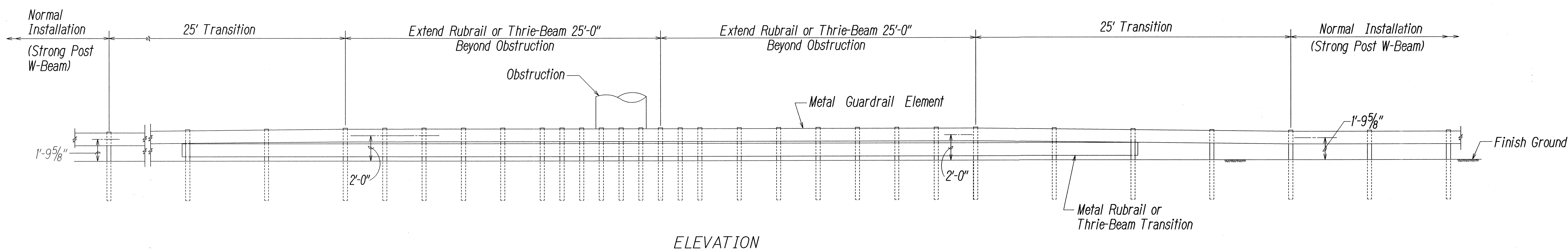
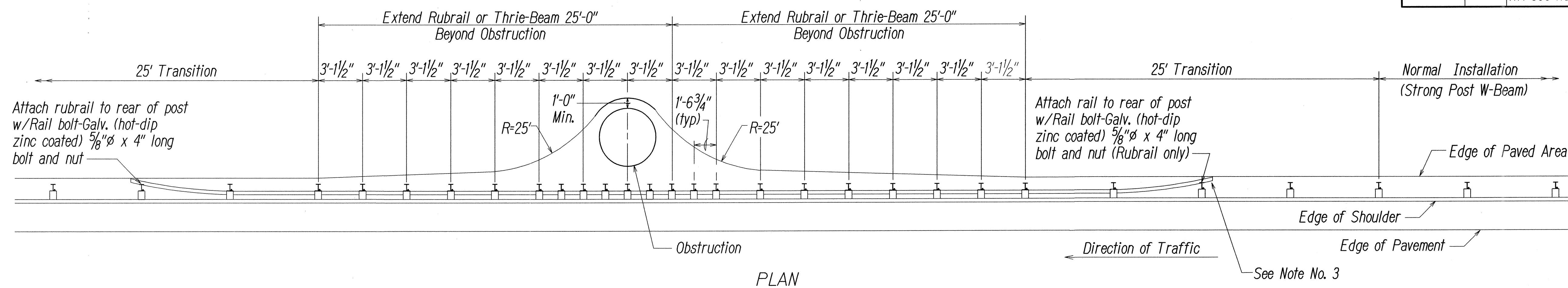
1/14/14 Inserted updated sheet.

DATE REVISION

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION  
**STRONG POST**  
**THRIE-BEAM GUARDRAIL**  
KAMEHAMEHA HIGHWAY RESURFACING  
Vicinity of Ka Uka Boulevard  
to Vicinity of Waihau Street  
Federal Aid Project No.NH-099-1(029)  
Scale: No to Scale Date: January 14, 2014

SHEET No. 5 OF 12 SHEETS

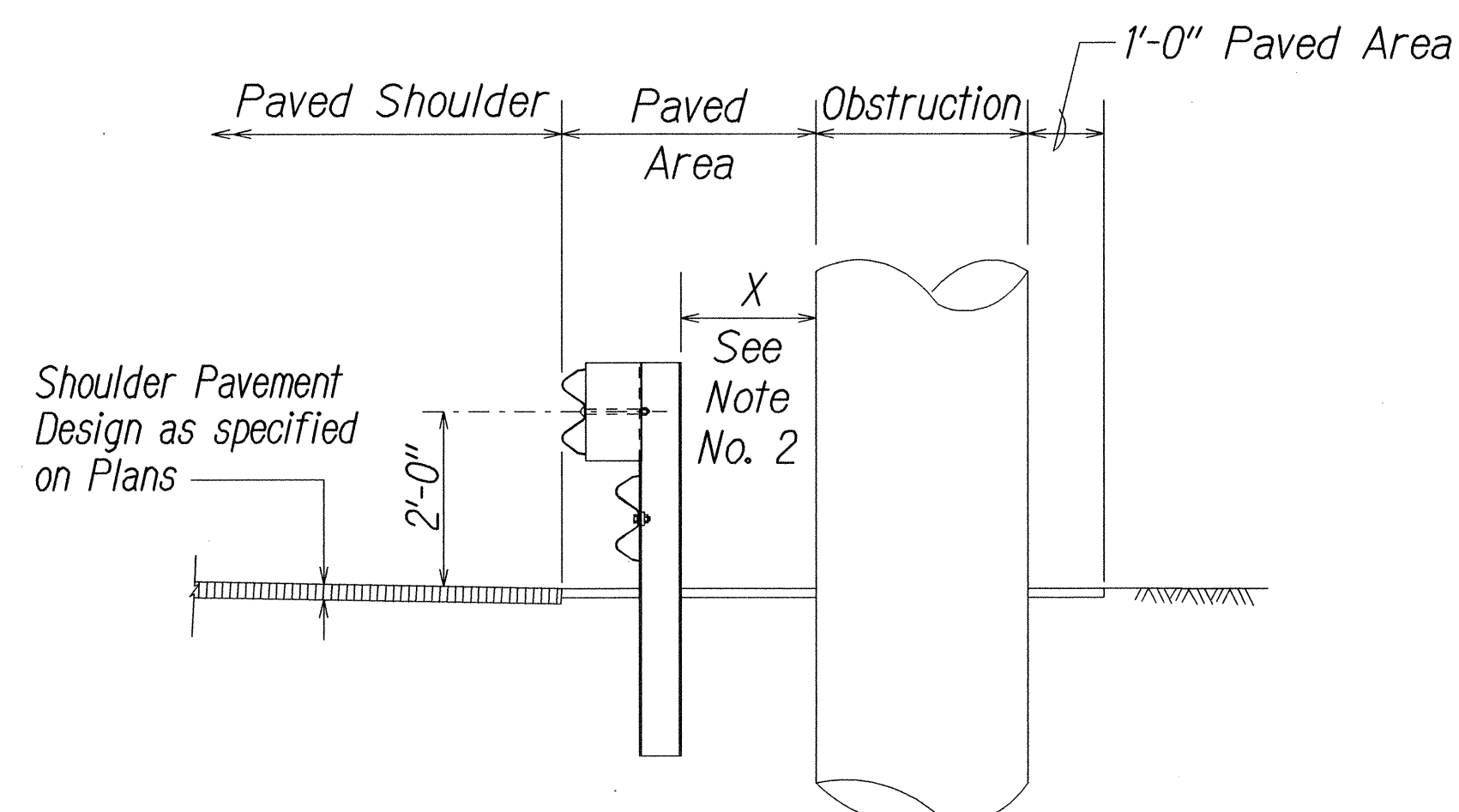
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-099-1(029)	2014	30	84



*ELEVATION*

NOTES:

1. All Guardrail and Concrete Barrier Designs at Obstructions shall be approved by the Engineer.
2. If  $X < 2'-0"$ , Concrete Barrier or special guardrail design;  
 $2'-0" \leq X < 3'-0"$ , Strong Post Rubrail or Strong Post Thrie-Beam  
with reduced post spacing;  
 $3'-0" \leq X$ , Strong Post W-Beam with 6'-3" post spacing  
(Normal Installation).
3. If a pedestrian walkway or bicycle route is located behind the guardrail, the Engineer should install the Thrie-Beam System. The Rubrail termini may become a hazard to pedestrians & bicyclists.



TYPICAL SECTION AT OBSTRUCTION

### DETAIL OF GUARDRAIL INSTALLATION AT OBSTRUCTION

ORIGINAL PLAN	SURVEY PLOTTED BY _____	DATE _____
NOTE BOOK dd335lew ekmndgr 06.dgn N <sub>6</sub>	DRAWN BY _____	_____
	TRACED BY _____	_____
	DESIGNED BY _____	_____
	QUANTITIES BY _____	_____
	CHECKED BY _____	_____

8/21/01  
tdlruby/guardrail//ts54rev.dgn (standard plan TE-53 -09/01/87 \$ TE-54 r11/03/89)

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**GUARDRAIL DETAILS**  
**(AT OBSTRUCTION)**

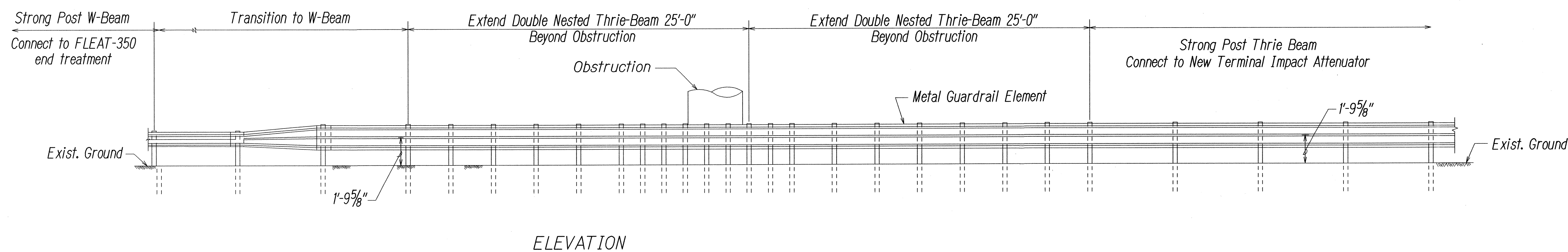
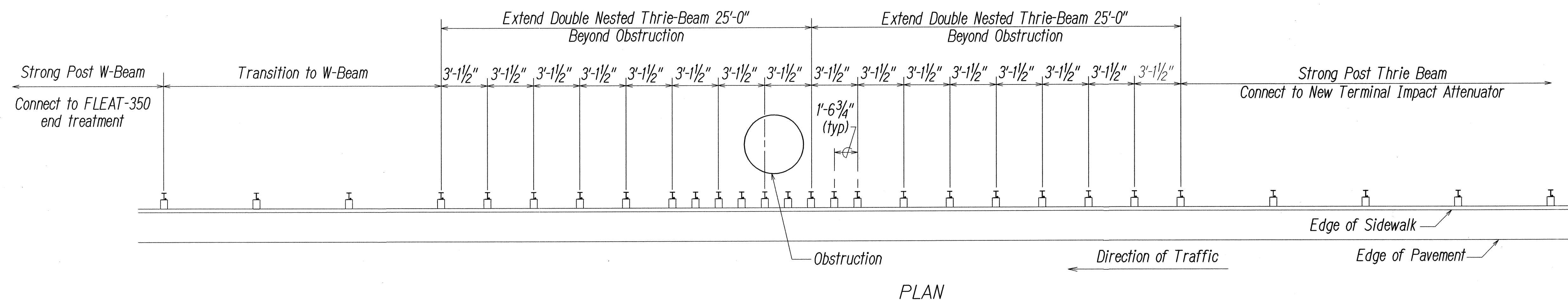
**KAMEHAMEHA HIGHWAY RESURFACING**  
**Vicinity of Ka Uka Boulevard to**  
**Vicinity of Waihau Street**  
**Federal Aid Project No. NH-099-1(029)**

Scale: NTS Date: Sept., 2013

SHEET No. 6 OF 12 SHEETS



FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-099-1(029)	2014	31	84



*SPECIAL DETAIL OF GUARDRAIL INSTALLATION AT OBSTRUCTION*

NOTES:

1. All Guardrail and Concrete Barrier Designs at Obstructions shall be approved by the Engineer.

ORIGINAL PLAN	SURVEY PLOTTED BY _____	DATE _____
NOTE BOOK	DRAWN BY _____	_____
0033549	TRACED BY _____	_____
ekmndgr01.dgn	DESIGNED BY _____	_____
N.	QUANTITIES BY _____	_____
	CHECKED BY _____	_____
	N.	_____

8/21/01 tdl.ruby/guardrail/te54rev.dgn (standard plan TE-53 r09/01/87 & TE-54 r11/03/89)

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**GUARDRAIL DETAILS**

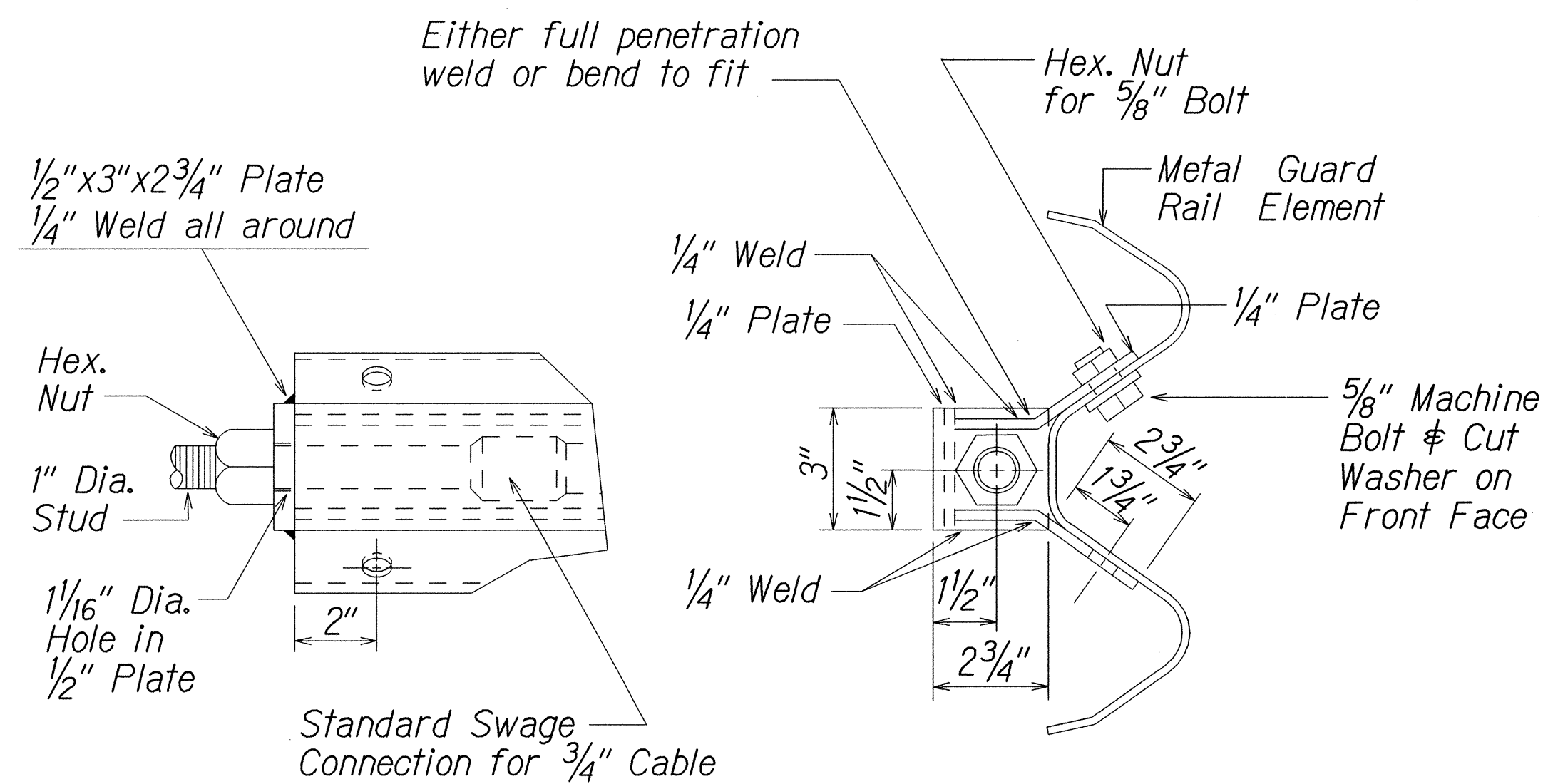
*(AT OBSTRUCTION - SPECIAL DESIGN)*

KAMEHAMEHA HIGHWAY RESURFACING  
*Vicinity of Ka Uka Boulevard to  
Vicinity of Waihau Street*  
*Federal Aid Project No. NH-099-1(029)*

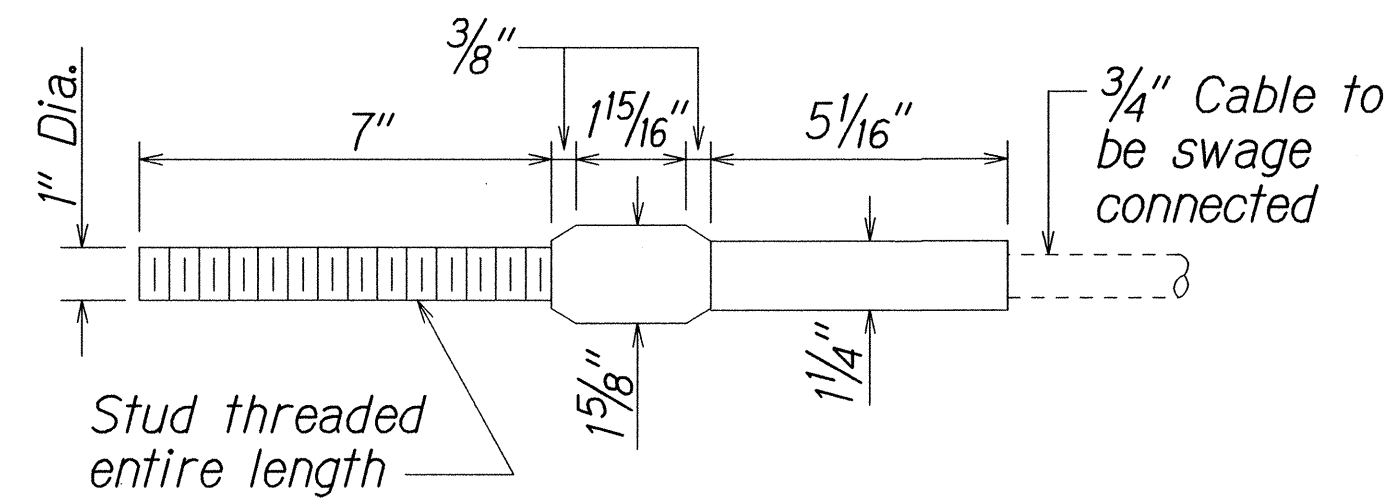
Scale: NTS Date: Sept., 2013

SHEET No. 7 OF 12 SHEETS

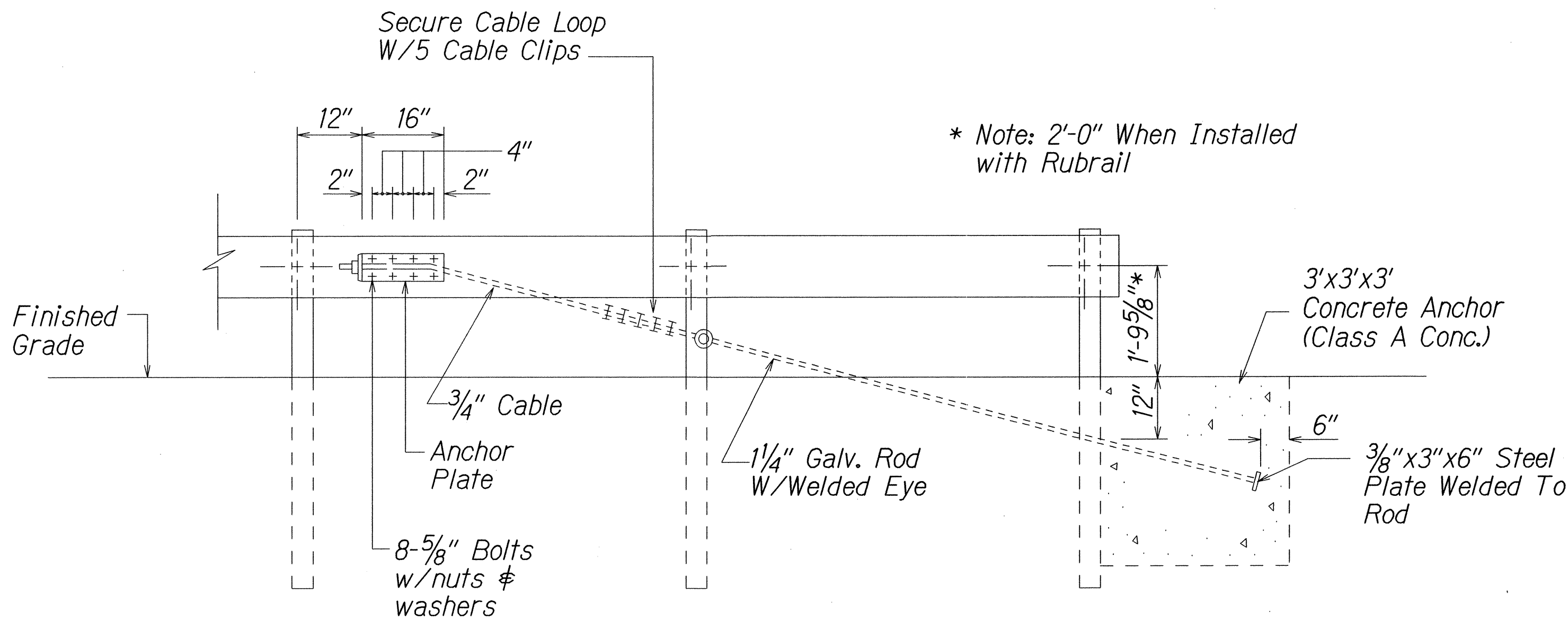
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-099-1(029)	2014	32	84



ANCHOR PLATE DETAILS

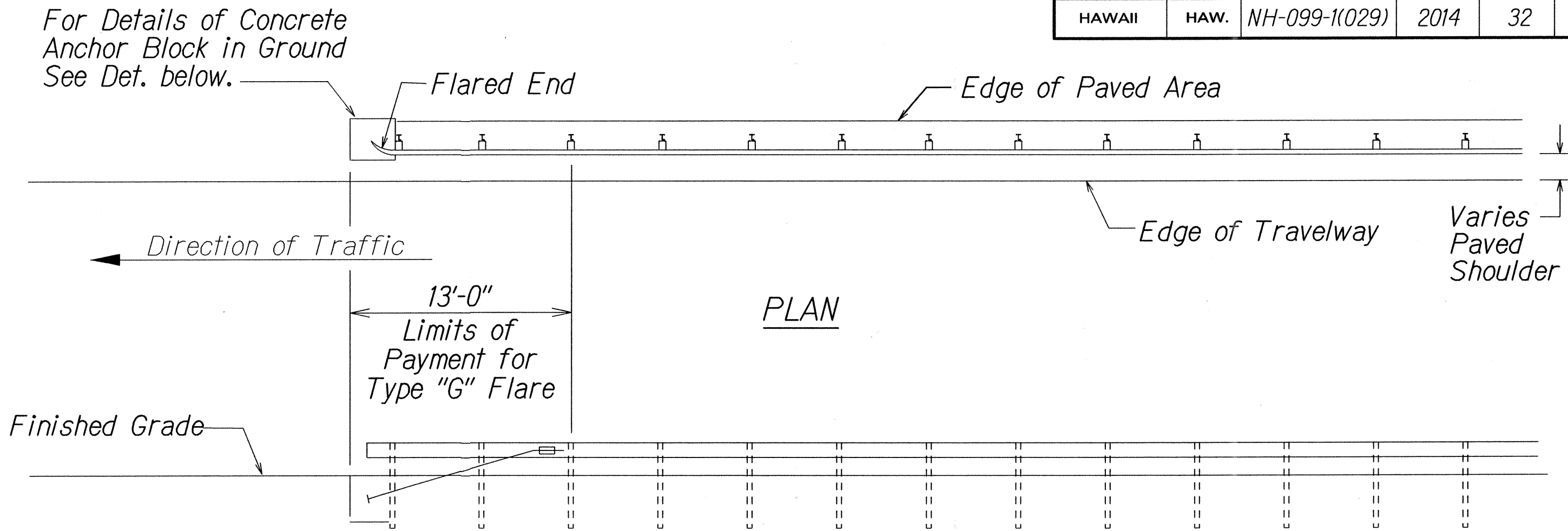


STANDARD SWAGED FITTING  
AND STUD



ANCHOR BLOCK DETAIL

- Concrete, G.R.P., excavation, anchor rod and miscellaneous appurtenances necessary to anchor the guardrail ends shall be incidental to metal guardrail.



ELEVATION

TYPE "G" FLARE END TERMINAL

NOTE:

Type "G" Modified End Terminal is a site specific end terminal with a taper and radial termini. A site specific detailed drawing is required for all Type "G" Modified End Terminal and must receive Engineer's approval.

The taper (flare rate) of the guardrail shall follow the latest edition of AASHTO'S Roadside Design Guide.

The radius of the radial termini is an Engineer's judgement based on the site evaluation. The Engineer shall consider safety (minimize the spearing & blunt end situation); degree and potential seriousness of the hazard; bicycle and pedestrian accessibility; maintenance equipment accessibility; Right-of-Way availability; the smallest radii the metal w-beam/thrie-beam railing can be constructed (check with supplier/contractor); posted speed limit; angle of vehicle impact; and aesthetics when designing the Type "G" Modified End Terminal.

During construction, the Contractor shall layout the proposed Type "G" Modified End Terminal and receive approval from the Construction Engineer prior to installation.

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HIGHWAYS DIVISION

GUARDRAIL DETAILS

TYPE "G" FLARE

KAMEHAMEHA HIGHWAY RESURFACING

Vicinity of Ka Uka Boulevard to

Vicinity of Waihau Street

Federal Aid Project No. NH-099-1(029)

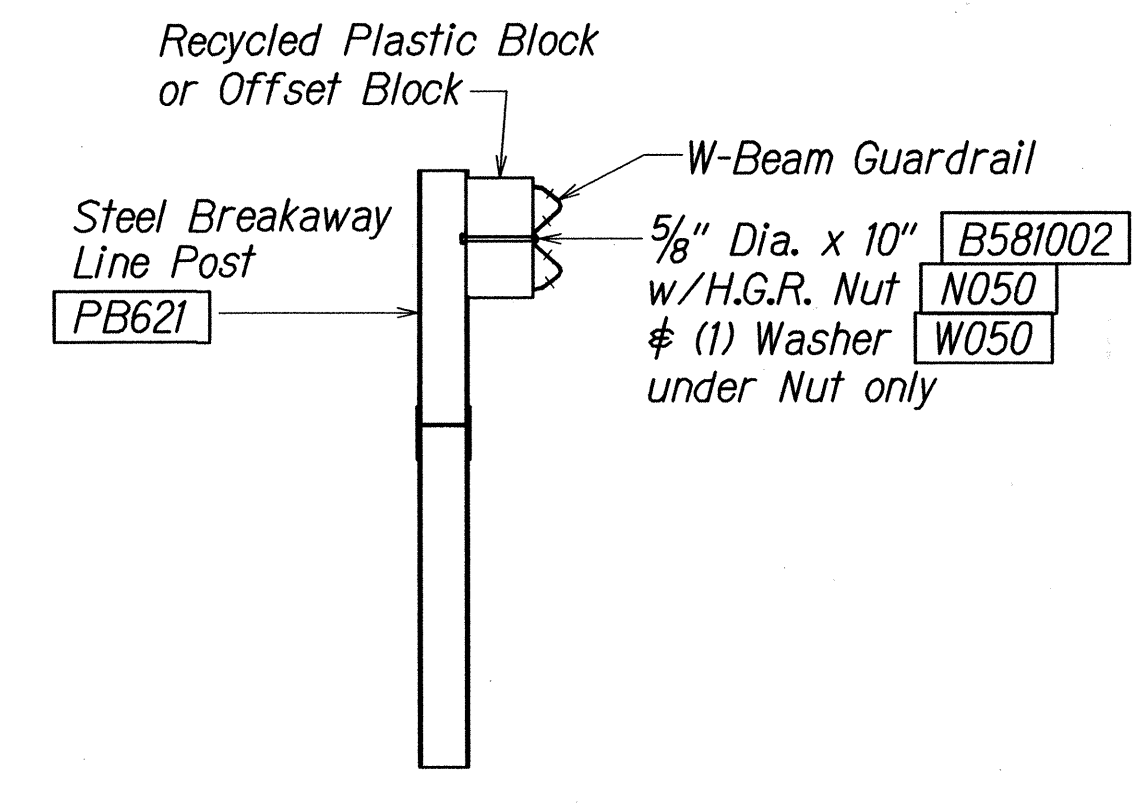
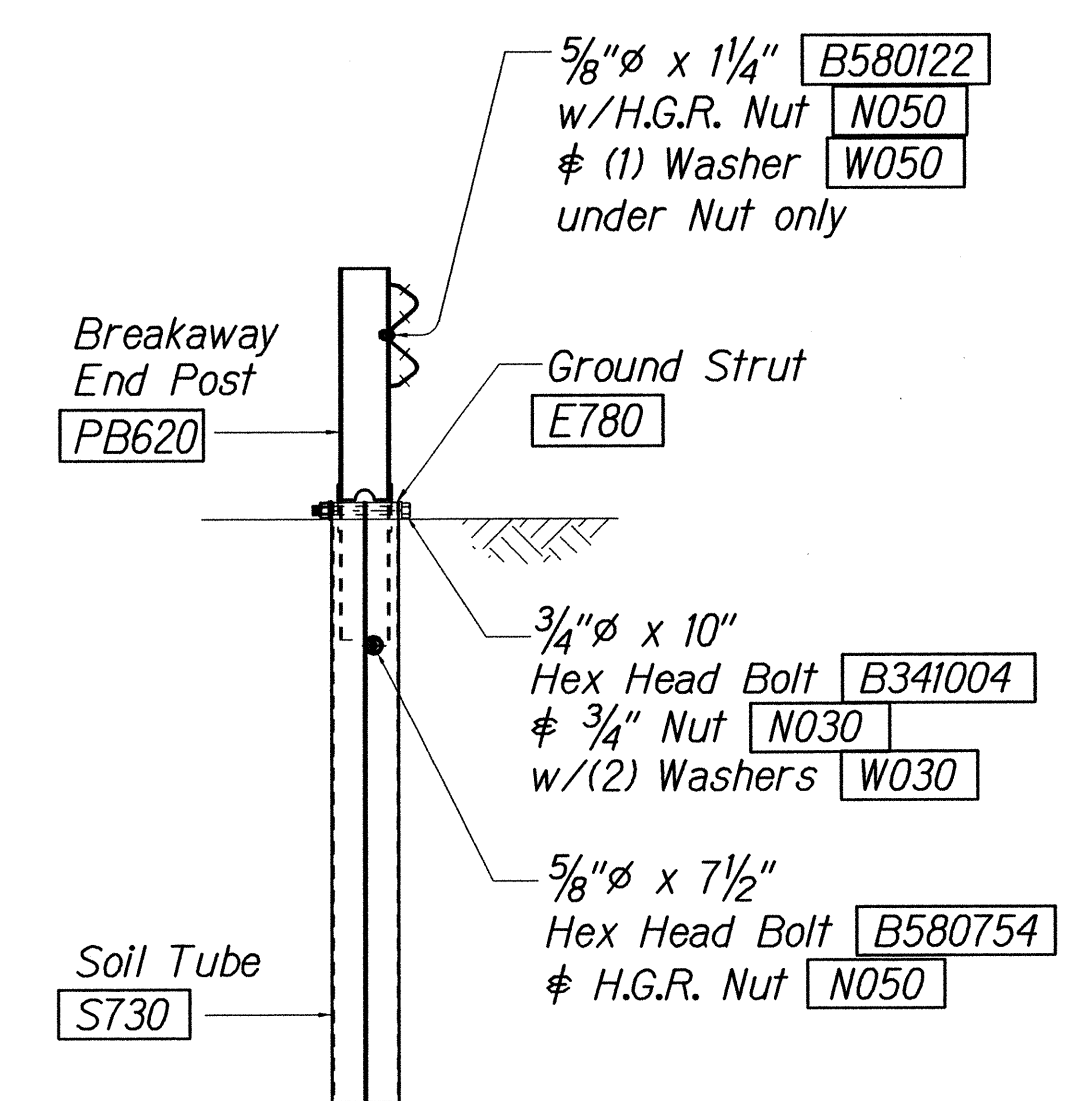
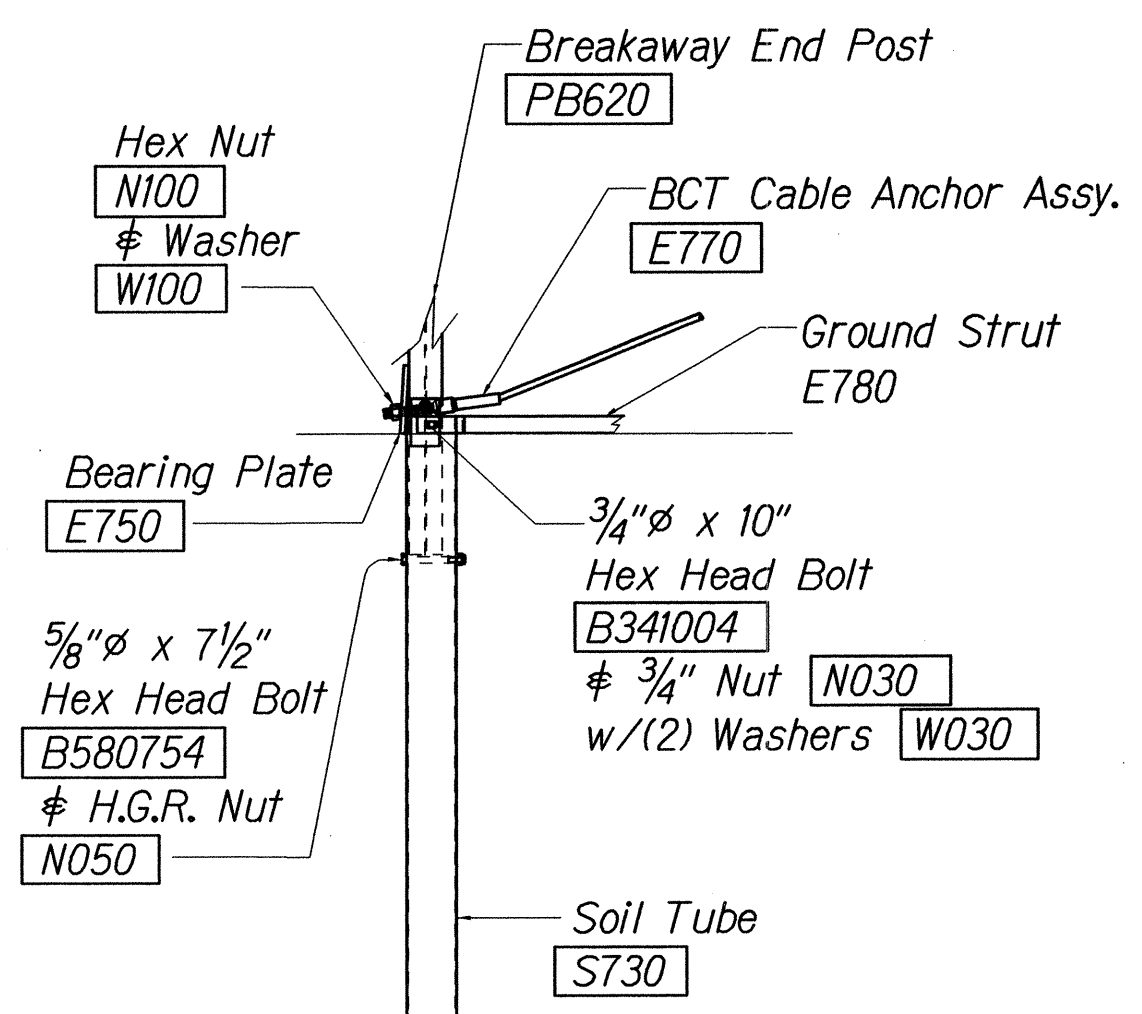
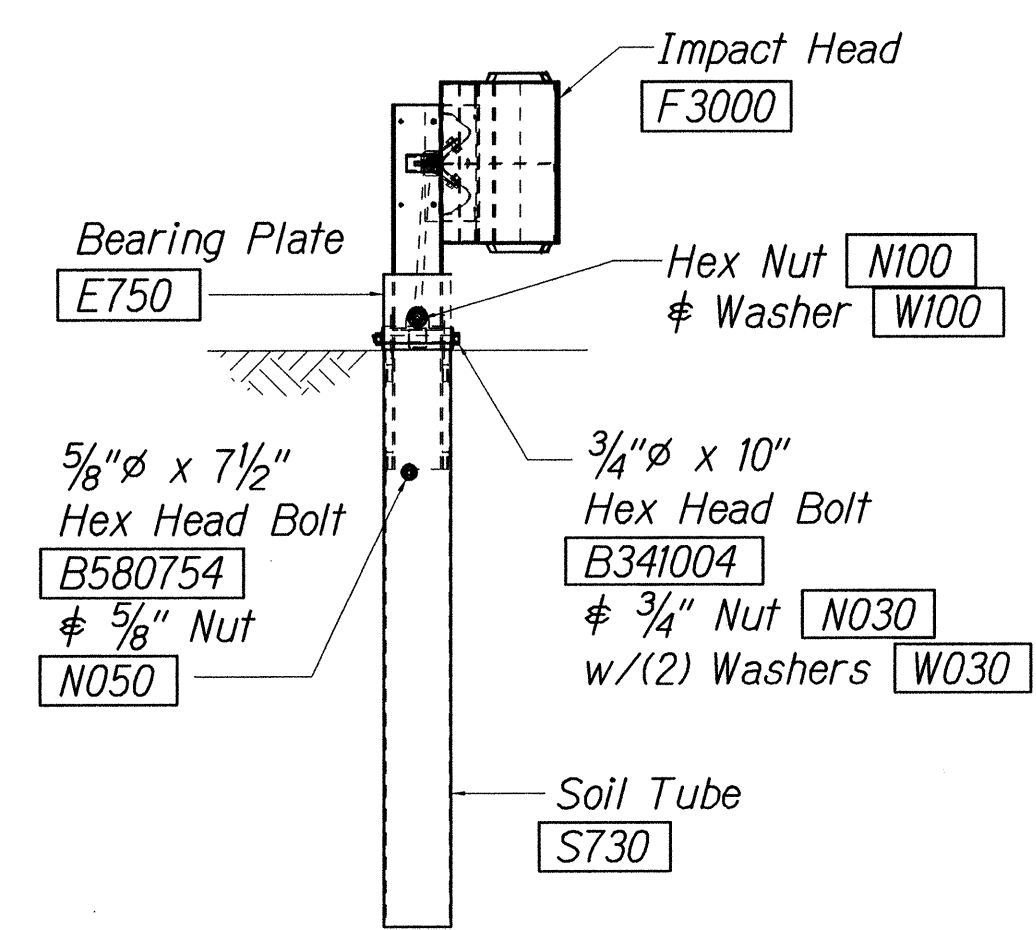
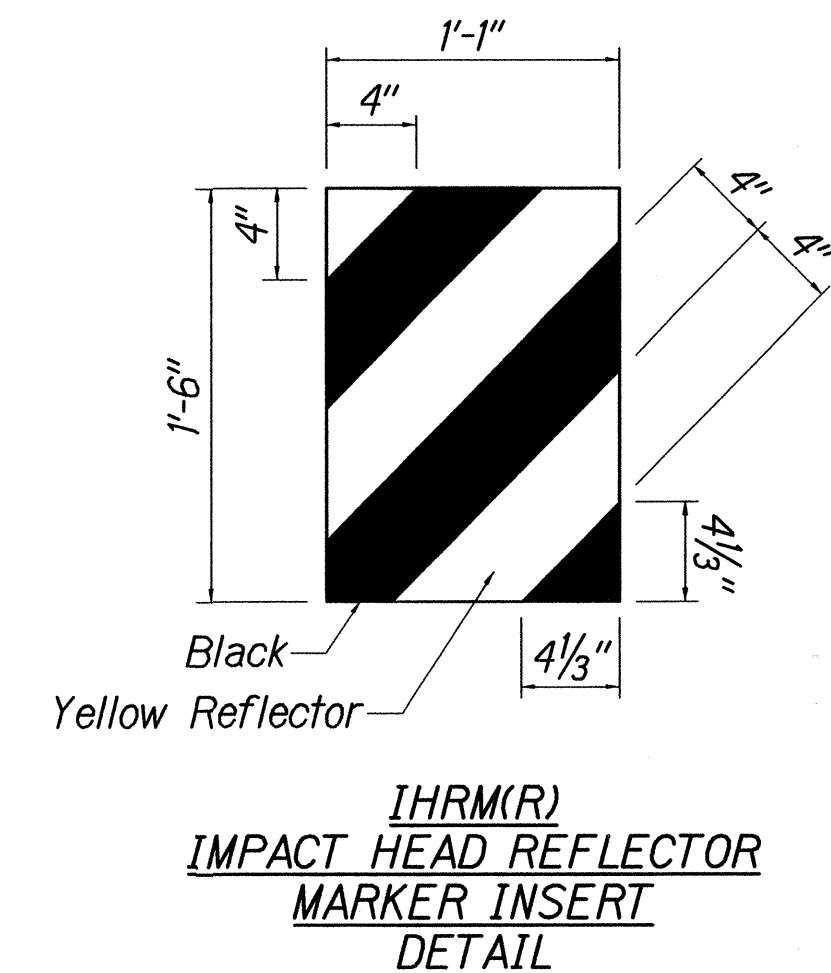
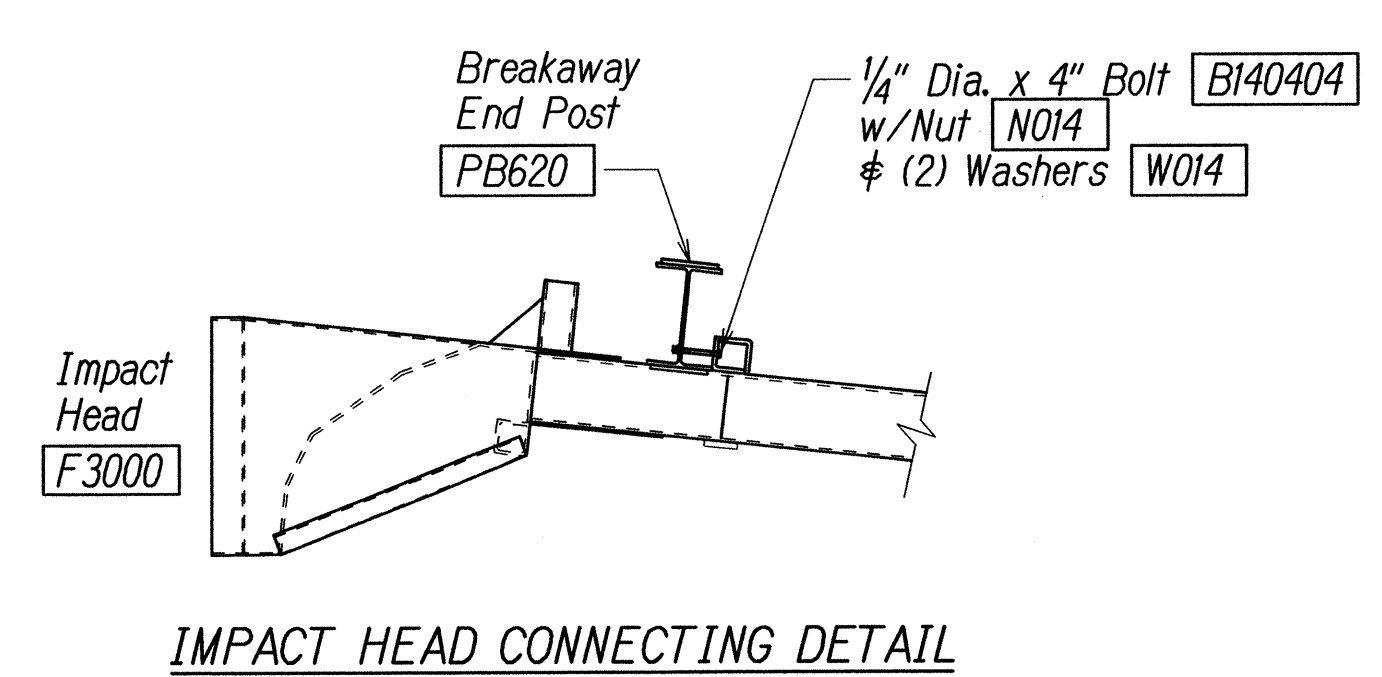
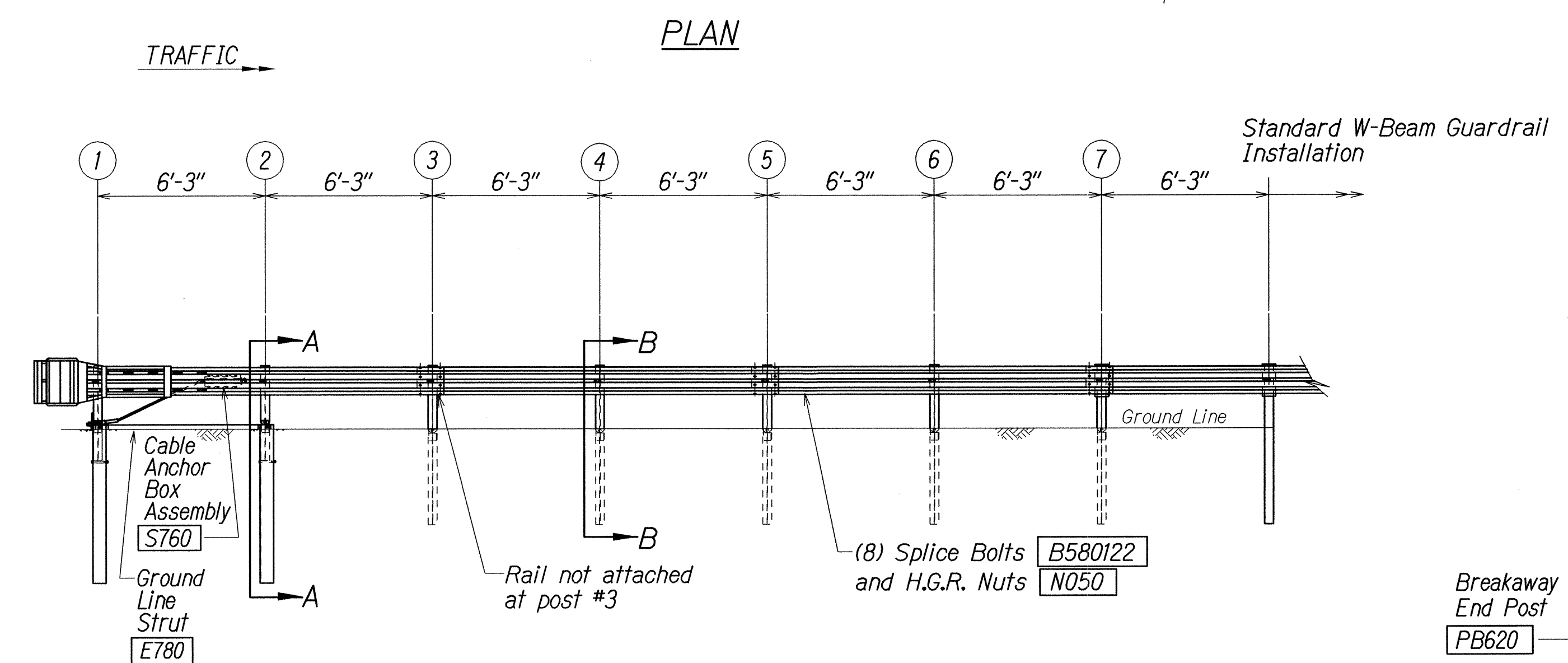
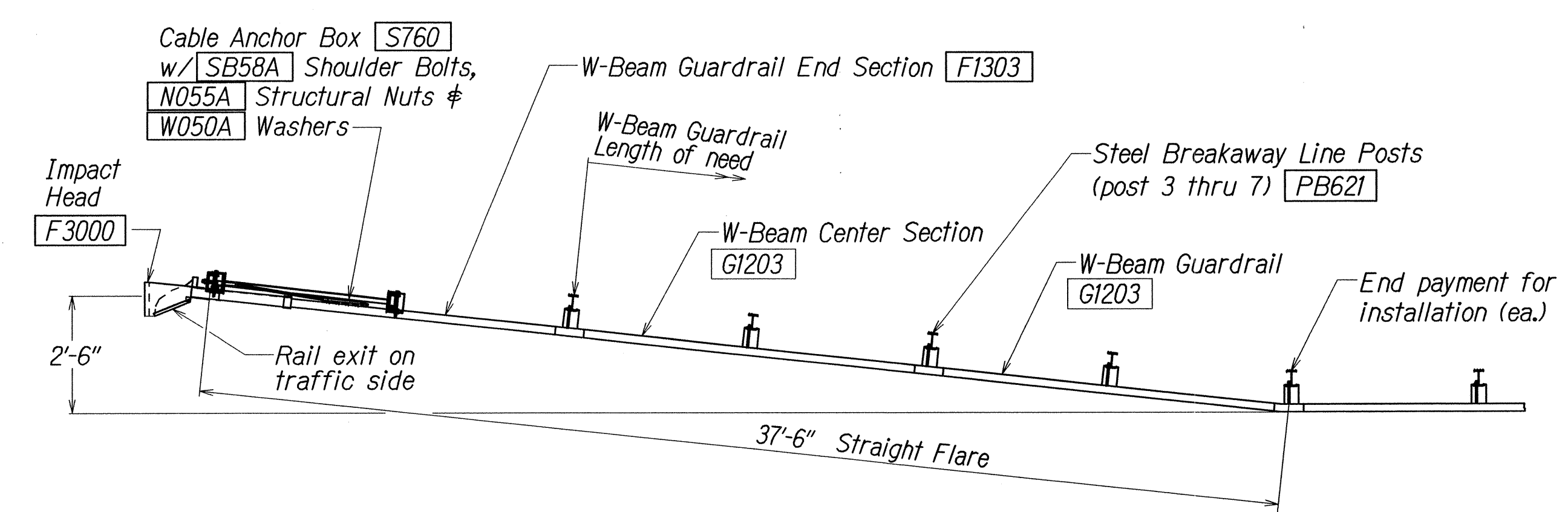
Scale: NTS

Date: Sept., 2013

SHEET No. 8 OF 12 SHEETS

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- GENERAL NOTES**
- Breakaway steel posts are required with the FLEAT Terminal.
  - All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
  - The soil tubes shall not protrude more than 4" above 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 shall 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.
  - (R) or (L) indicates right or left Impact Head Reflector Marker (IHRM). Providing and installing of IHRM shall be considered incidental to end treatment.
  - The stripes for IHRM shall slope downward at an angle of 45° towards the side of the end treatment that traffic is to pass.

ITEM NO.	QTY.	BILL OF MATERIALS
F3000	1	IMPACT HEAD
F1303	1	W-BEAM GUARDRAIL END SECTION, 12 GA.
G1203	2	W-BEAM GUARDRAIL, 12 GA.
S730	2	*FOUNDATION SOIL TUBE, 6" x 8" x 72"
E750	1	BEARING PLATE
S760	1	CABLE ANCHOR BOX
E770	1	BCT CABLE ANCHOR ASSEMBLY
E780	1	GROUND STRUT
PB620	2	STEEL BREAKAWAY END POST
PB621	5	STEEL BREAKAWAY LINE POST
	5	RECYCLED PLASTIC BLOCKOUT OR OFFSET BLOCK
	1	IMPACT HEAD REFLECTOR MARKER - IHRM(R) OR (L)
HARDWARE		
B580122	25	5/8" Dia. x 1 1/4" SPLICE BOLT, POST #2
B580754	2	5/8" Dia. x 7 1/2" HEX BOLT
B341004	2	3/4" Dia. x 10" HEX BOLT
B581002	5	5/8" Dia. x 10" H.G.R. BOLT (POST 3 THRU 7)
N050	32	5/8" Dia. H.G.R. NUT (SPLICE 24, SOIL TUBES 2, POST 2 THRU 7, 6)
N030	2	3/4" Dia. HEX NUT
W050	6	H.G.R. WASHER
W030	4	3/4" ID WASHER
N100	2	1" ANCHOR CABLE HEX NUT
W100	2	1" ANCHOR CABLE WASHER
B140404	2	1/4" x 4" HEX BOLT
N014	2	1/4" HEX NUT
W014	4	1/4" WASHER
SB58A	8	CABLE ANCHOR BOX SHOULDER BOLT
N055A	8	1/2" A325 STRUCTURAL NUT
W050A	16	1 1/16" OD x 9/16" ID A325 STR. WASHER

Foundation Tube Options For Posts 1 & 2  
\*6'-0" Split Foundation Tubes S730  
\*6'-0" Solid Foundation Tubes E731  
\*5'-0" Foundation Tubes S735 W/Soil Plates SP600  
\*4'-6" Foundation Tubes E735 W/Soil Plates SP600

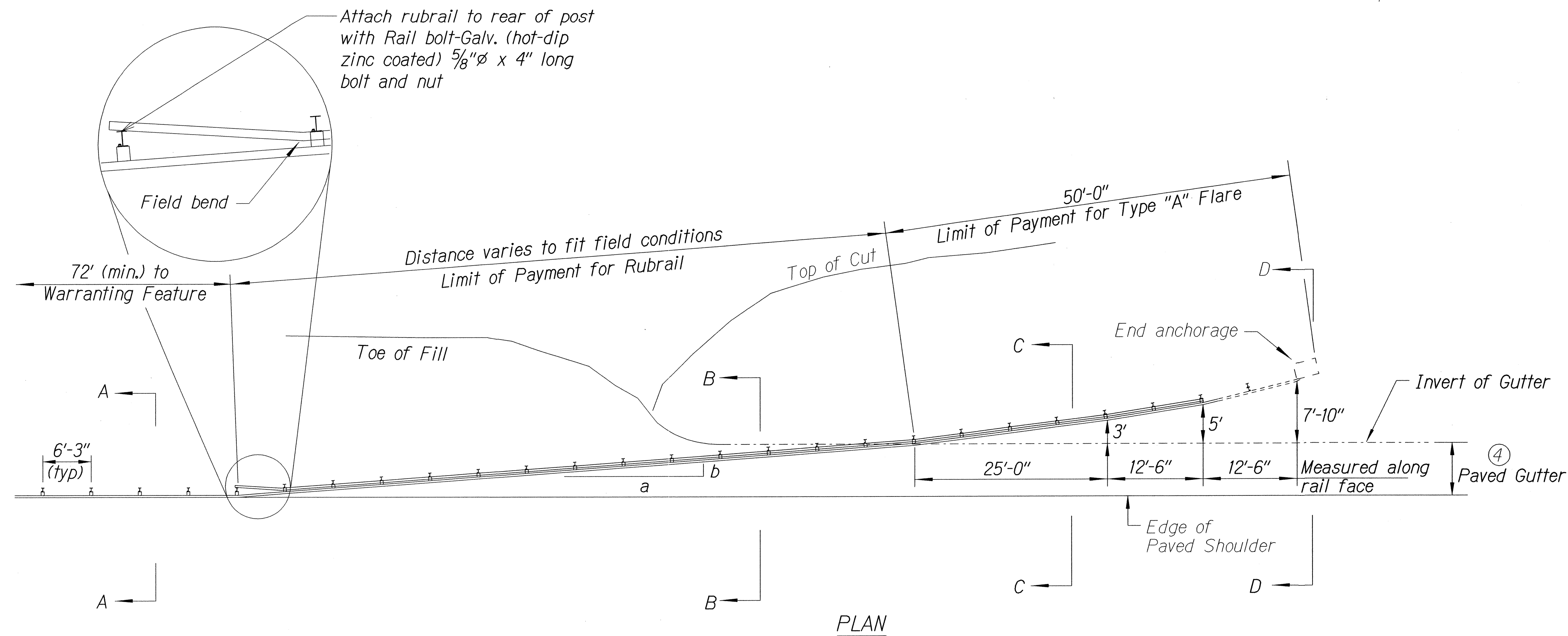
STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION  
**FLEAT-350**  
**FLARED ENERGY ABSORBING TERMINAL**  
KAMEHAMEHA HIGHWAY RESURFACING  
Vicinity of Ka Uka Boulevard to  
Vicinity of Waihau Street  
Federal Aid Project No. NH-099-1(029)  
Scale: NTS Date: Sept., 2013  
SHEET No. 9 OF 12 SHEETS

DATE: \_\_\_\_\_  
DRAWN BY: \_\_\_\_\_  
DESIGNED BY: \_\_\_\_\_  
CHECKED BY: \_\_\_\_\_  
NOTED BY: \_\_\_\_\_  
ORIGINAL PLAN: \_\_\_\_\_  
NOTE: RAIL NOT BOLTED @ POST #3

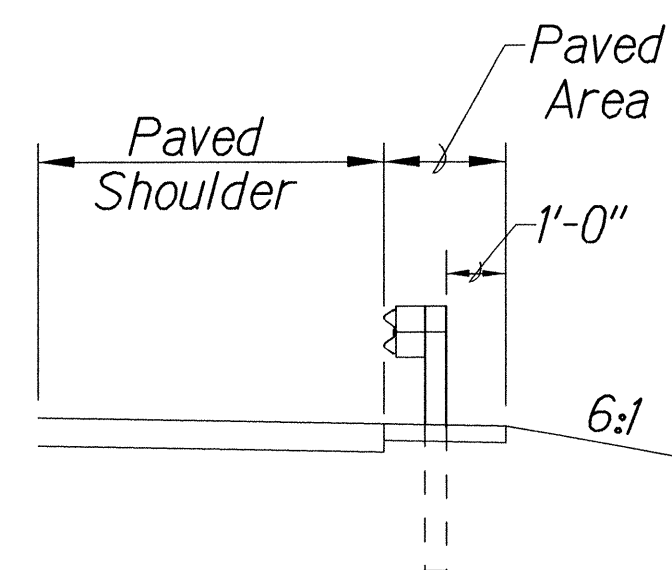
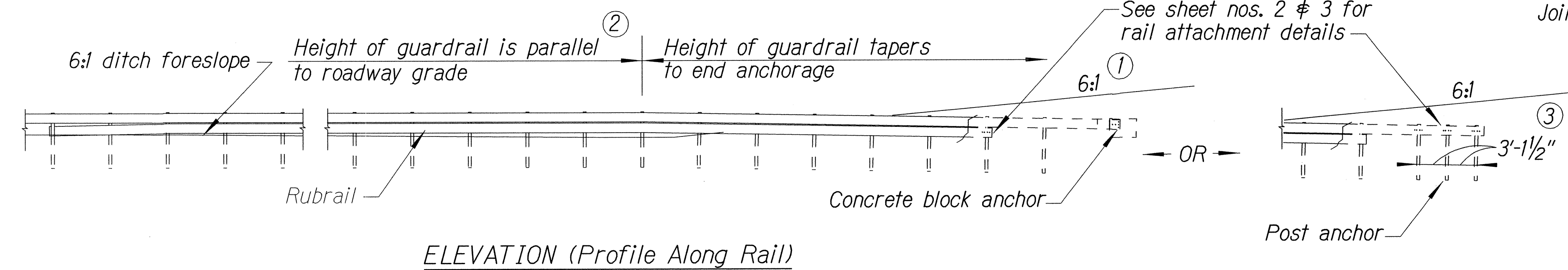
Standard plan TE-61 (11/03/89) & TE-62 (09/01/87)  
r8/12/02  
rdr:ubv:guardrail/fleat350.dgn

General Notes

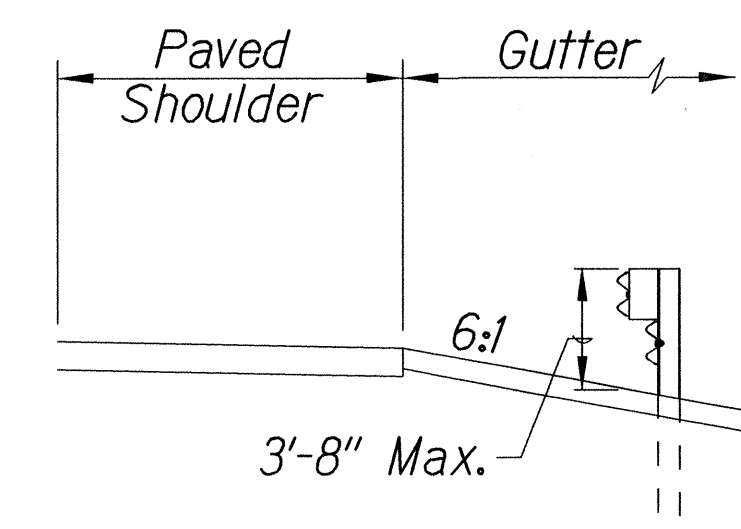
1. A 6:1 or flatter slope is desirable. However, a steeper or flatter existing slope may be used.
2. Height of guardrail may be tapered down in elevation to maintain 3'-8" maximum height.
3. All posts are 8'-0" in length from where the guardrail flares away from the shoulder back to the post anchor. Posts for the post anchor are 6'-0" long.
4. Variable Paved Gutter offsets may be used to fit field conditions.
5. The Guardrail Posts shall be located away from the gutter/swale invert.
6. All fasteners, posts, blocks and rail elements shall conform to the latest edition and amendments of "A Guide to Standardized Highway Barrier Rail Hardware," a report prepared and approved by the AASHTO-AGCARTBA Joint Cooperative Committee.



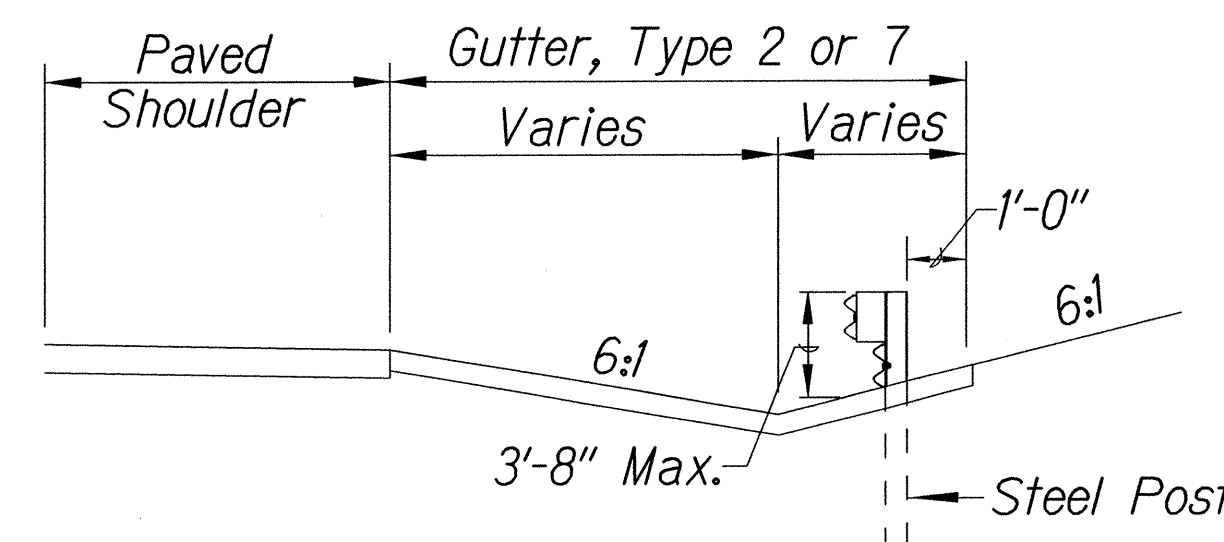
Design speed mph	a:b
68	15:1
62	13:1
56	12:1
50	11:1
43	10:1
37	9:1
31	7:1



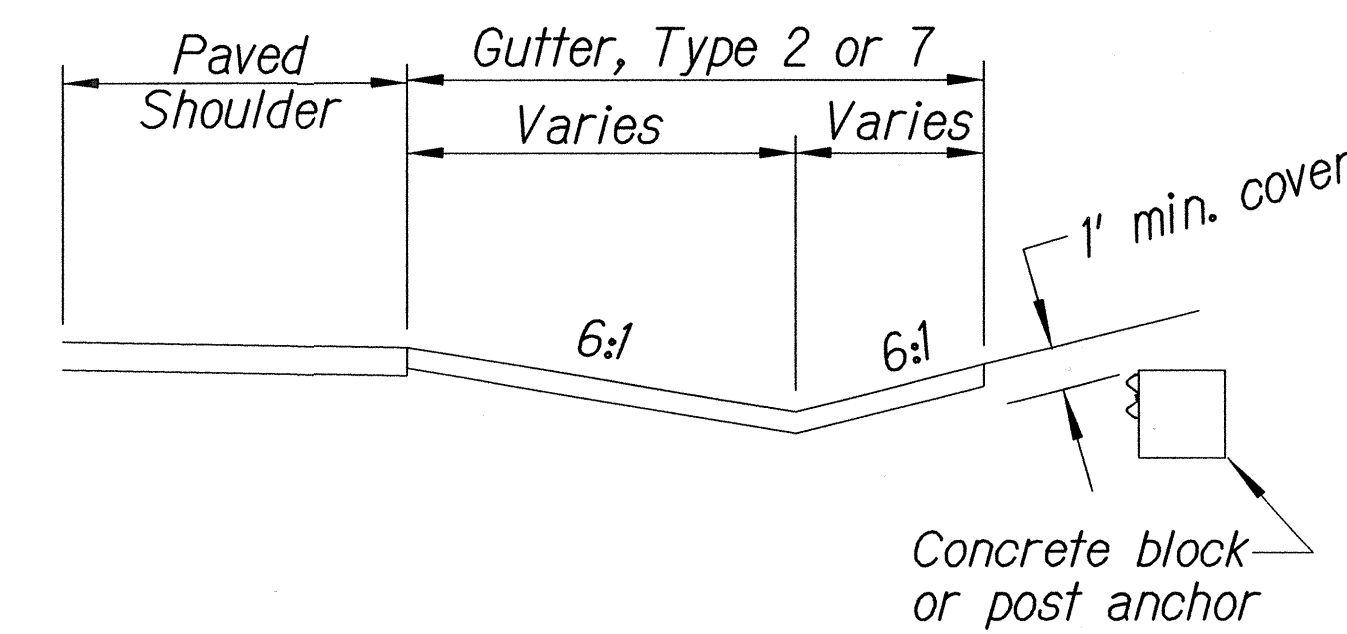
Section A-A



Section B-B  
(With Rubrail)



Section C-C  
(With Rubrail)



Concrete block  
or post anchor

BACKSLOPE ANCHOR TERMINAL (WITH 6:1 PAVED GUTTER AND TYPE "A" FLARE)

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HIGHWAYS DIVISION

TYPE "A" FLARE

KAMEHAMEHA HIGHWAY RESURFACING

Vicinity of Ka Uka Boulevard

to Vicinity of Waihau Street

Project No. NH-099-1(029)

Scale: NTS

Date: Sept., 2013

SHEET No. 1 OF 3 SHEETS

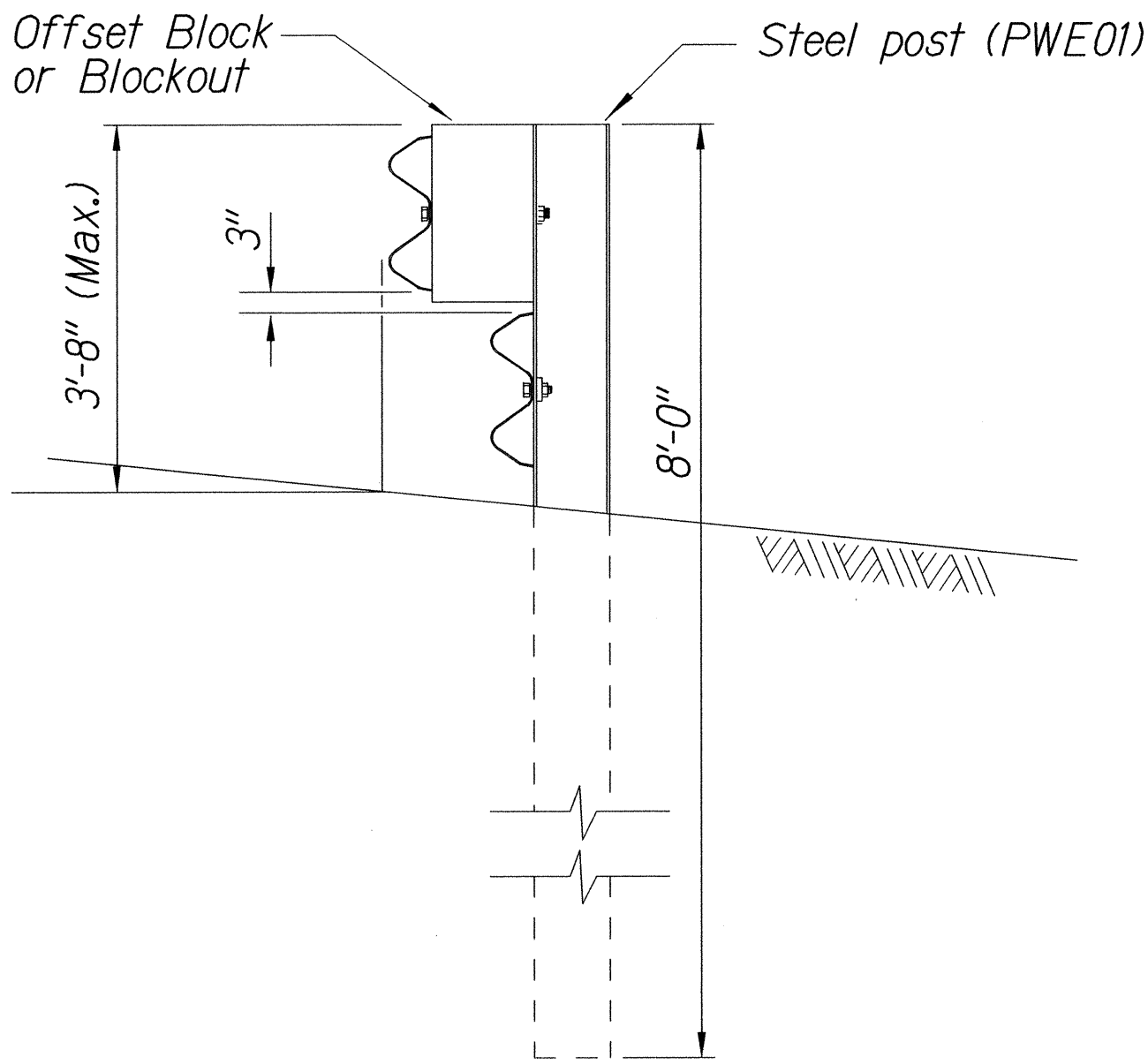
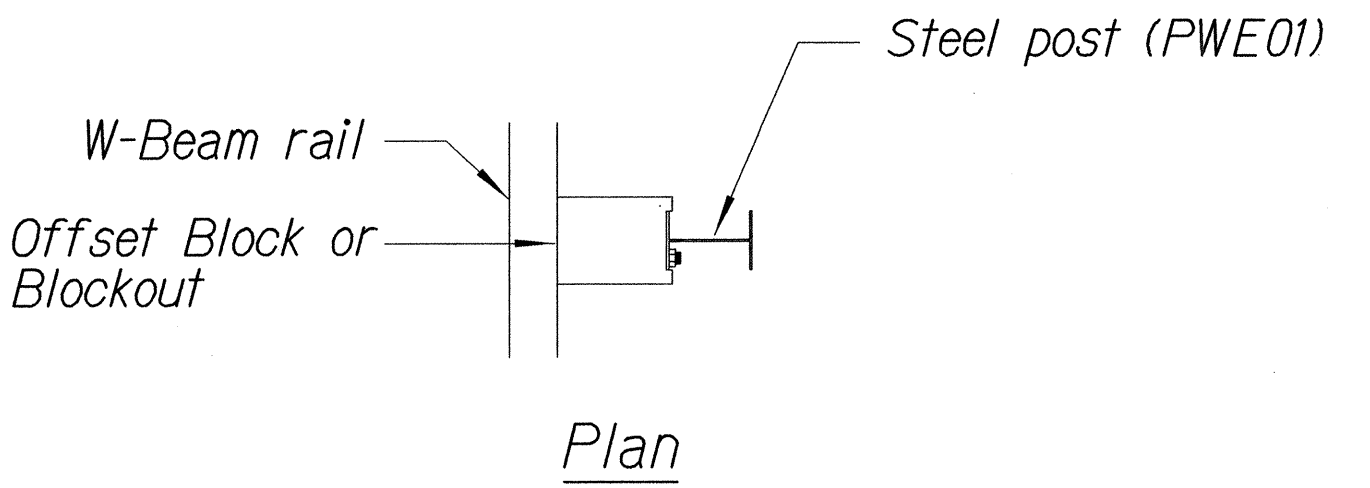
SURVEY PLOTTED BY	DATE
DRAWN BY	
DESIGNED BY	
QUANTITIES BY	
CHECKED BY	
ORIGINAL PLAN	
NOTE BOOK	
DATE	
BY	

18/21/01 rd/rubrail/gdr/gdr/rubrail/standard plan TE-58 07/01/06, TE-58 11/03/09 & TE-60 07/01/06

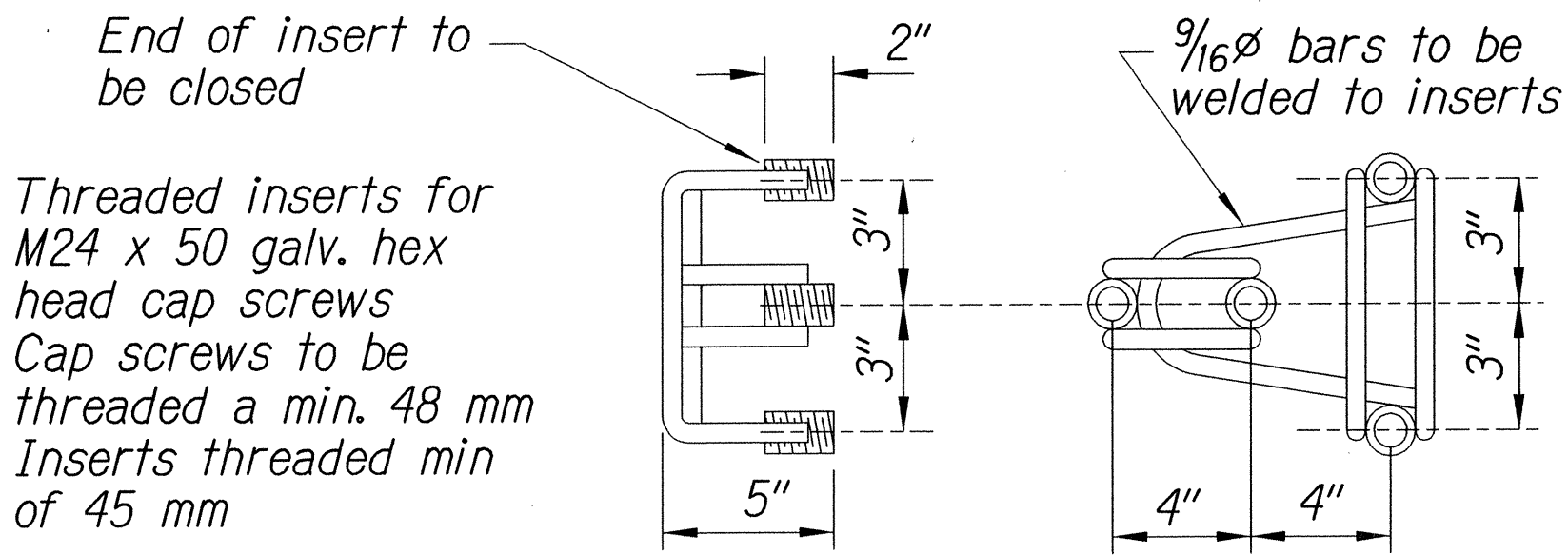




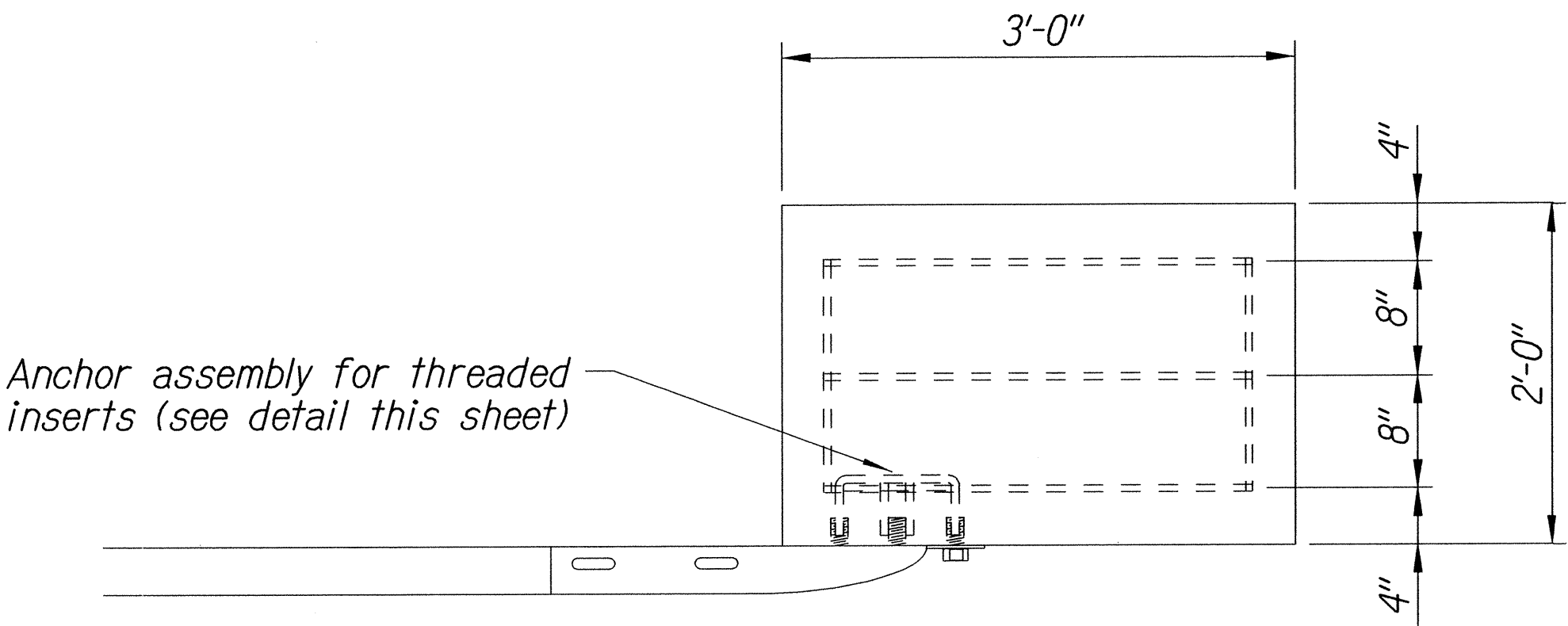
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-099-1(029)	2014	36	84



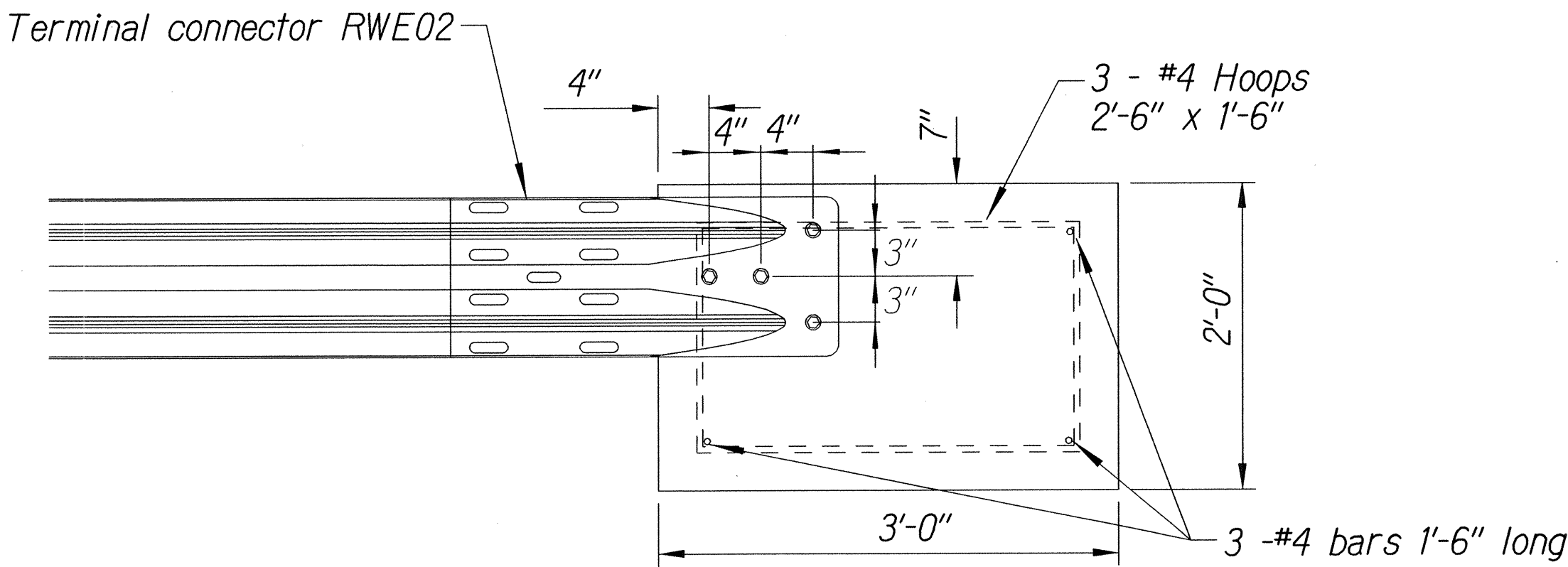
STEEL POST GUARDRAIL  
WITH RUBRAIL



ANCHOR ASSEMBLY  
CONCRETE BLOCK ANCHOR



Plan



Elevation

CONCRETE BLOCK ANCHOR  
(2' X 2' X 3')

BACKSLOPE ANCHOR TERMINAL END ANCHORAGE DETAILS  
TYPE "A" FLARE)

Note:

All fasteners, posts, blocks and rail elements shall conform to the latest edition and amendments of "A Guide to Standardized Highway Barrier Rail Hardware," a report prepared and approved by the AASHTO-AGCARTBA Joint Cooperative Committee.

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**TYPE "A" FLARE**

KAMEHAMEHA HIGHWAY RESURFACING

Vicinity of Ka Uka Boulevard

to Vicinity of Waihau Street

Project No. NH-099-1(029)

Scale: NTS
Date: Sept., 2013

SHEET No. 3 OF 3 SHEETS

SURVEY PLOTTED BY	DATE
DRAWN BY	
DESIGNED BY	
QUANTITIES BY	
CHECKED BY	
ORIGINAL PLAN	
NOTE BOOK	
DESIGNED BY	
QUANTITIES BY	
CHECKED BY	
DATE	

r3/01/99 tdt:rbj/guardrail/gdaelldgn (standard plan TE-58 07/01/86, TE-59 01/03/89 & TE-60 07/01/86)