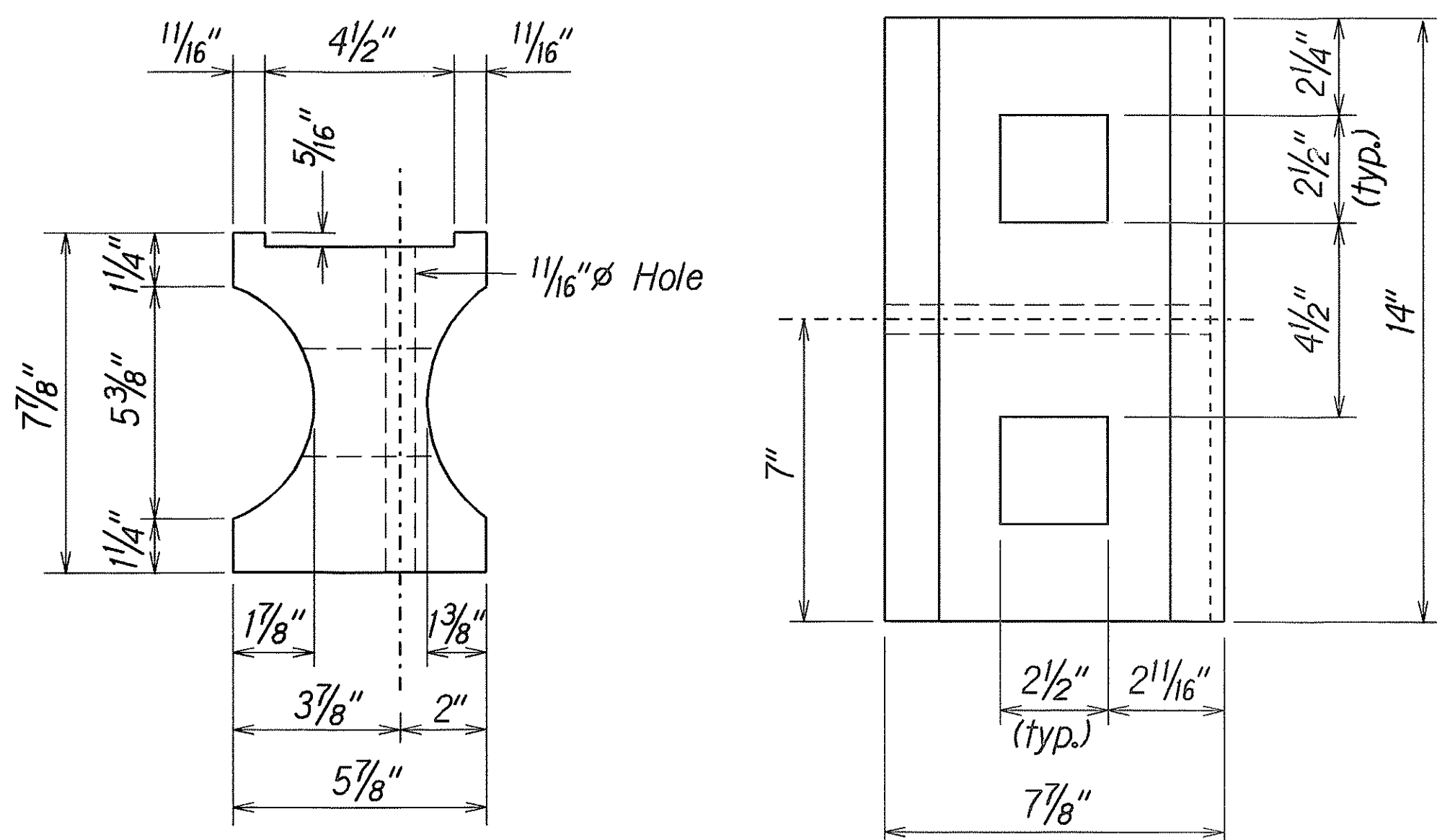
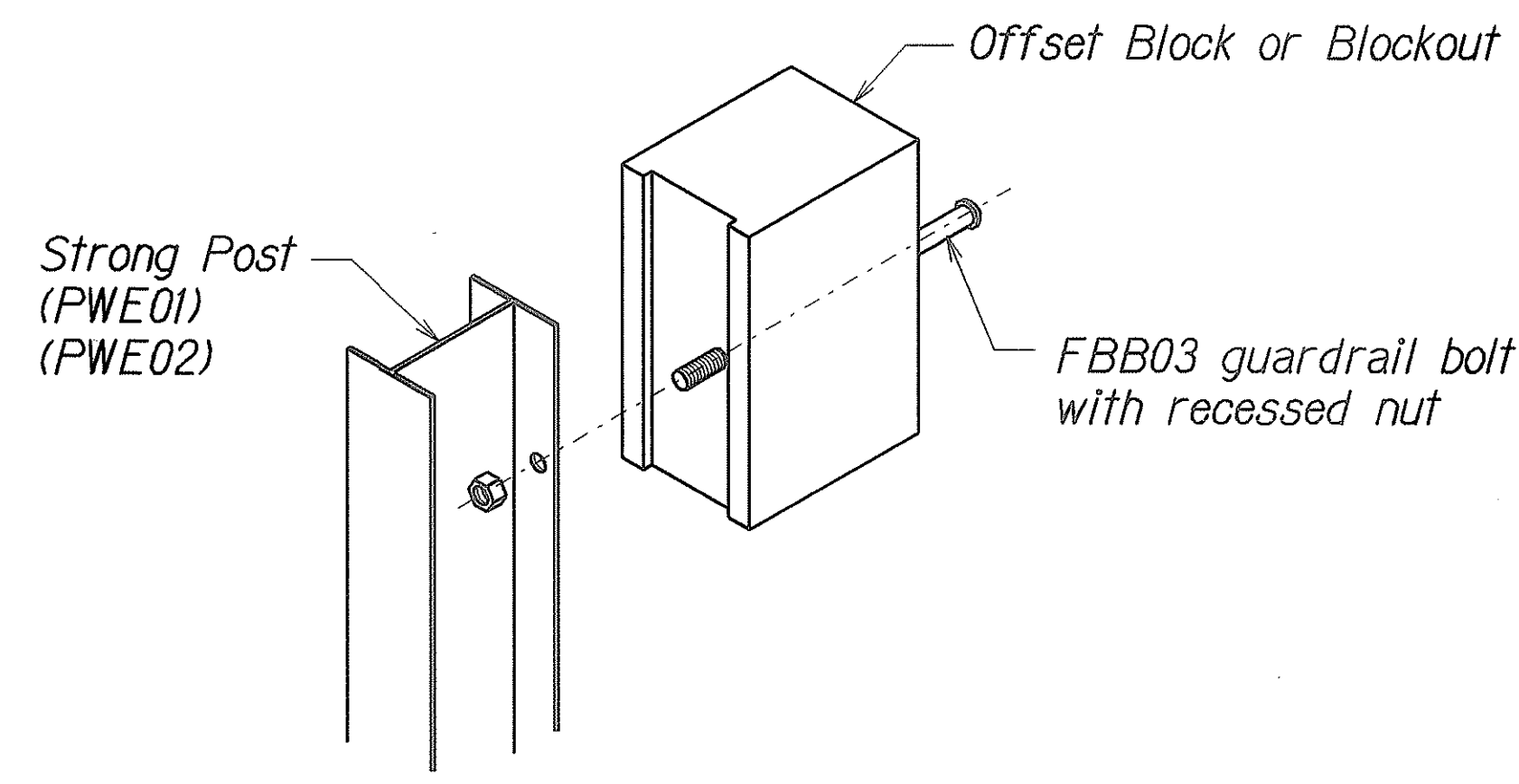


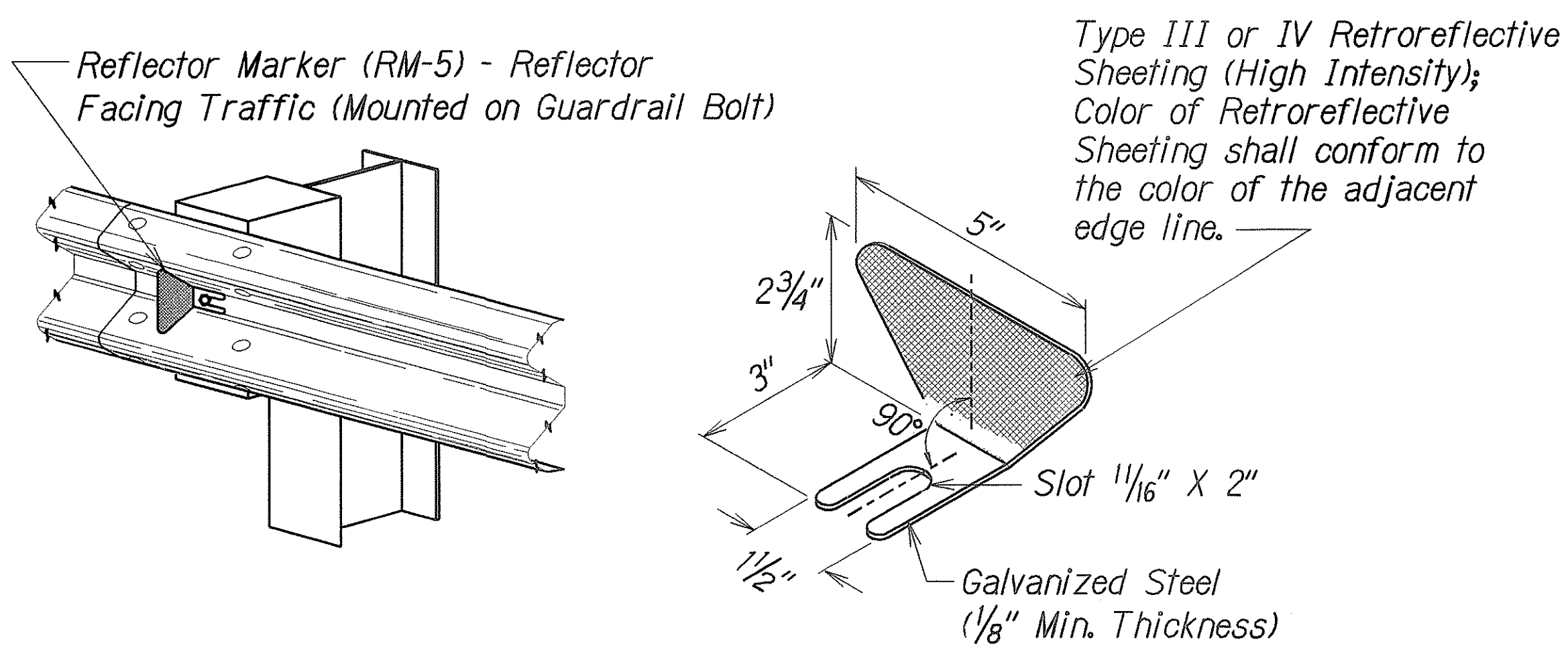
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	ADD. 6	47



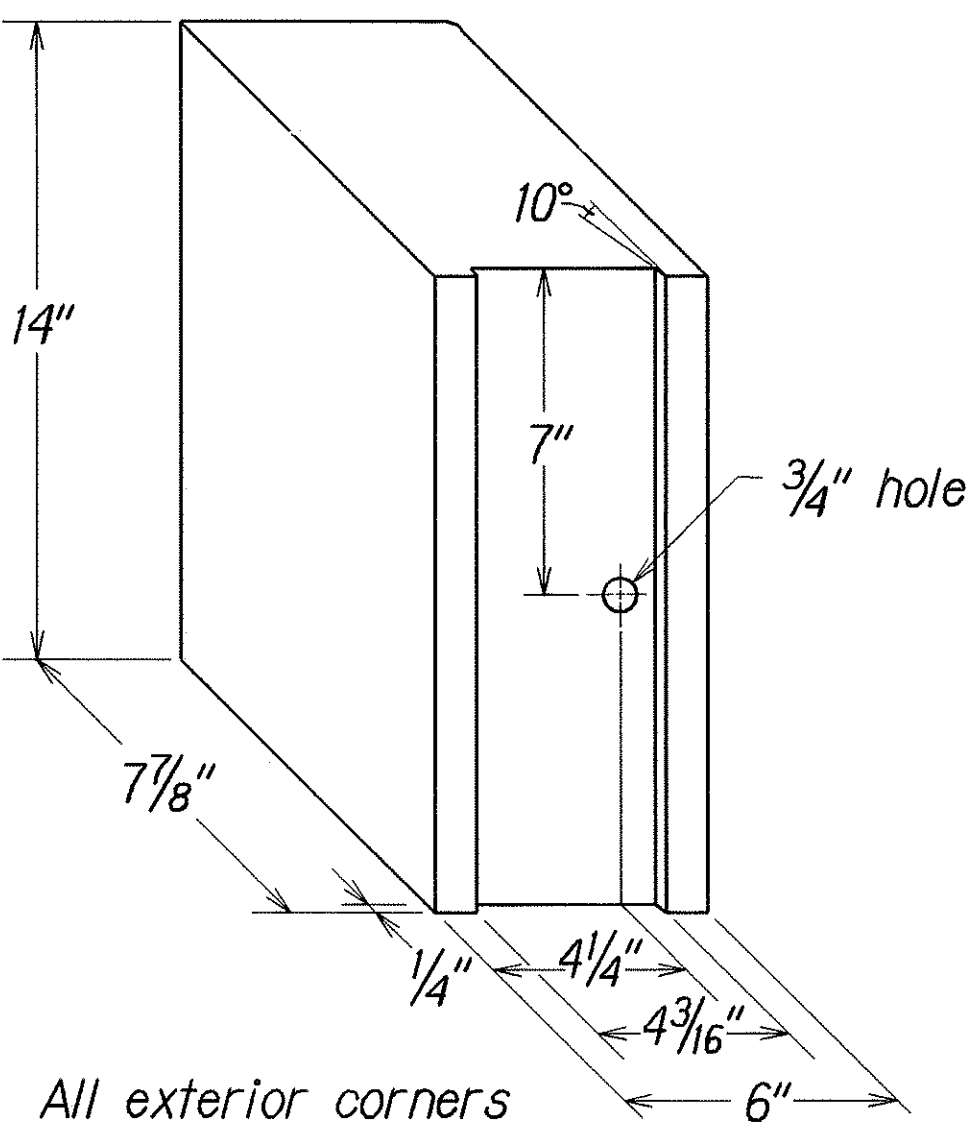
TOP  
SIDE  
RECYCLED PLASTIC BLOCKOUT (TYPE I)



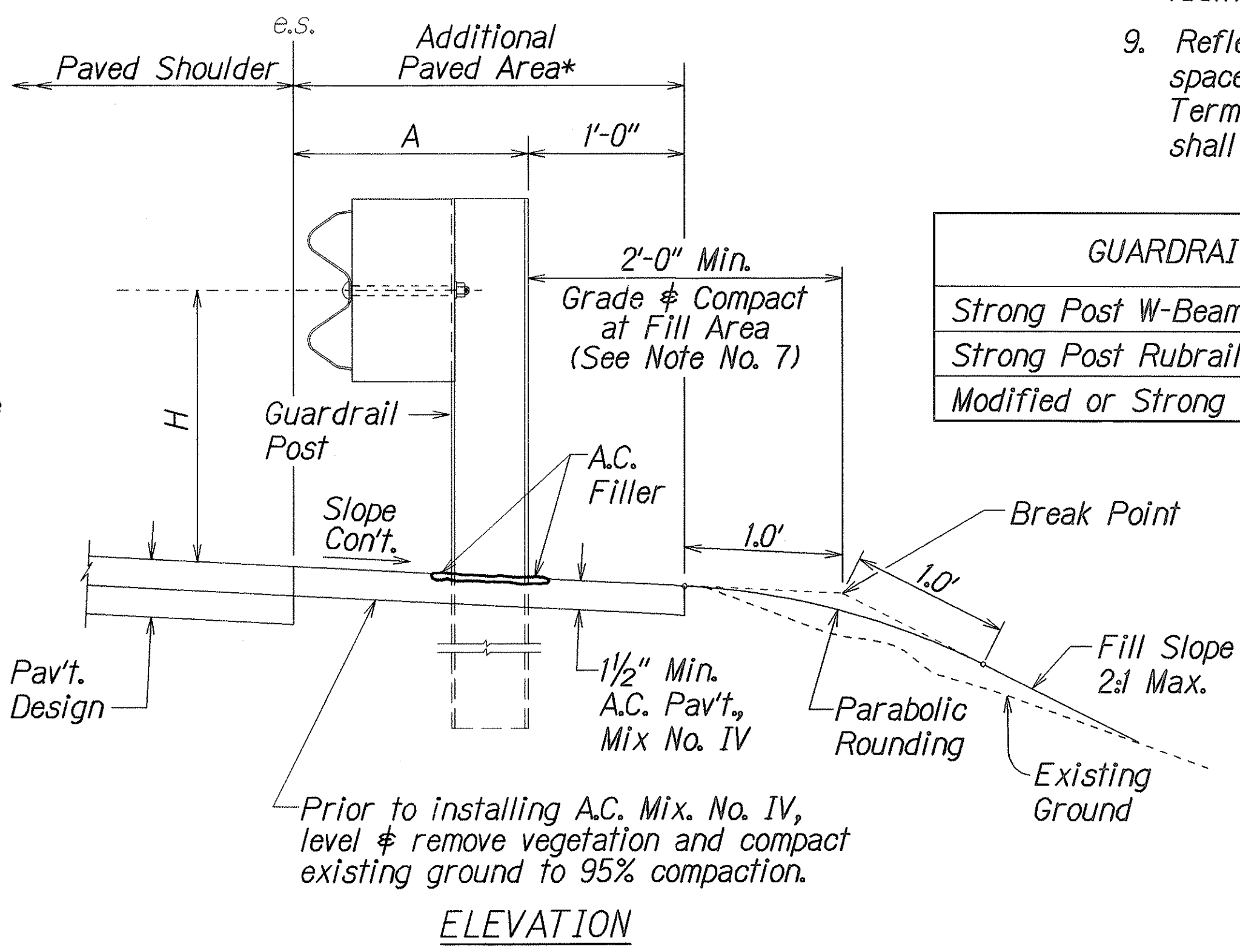
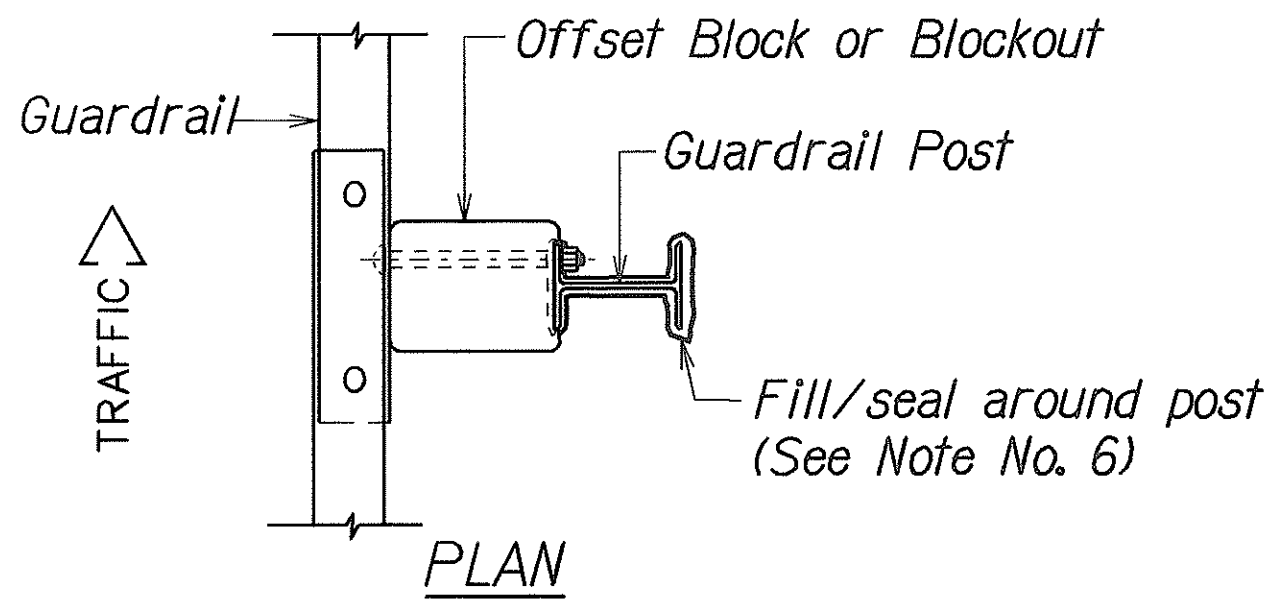
Exploded View  
(Rail and washer not shown)  
STEEL POST AND BLOCK DETAIL



REFLECTOR MARKER (RM-5) DETAIL AND TYPICAL INSTALLATION



RECYCLED POLYETHYLENE  
OFFSET BLOCK (TYPE II)



TYPICAL GUARDRAIL INSTALLATION

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. New A.C. pavement at guardrails shall extend 6 feet longitudinally beyond terminal ends.
9. 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.

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"

4/20/07 Replaced sheet with updated version.

DATE REVISION

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HIGHWAYS DIVISION

**GUARDRAIL DETAILS & NOTES**

**HAWAII BELT ROAD**

**GUARDRAIL AND SHOULDER IMPROVEMENTS**

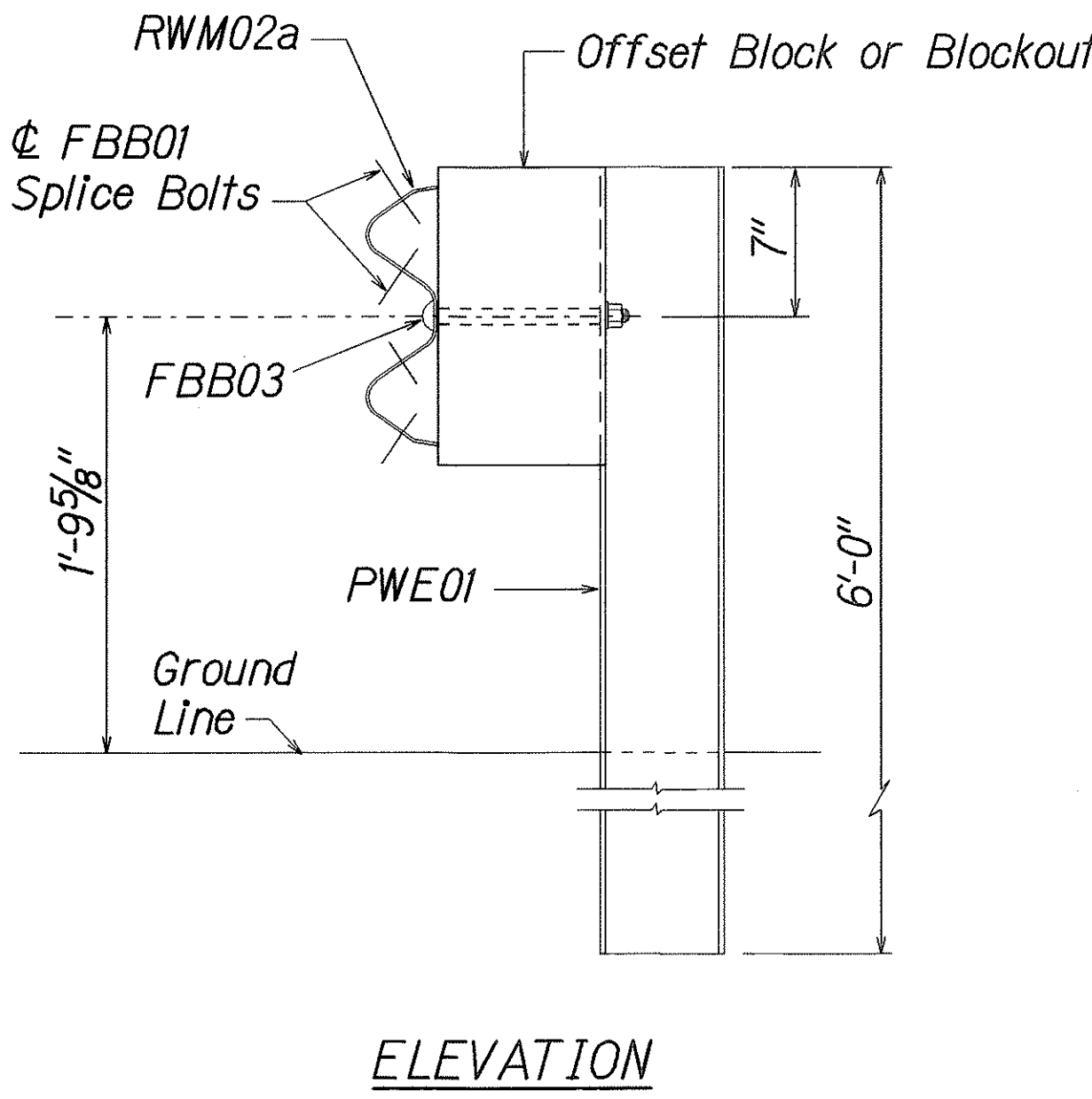
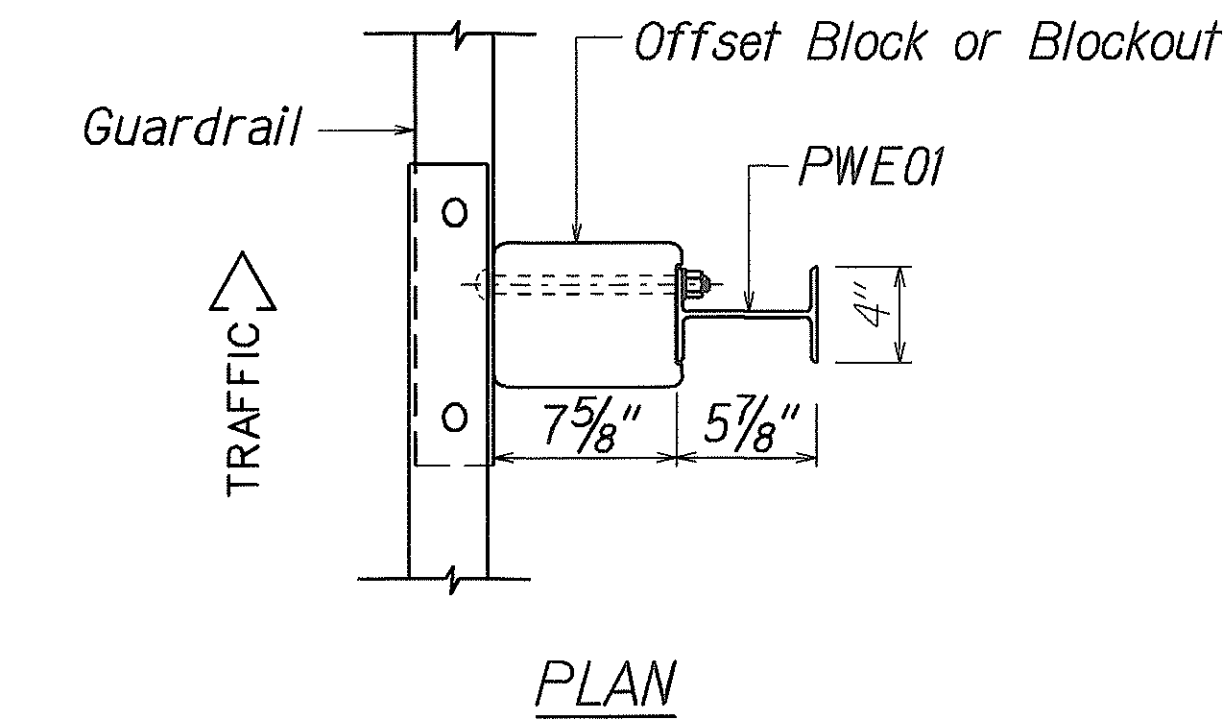
**Paauhau Road to Papalele Road and Various Locations**

**Federal Aid Project No. NH-019-1(37)**

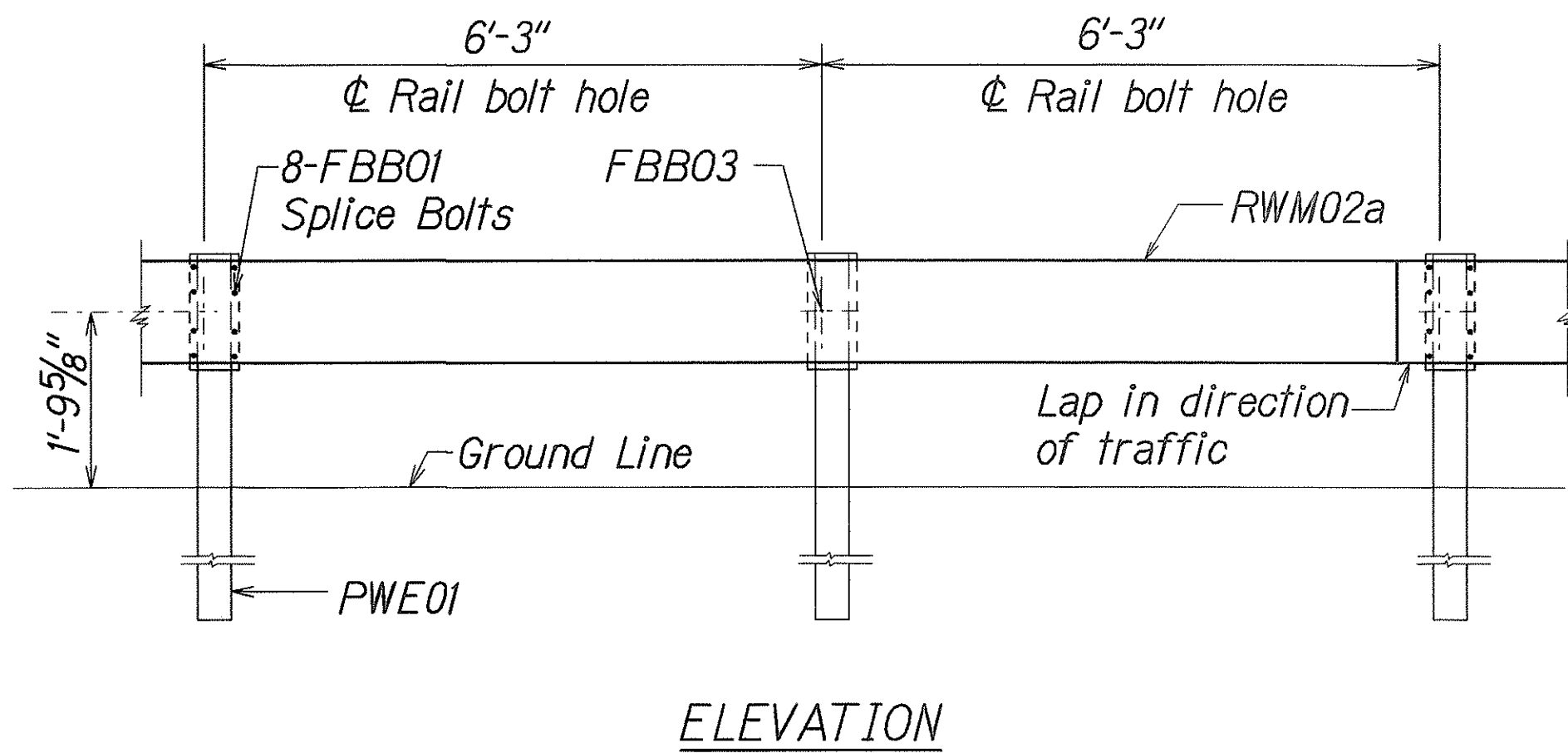
Scale: NTS Date: March, 2007

SHEET No. 1 OF 10 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	ADD. 7	47

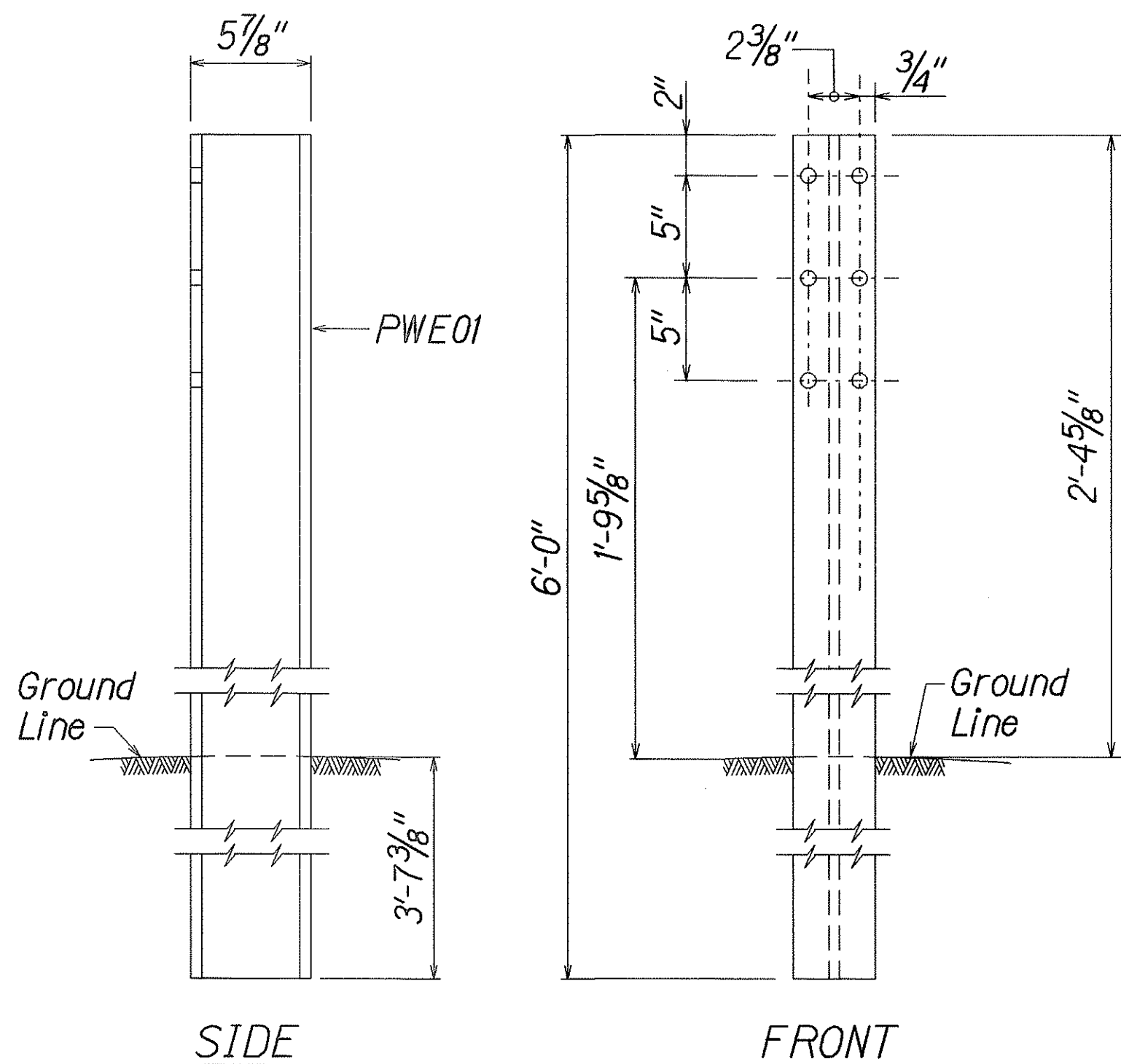


**STRONG POST W-BEAM GUARDRAIL (SGR04a)**

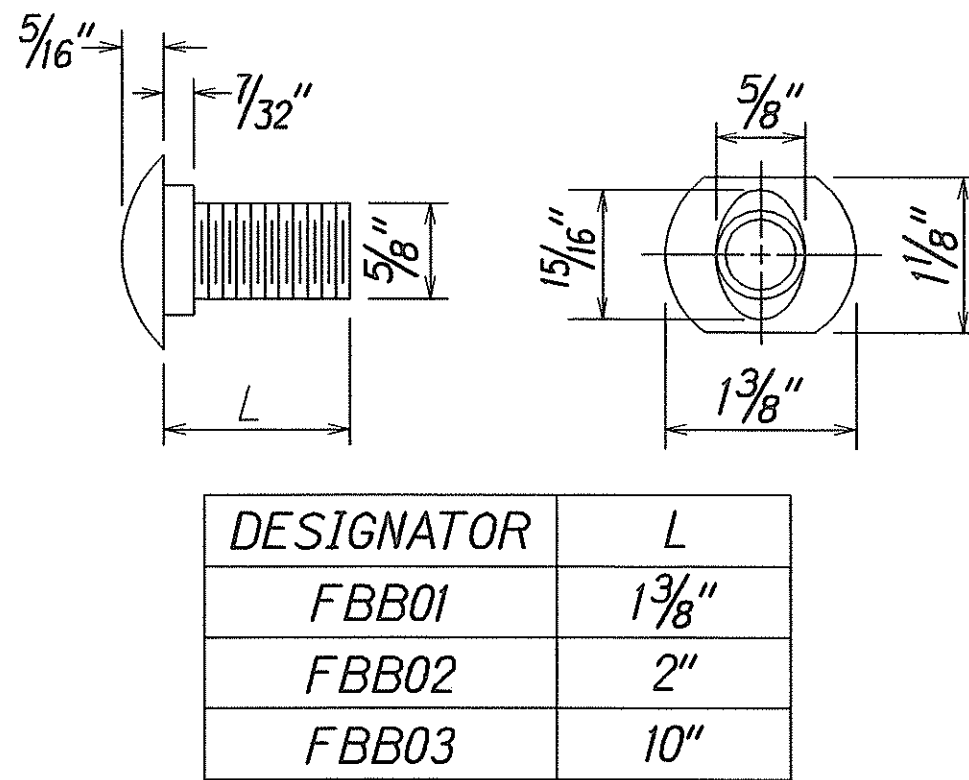


**STRONG POST W-BEAM GUARDRAIL WITH RECYCLED OFFSET BLOCK OR PLASTIC BLOCKOUT**

NOTE:  
All Holes are 3/4" Dia.  
W6x8.5 Structural Shape

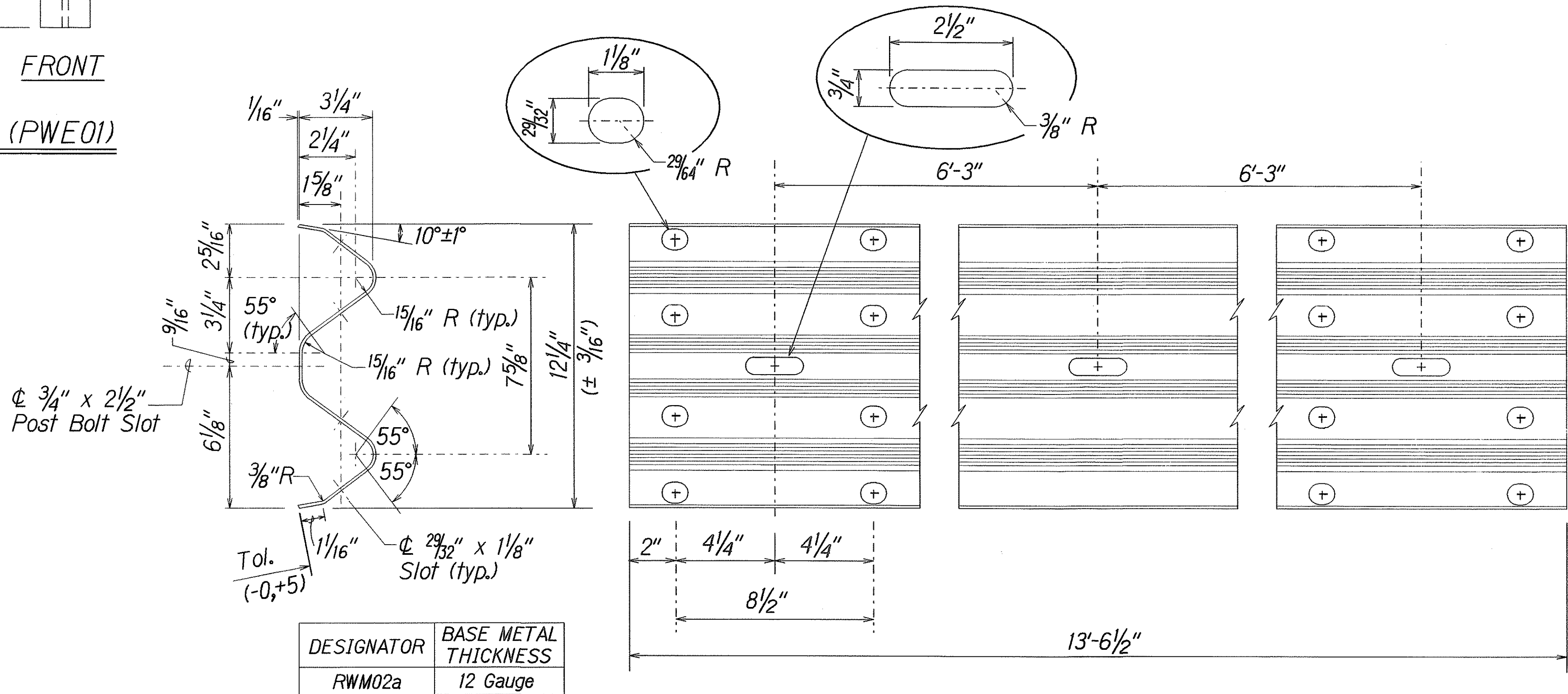


**W-BEAM STRONG POST (PWE01)**



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

**GUARDRAIL BOLTS AND RECESSED NUT**



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

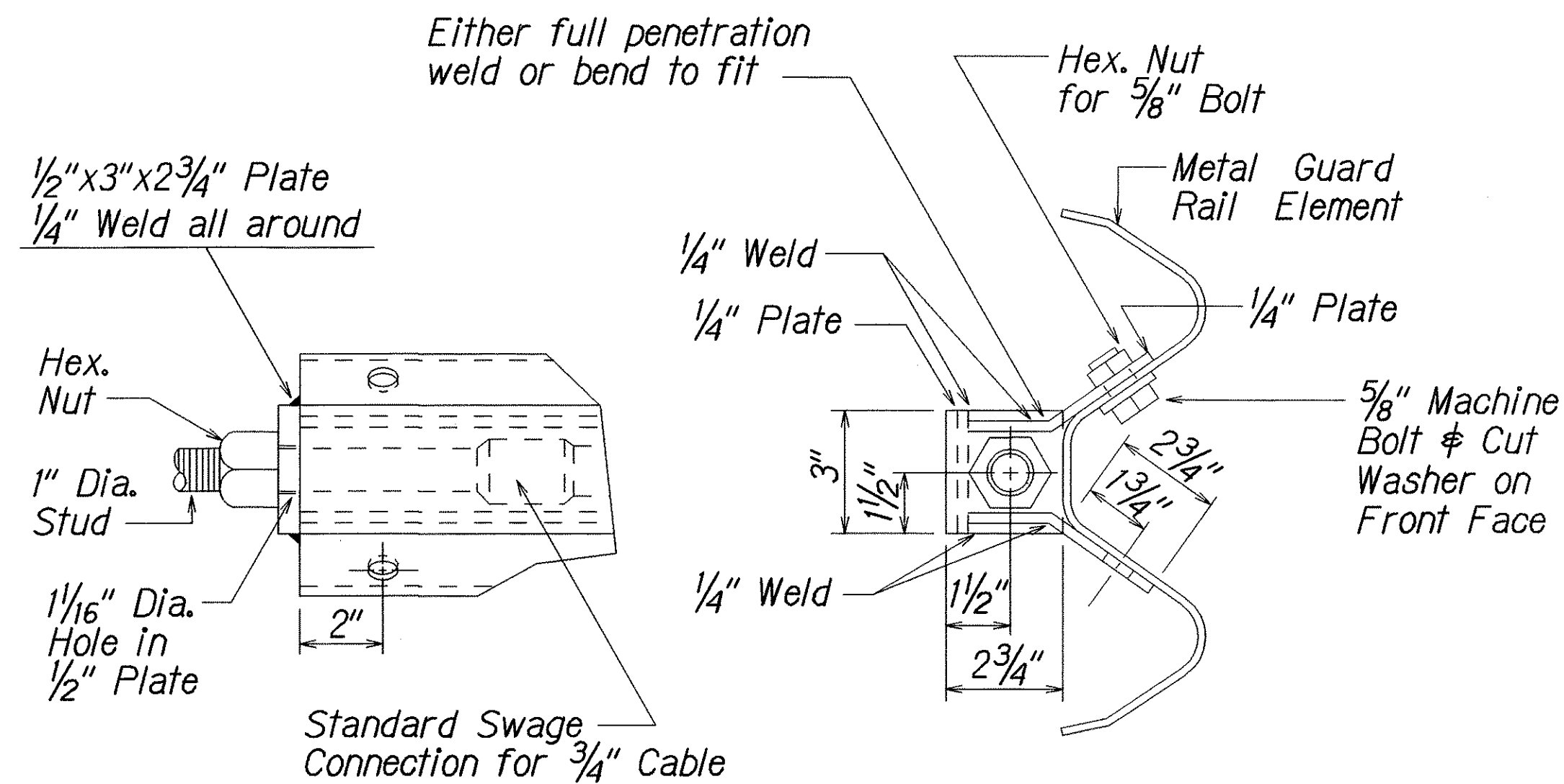
STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**STRONG POST W-BEAM GUARDRAIL**  
HAWAII BELT ROAD  
GUARDRAIL AND SHOULDER IMPROVEMENTS  
Paauhau Road to Papalele Road and Various Locations  
Federal-Aid Project No. NH-019-1(37)  
Scale: NTS Date: April, 2007

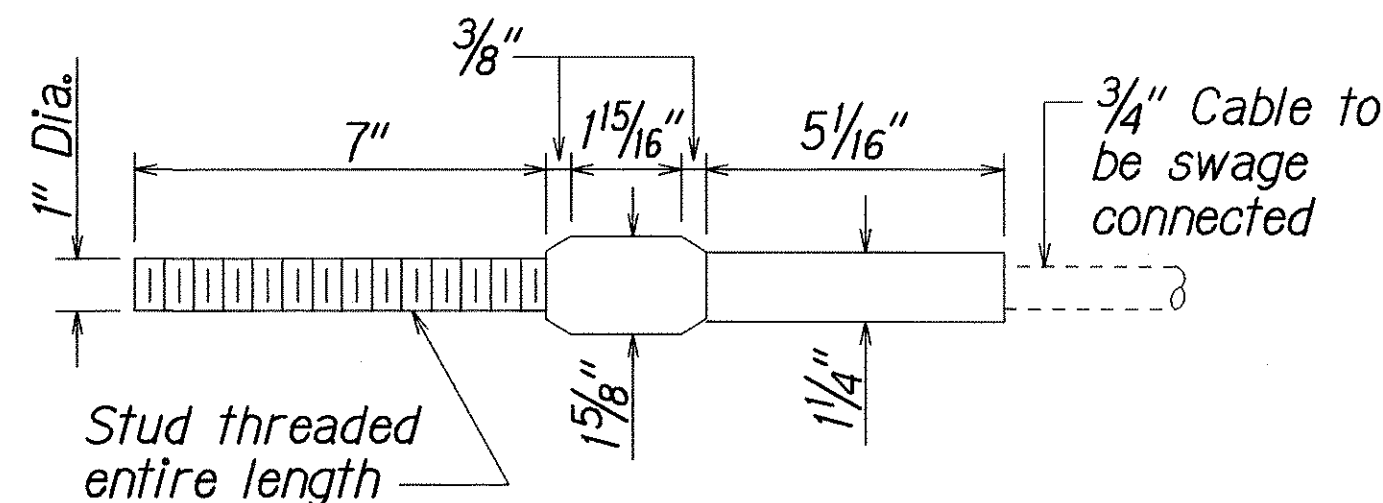
4/20/07	Replaced sheet with updated version.
DATE	REVISION



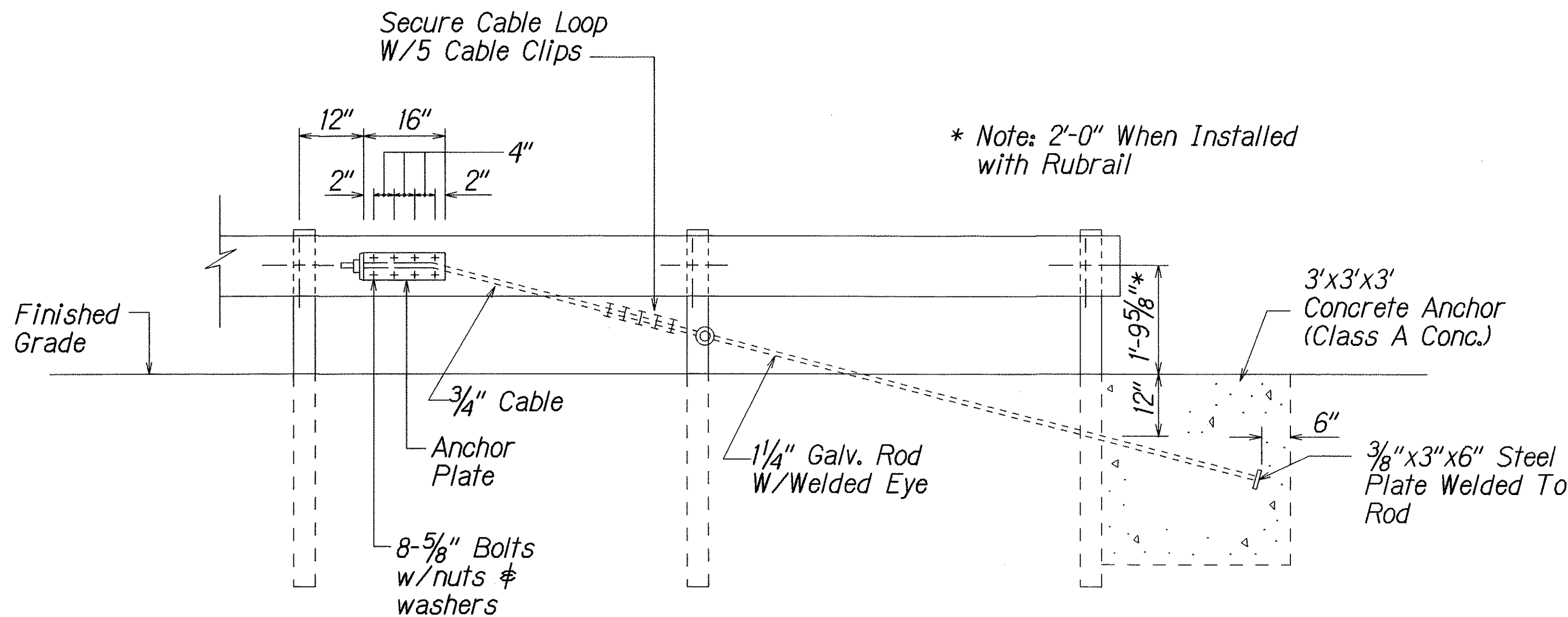
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	ADD. 8	47



ANCHOR PLATE DETAILS

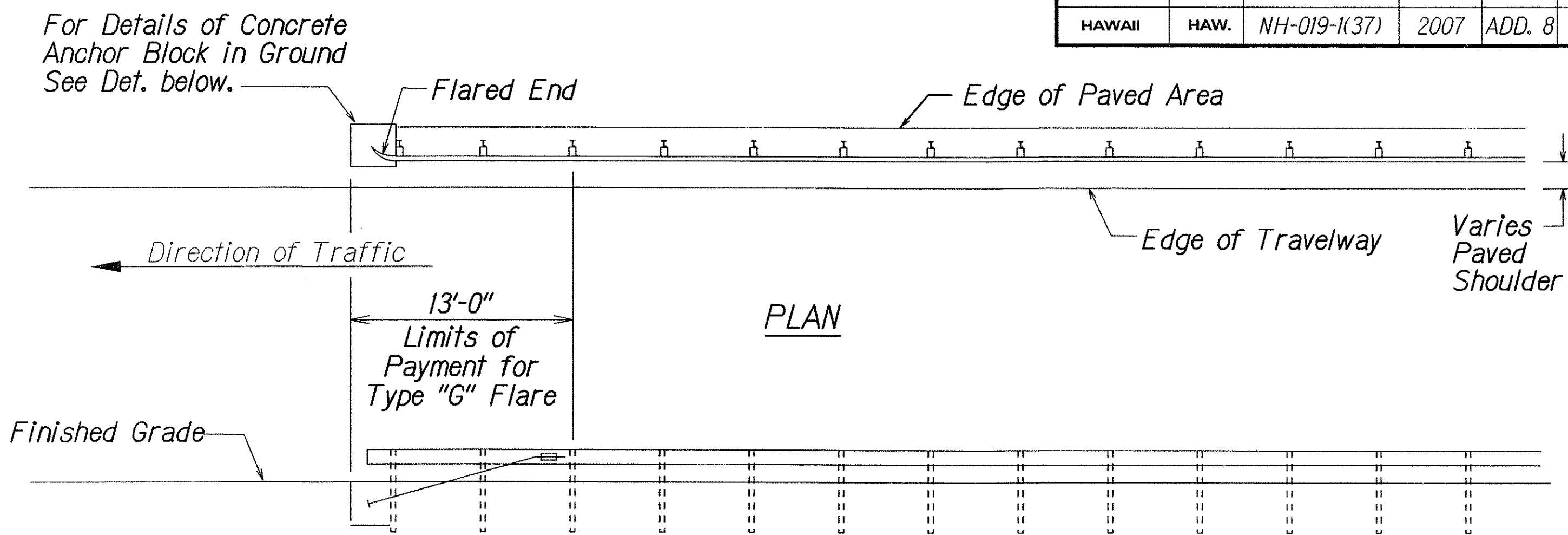


STANDARD SWAGED FITTING  
AND STUD



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 (currently, Table 5.6 - Suggested Flare Rate for Barrier Design, page 5-21, Jan. 1996 edition).

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.

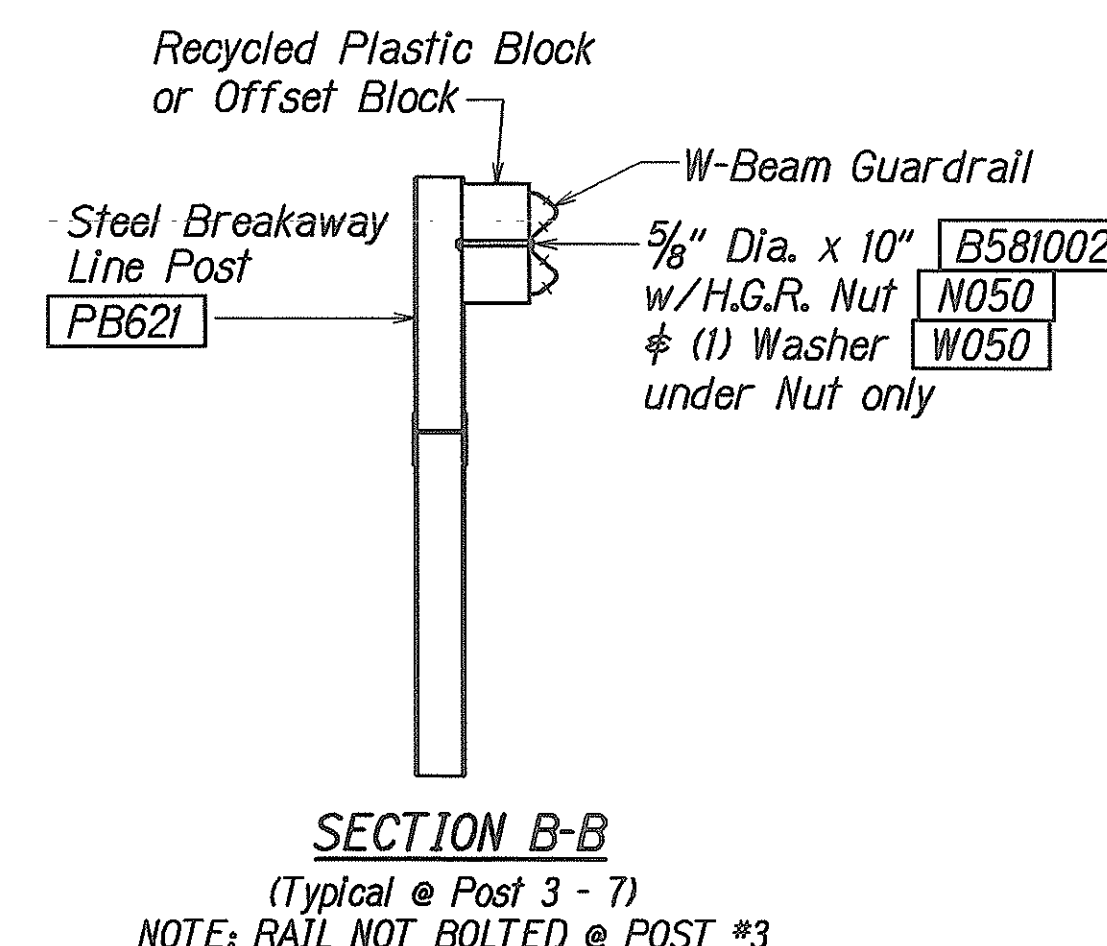
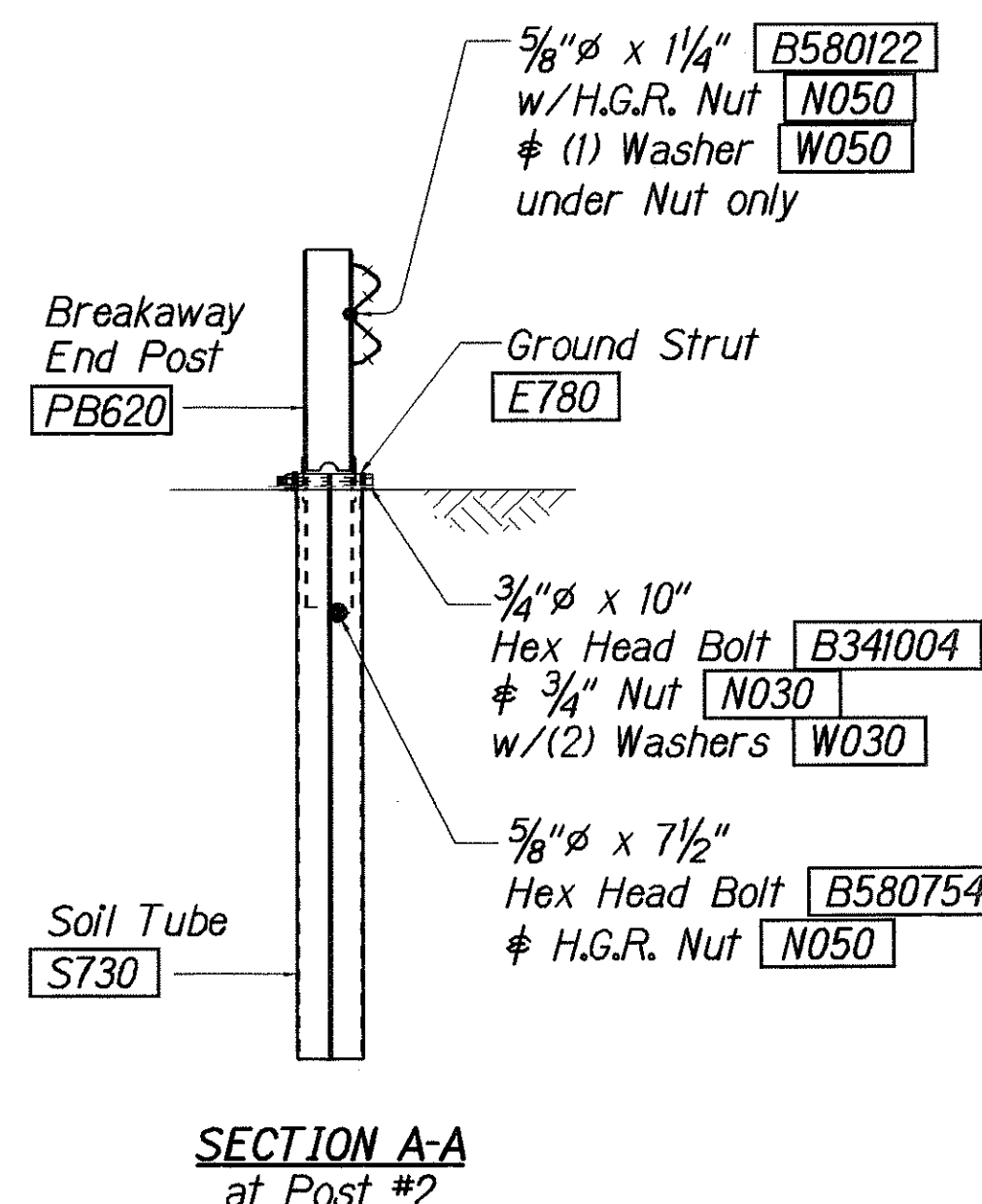
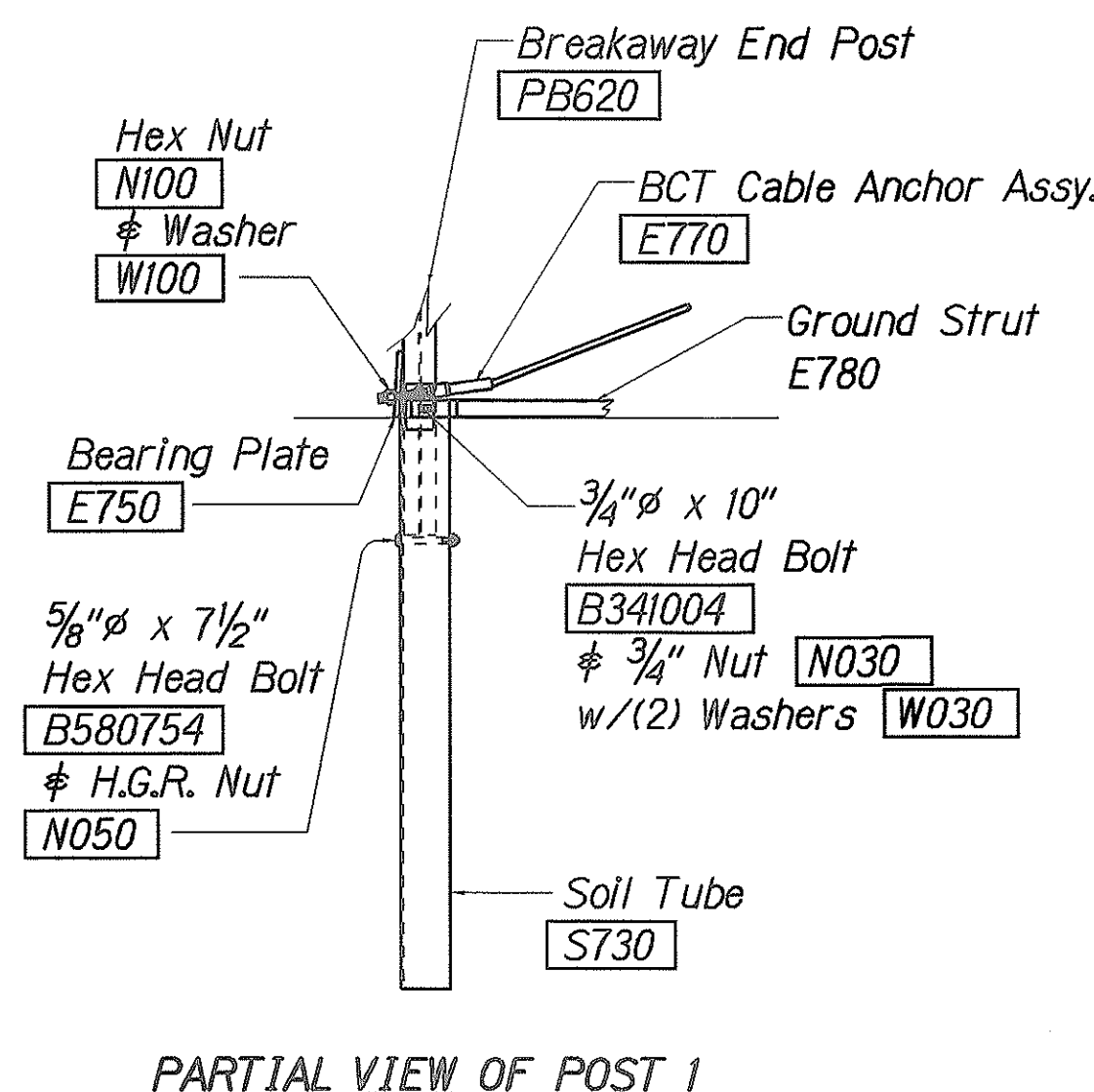
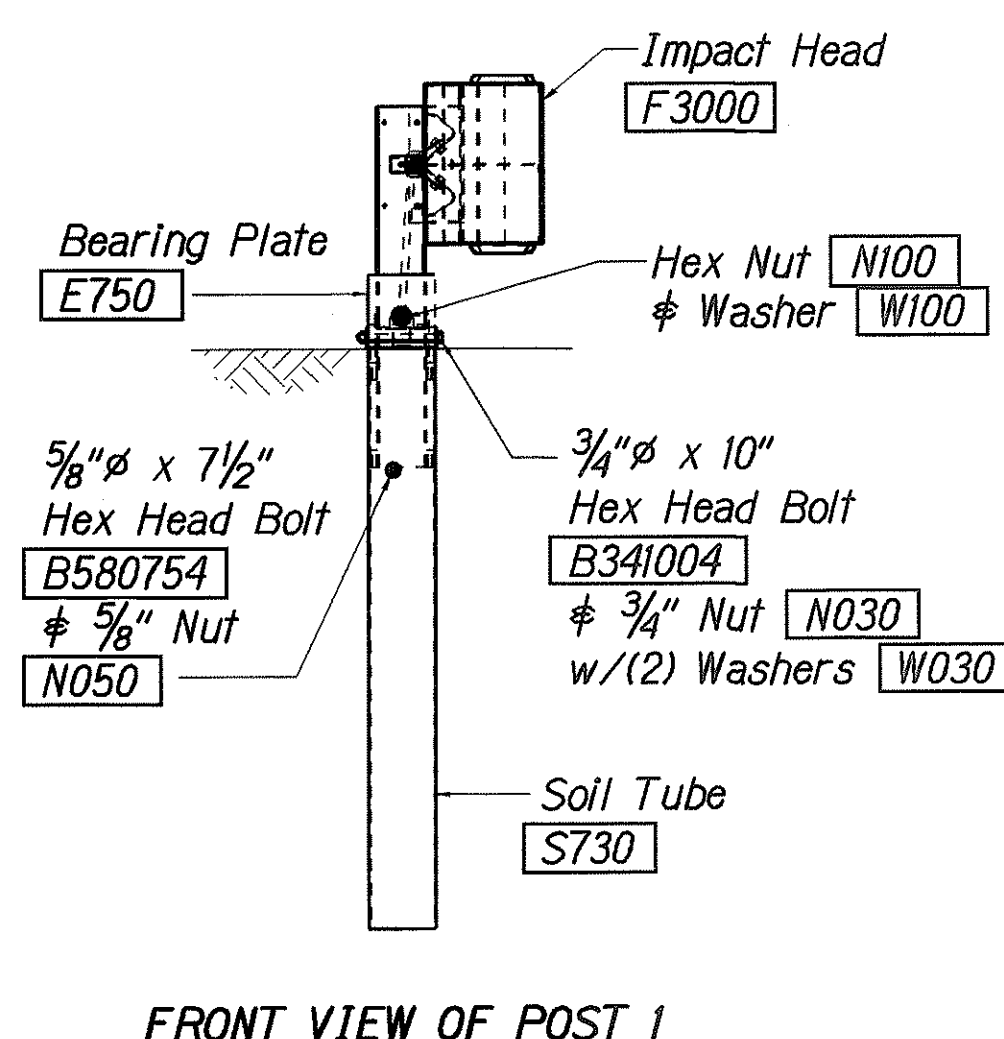
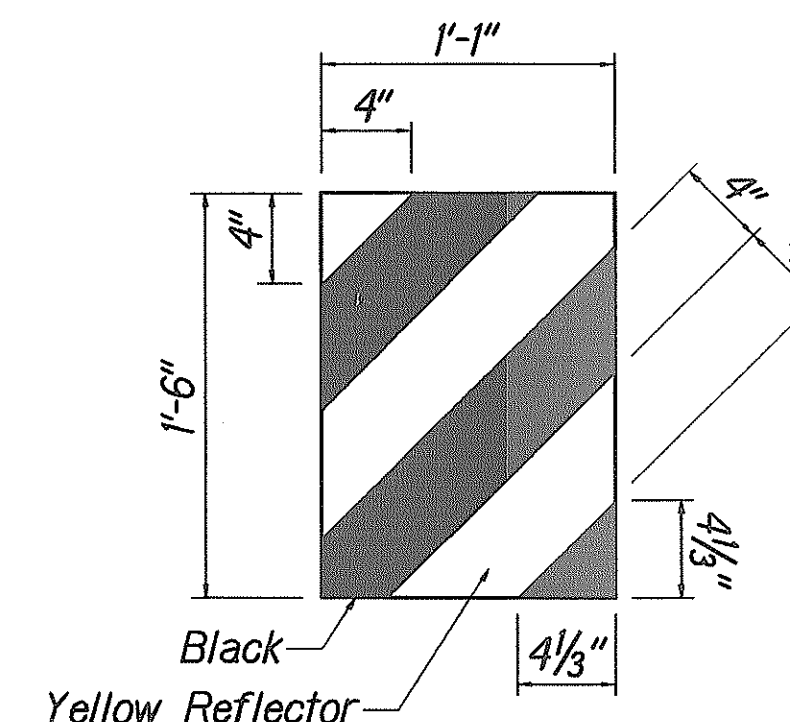
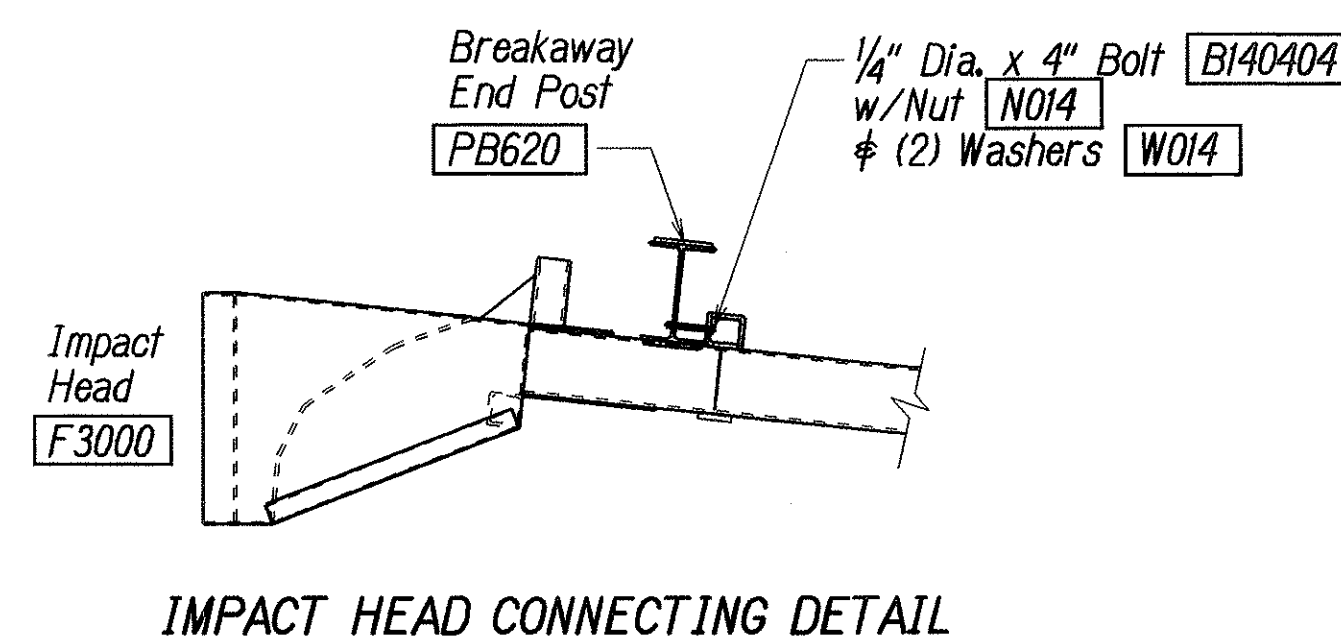
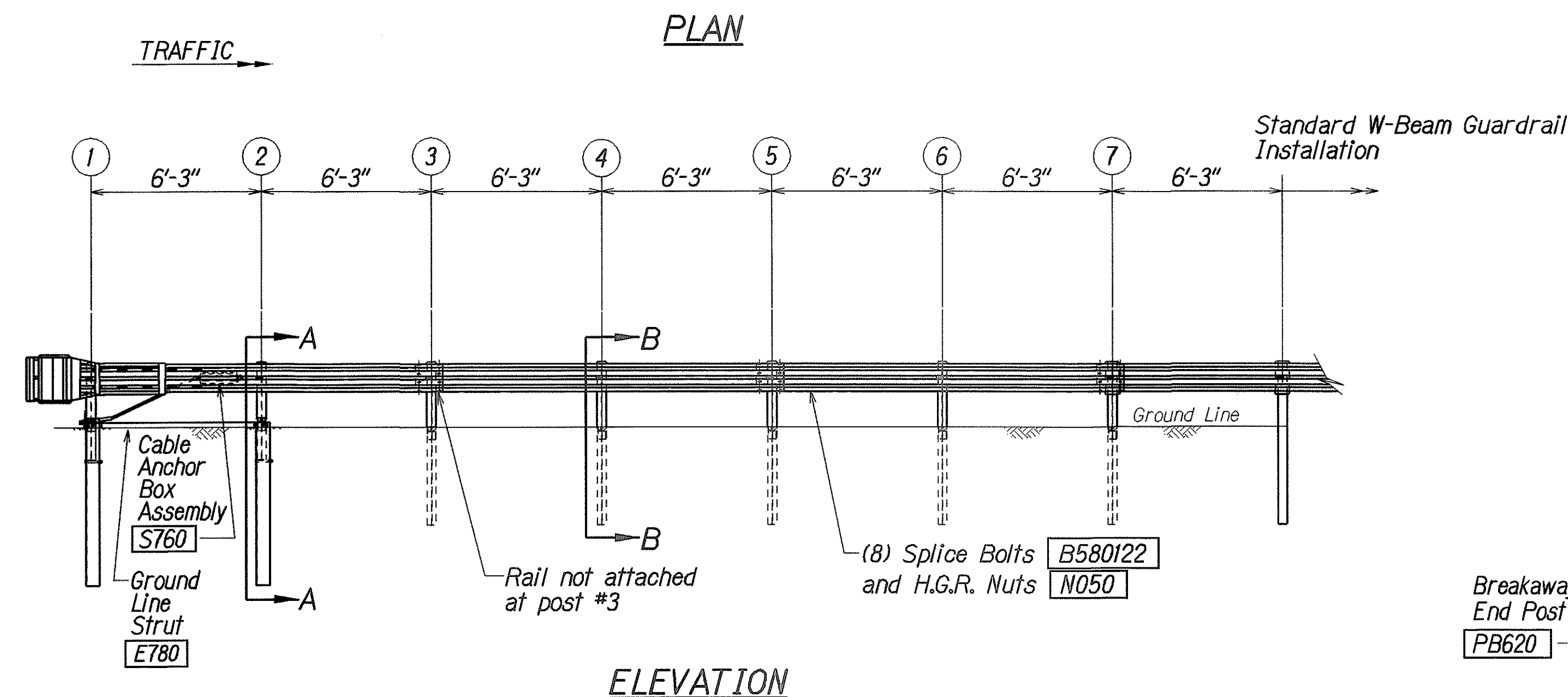
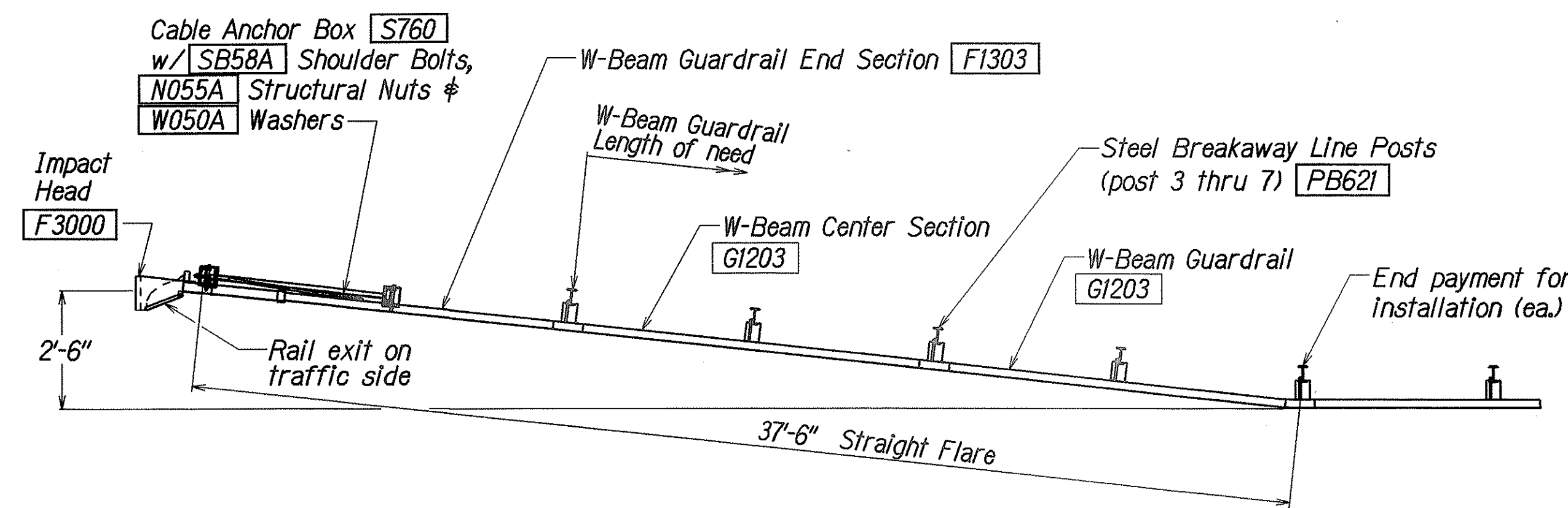
During construction, the Contractor shall layout the proposed Type "G" Modified End Terminal and receive approval from the Construction Engineer prior to installation.

DATE	DATE
DESIGNED BY	DESIGNED BY
CHECKED BY	CHECKED BY
NOTED BY	NOTED BY
QUANTITIES BY	QUANTITIES BY
ORIGINAL PLAN	ORIGINAL PLAN

dd2.chltdms03add.dgn

4/20/07	Replaced sheet with updated version.
DATE	REVISION
STATE OF HAWAII DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION <b>GUARDRAIL DETAILS</b> <b>HAWAII BELT ROAD</b> <b>GUARDRAIL AND SHOULDER IMPROVEMENTS</b> <b>Paauhau Road to Papalele Road and Various Locations</b> <b>Federal Aid Project No. NH-019-1(37)</b> Scale: NTS Date: April, 2007	
SHEET No. 3 OF 10 SHEETS	

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	ADD. 9	47



# GENERAL NOTES

1. Breakaway steel posts are required with the FLEAT Terminal.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. 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.
4. 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.
5. 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.
6. 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.
7. (R) or (L) indicates right or left Impact Head Reflector Marker (IHRM). Providing and installing of IHRM shall be considered incidental to end treatment.
8. 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, 8)
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 1/6" 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

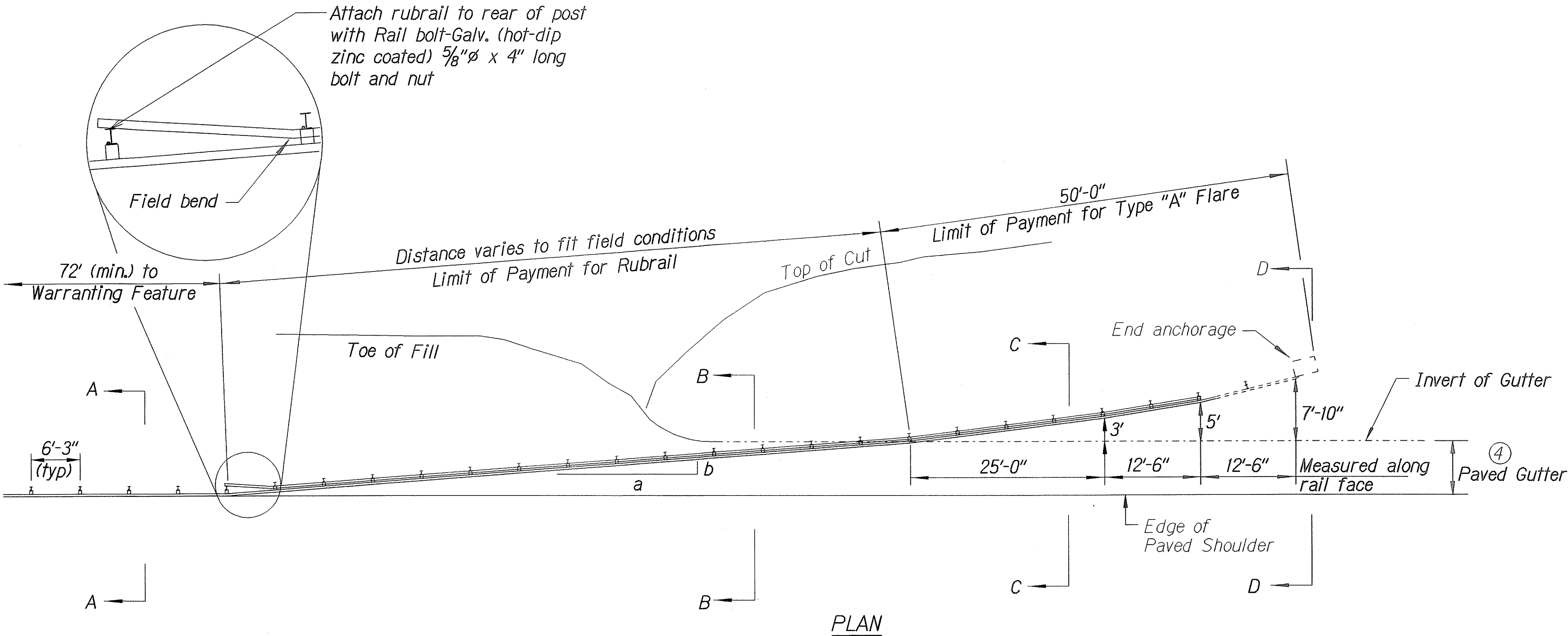
4/20/07	Replaced sheet with updated version.
DATE	REVISION
STATE OF HAWAII DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION <b>FLEAT-350</b> <b>FLARED ENERGY ABSORBING TERMINAL</b> <b>HAWAII BELT ROAD GUARDRAIL</b> <b>AND SHOULDER IMPROVEMENTS</b> Paauhau Road to Papalele Road and Various Locations Federal-Aid Project No. NH-019-1(37) Not to Scale Date: April, 2007	
SHEET No. 4 OF 10 SHEETS	



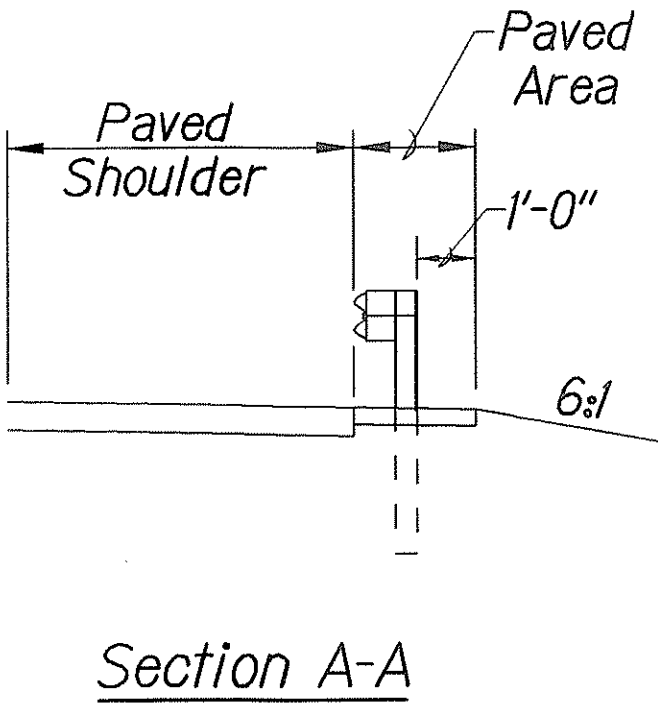
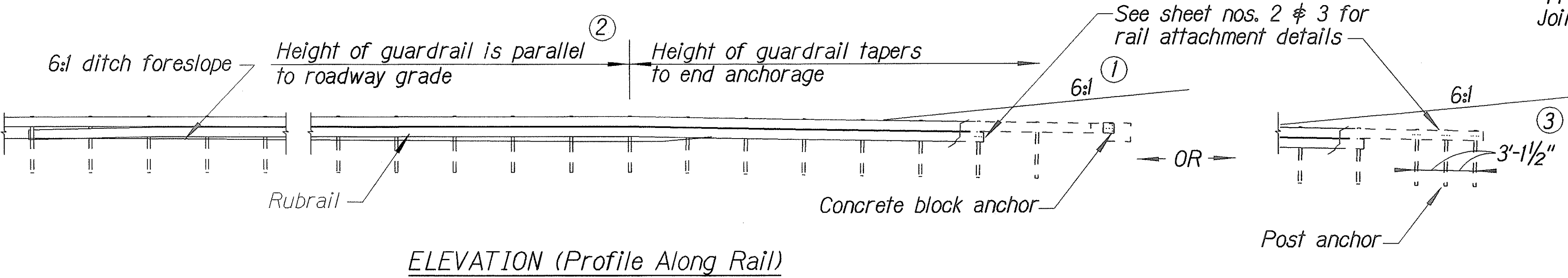
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	10	47

General Notes

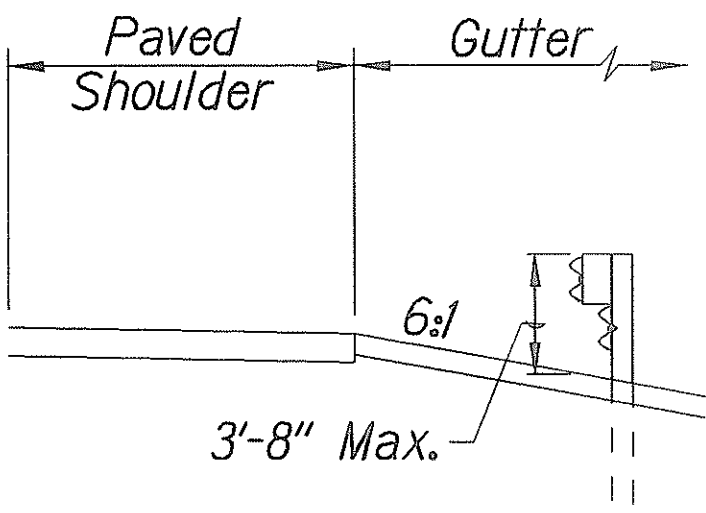
1. A 6:1 or flatter slope is desirable. However, a steeper or flatter existing slope may be used.
2. Height of guardrail may be tapered down in elevation to maintain 3'-8" maximum height.
3. All posts are 8'-0" in length from where the guardrail flares away from the shoulder back to the post anchor. 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.



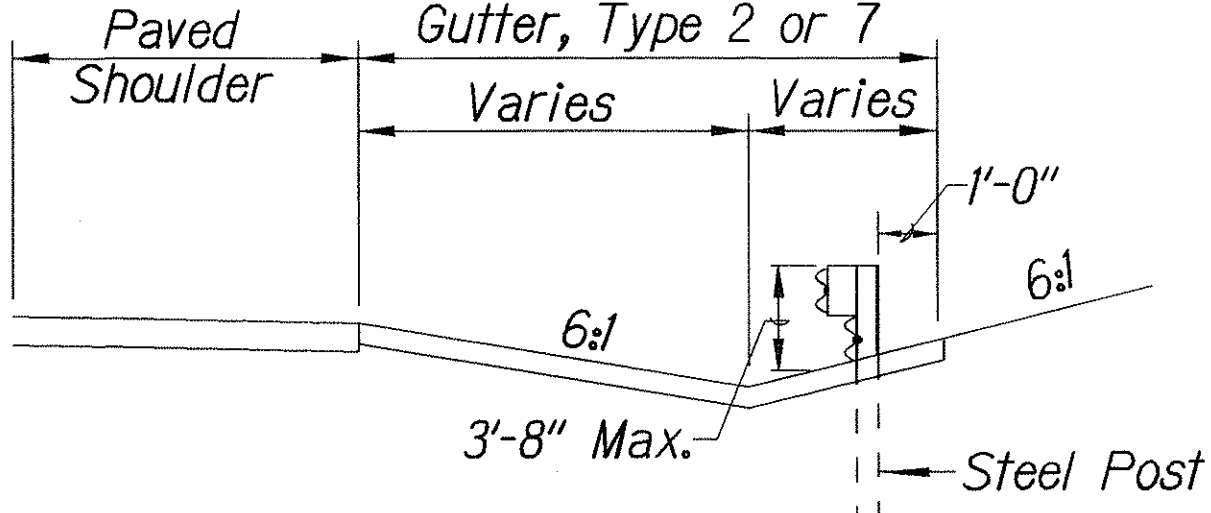
Design speed mph	a:b
68	15:1
62	13:1
56	12:1
50	11:1
43	10:1
37	9:1
31	7:1



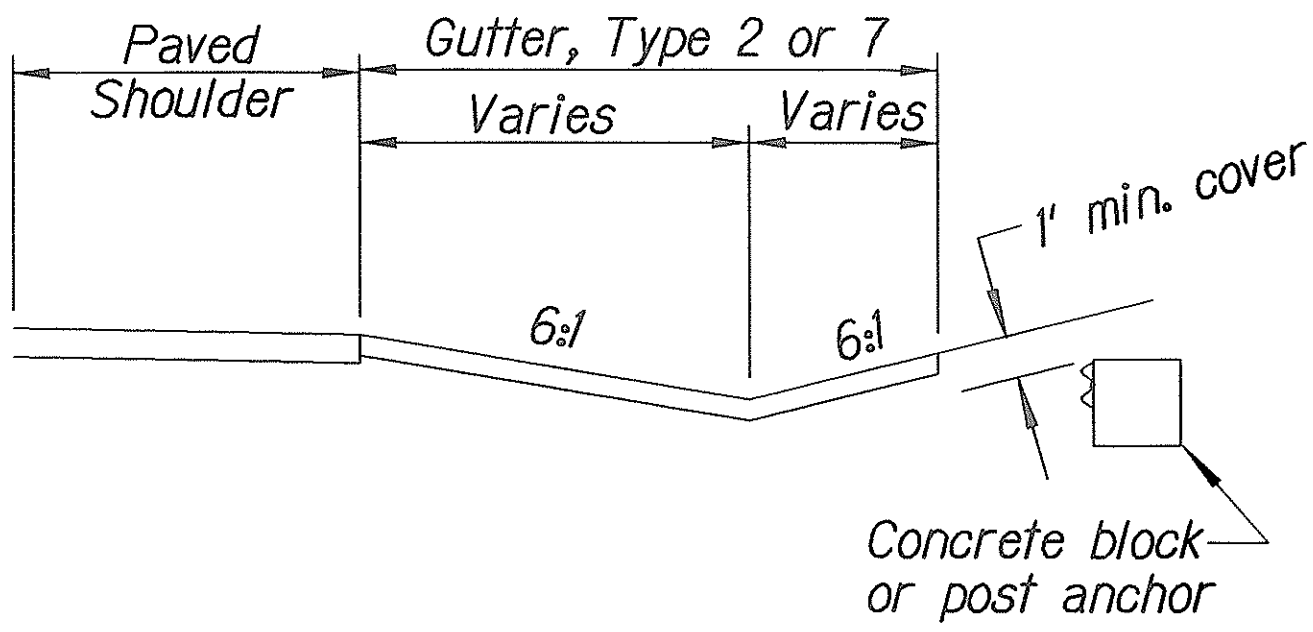
Section A-A



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

HAWAII BELT ROAD

GUARDRAIL AND SHOULDER IMPROVEMENTS

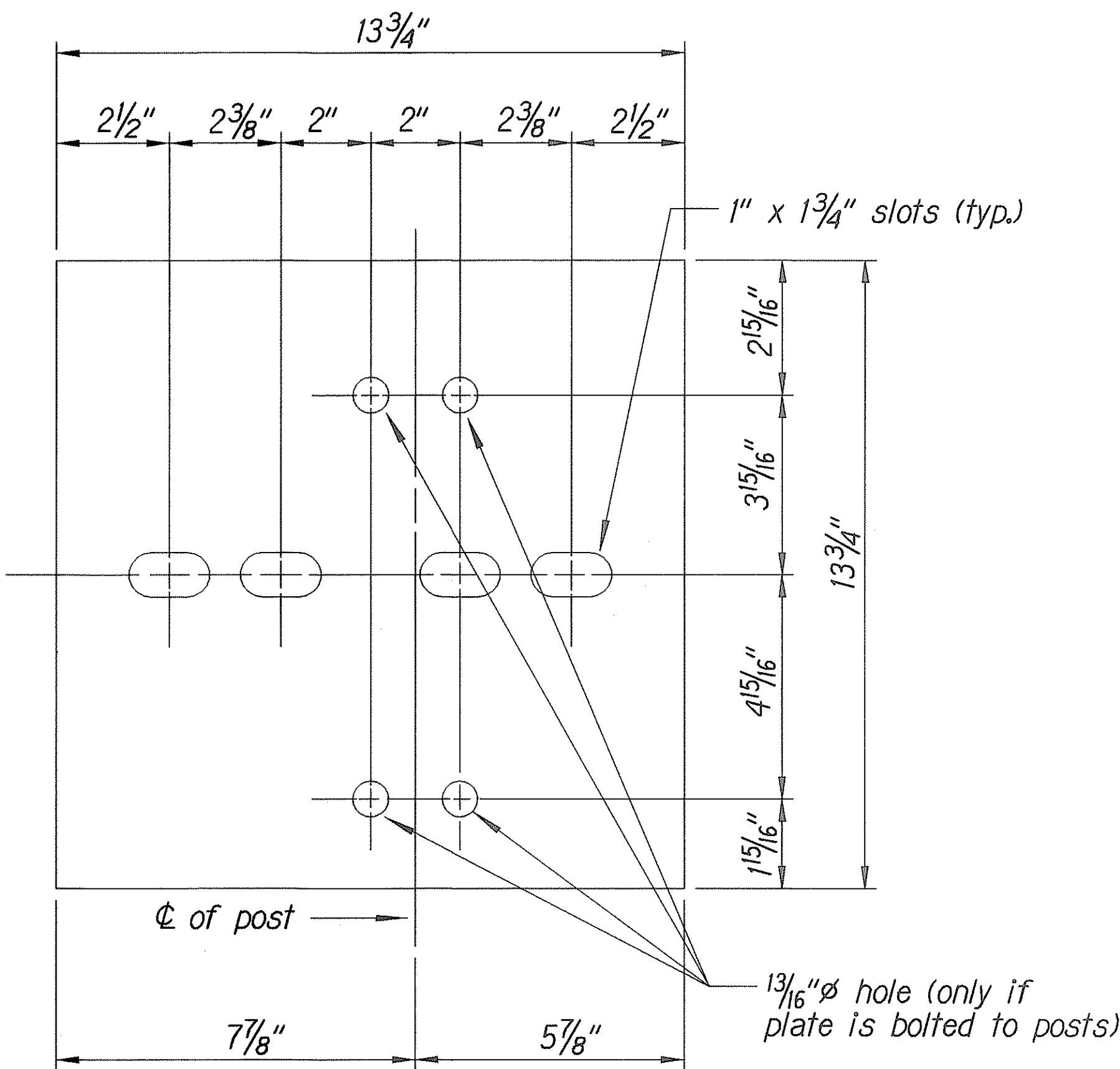
Paauhau Road to Papalele Road and Various Locations

Federal-Aid Project No. NH-019-1(37)

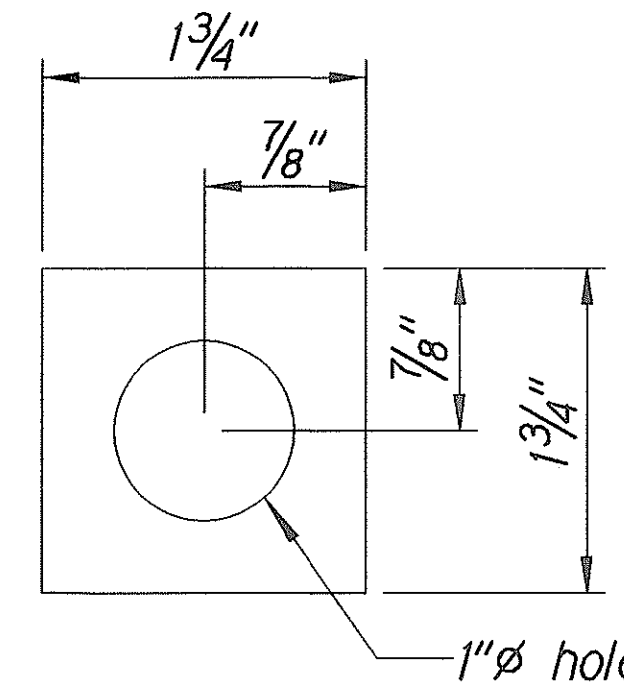
Scale: NTS

Date: March, 2007

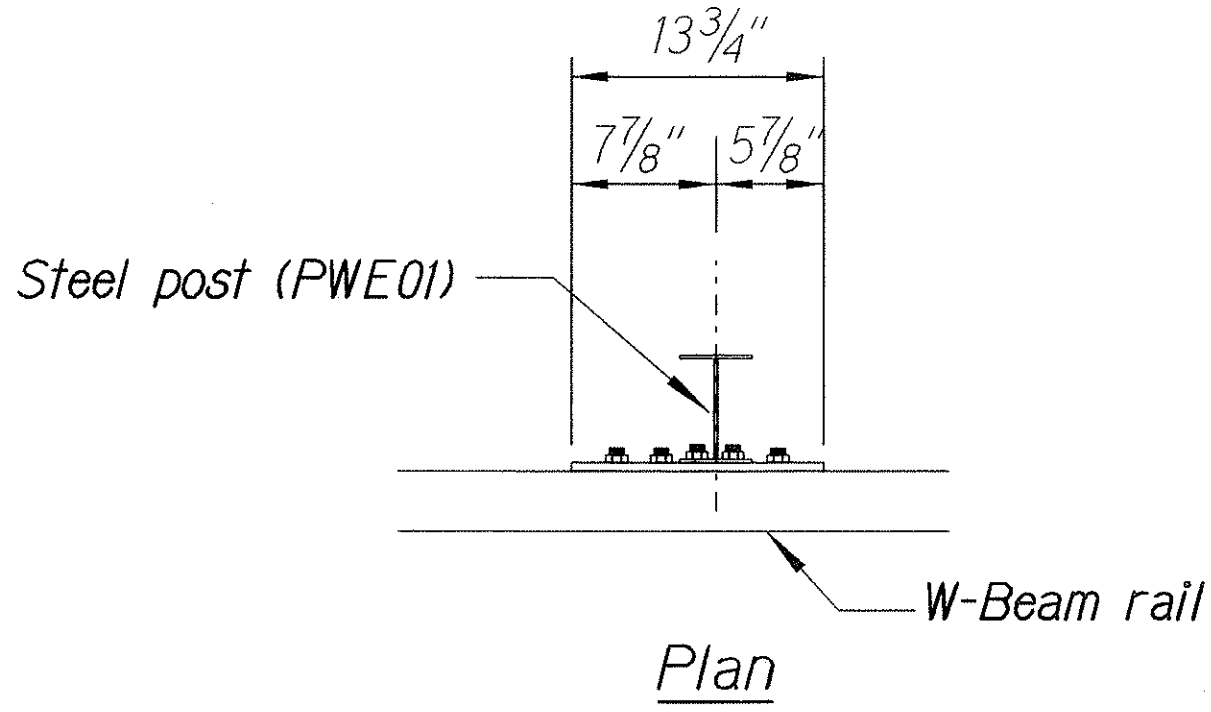
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	11	47



Steel Plate - 1/2"  
(Hot-dip Zinc Coated Galvanized  
Welded or Bolted to Post)

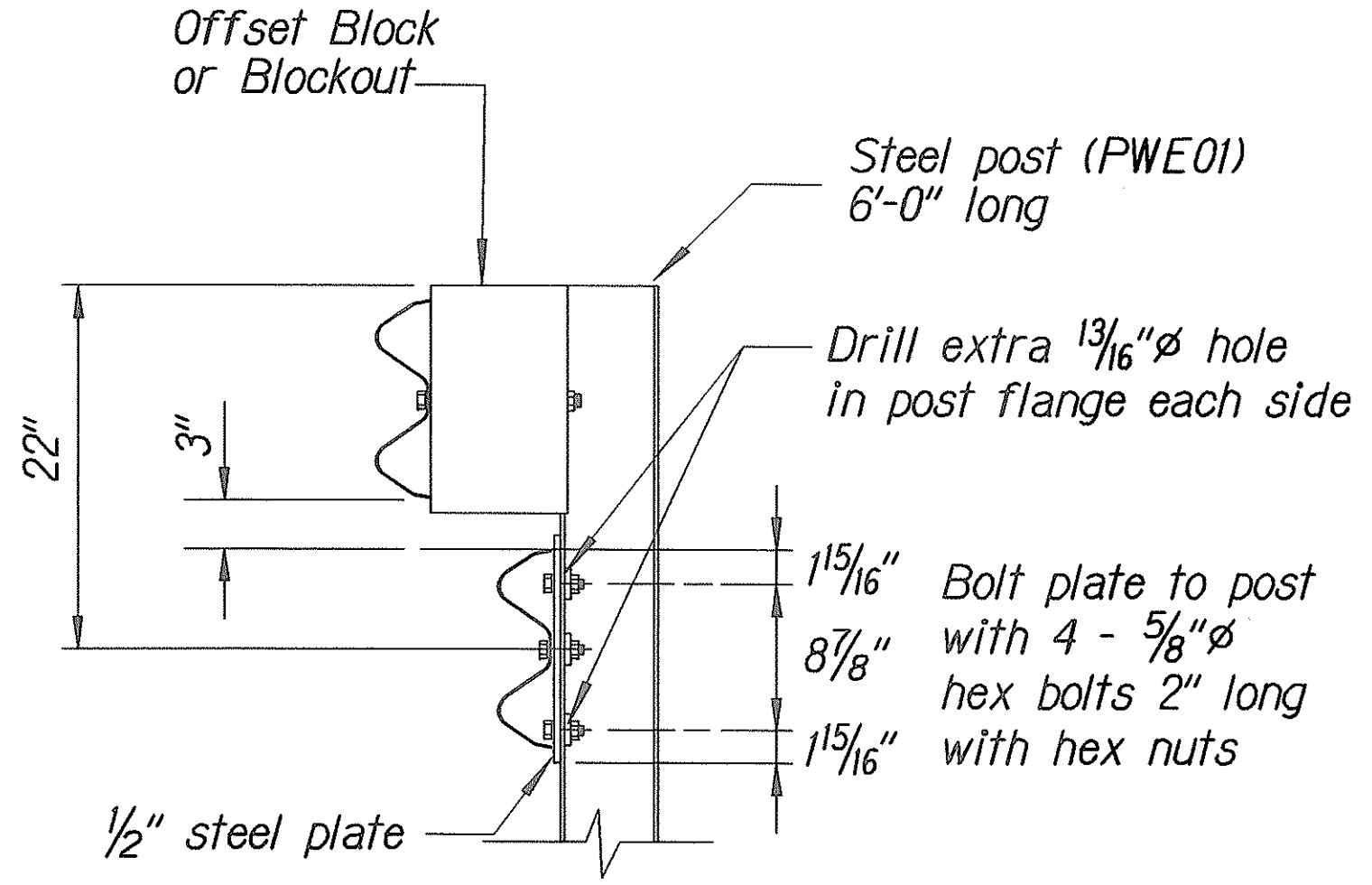
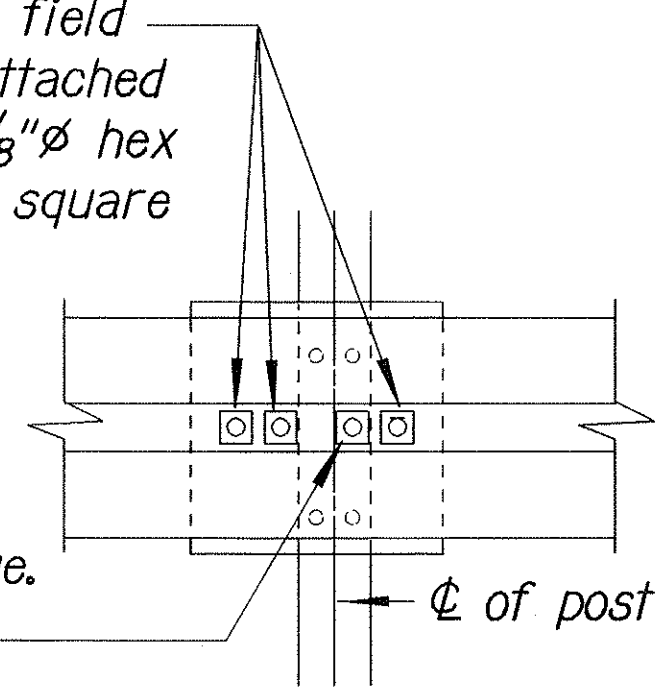


Square Washer  
(3/16" Thick - Hot-dip  
Zinc Coated Galvanized)

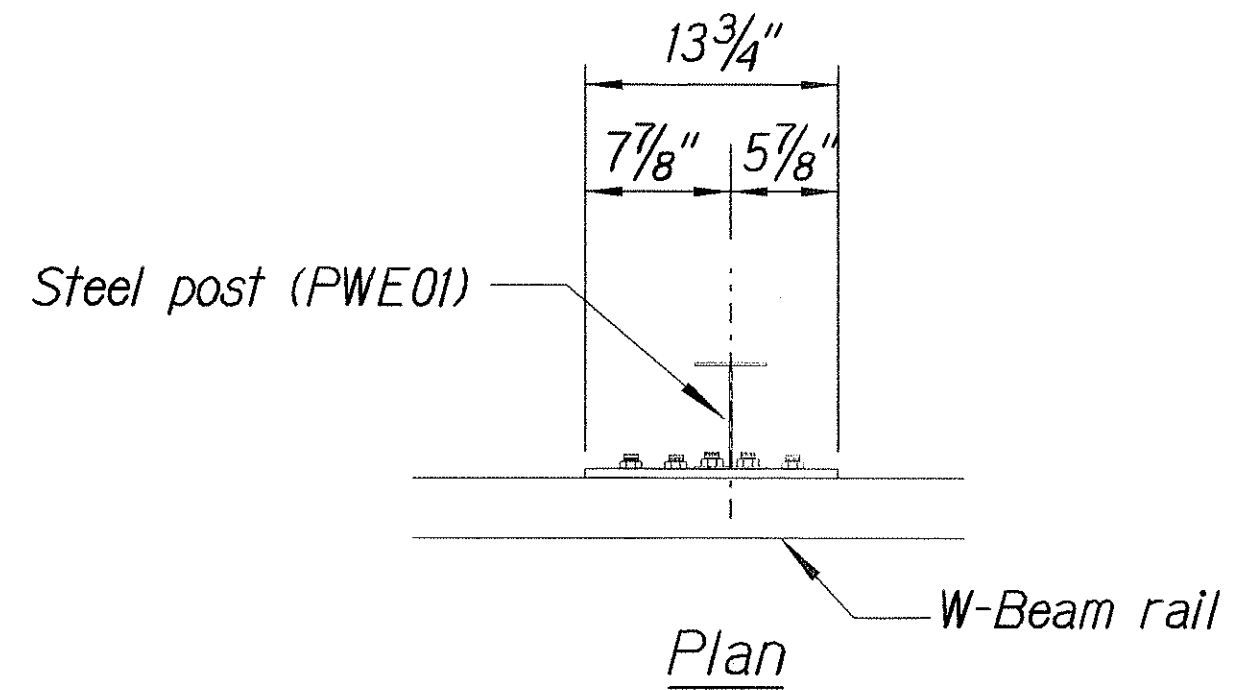


3 - 7/8"Ø holes to be field drilled in rail and attached to steel plate with 7/8"Ø hex bolts 1 5/16" long with square washer

1"Ø holes to be field drilled in rail and through post flange. Attach to steel plate with 7/8"Ø hex bolts 2" long with square washer

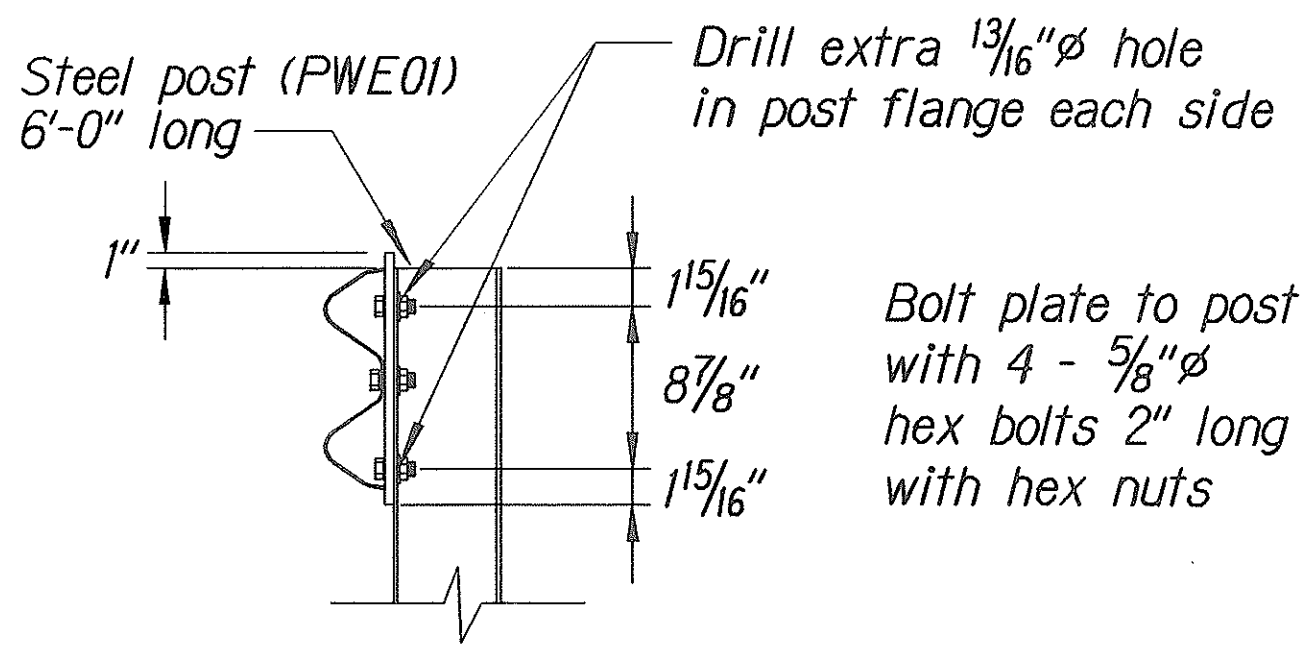
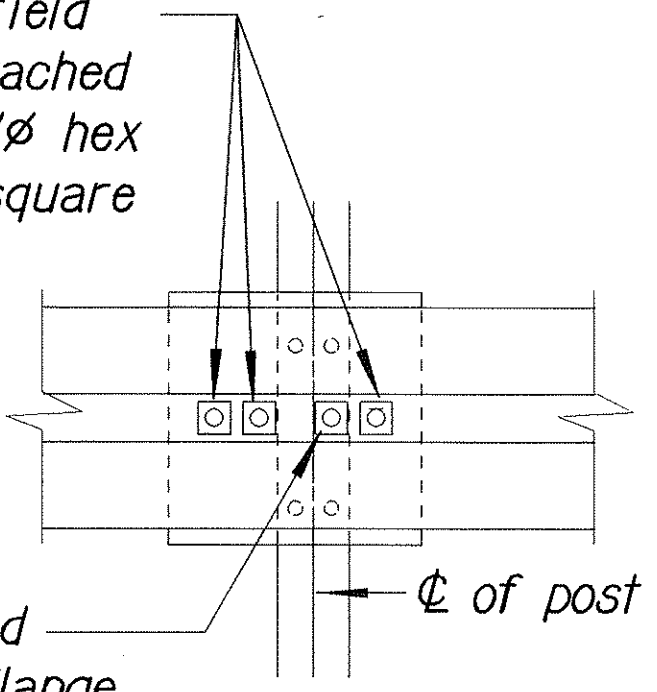


RUBRAIL ANCHOR DETAILS



3 - 7/8"Ø holes to be field drilled in rail and attached to steel plate with 7/8"Ø hex bolts 1 5/16" long with square washer

1"Ø holes to be field drilled in rail and through post flange. Attach to steel plate with 7/8"Ø hex bolts 2" long with square washer



POST ANCHOR DETAILS

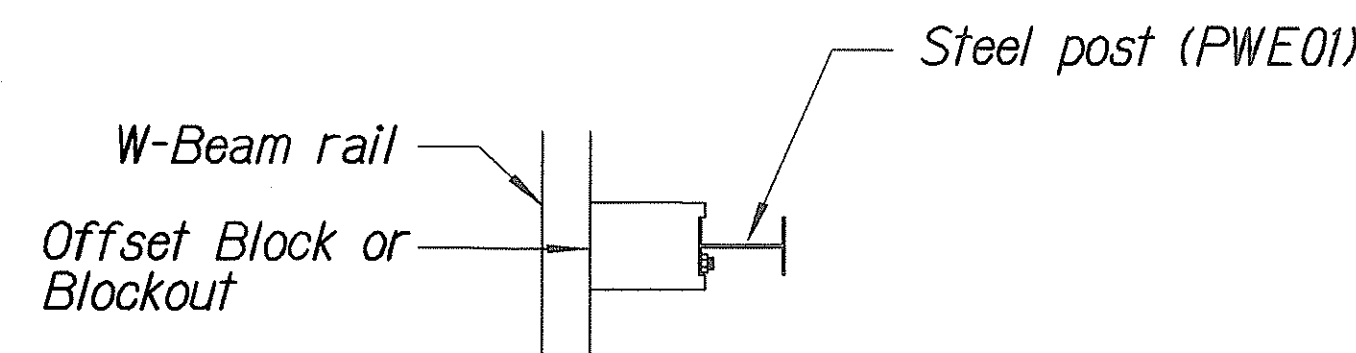
BACKSLOPE ANCHOR TERMINAL END ANCHORAGE DETAILS  
TYPE "A" FLARE)

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.

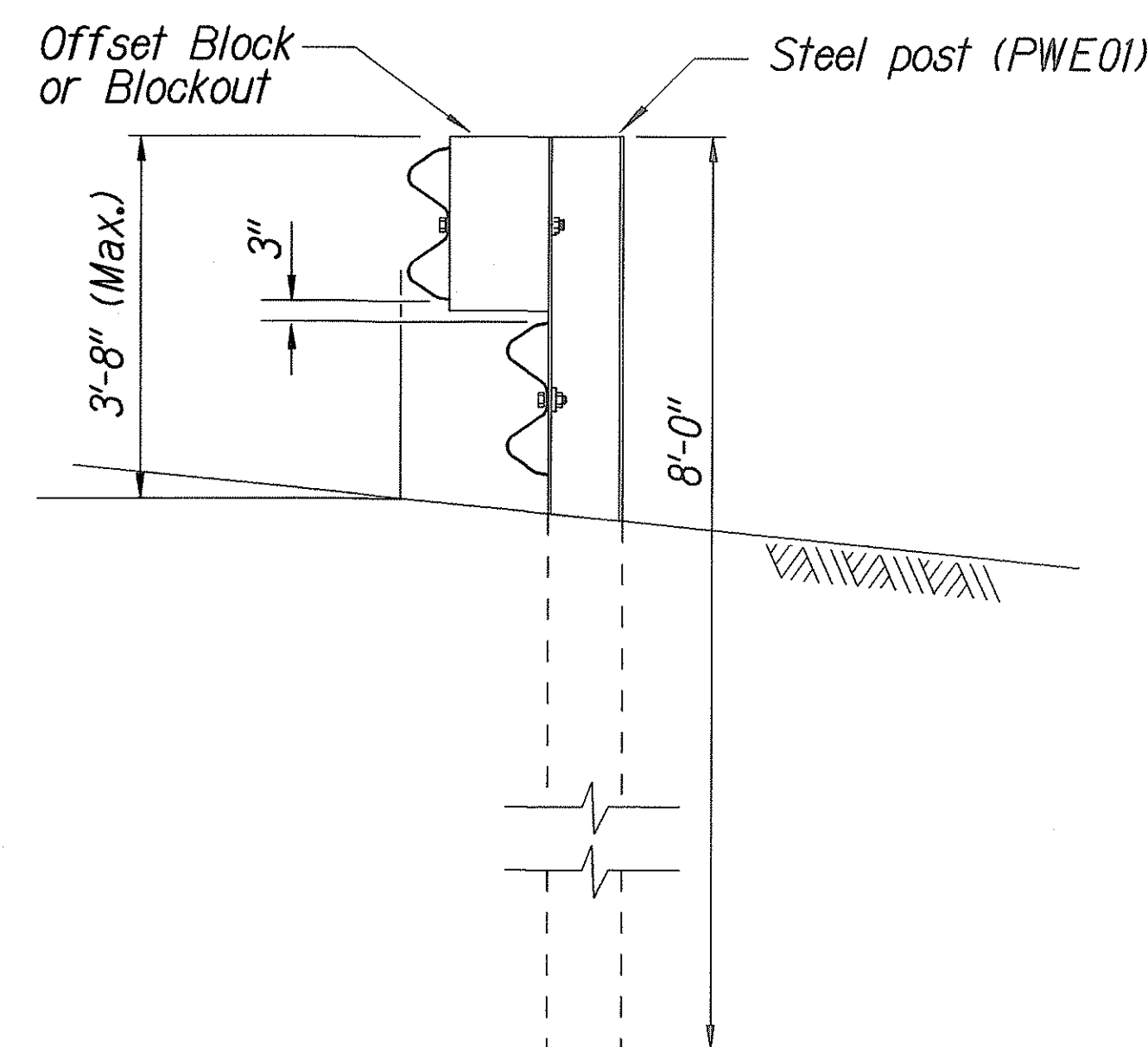
STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**TYPE "A" FLARE**  
HAWAII BELT ROAD  
GUARDRAIL AND SHOULDER IMPROVEMENTS  
Paauhau Road to Papalele Road and Various Locations  
Federal-Aid Project No. NH-019-1(37)  
Scale: NTS Date: March, 2007

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	12	47

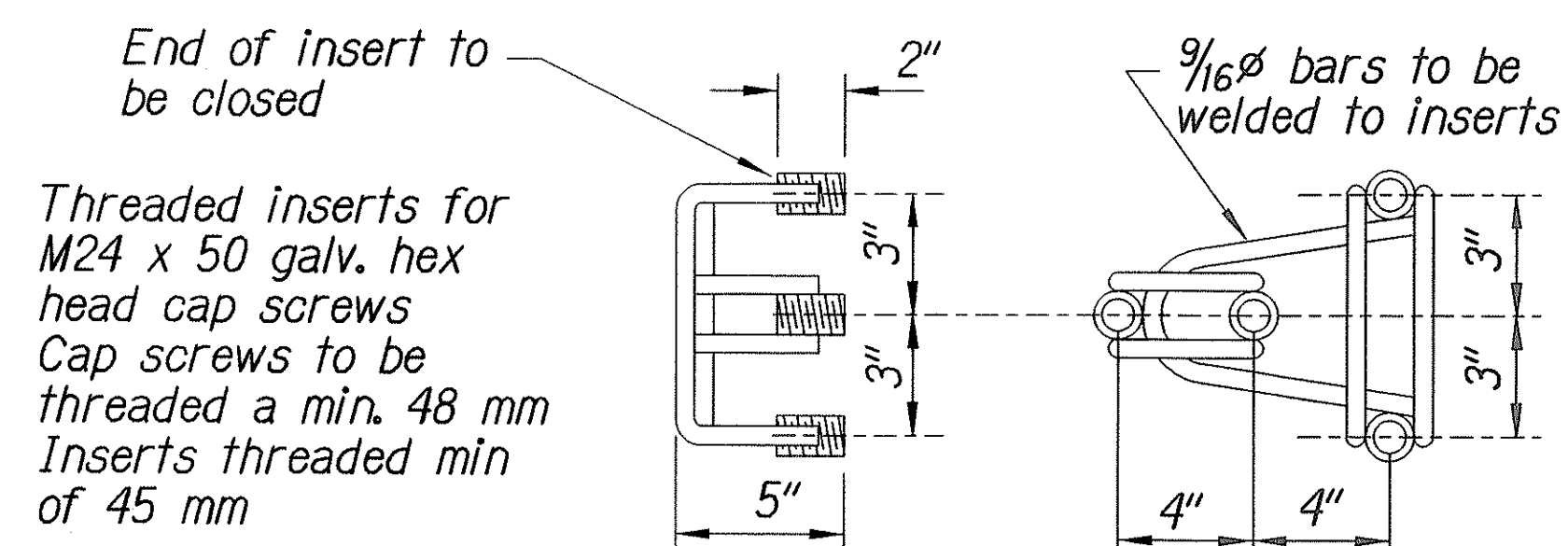


Plan



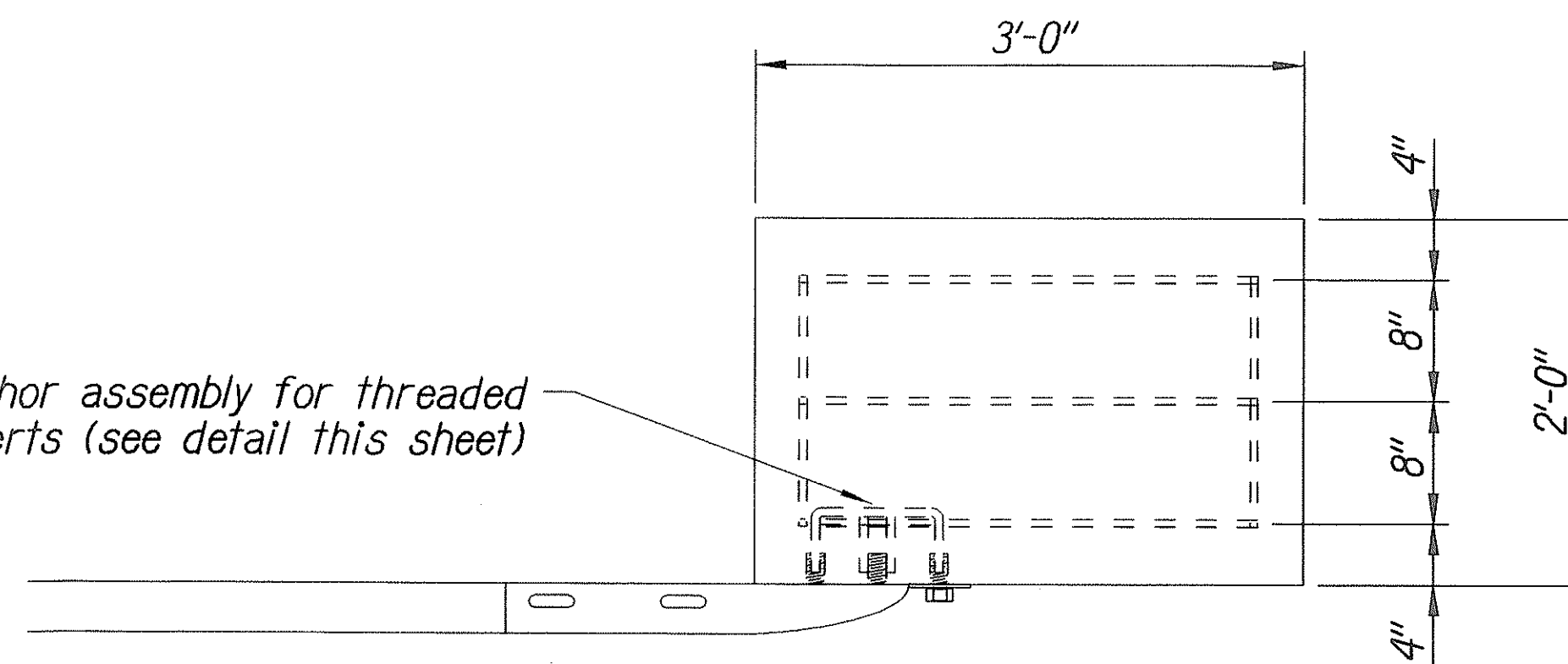
Elevation

STEEL POST GUARDRAIL  
WITH RUBRAIL

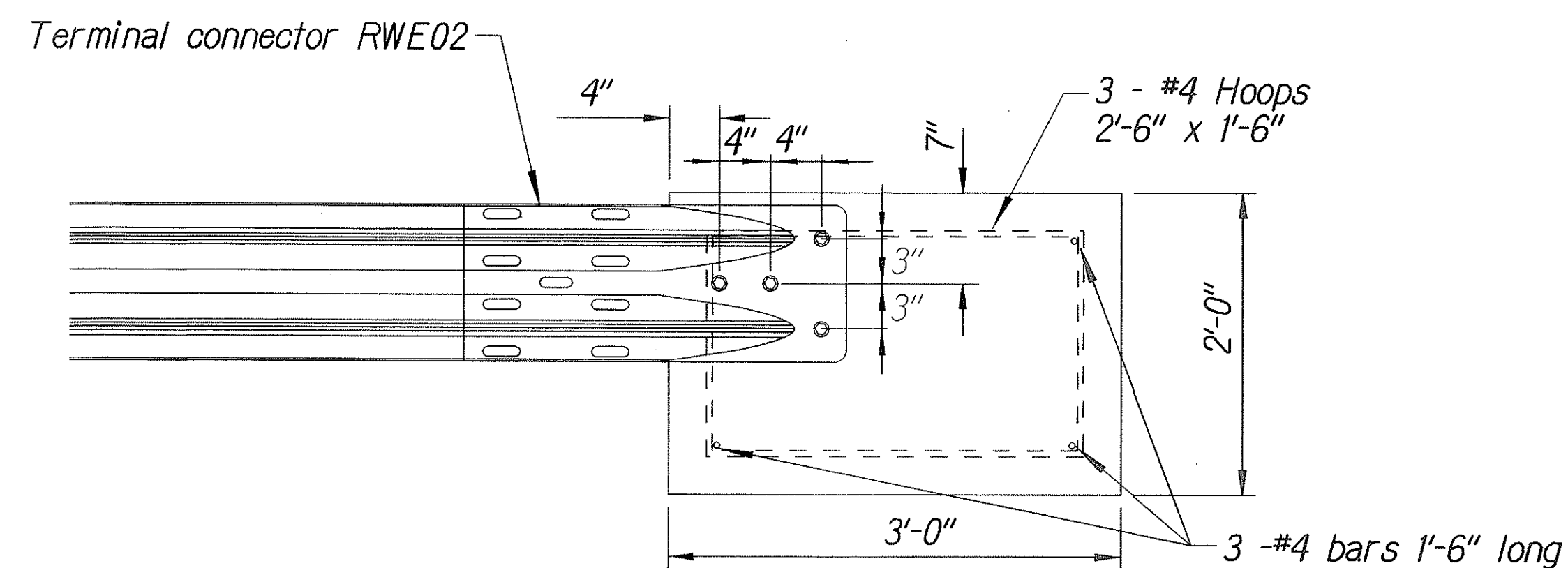


ANCHOR ASSEMBLY  
CONCRETE BLOCK ANCHOR

Anchor assembly for threaded inserts (see detail this sheet)



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.

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

Standard plan TE-58 07/01/86, TE-59 11/03/89 # TE-60 07/01/86

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

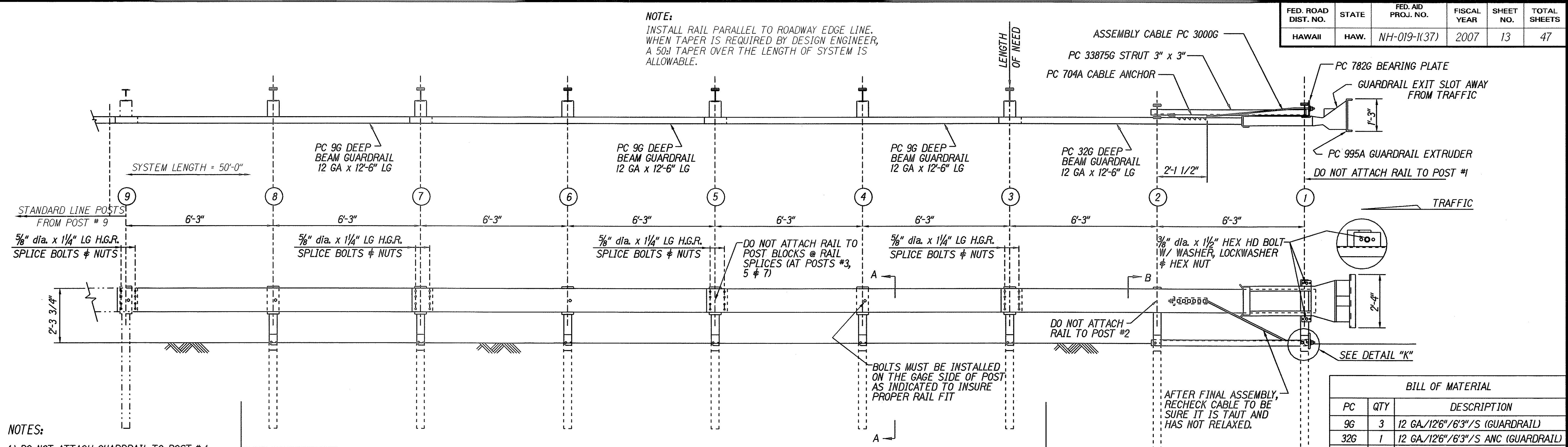
**TYPE "A" FLARE**  
HAWAII BELT ROAD  
GUARDRAIL AND SHOULDER IMPROVEMENTS  
Paauhau Road to Papalele Road and Various Locations

Federal-Aid Project No. NH-019-1(37)  
Scale: NTS Date: March, 2007

SHEET No. 7 OF 10 SHEETS



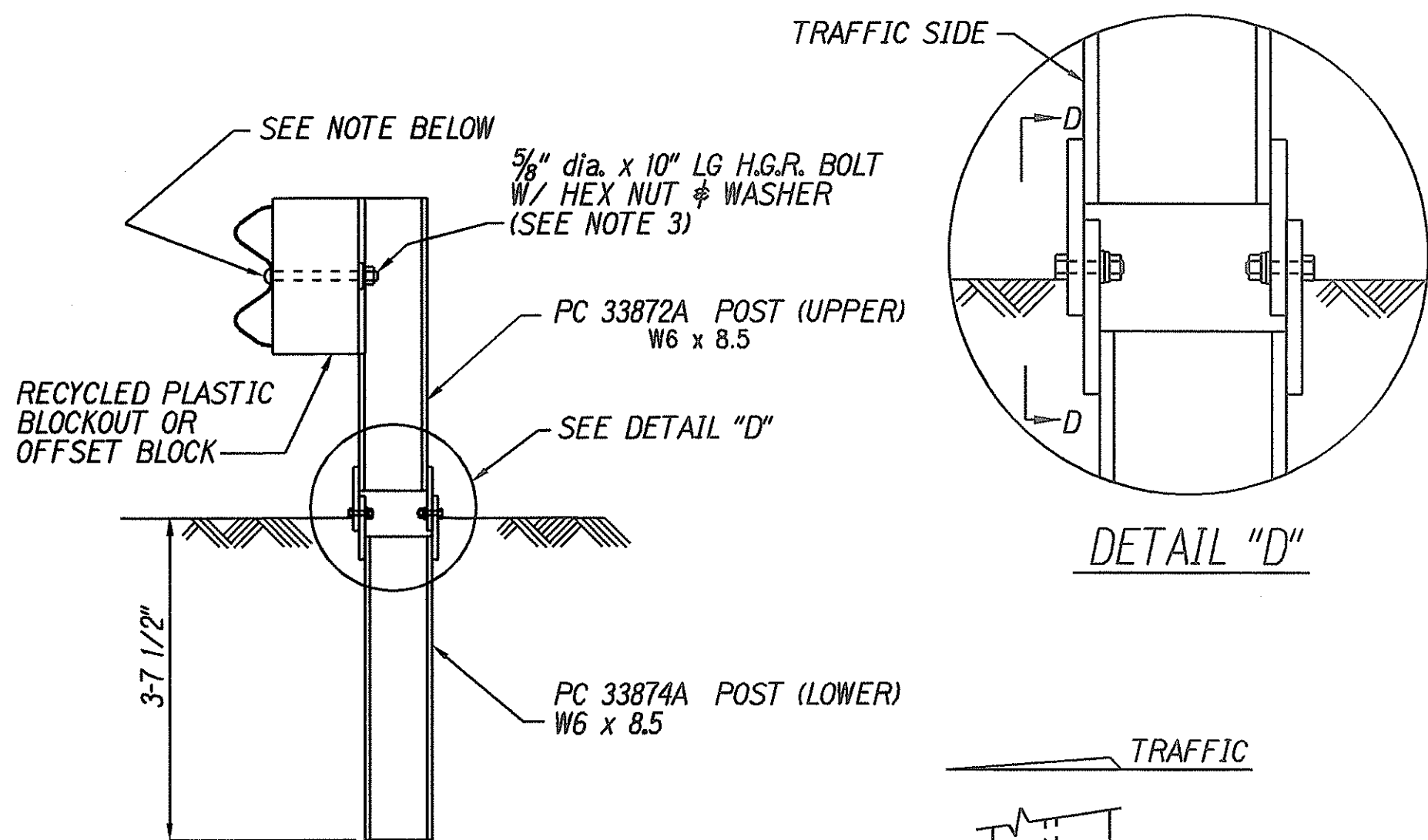
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	13	47



#### NOTES:

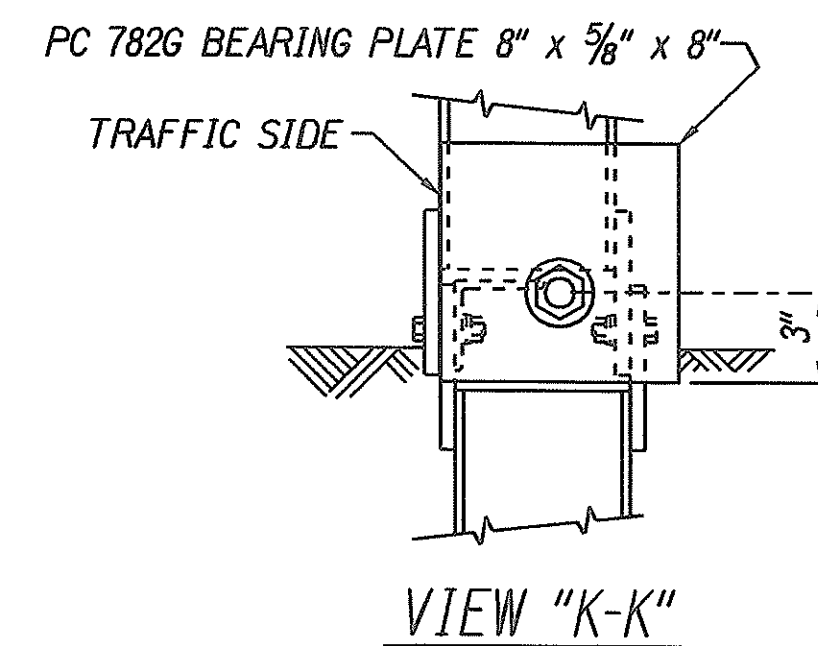
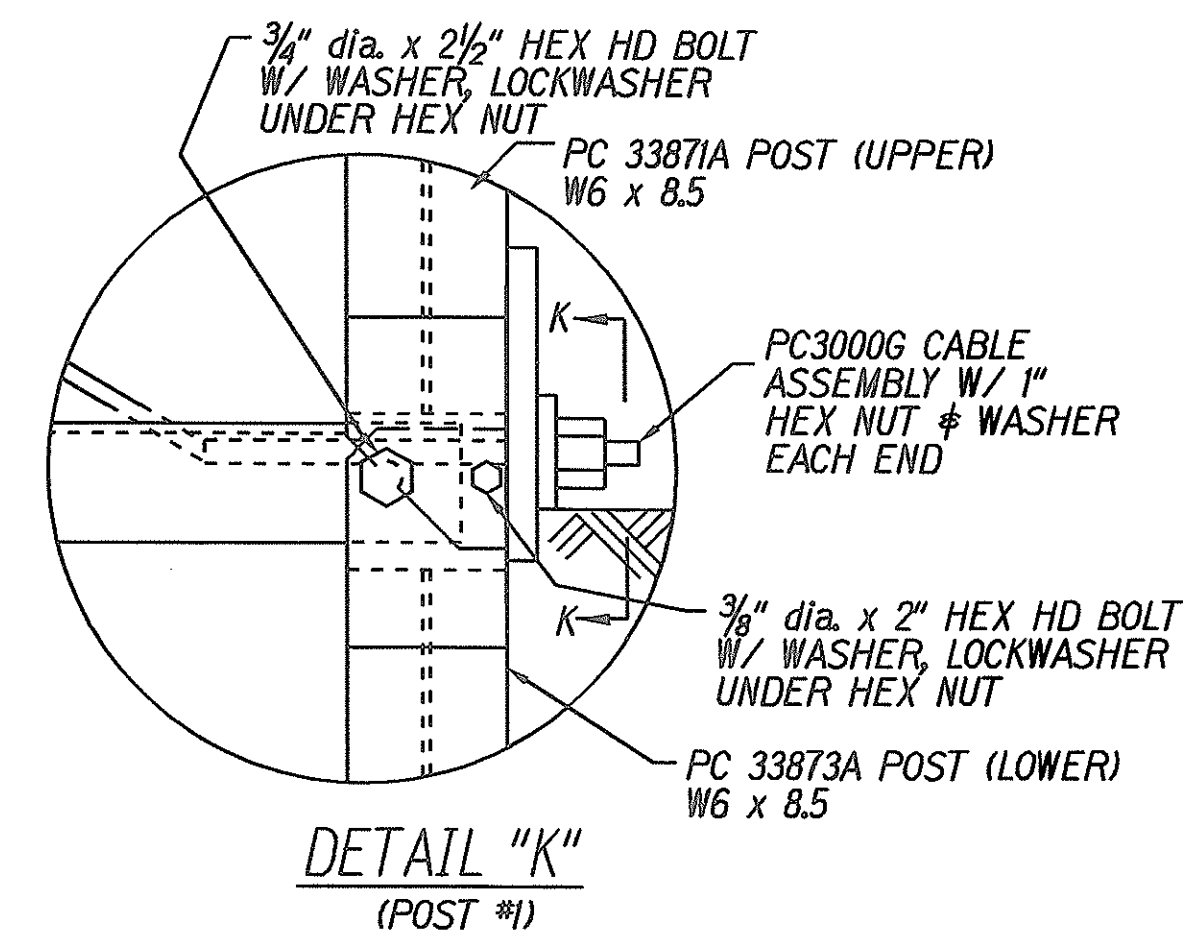
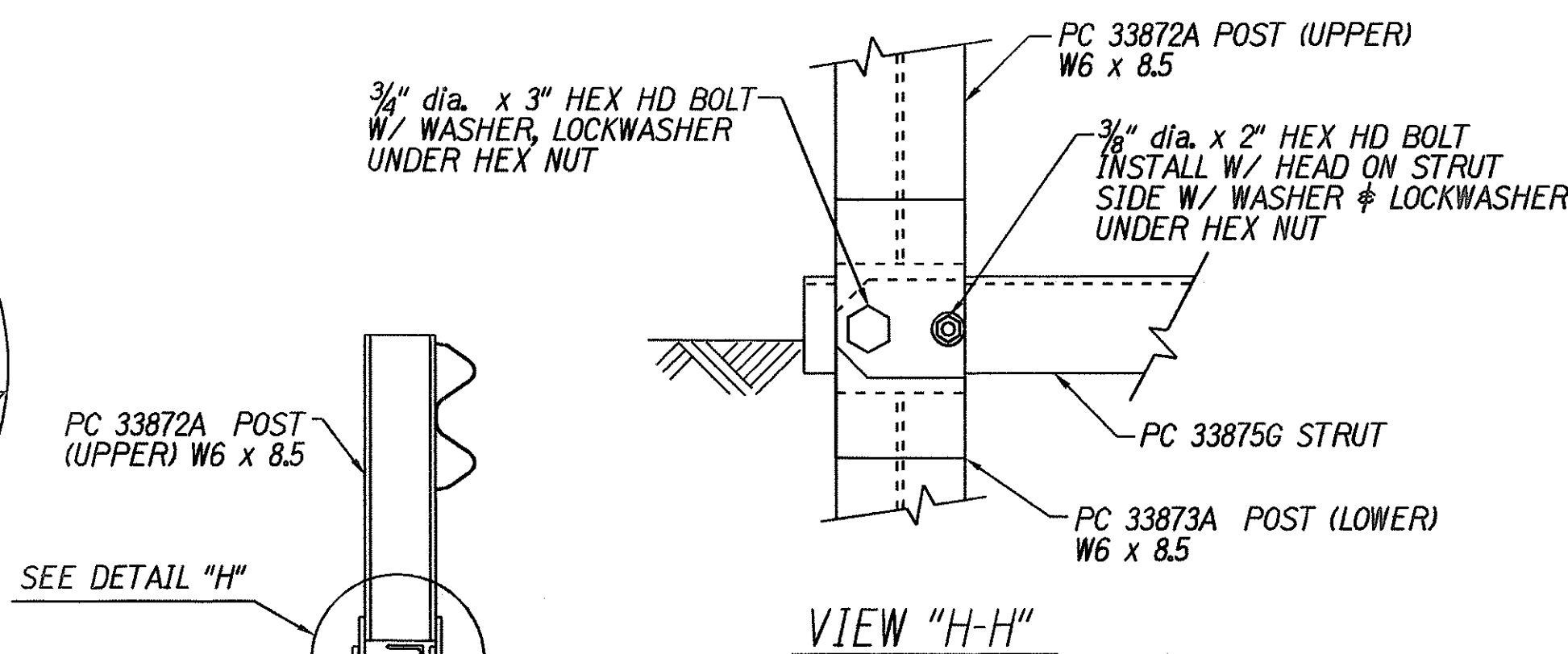
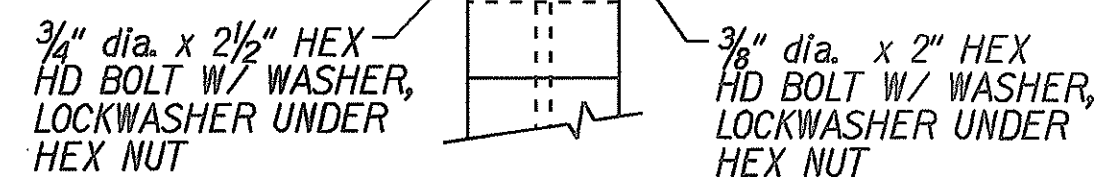
- DO NOT ATTACH GUARDRAIL TO POST # 1.
- DO NOT ATTACH GUARDRAIL TO POST BLOCKS AT GUARDRAIL LAP SPLICES. (AT POSTS #3, 5 & 7)
- THE 5/8" FLAT WASHER IS USED UNDER THE NUT, BEHIND THE POST ONLY. NO WASHER IS USED AT THE RAIL.
- MANUFACTURER SUGGESTS CUSTOMER TO PROVIDE REFLECTORIZATION OF TERMINAL.

BILL OF MATERIAL		
PC	QTY	DESCRIPTION
9G	3	12 GA/12'6"/6'3"/S (GUARDRAIL)
32G	1	12 GA/12'6"/6'3"/S ANC (GUARDRAIL)
704A	1	CABLE ANCHOR BRACKET
782G	1	5/8" x 8" x 8" BEARING PLATE
995A	1	ET-2000 PLUS EXTRUDER
3000G	1	CABLE 3/4" x 6'6"
3300G	6	5/8" WASHER
3340G	38	5/8" HEX NUT
3360G	32	5/8" dia. x 1 1/4" SPLICE BOLT
3500G	6	5/8" dia. x 10" POST BOLT
3701G	19	3/4" WASHER
3704G	16	3/4" HEX NUT
3717G	15	3/4" dia. x 2 1/2" HEX HD BOLT
3718G	1	3/4" dia. x 3" HEX HD BOLT
3900G	2	1" WASHER
3910G	2	1" HEX NUT
5326B	6	RECYCLED PLASTIC BLOCKOUT OR OFFSET BLOCK
4254G	18	3/8" WASHER
4255G	2	3/8" FENDER WASHERS
4258G	16	3/8" LOCKWASHER
4261G	2	3/8" dia. x 1 1/2" HEX HD BOLT
4699G	16	3/4" LOCKWASHER
6321G	16	3/8" dia. x 2" HEX HD BOLT
6405G	18	3/8" HEX NUT
33871A	1	ET2000 HBA POST #1 TOP
33872A	7	ET2000 HBA POST #2-#8 TOP
33873A	2	ET2000 HBA POST #1-#2 BOTTOM
33874A	6	ET2000 HBA POST #3-#8 BOTTOM
33875G	1	6'-6" ANGLE STRUT ET HBA



NOTE:  
SECTION "A-A" IS SIMILAR @ POST #3, 5 & 7.  
EXCEPT RAIL IS NOT ATTACHED.

SECTION "A-A"  
(TYP @ POSTS #4, 6 & 8)



SECTION "B-B"  
(POST #2)

DETAIL "H"  
(POST #2)

STACK 2-3 WASHERS ON 3/4" dia. BOLT BETWEEN POST PL & STRUT TO ALLOW STRUT TO PASS OVER 3/8" dia. BOLT HEAD.

DATE	1/2
SURVEY PLOTTED BY	X
DRAWN BY	X
DESIGNED BY	X
QUANTITIES BY	X
CHECKED BY	X
ORIGINAL PLAN	
NOTE BOOK	
4424010508	
N.	dan

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

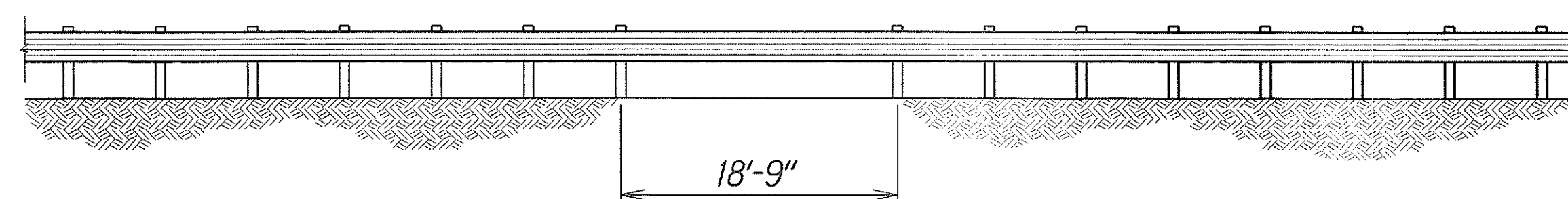
**ET-2000 PLUS**  
HAWAII BELT ROAD  
GUARDRAIL AND SHOULDER IMPROVEMENTS  
Paauhau Road to Papalele Road and Various Locations  
Federal Aid Project No. NH-019-1(37)

Scale: Not to Scale Date: March, 2007

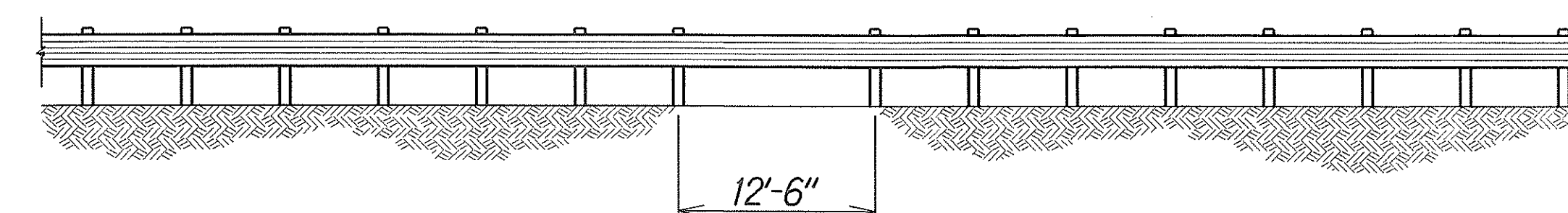
SHEET No. 8 OF 10 SHEETS



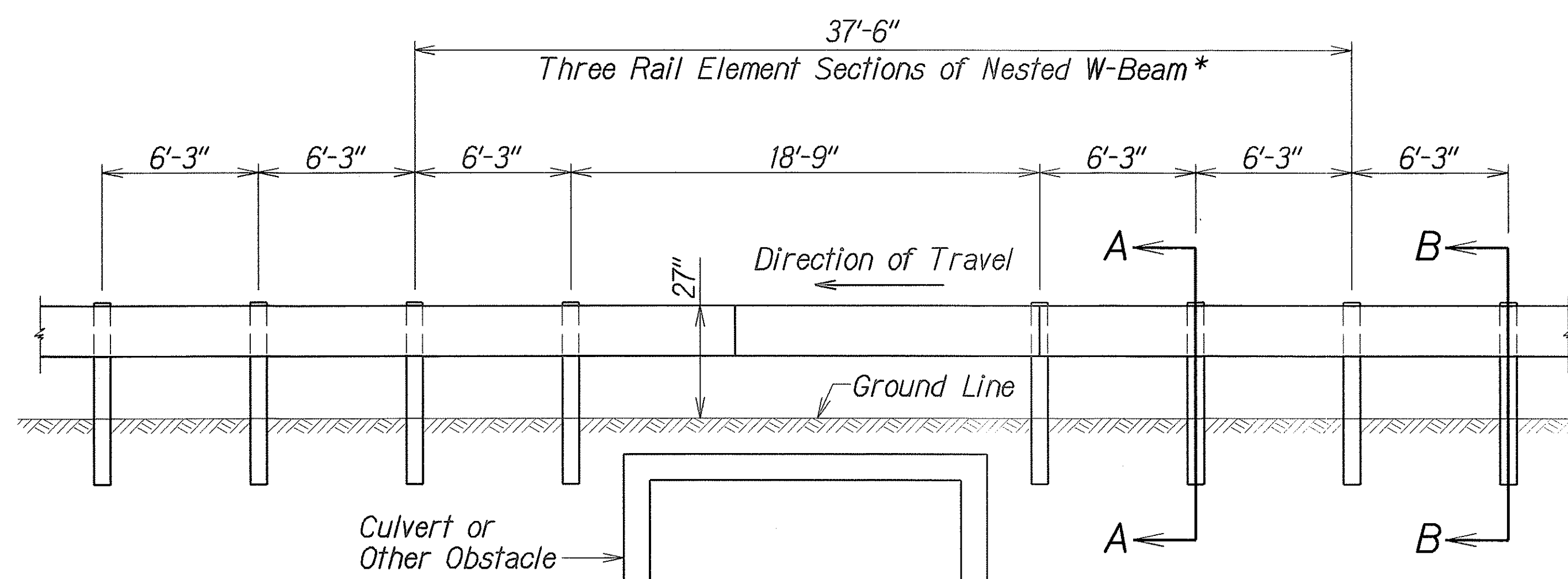
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	14	47



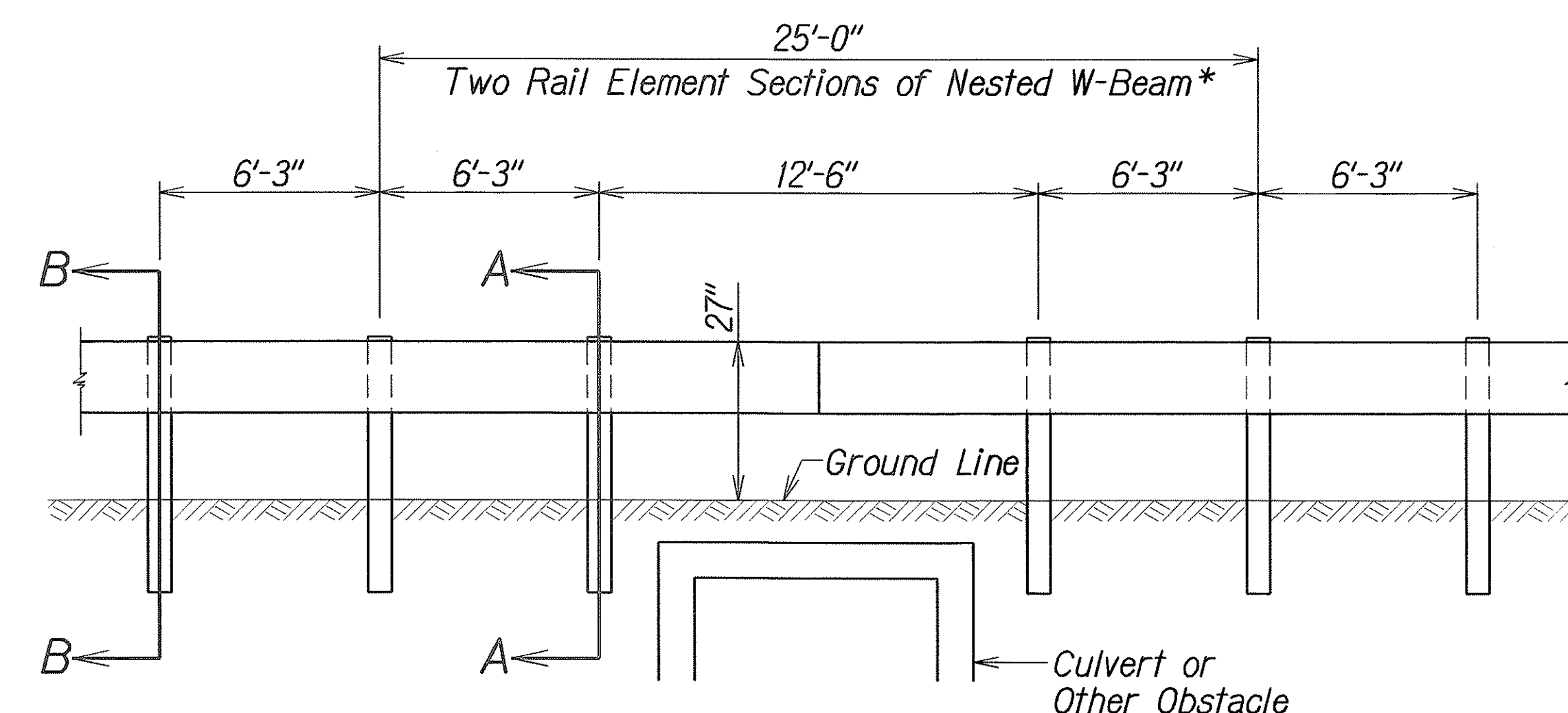
LONG SPAN OVER CULVERT



LONG SPAN OVER CULVERT

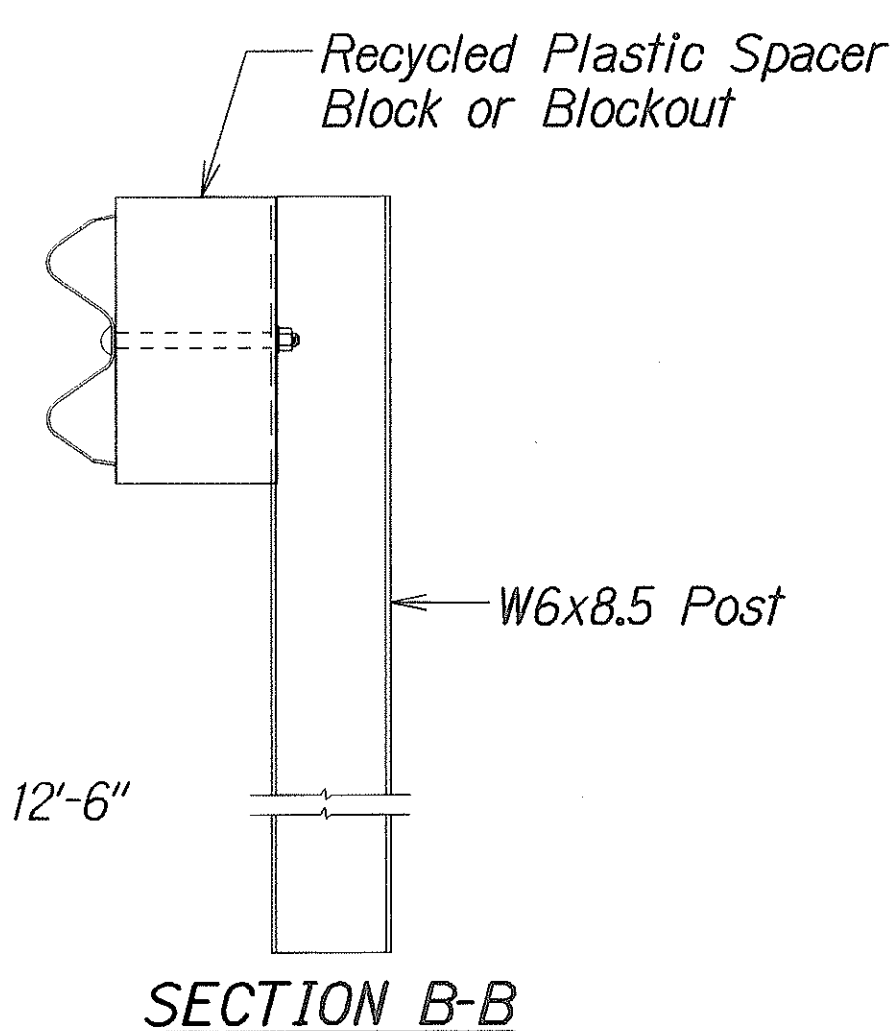
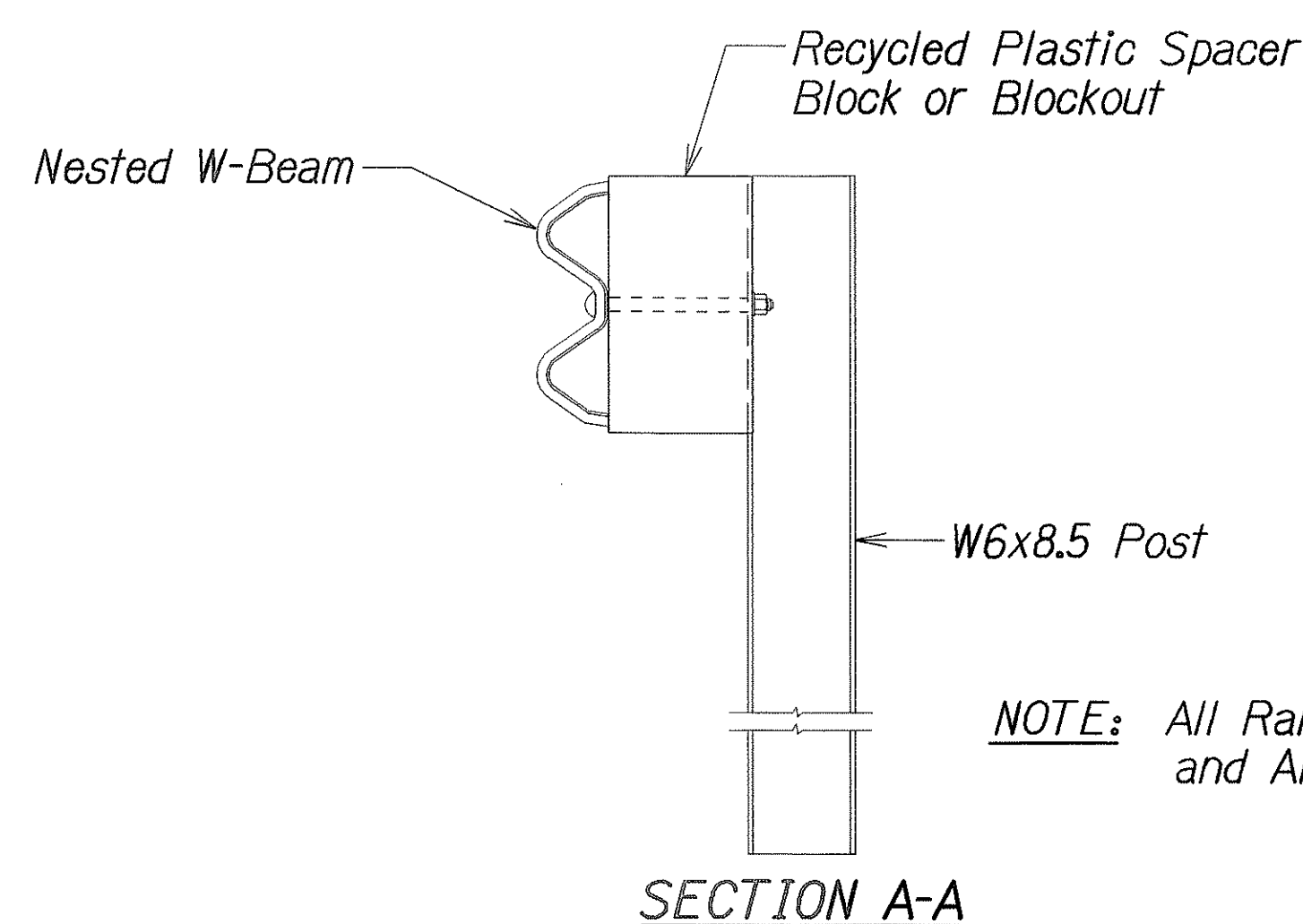


NESTED LONG SPAN STRONG POST  
W-BEAM GUARDRAIL OVER 18'-9\"/>



NESTED LONG SPAN STRONG POST  
W-BEAM GUARDRAIL OVER 12'-6\"/>

\*Note: All nested W-Beam splices points shall be staggered.



NOTE: All Rail Elements Sections are 12'-6\"/>

SURVEY PLOTTED BY	DATE
DRAWN BY	
TRACED BY	
QUANTITIES BY	
CHECKED BY	

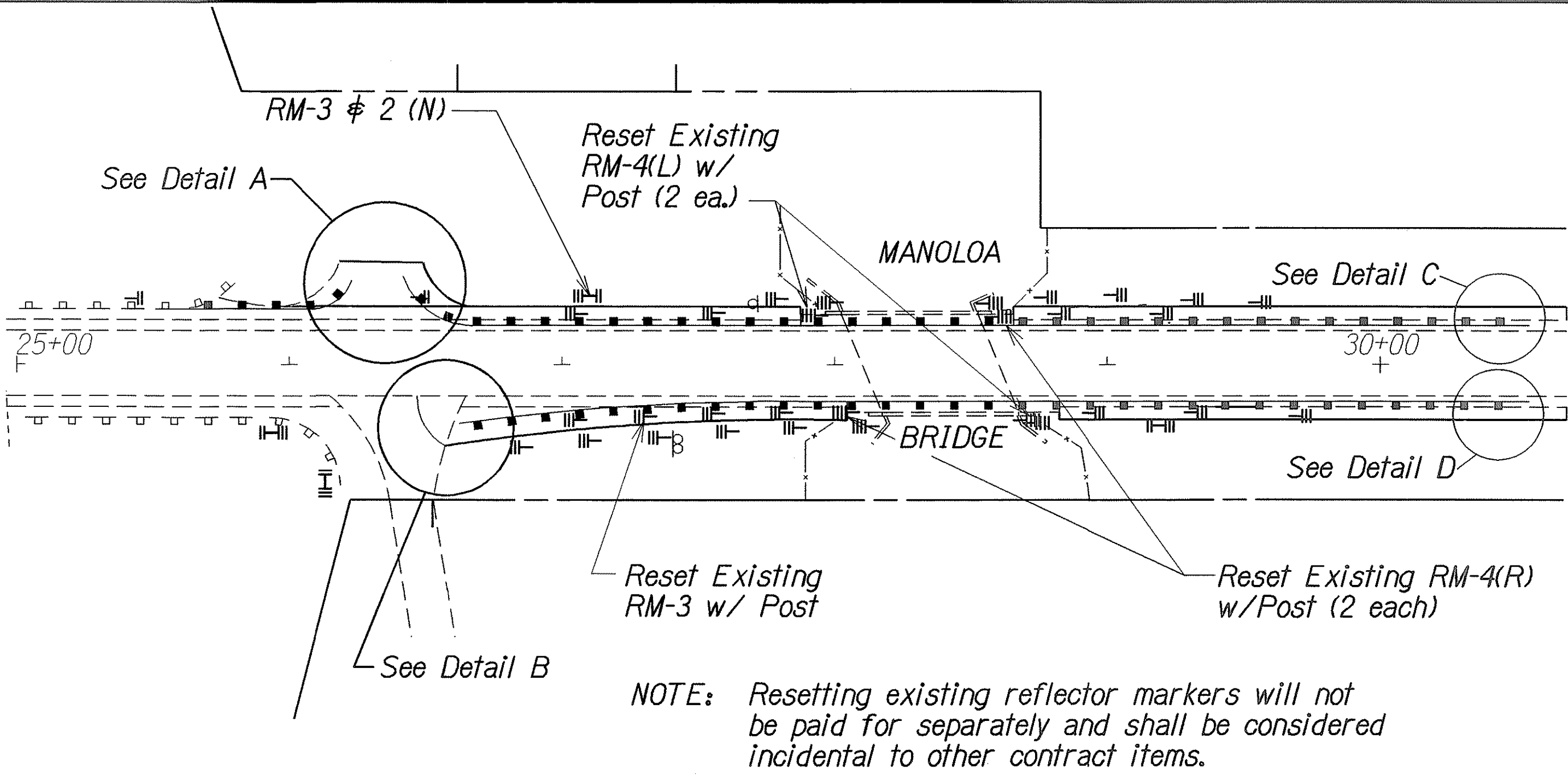
4/22/04  
ad2ch0m090m

STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**NESTED LONG SPAN STRONG POST**  
**W-BEAM GUARDRAIL OVER CULVERT**  
HAWAII BELT ROAD  
GUARDRAIL AND SHOULDER IMPROVEMENTS  
Paauhau Road to Papalele Road and Various Locations  
Federal-Aid Project No. NH-019-1(37)  
Scale: NTS Date: March, 2007

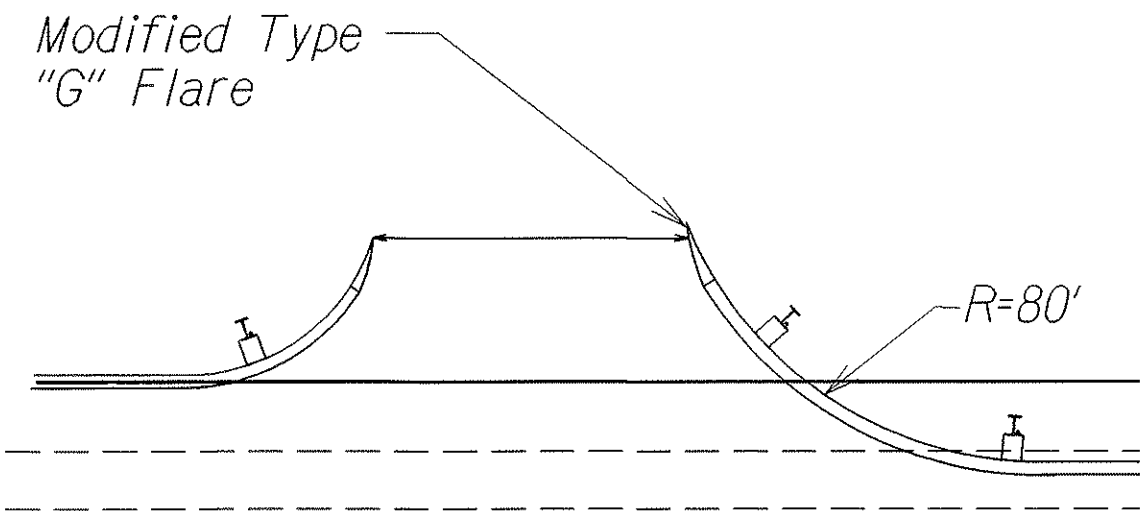
SHEET No. 9 OF 10 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	NH-019-1(37)	2007	ADD. 15	47

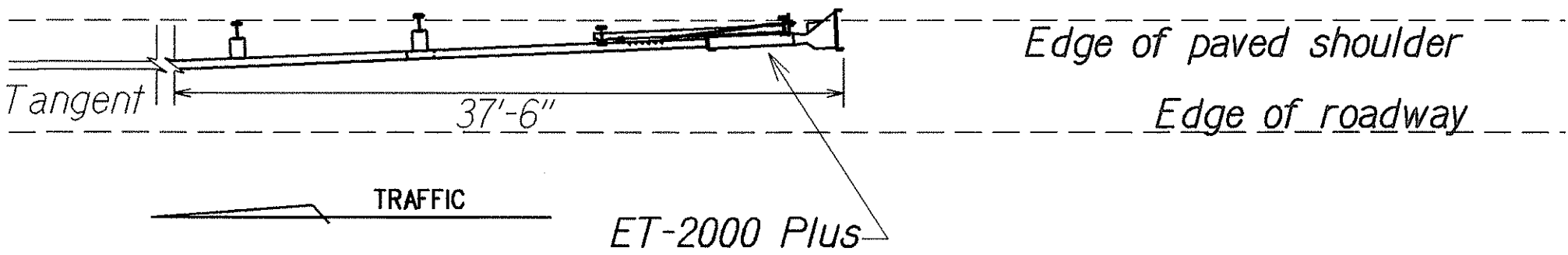


NOTE: Resetting existing reflector markers will not be paid for separately and shall be considered incidental to other contract items.

MANOLOA BRIDGE  
Not to Scale

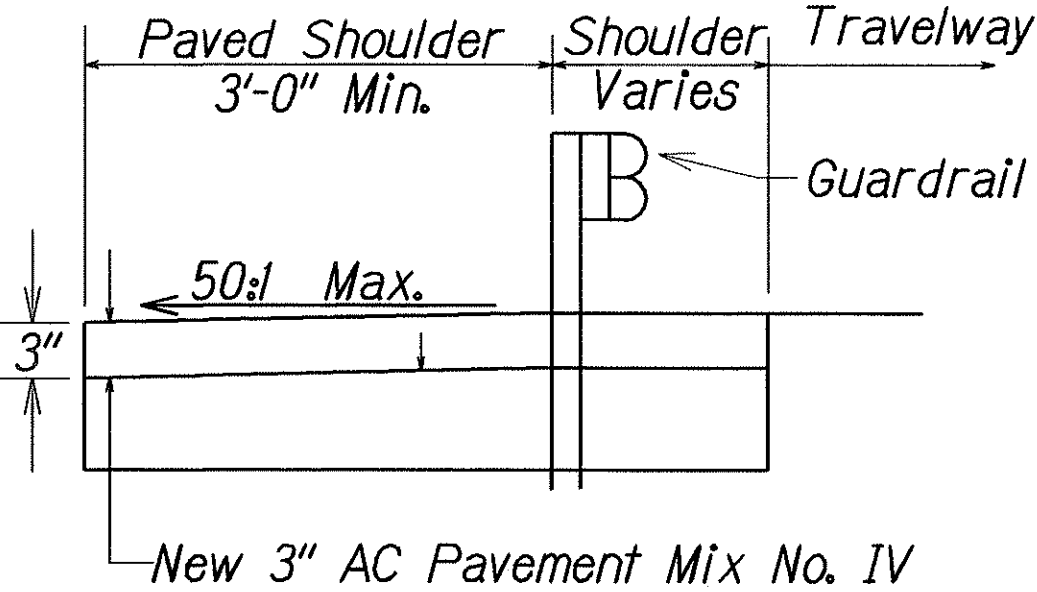


DETAIL A  
Scale: 1"=40'

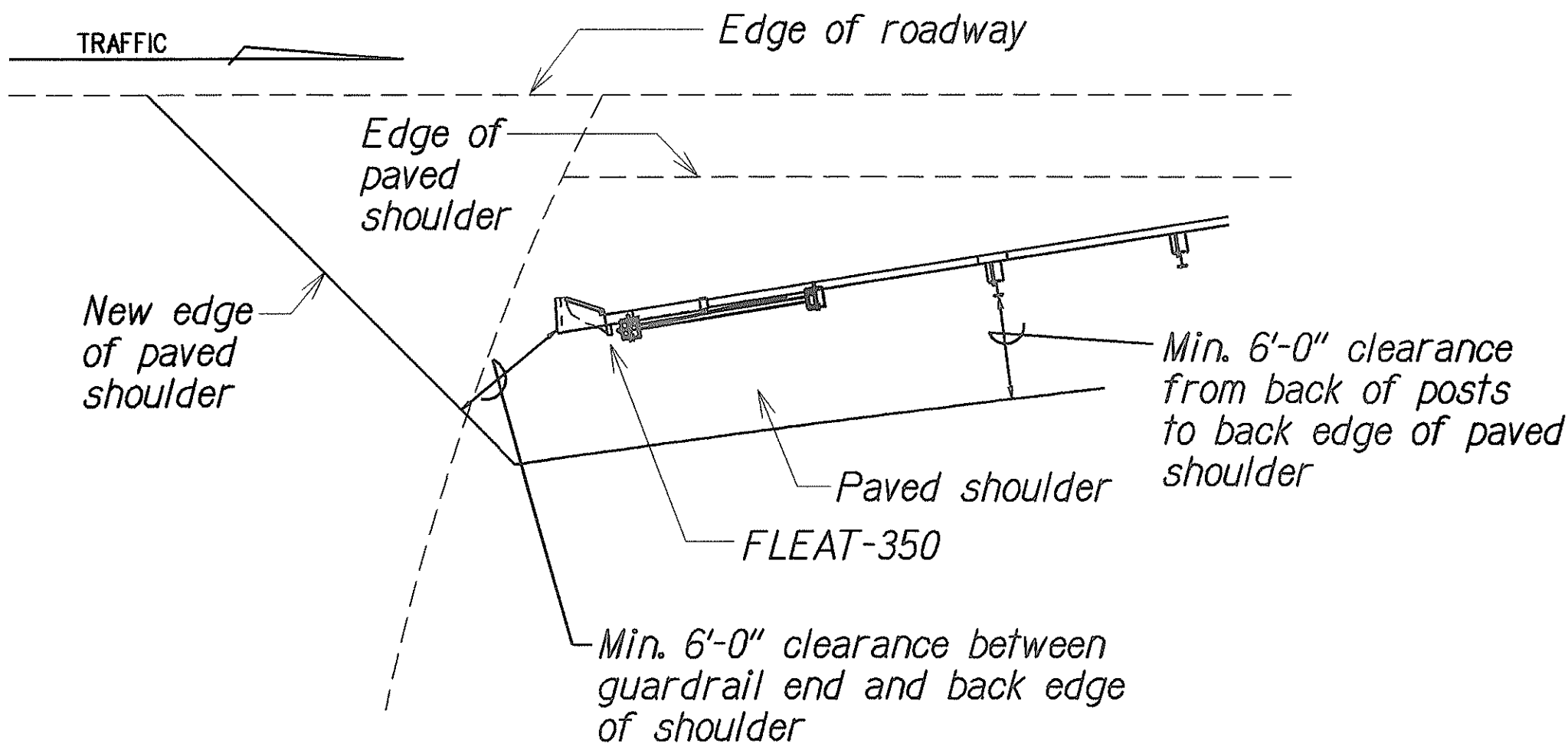


DETAIL C  
Scale: 1"=40'

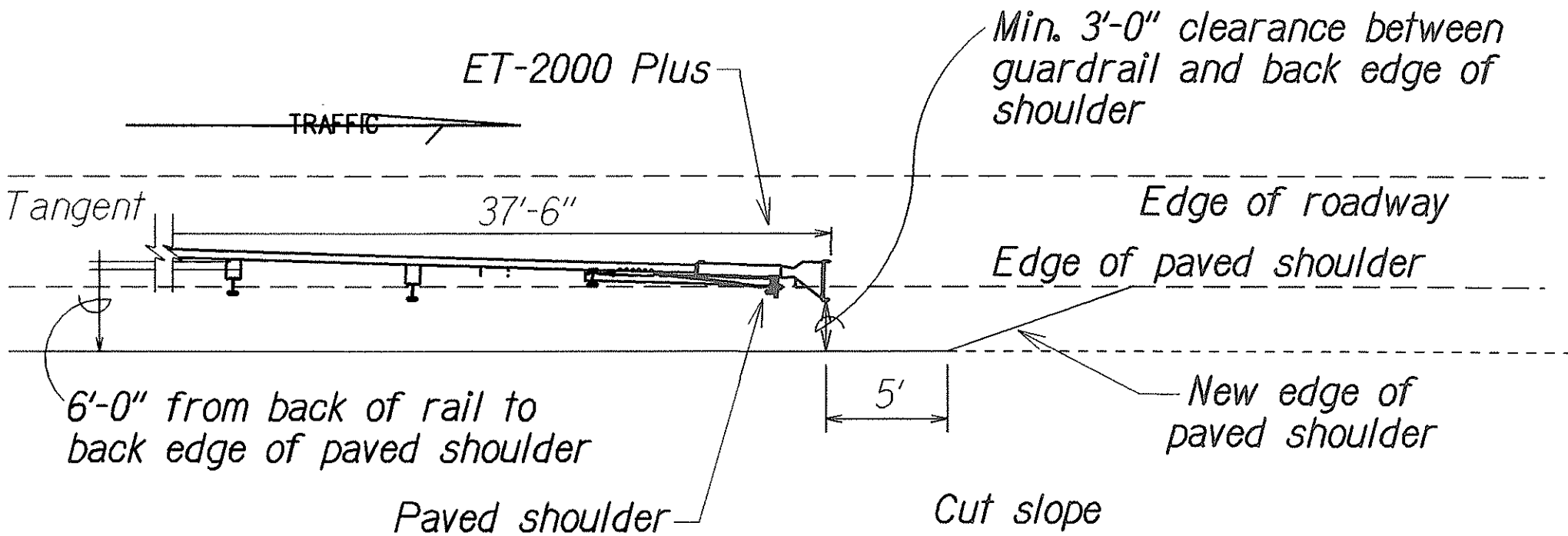
NOTE: Install ET-2000 Plus with black/yellow striped retroreflective sheeting on faceplate.



SHOULDER DETAIL  
Not to Scale



DETAIL B  
Scale: 1"=40'



DETAIL D  
Scale: 1"=40'

4/26/07	Added Note and Modified Manaloa Bridge Detail. Clarified Note for Shoulder Detail. Modified Detail D.
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DATE	REVISION
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STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION

**GUARDRAIL DETAILS & NOTES**  
HAWAII BELT ROAD  
GUARDRAIL AND SHOULDER IMPROVEMENTS  
Paauhau Road to Papalele Road and Various Locations  
Federal-Aid Project No. NH-019-1(37)  
Date: April, 2007