FED. ROAD DIST.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	19	46

GUARDRAIL NOTES

1. The locations and limits of guardrails shown on the plans are approximate. The Contractor shall stake-out guardrail locations in the field for acceptance by the Engineer.
2. Unless otherwise noted all guardrail elements shall be 12' - 6" nominal length.
3. For all Modified Type 'G' end treatments:
   a) Provide a curve radius to extend the flare away from the travelway.
   b) Use the 'Rounded End Section' in lieu of the 'Flared End Section' (Refer to Plan Sheet 28).
4. Placement of Asphalt Concrete Mix V from edge of shoulder to 1 - 0" beyond the guardrail post applies to the entire length of guardrail, including flared segments and end treatments.
5. All existing posts and guardrails for removal shall be disposed of by the contractor at no cost to the State. This work shall be considered incidental to the contract Item No. 606.3110 - Strong Post W-Beam Guardrail.
6. The Contractor shall provide new edge of pavement striping (equal or better than existing) and Type 'C' markers at each work site destroyed by his operation as determined by the Engineer. The Contractor shall also replace striping or reflector markers damaged by his operations. Payment for this work shall be incidental to various Contract Items.
7. Removal and reinstallation or relocation of existing signs for the purpose of guardrail removal and installation shall be incidental to Item No. 606.3110 - Strong Post W-Beam Guardrail. Signs damaged by the contractor's operations shall be repaired or replaced at no cost to the State.
8. All end treatments (Terminal, modified "A-1", "G", Fleat 350, etc.) not completed by day's end shall be properly delineated with Triton Barriers as directed by the Engineer. Payment for use of the Triton Barrier shall be considered incidental to guardrail installation.
9. Replacement of existing guardrails shall be completed within the same day. No unshielded areas shall be permitted at the end of the work day.
10. References on the plans to Standard Metal Guardrails and Posts shall be considered the same as Strong Post W-Beam Guardrail.

ORIGINAL PLAN
NOTE BOOK
No.

SURVEY PLOTTED BY
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QUANTITIES BY
CHECKED BY
DATE

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

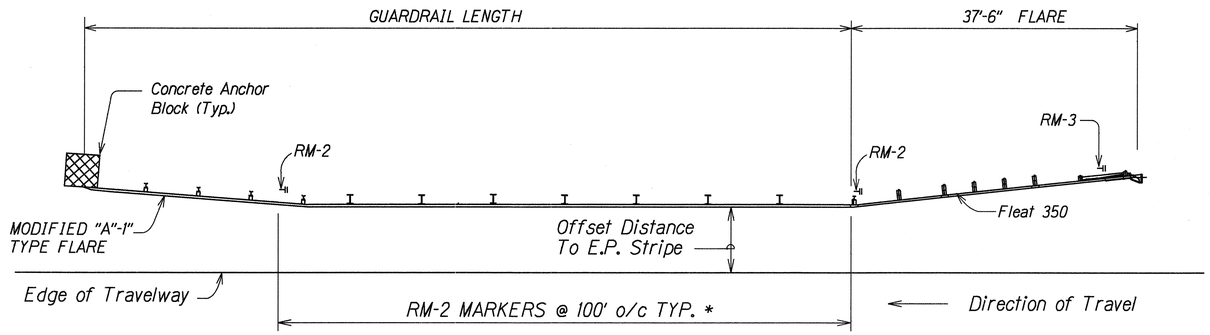
GUARDRAIL NOTES

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS TO
KALOKO-HONOKŌHAU NATIONAL HISTORICAL PARK
PROJECT NO. FLH-019-1(26)

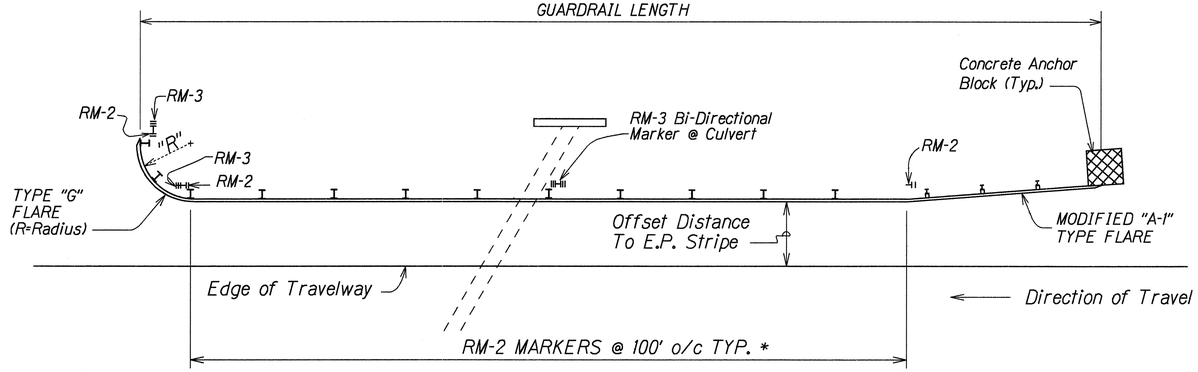
Scale: Noted Date: Feb., 1998

SHEET No. 1 OF 15 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	20	46



TYPICAL @ MODIFIED "A-1" & FLEAT 350 END TREATMENT



TYPICAL @ "G" & MODIFIED "A-1" END TREATMENT

NOTE:

* Exact location of Reflector Markers shall be determined in the field by the Engineer.

REFLECTOR MARKER NOTES:

1. All reflector markers located behind guardrail and other locations shall be installed with flexible delineator posts.
2. Exact location of Reflector Markers shall be determined in the field by the Engineer.
3. Color of flexible delineator posts shall be white except for RM-3, RM-3 bidirectional, and RM-3/RM-2 combinations shall be yellow posts.
4. RM-2 shall be white.

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

TYPICAL REFLECTOR MARKER INSTALLATION AT GUARDRAILS

Not To Scale

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

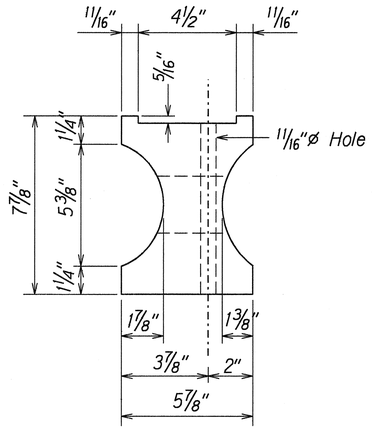
GUARDRAIL REFLECTOR MARKER DETAIL

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS
PROJECT NO. FLH-019-1(26)

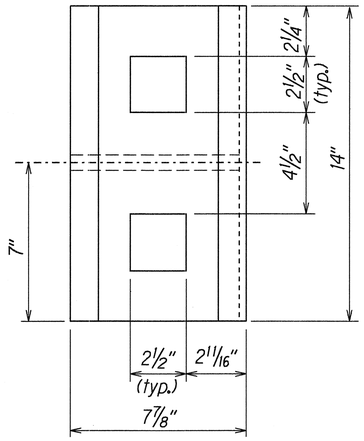
Scale: Noted Date: Mar., 1998

SHEET No. 2 OF 15 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	21	46

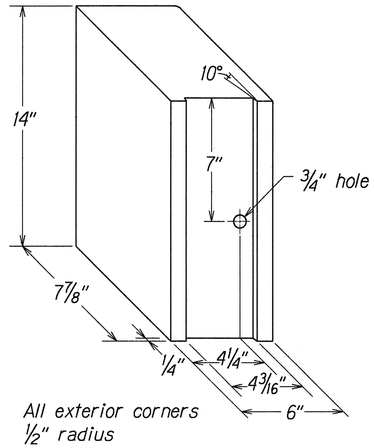


TOP

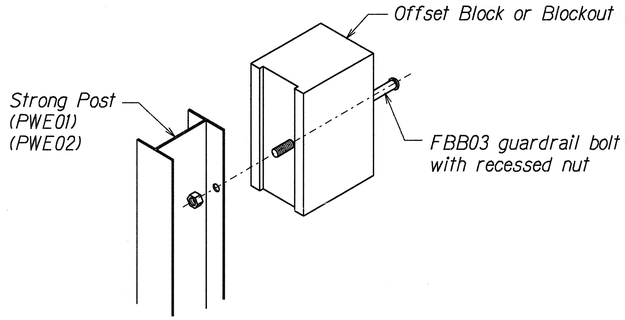


SIDE

RECYCLED PLASTIC BLOCKOUT (TYPE I)

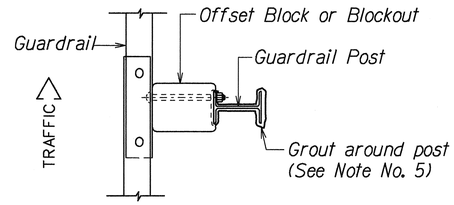


RECYCLED POLYETHYLENE OFFSET BLOCK (TYPE II)

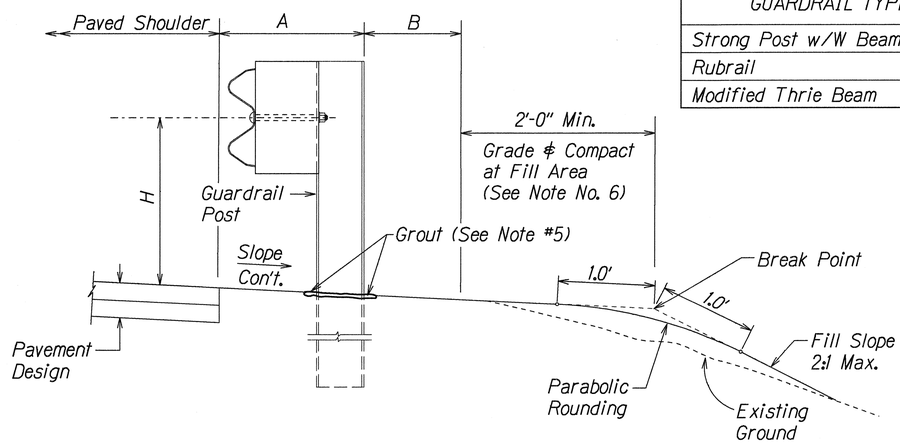


Exploded View
(Rail and washer not shown)

STEEL POST AND BLOCK DETAIL



PLAN



ELEVATION

TYPICAL GUARDRAIL INSTALLATION

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

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. If paving under guardrails is provided for in the contract, the Contractor shall grout around the guardrail post and seal all cracks in the paved area that was 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 grouting. The cost for this work shall not be paid for separately, but shall be considered incidental to the various guardrail items.
6. When standards for the fill slope area cannot be met, a site specific, engineer approved design may be used.

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE X
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	QUANTITIES BY	
	CHECKED BY	

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

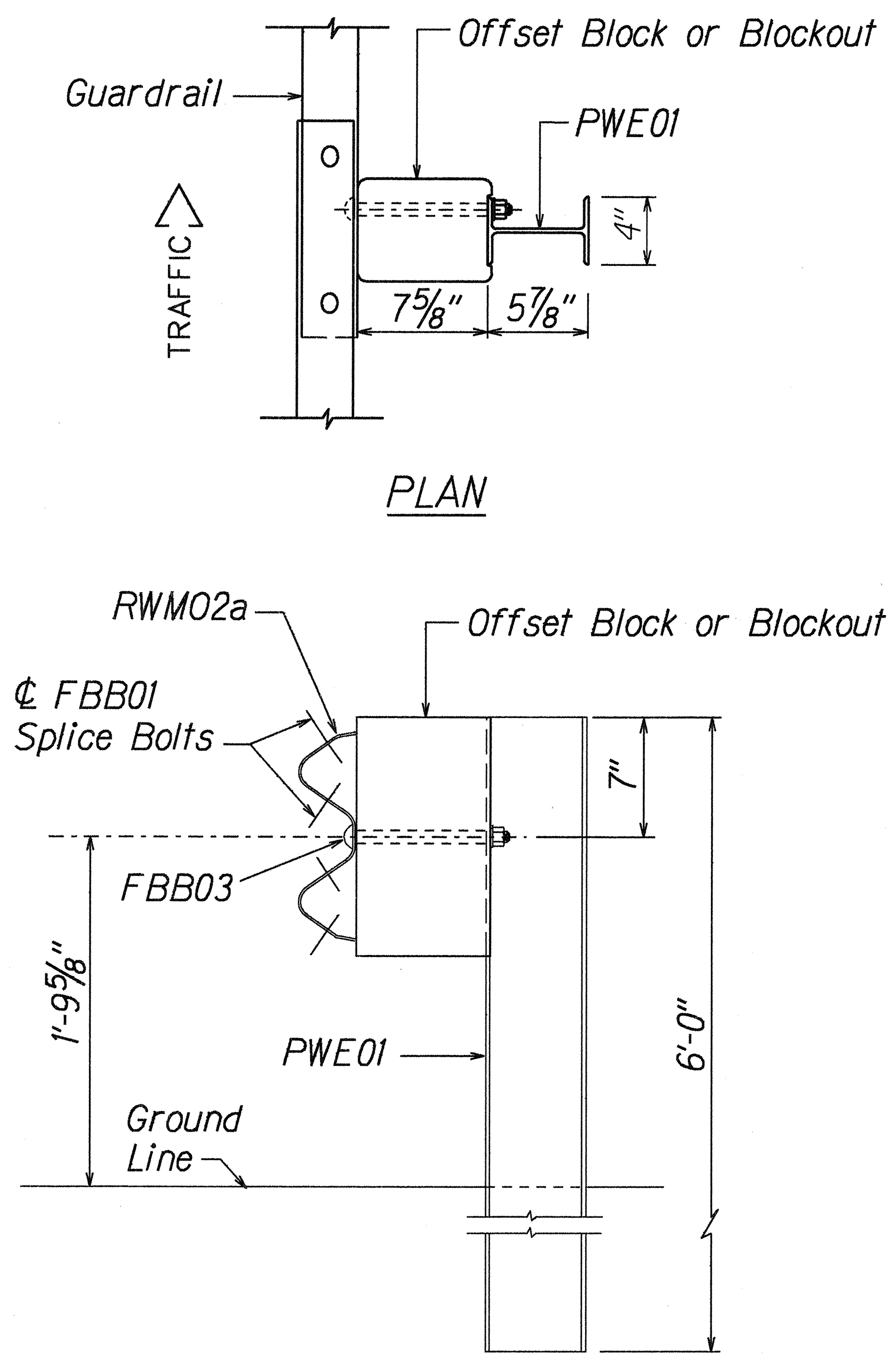
GUARDRAIL DETAILS & NOTES

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS TO
KALOKO-HONOKŌHAU NATIONAL HISTORICAL PARK
PROJECT NO. FLH-019-1(26)

Scale: Noted Date: Aug., 1999

SHEET No. 3 OF 15 SHEETS

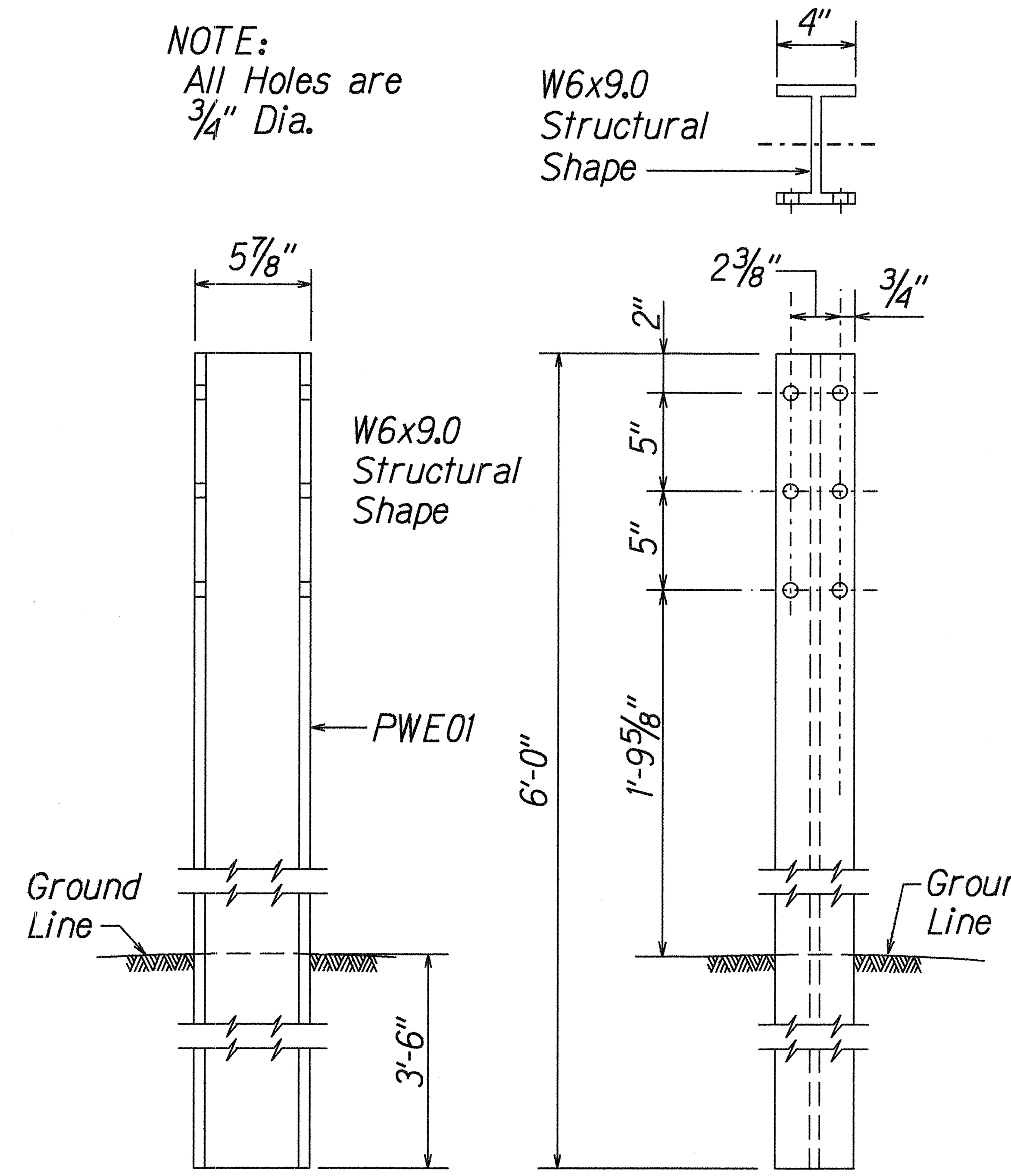
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	22	46



PLAN

ELEVATION

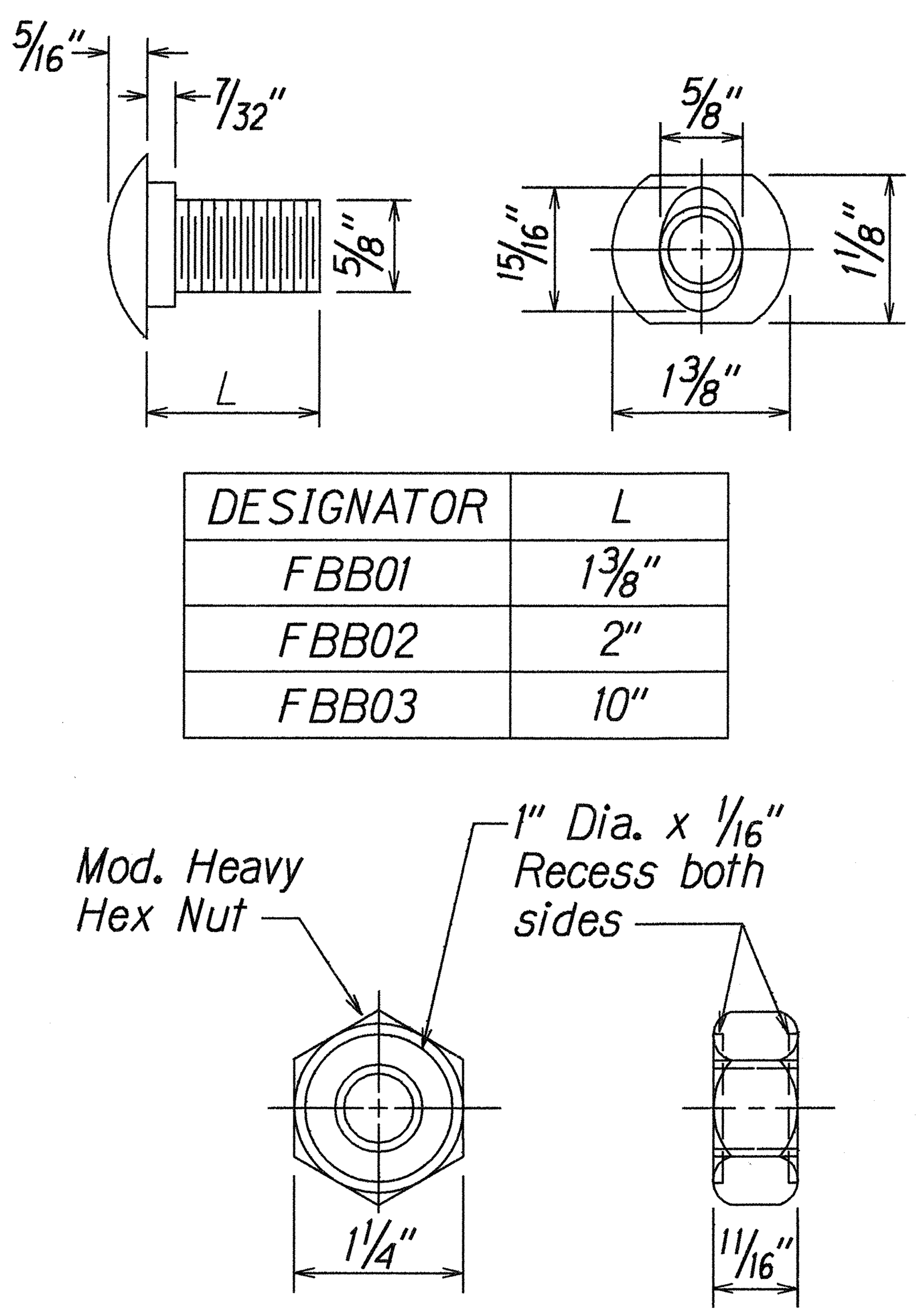
STRONG POST W-BEAM GUARDRAIL
(SGR04a)



SIDE

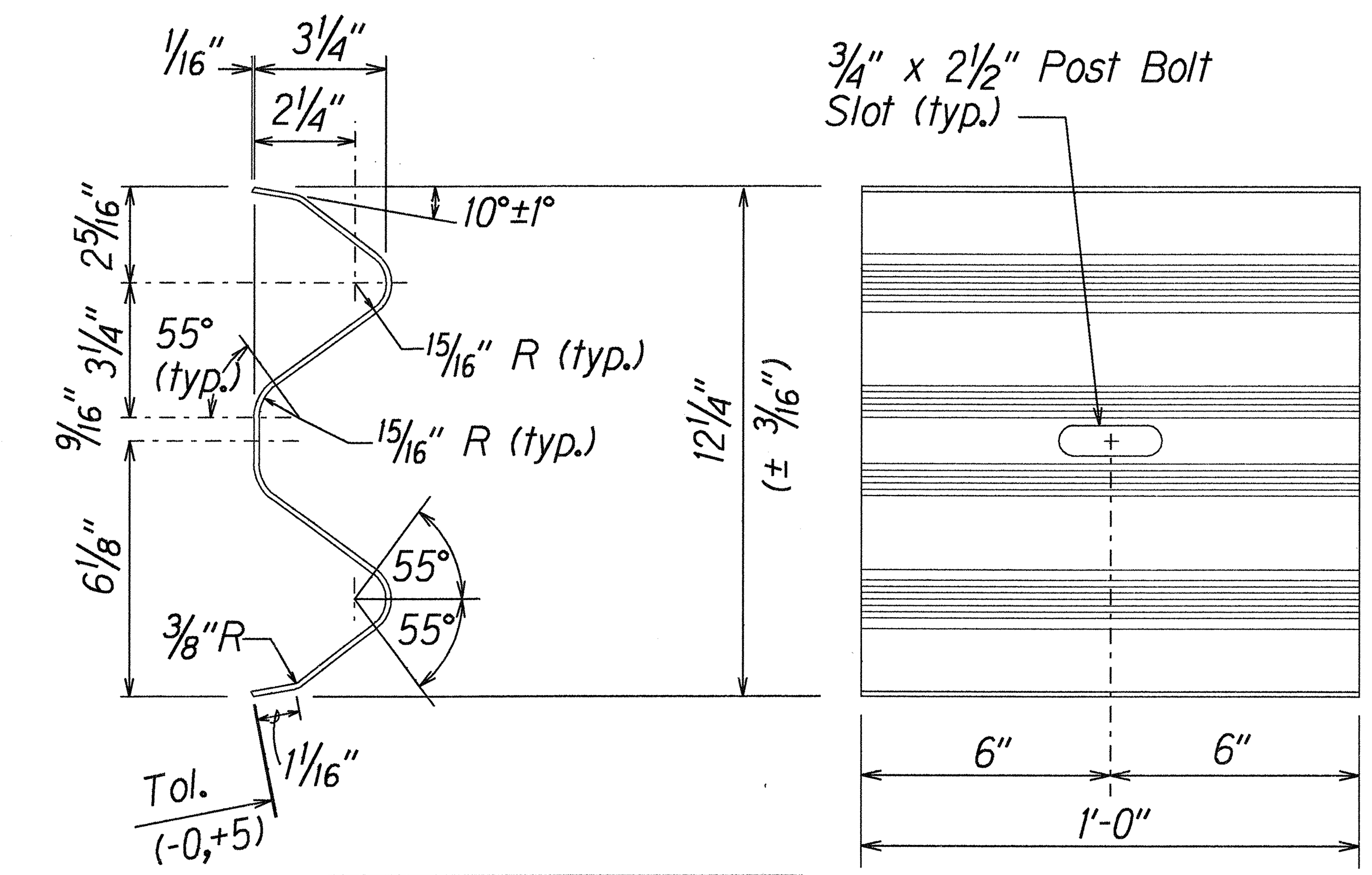
FRONT

W-BEAM STRONG POST (PWE01)



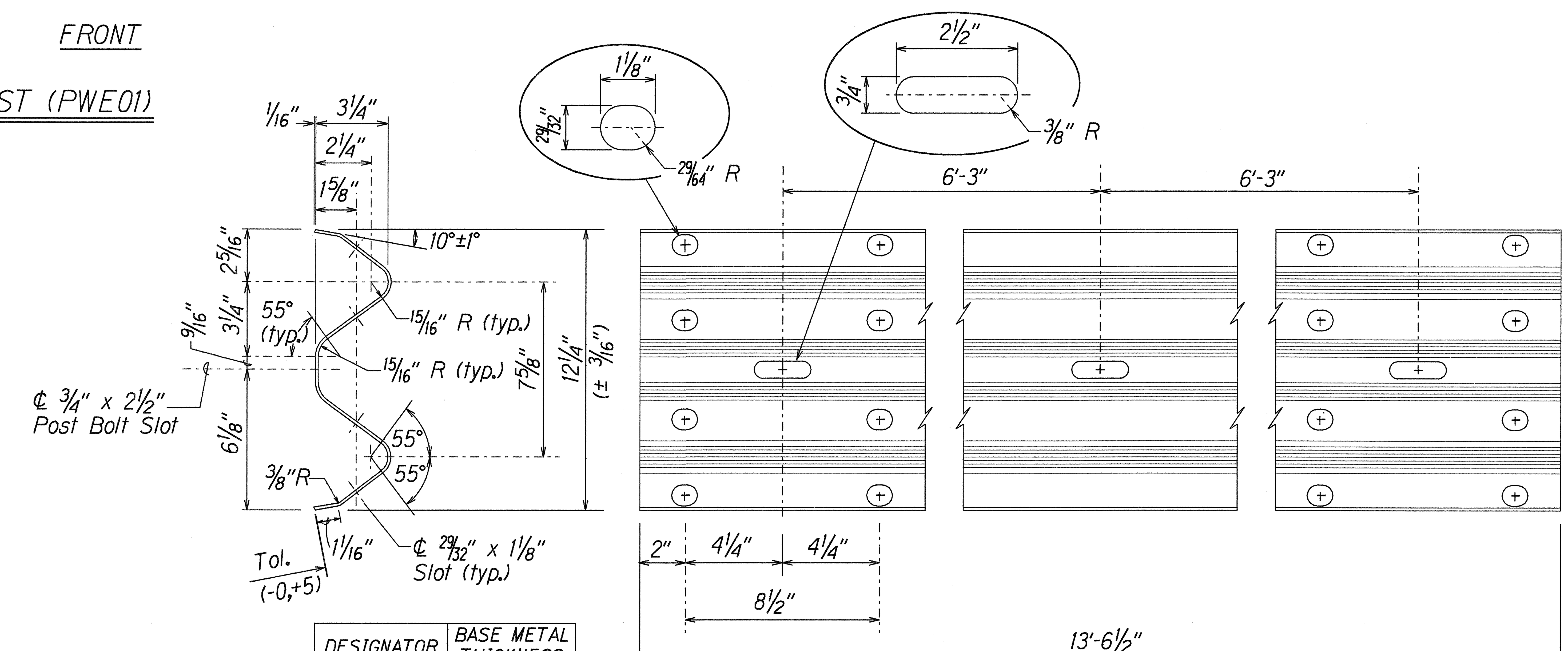
DESIGNATOR	L
FBB01	1⅜"
FBB02	2"
FBB03	10"

GUARDRAIL BOLTS AND
RECESSED NUT



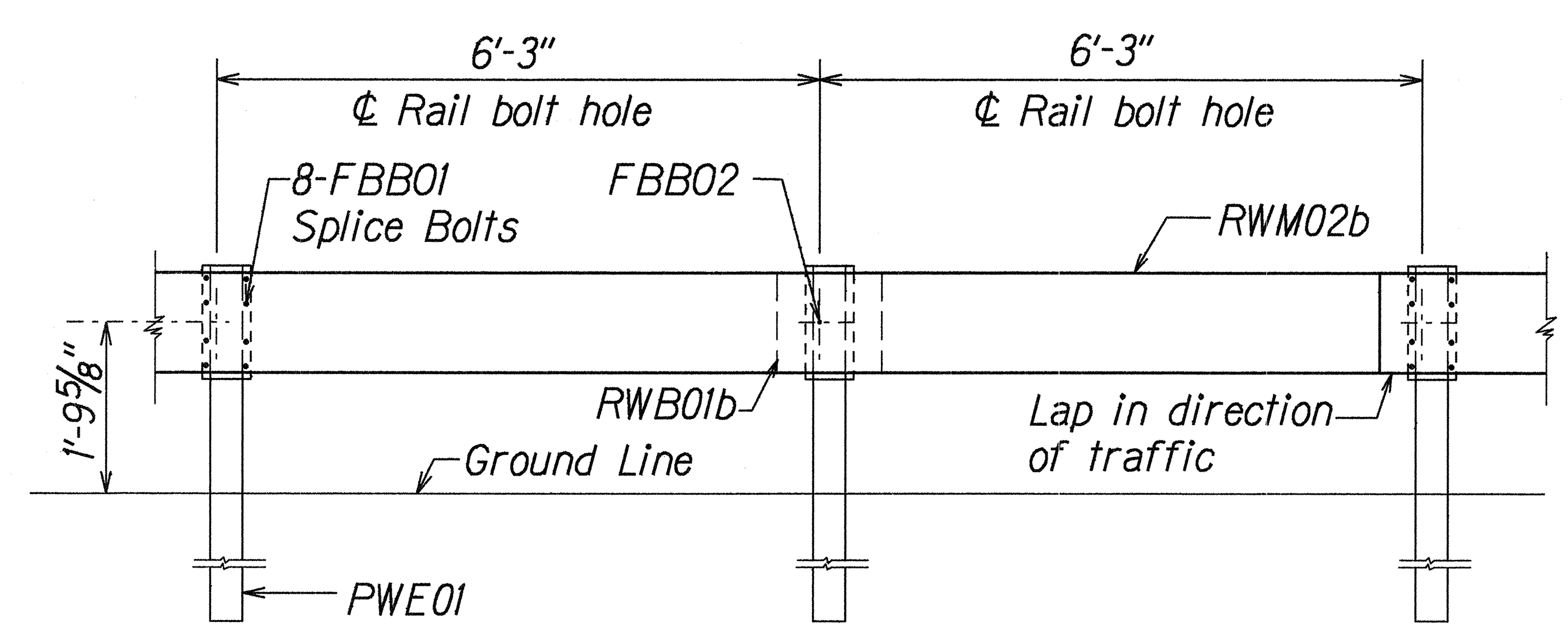
DESIGNATOR	BASE METAL THICKNESS
RWB01b	17/128"

W-BEAM BACK-UP-PLATE (RWB01b)



DESIGNATOR	BASE METAL THICKNESS
RWM02b	17/128"

2 SPACE W-BEAM GUARDRAIL (RWM02b)



ELEVATION

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

ORIGINAL PLAN	SURVEY PLOTTED BY / DRAWN BY / TRACED BY / DESIGNED BY / QUANTITIES BY / CHECKED BY	DATE
NOTE BOOK / No.		

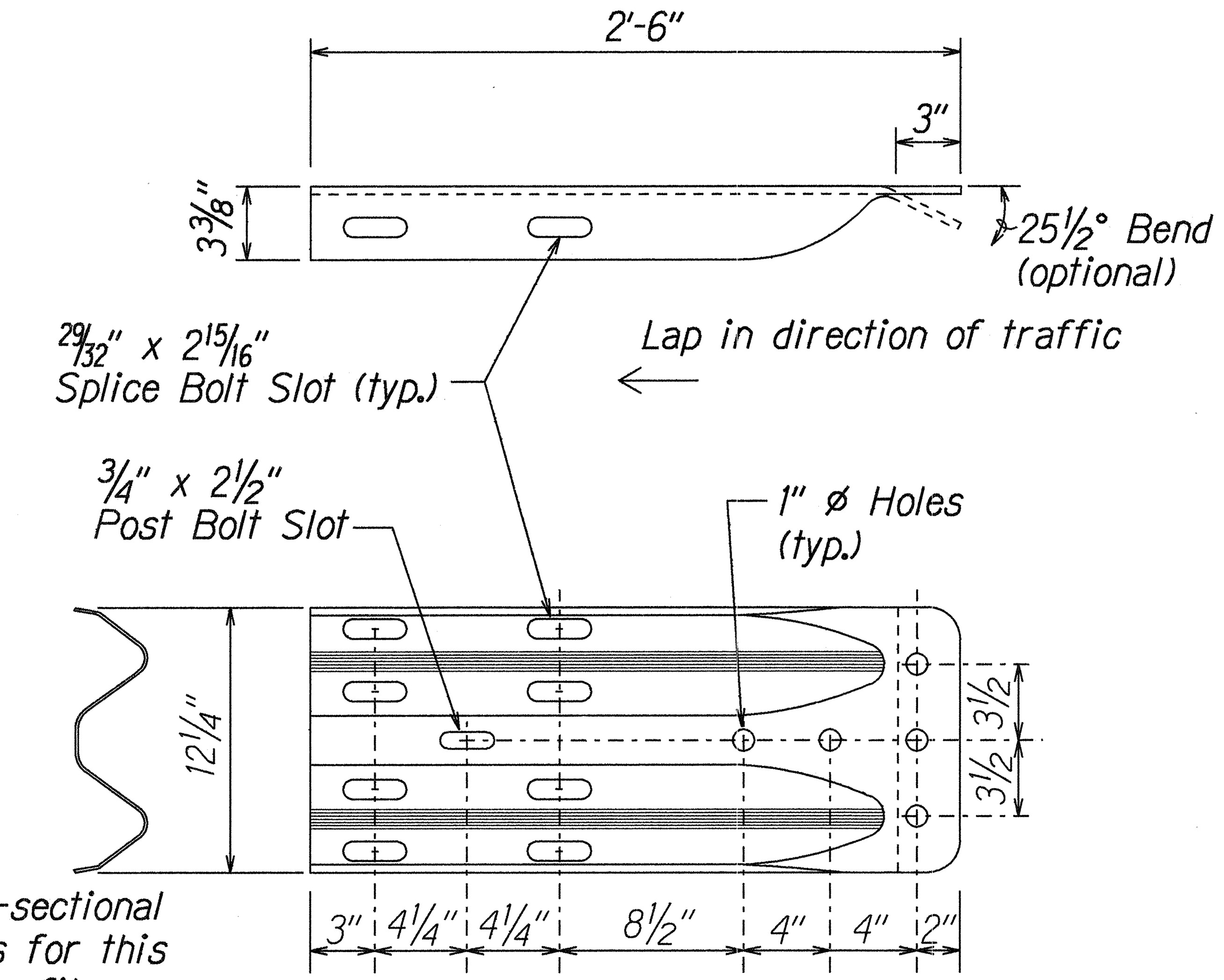
STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRONG POST W-BEAM GUARDRAIL

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS TO
KALOKO-HONOKOHAU NATIONAL HISTORICAL PARK
PROJECT NO. FLH-019-1(26)

Scale: Noted Date: Aug., 1999

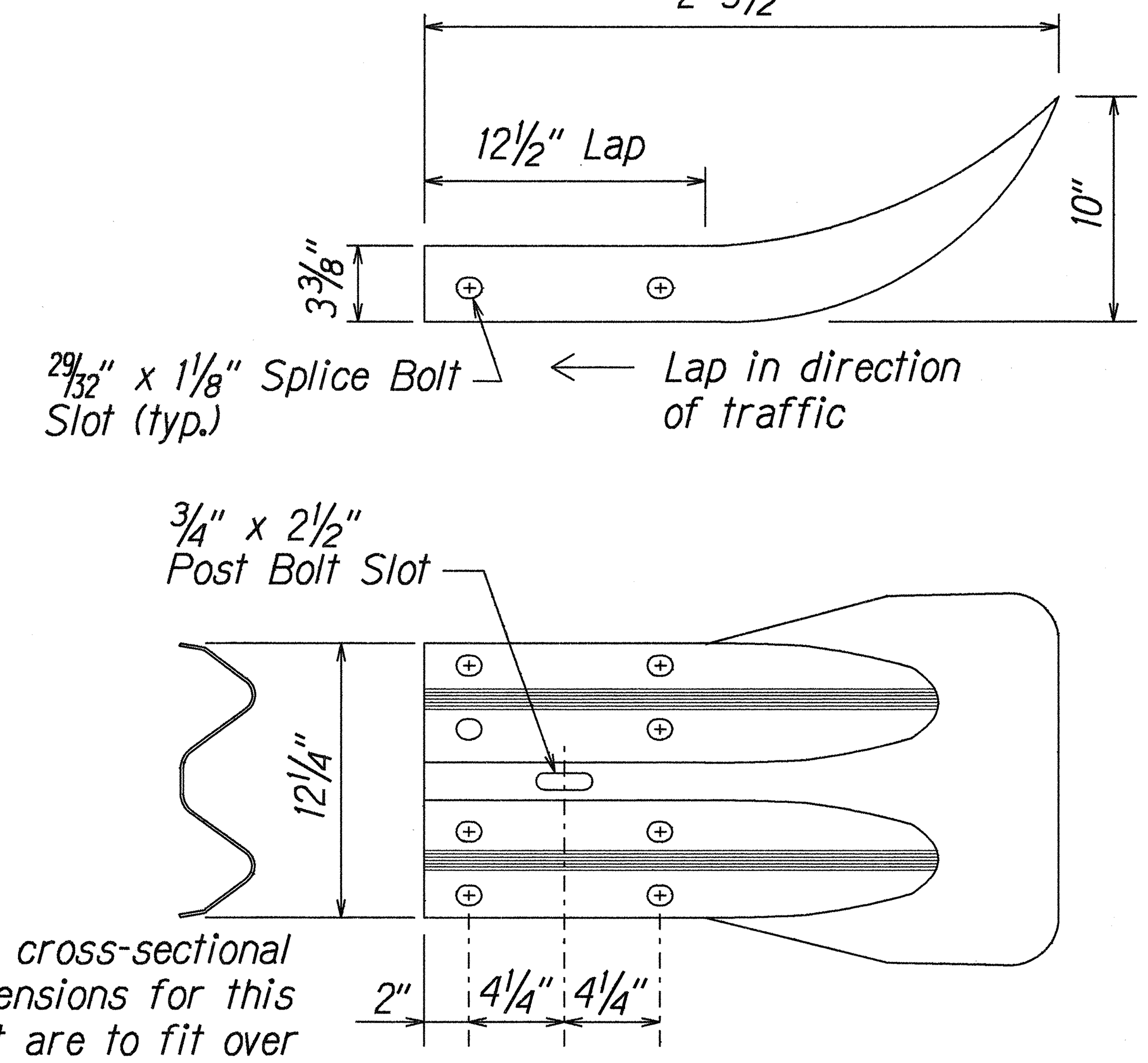
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	23	46



The cross-sectional dimensions for this part are to fit over part RWM02b on the approach end and under part RWM02b on the trailing end.

DESIGNATOR	BASE METAL THICKNESS
RWE02b	17/128"

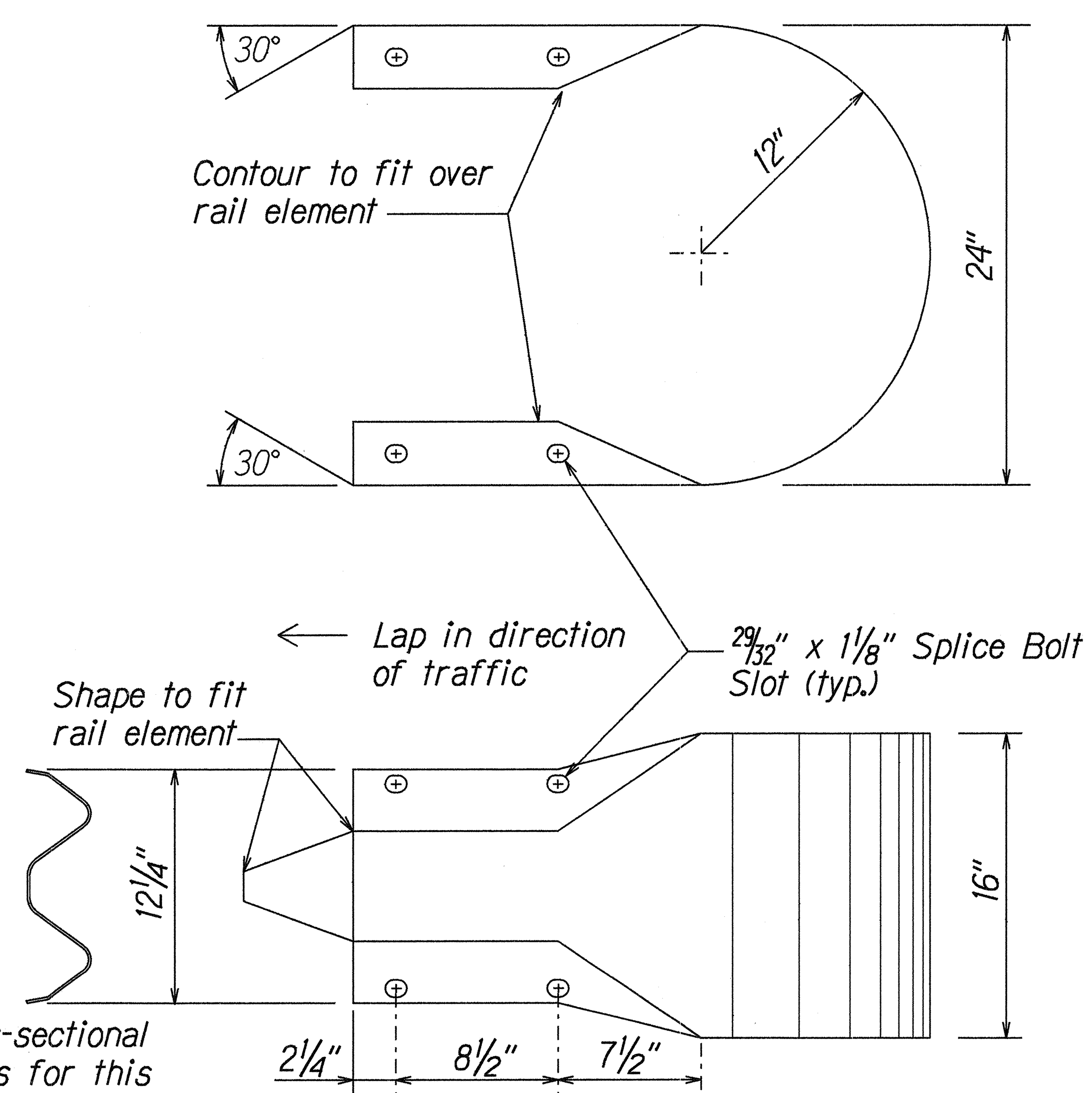
W-BEAM TERMINAL CONNECTOR (RWE02b)



The cross-sectional dimensions for this part are to fit over part RWM02b on the approach end and under part RWM02b on the trailing end.

DESIGNATOR	BASE METAL THICKNESS
RWE01b	17/128"

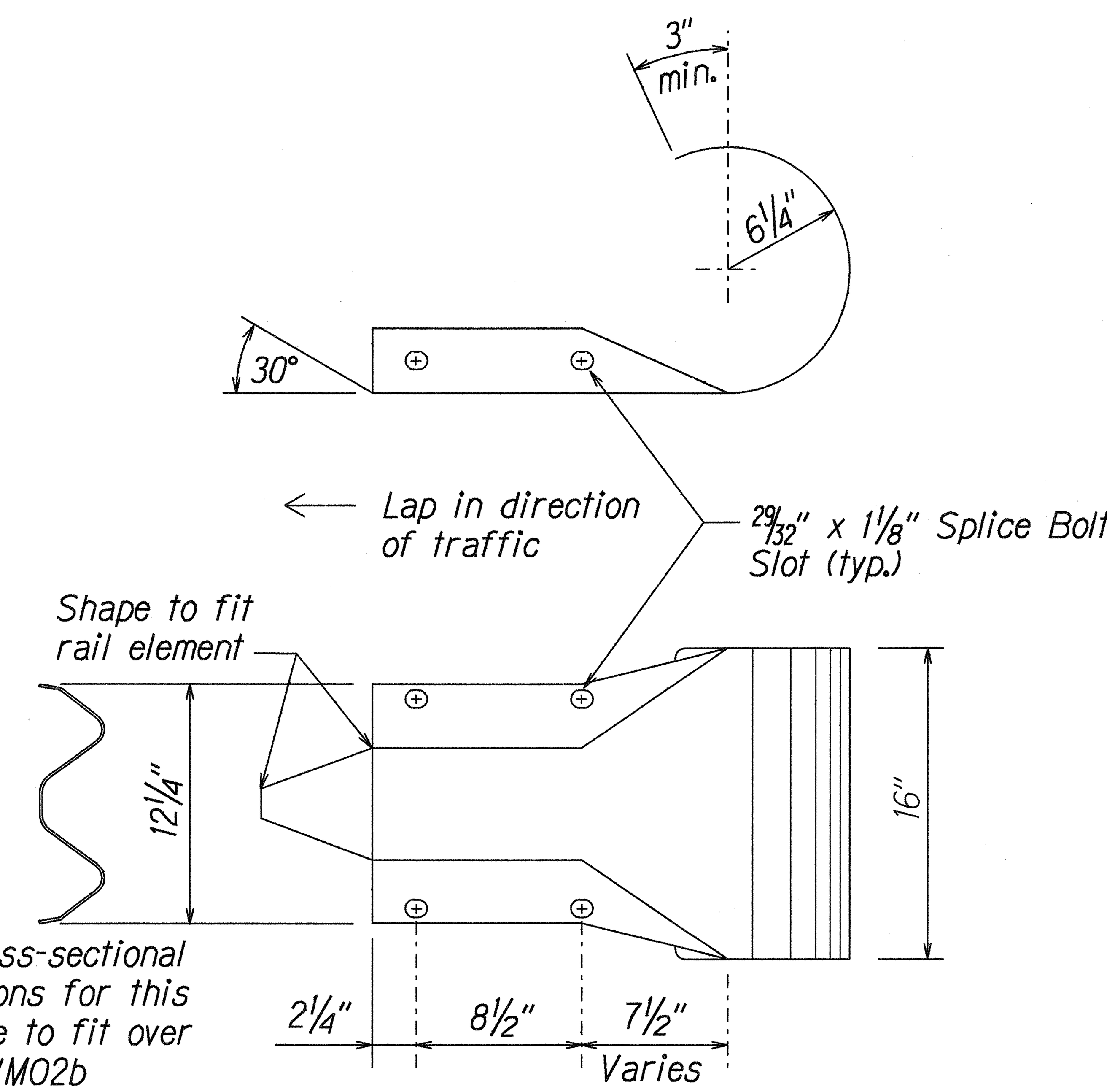
W-BEAM END SECTION (FLARED RWE01b)



The cross-sectional dimensions for this part are to fit over part RWM02b

DESIGNATOR	BASE METAL THICKNESS
RWE06b	17/128"

W-BEAM END SECTION (BUFFER RWE06b)



The cross-sectional dimensions for this part are to fit over part RWM02b

DESIGNATOR	BASE METAL THICKNESS
RWE03a	7/64"

W-BEAM END SECTION (ROUNDED RWE03a)

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

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

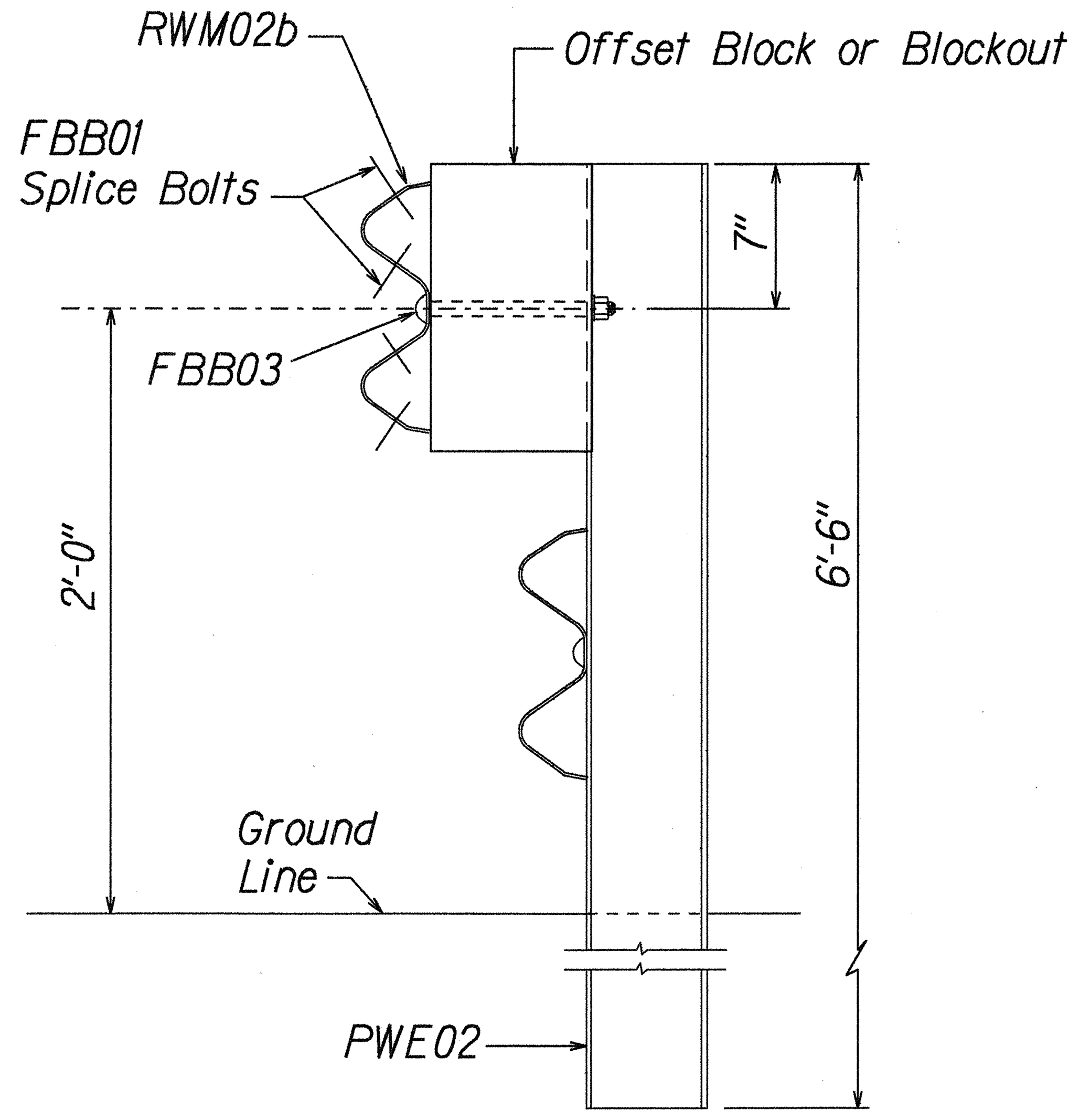
STRONG POST W-BEAM GUARDRAIL

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS TO
KALOKO-HONOKŌHAU NATIONAL HISTORICAL PARK
PROJECT NO. FLH-019-1(26)

Scale: Noted Date: Aug., 1999

SHEET No. 5 OF 13 SHEETS

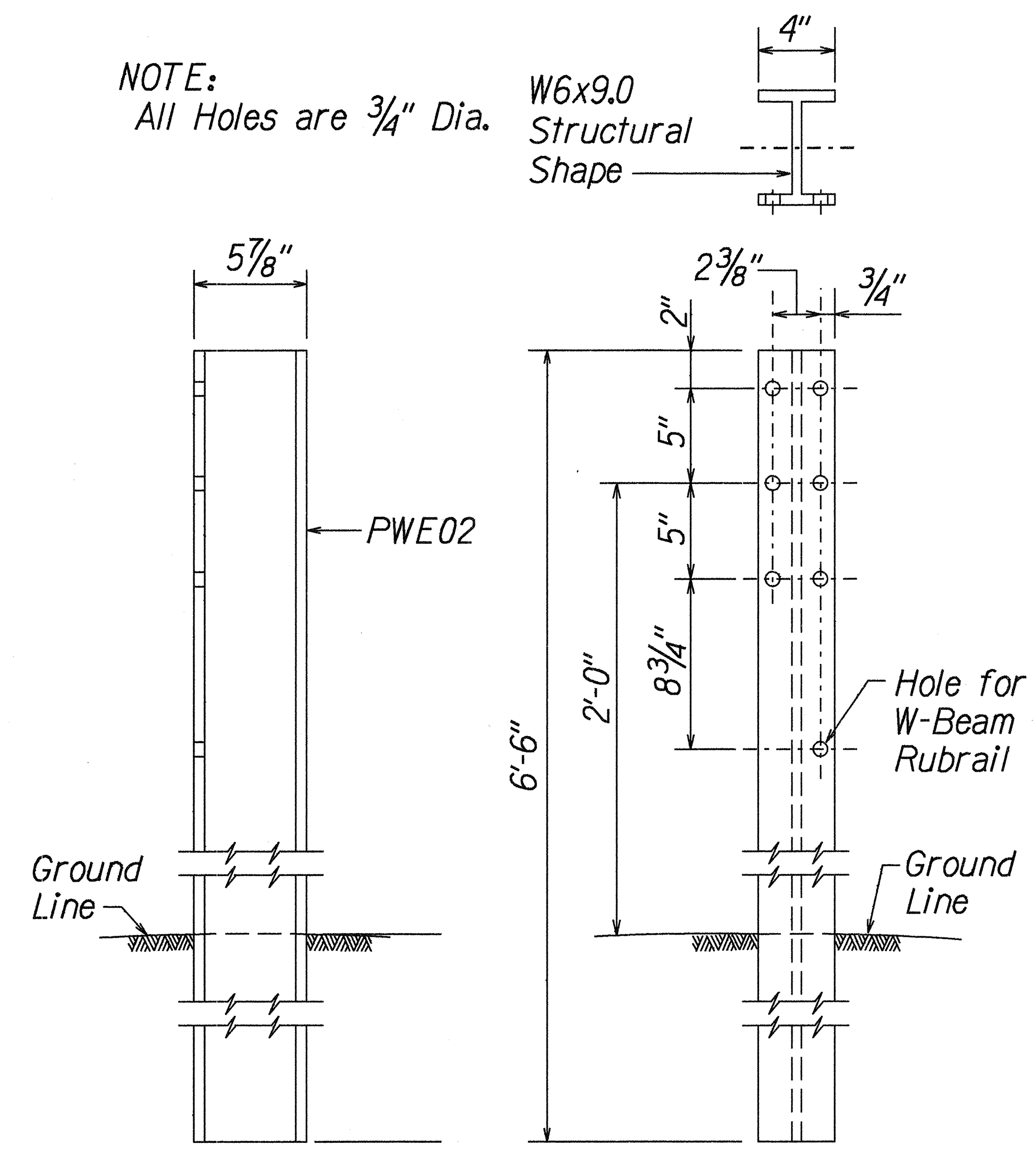
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	24	46



ELEVATION

STRONG POST RUBRAIL (W-BEAM) GUARDRAIL

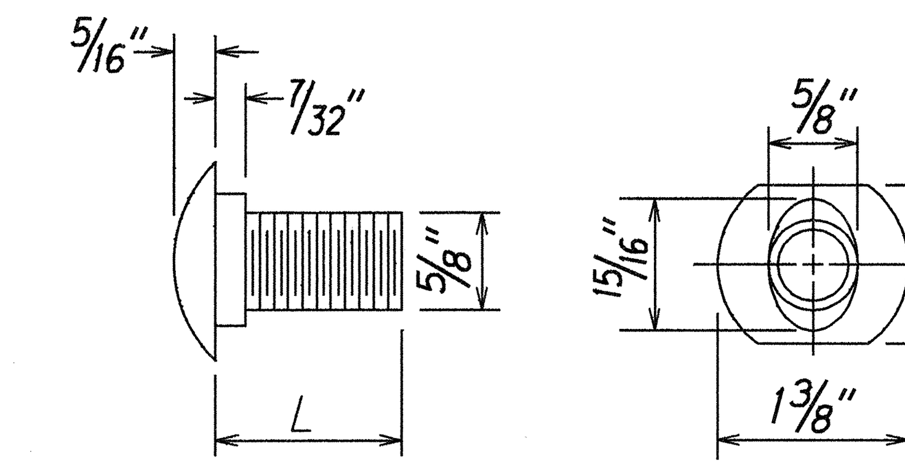
NOTE:
All Holes are 3/4" Dia.



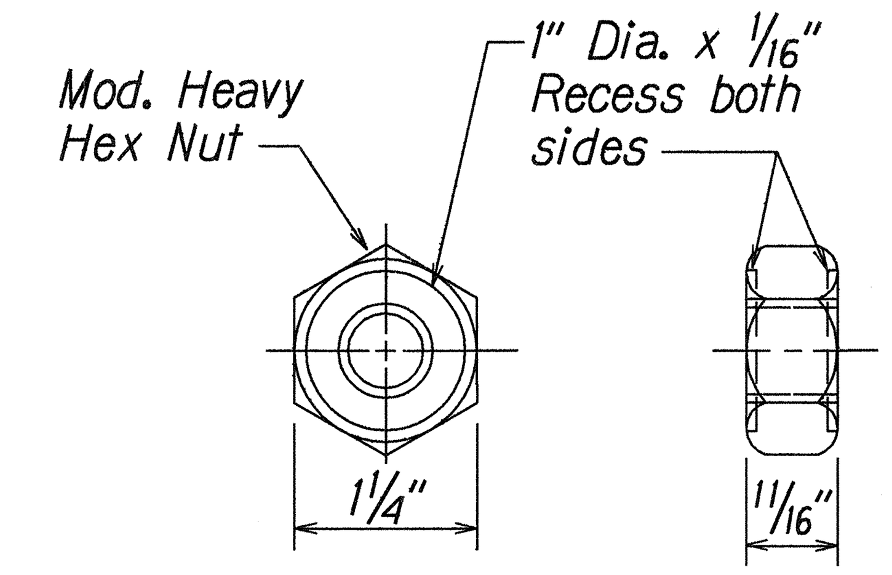
SIDE

FRONT

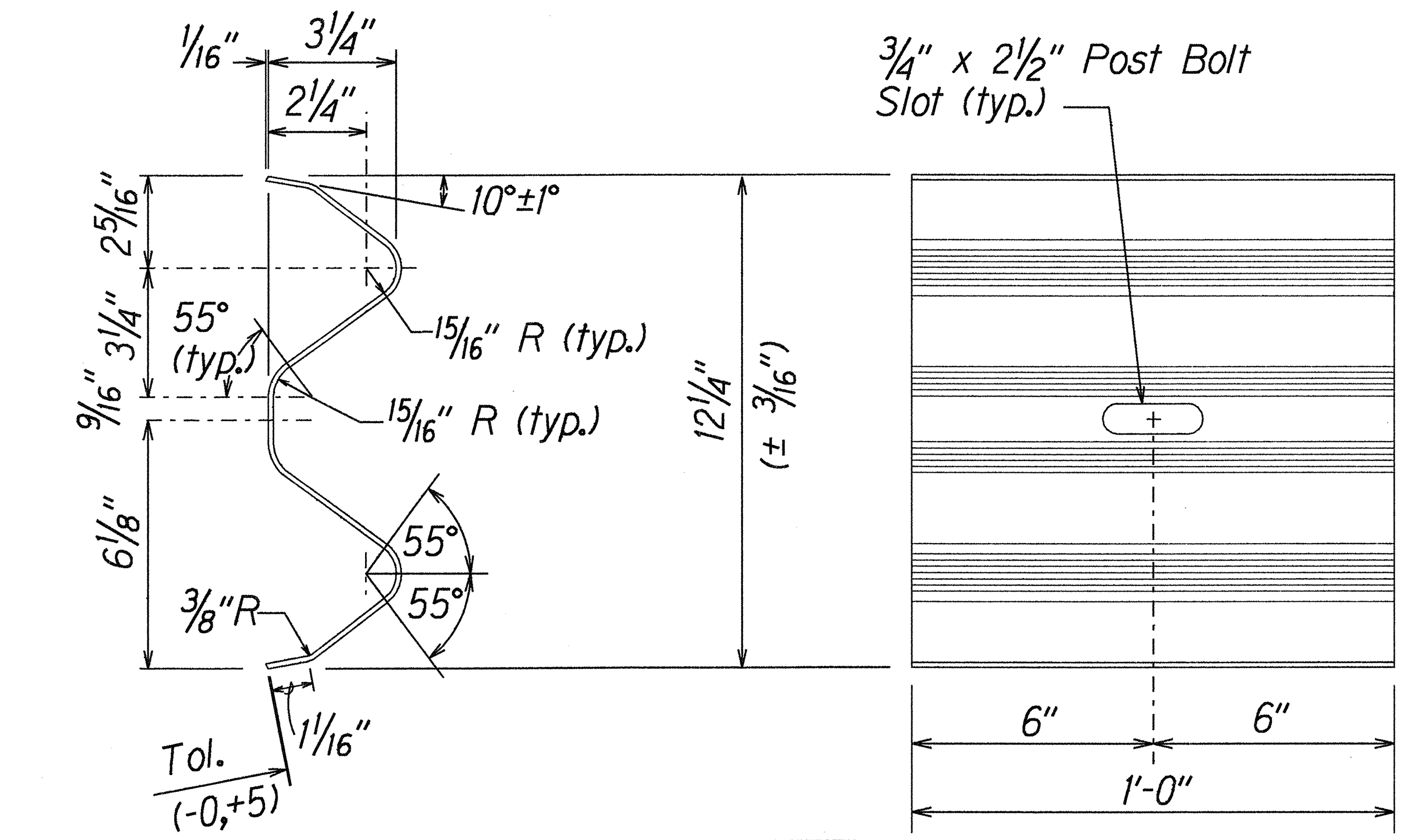
W-BEAM STRONG POST (PWE02)



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

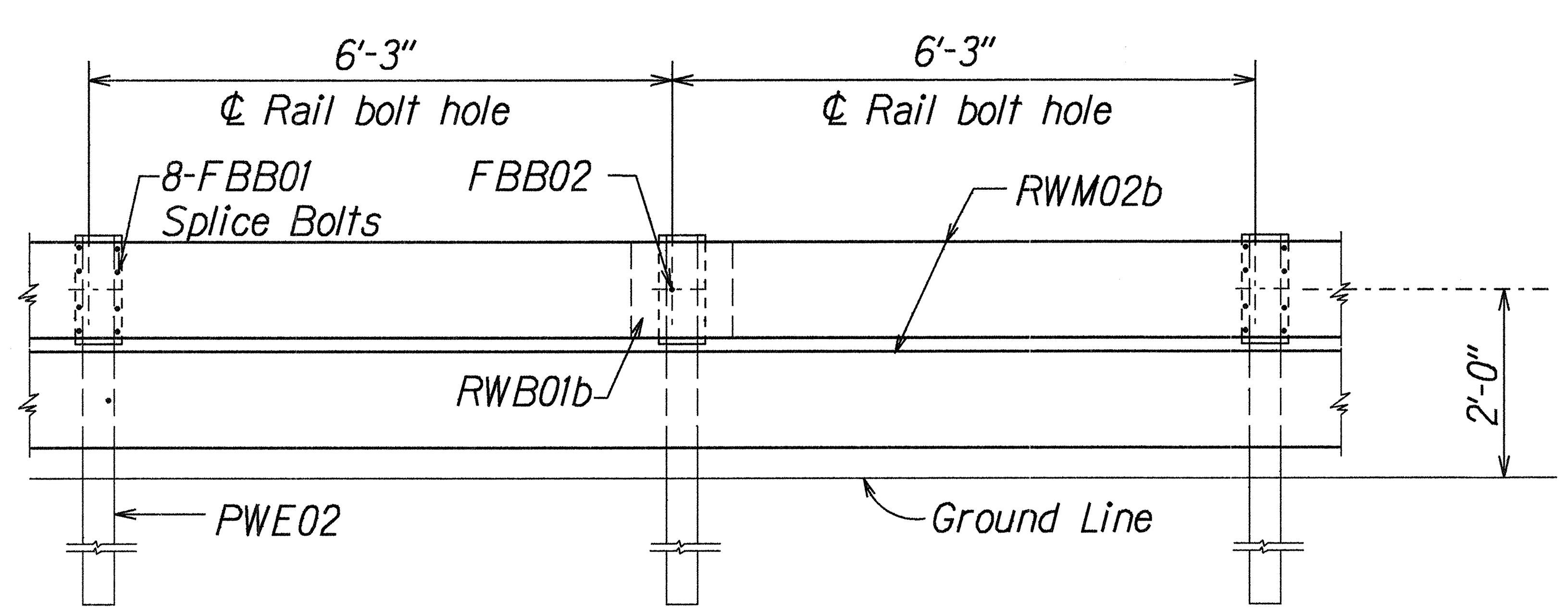


GUARDRAIL BOLTS AND RECESSED NUT



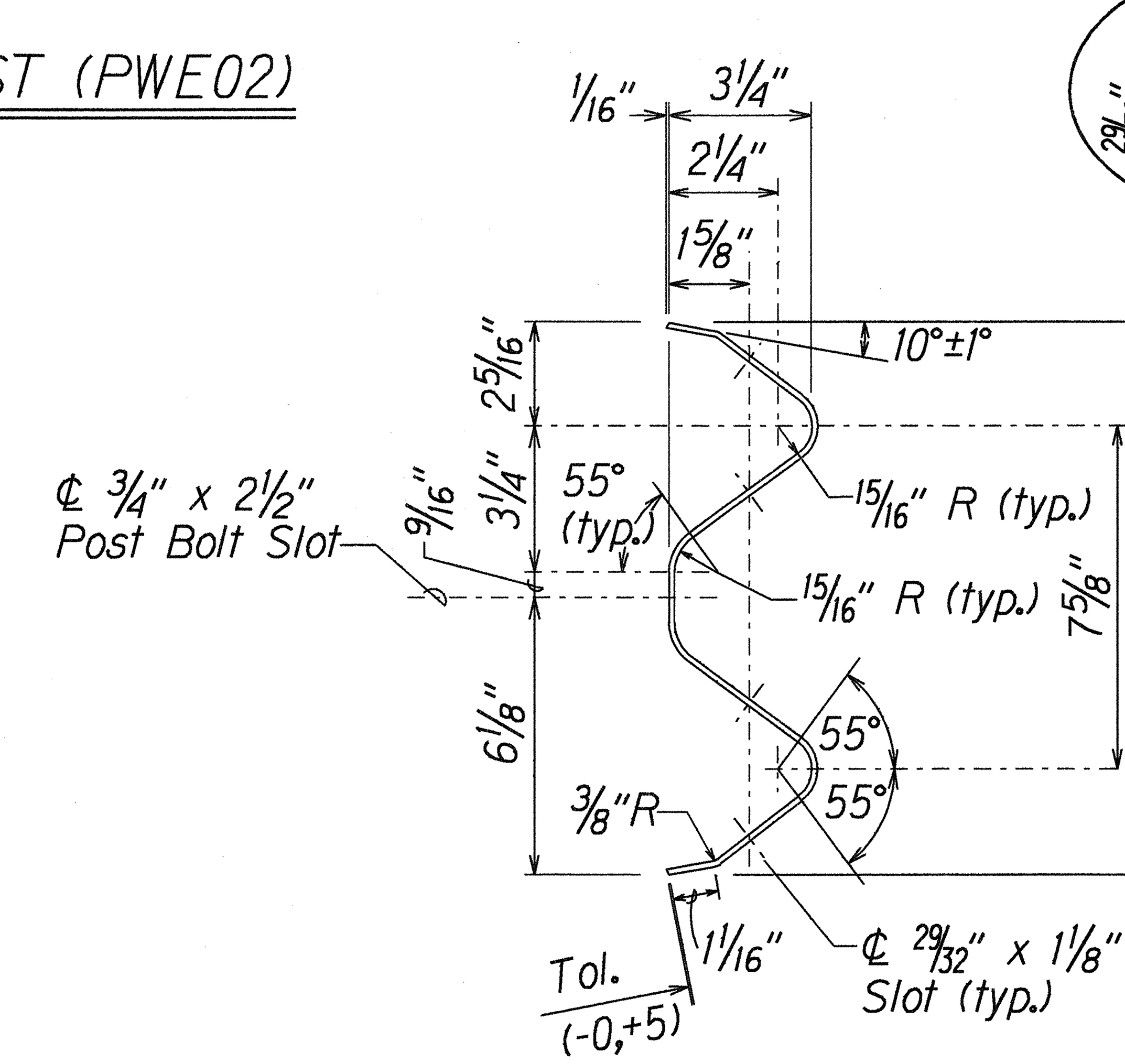
DESIGNATOR	BASE METAL THICKNESS
RWB01b	17/128"

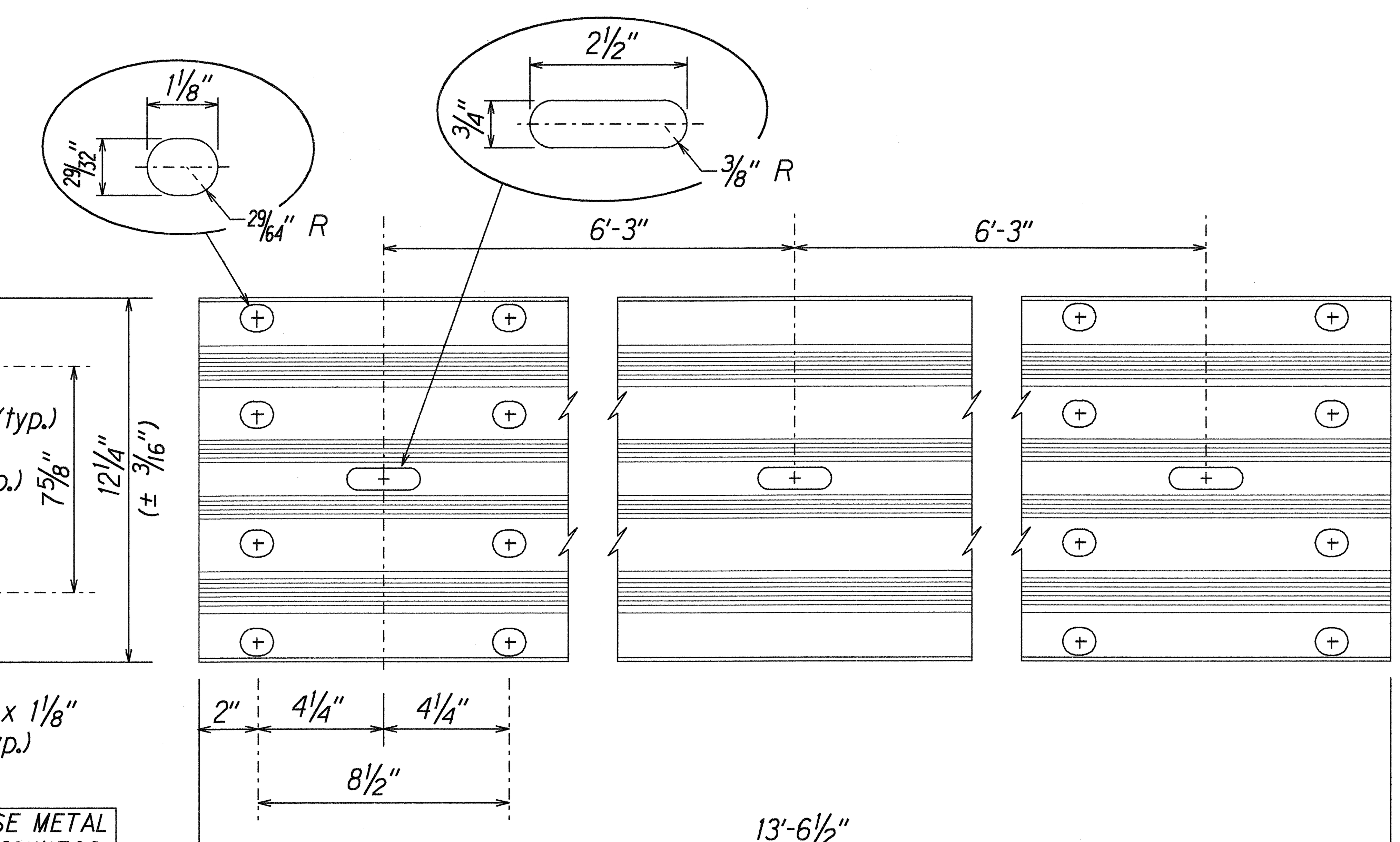
W-BEAM BACK-UP-PLATE (RWB01b)



ELEVATION

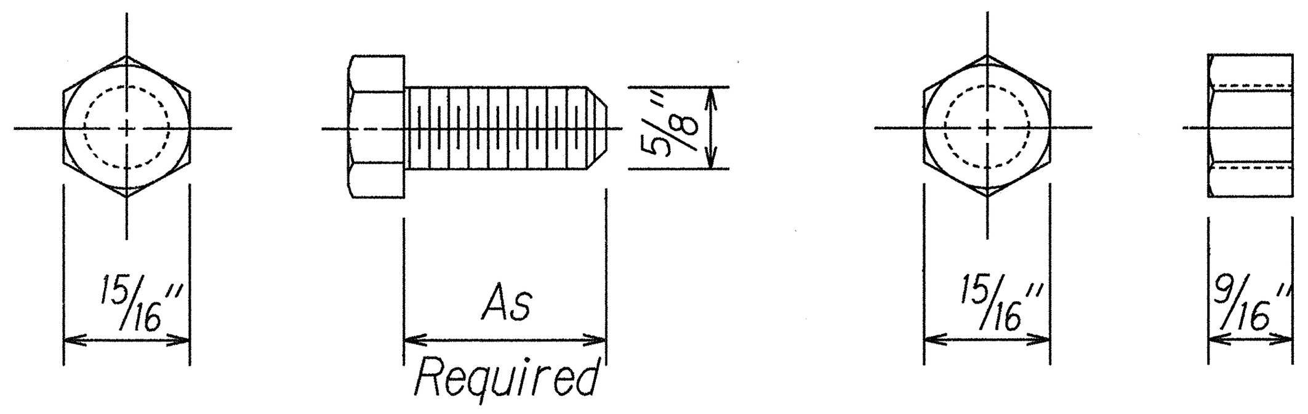
STRONG POST RUBRAIL (W-BEAM) GUARDRAIL WITH RECYCLED OFFSET BLOCK OR PLASTIC BLOCKOUT





DESIGNATOR	BASE METAL THICKNESS
RWM02b	17/128"

2 SPACE W-BEAM GUARDRAIL (RWM02b)



HEX BOLT & NUT (FBX16a)

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
NOTE BOOK 8qthab4	DRAWN BY X	
No. dgn	TRACED BY X	
	DESIGNED BY X	
	QUANTITIES BY	
	CHECKED BY	

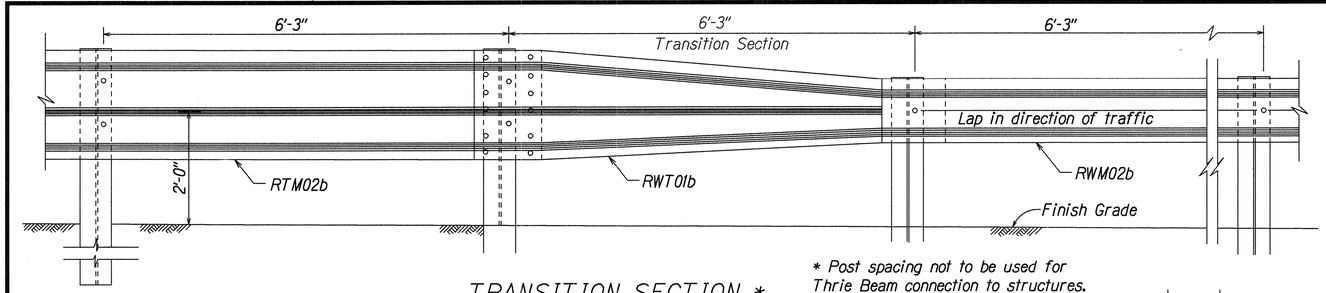
STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRONG POST RUBRAIL (W-BEAM) GUARDRAIL

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS
PROJECT NO. FLH-019-1(26)

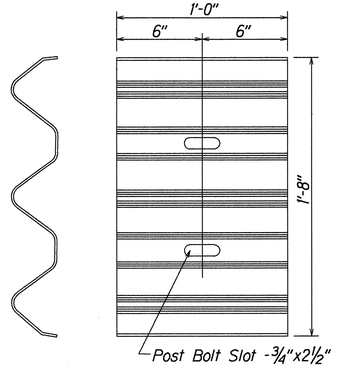
Scale: As Shown   Date: Aug., 1999

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	25	46



TRANSITION SECTION *

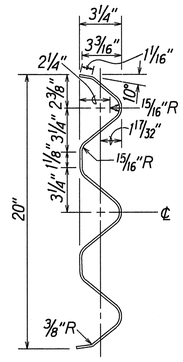
* Post spacing not to be used for Thrie Beam connection to structures.



BACKUP PLATE

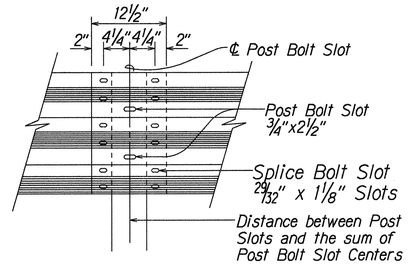
(RTB01b)

(Use at Posts where Splices do not occur)

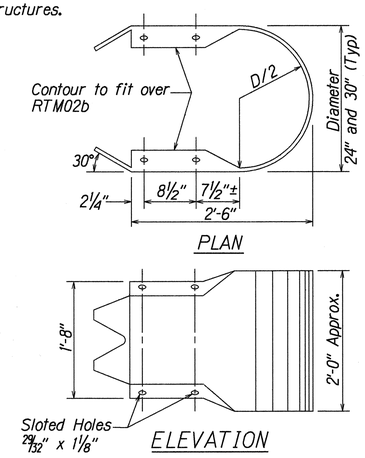


SECTION THRU RAIL ELEMENT

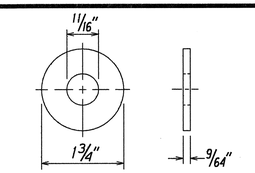
(RTM02b)



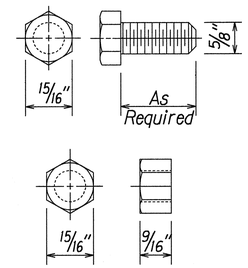
RAIL SPLICE



END SECTION (BUFFER RTE03b or RTE04b)



STEEL WASHER FOR 5/8" BOLT

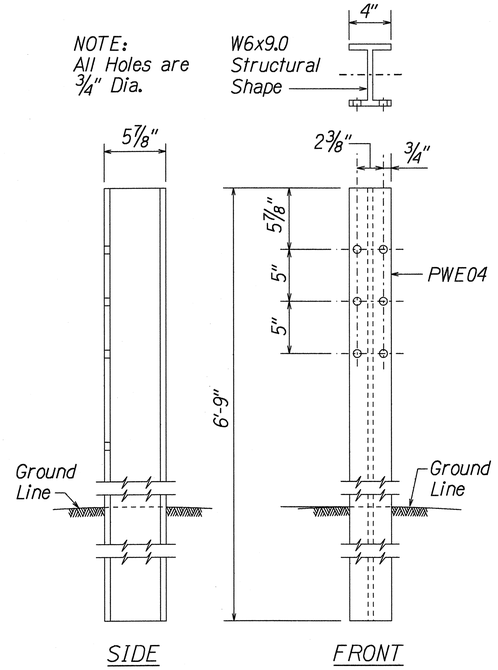


HEX BOLT & NUT

(FBX16a)

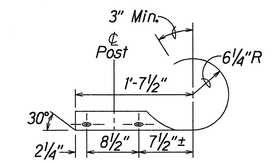
NOTE:
All Holes are 3/4" Dia.

W6x9.0 Structural Shape

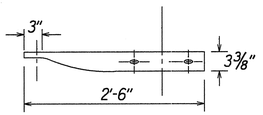


SIDE FRONT

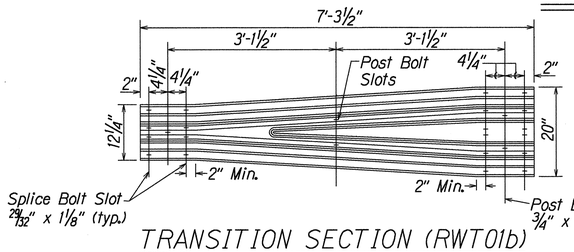
W-BEAM STRONG POST (PWE04)



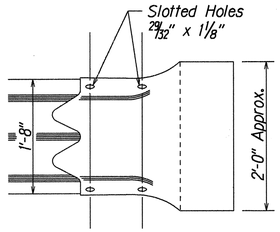
PLAN



PLAN



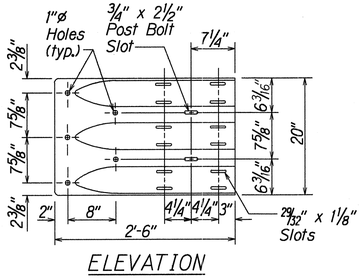
TRANSITION SECTION (RWT01b)



ELEVATION

SECTION (ROUNDED)

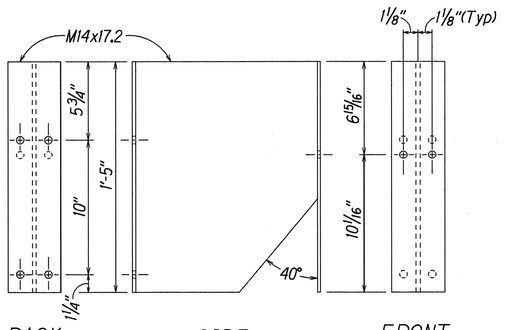
(RTE02b)



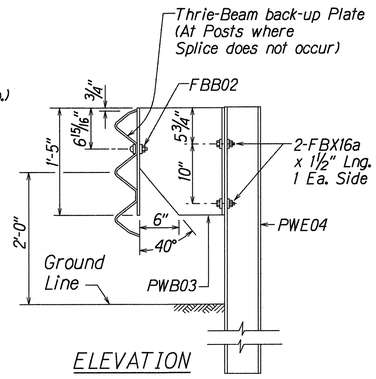
ELEVATION

TERMINAL CONNECTOR

(RTE01b)



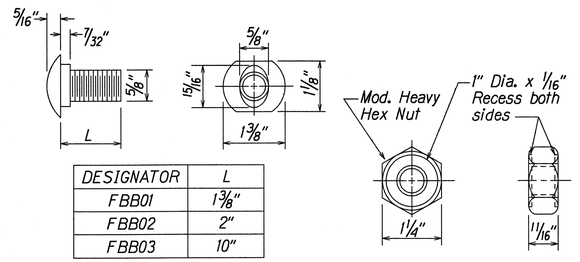
SPACER BLOCK PWB03



ELEVATION

STRONG POST MODIFIED THRIE-BEAM GUARDRAIL

(SGR09b)



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

GUARDRAIL BOLTS AND RECESSED NUT

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY X	
	TRACED BY Y	
	DESIGNED BY	
NOTE BOOK dated	QUANTITIES BY	
No. dgn	CHECKED BY	

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

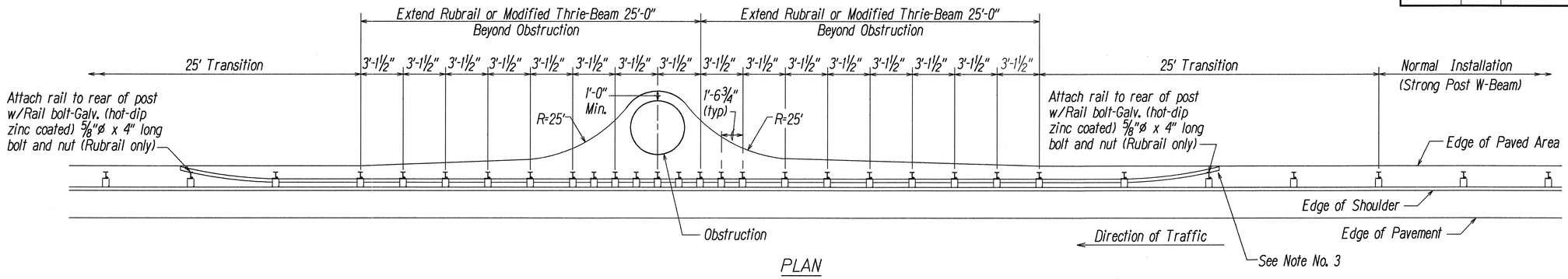
STRONG POST MODIFIED THRIE-BEAM GUARDRAIL

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS
PROJECT NO. FLH-019-1(26)

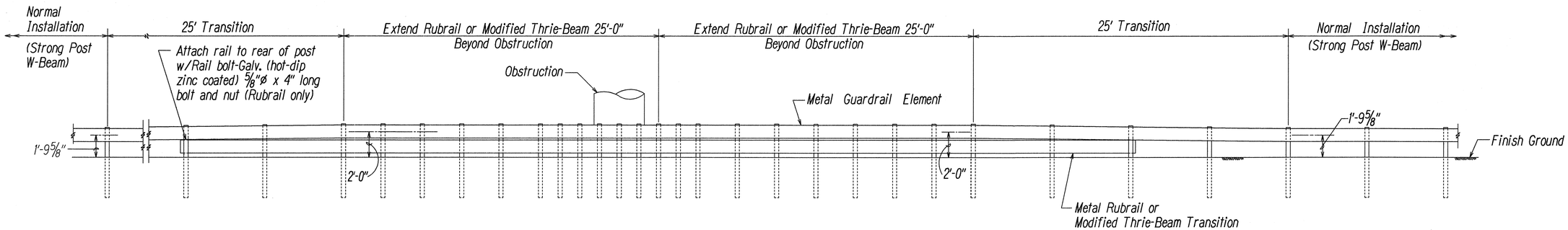
Scale: As Shown Date: Aug., 1999

SHEET No. 7 OF 15 SHEETS

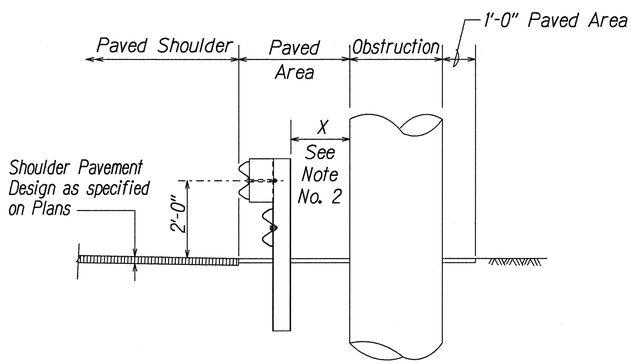
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	26	46



PLAN



ELEVATION



TYPICAL SECTION AT OBSTRUCTION

DETAIL OF GUARDRAIL INSTALLATION AT OBSTRUCTION

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 Modified Thrie-Beam with reduced post spacing.
   $3'-0" \leq X$, Strong Post W-Beam or Modified Thrie-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 Modified Thrie-Beam System. The rubrail termini may become a hazard to pedestrians & bicyclists.

ORIGINAL PLAN
SURVEY PLOTTED BY — DATE
DRAWN BY X
TRACED BY
DESIGNED BY X
QUANTITIES BY
CHECKED BY
NOTE BOOK Bakhaus
No. dgn

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

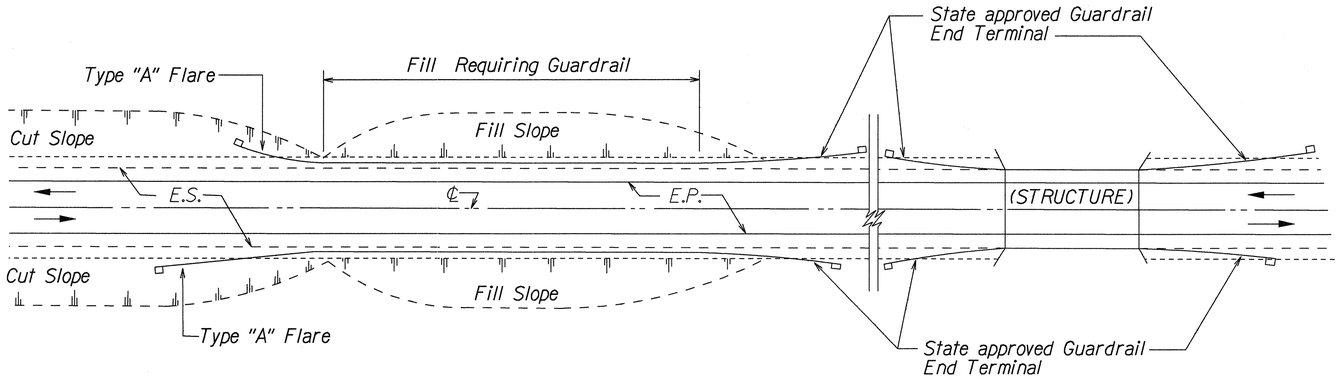
GUARDRAIL DETAILS (AT OBSTRUCTION)

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS
PROJECT NO. FLH-019-1(26)

Scale: NTS Date: Aug., 1999

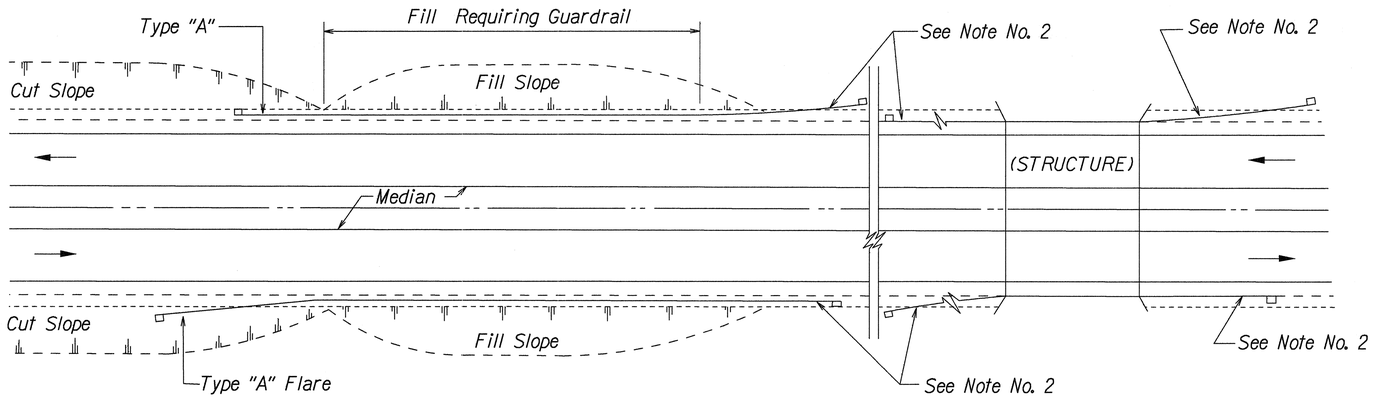
SHEET No. 8 OF 15 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	27	46



PLAN

TWO WAY ROADWAY



PLAN

ONE WAY ROADWAY (DIVIDED HIGHWAY)

NOTES:

1. Metal Guardrail connection to concrete structures requires End Post Connection. See Structure Plans.
2. Depending on the existing field conditions, the Engineer shall determine which guardrail end terminal should be installed.
3. Refer to State's most current approved Product List for NCHRP 350 approved Guardrail End Terminals.

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY X	
	TRACED BY	
NOTE BOOK	DESIGNED BY X	
No. dgn	QUANTITIES BY	
	CHECKED BY	

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

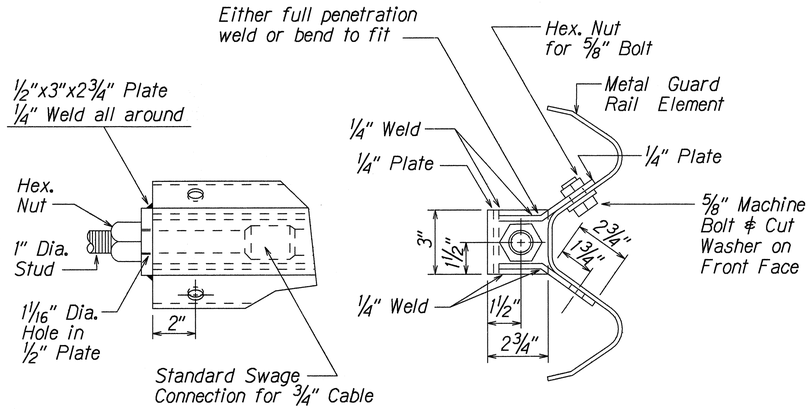
GUARDRAIL DETAILS APPROACH END FLARE

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS
PROJECT NO. FLH-019-1(26)

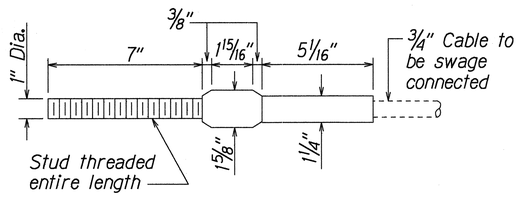
Scale: NTS Date: Aug., 1999

SHEET No. 9 OF 15 SHEETS

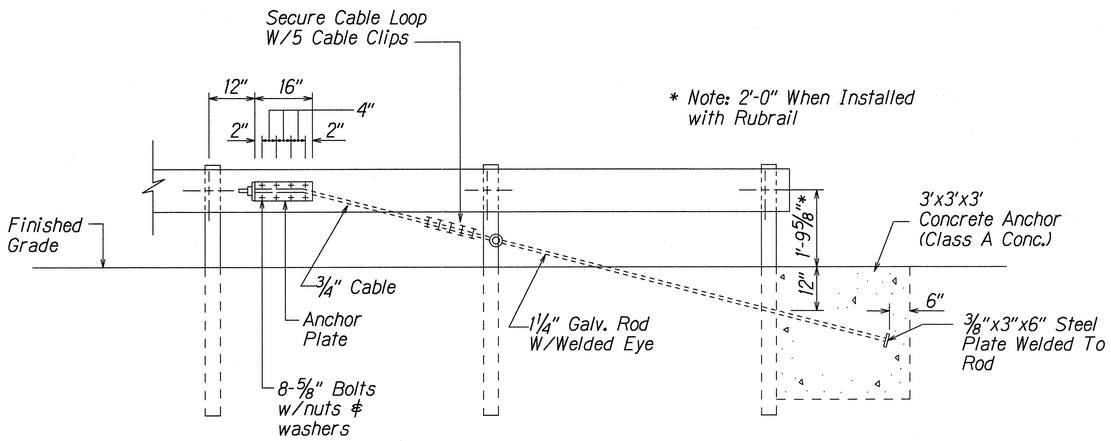
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	28	46



ANCHOR PLATE DETAILS

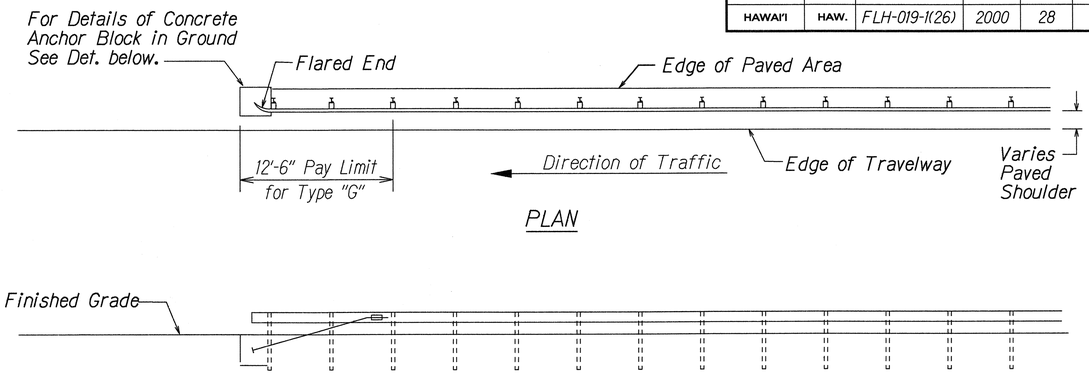


STANDARD SWAGED FITTING AND STUD



ANCHOR BLOCK DETAIL

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



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.

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY X	
	TRACED BY X	
NOTE BOOK Bathood No. 491	DESIGNED BY X	
	QUANTITIES BY	
	CHECKED BY	

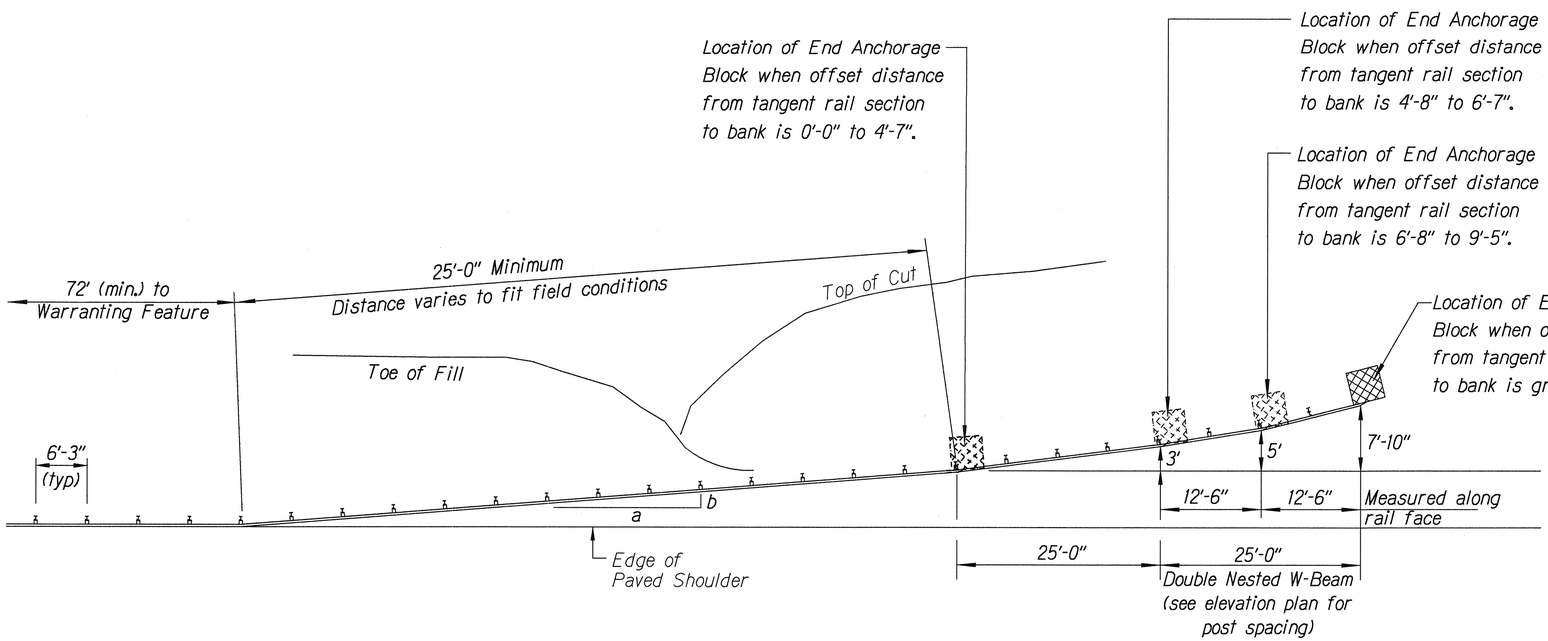
STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GUARDRAIL DETAILS
"G" MODIFIED FLARE END TERMINAL
QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS
PROJECT NO. FLH-019-1(26)

Scale: Noted Date: Aug., 1999

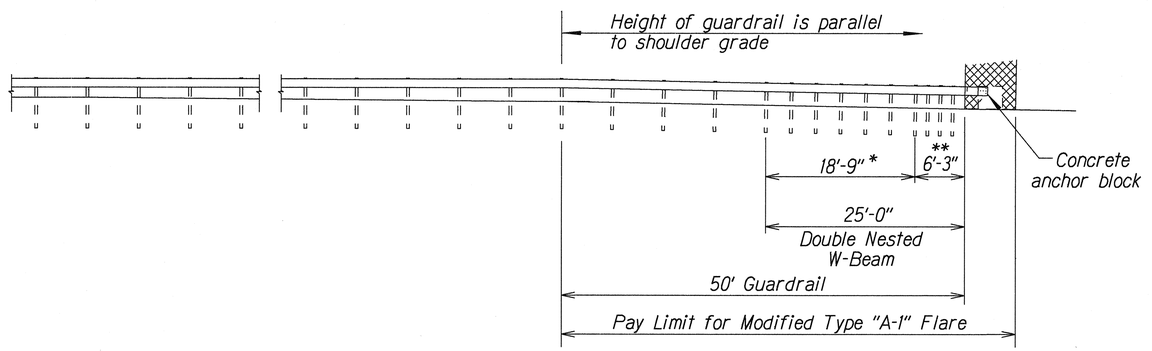
SHEET No. 10 OF 15 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	29	46



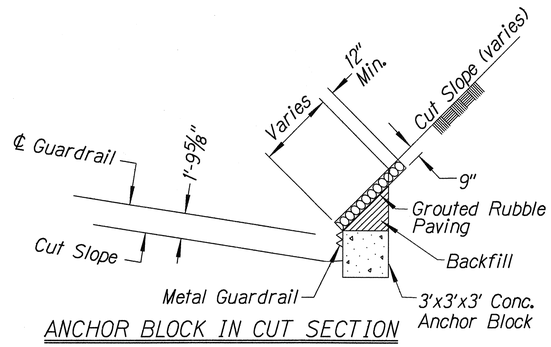
PLAN

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

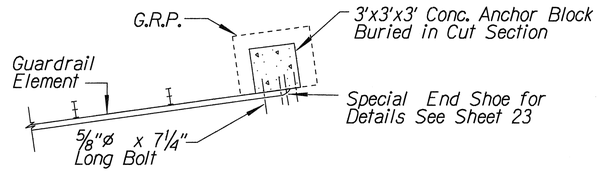


ELEVATION (Profile Along Rail)

* Posts at 3'-1½" o.c.
** Posts at 1'-6¾" o.c.



ANCHOR BLOCK IN CUT SECTION



PLAN - ANCHOR BLOCK IN CUT SECTION

General Notes

1. All posts are 8'-0" in length within the 50'-0" pay limit for the Modified Type "A-1" Flare.
2. 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.
3. Limit of payment for Modified Type "A-1" Flare shall be 50'-0" from End Shoe including Anchor Block and GRP work.
4. Excavation, Anchor Block, Backfill and GRP work shall be considered incidental to the Modified Type "A-1" Flare.

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

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

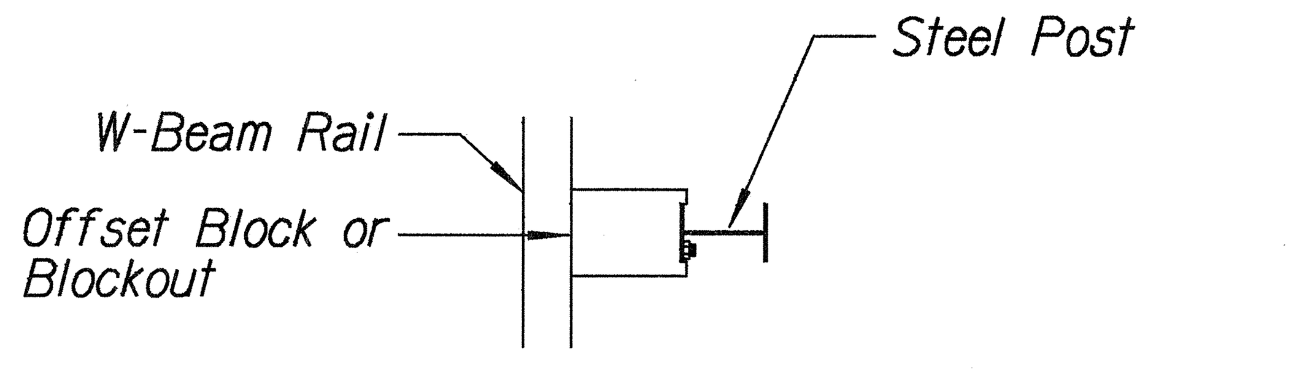
MODIFIED TYPE "A-1" FLARE

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS TO
KALOKO-HONOKOHAU NATIONAL HISTORICAL PARK
PROJECT NO. FLH-019-1(26)

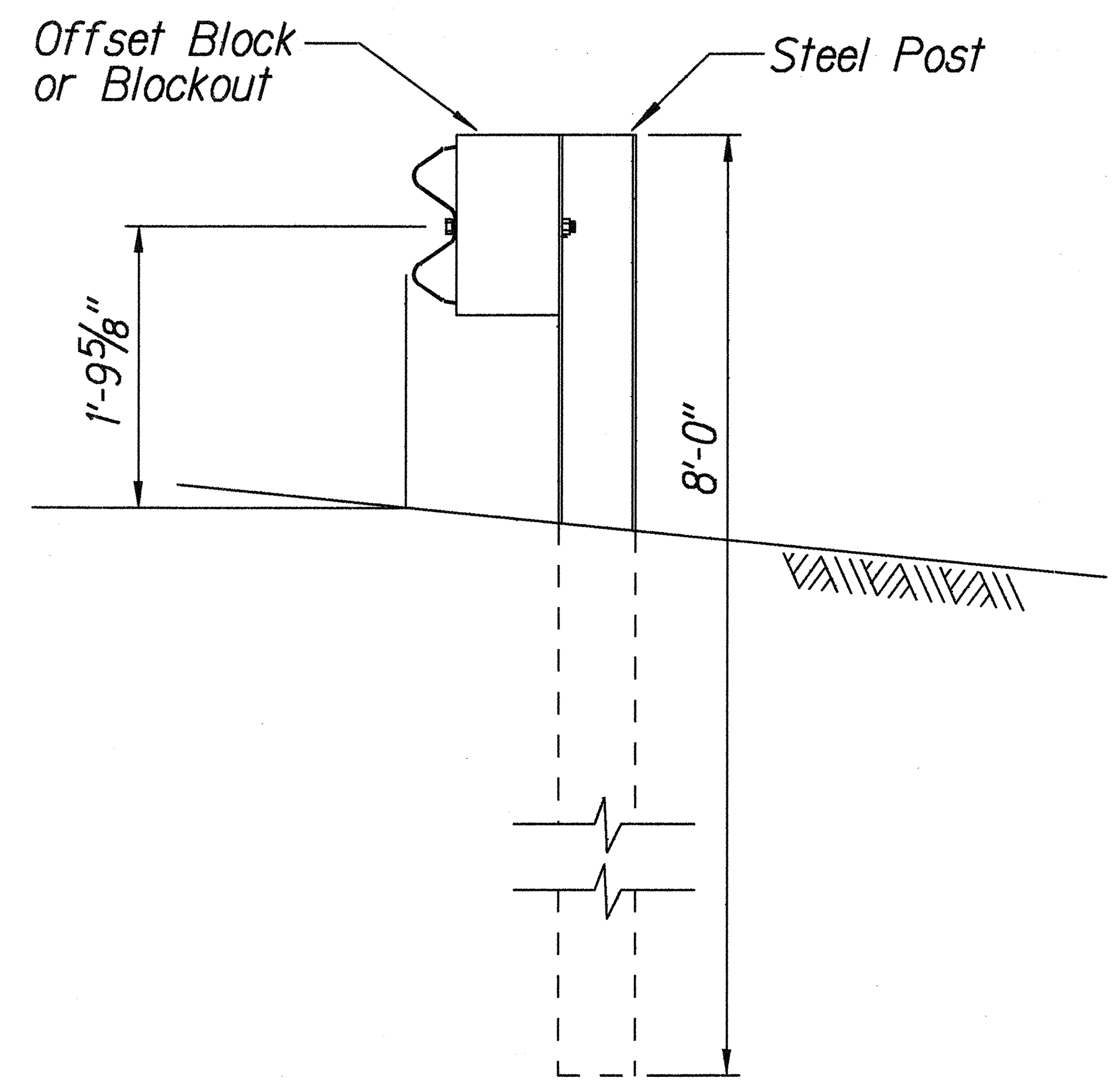
Scale: Noted Date: Aug., 1999

SHEET No. 11 OF 15 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	FLH-019-1(26)	2000	30	46

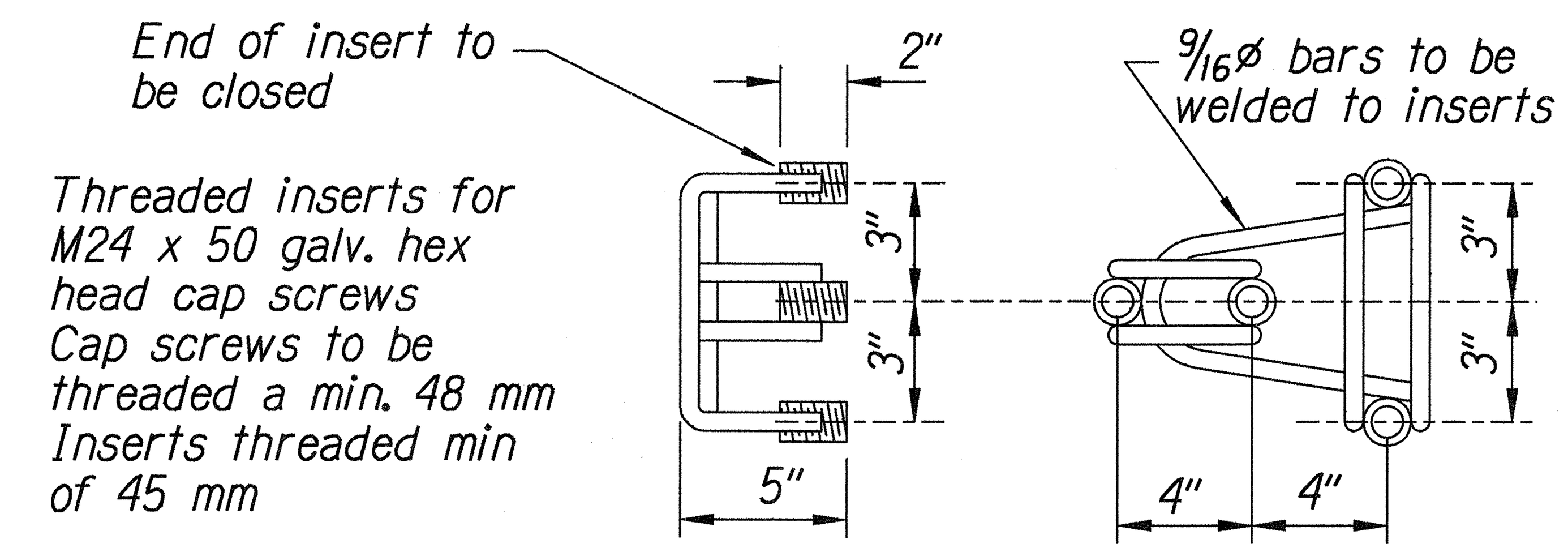


Plan

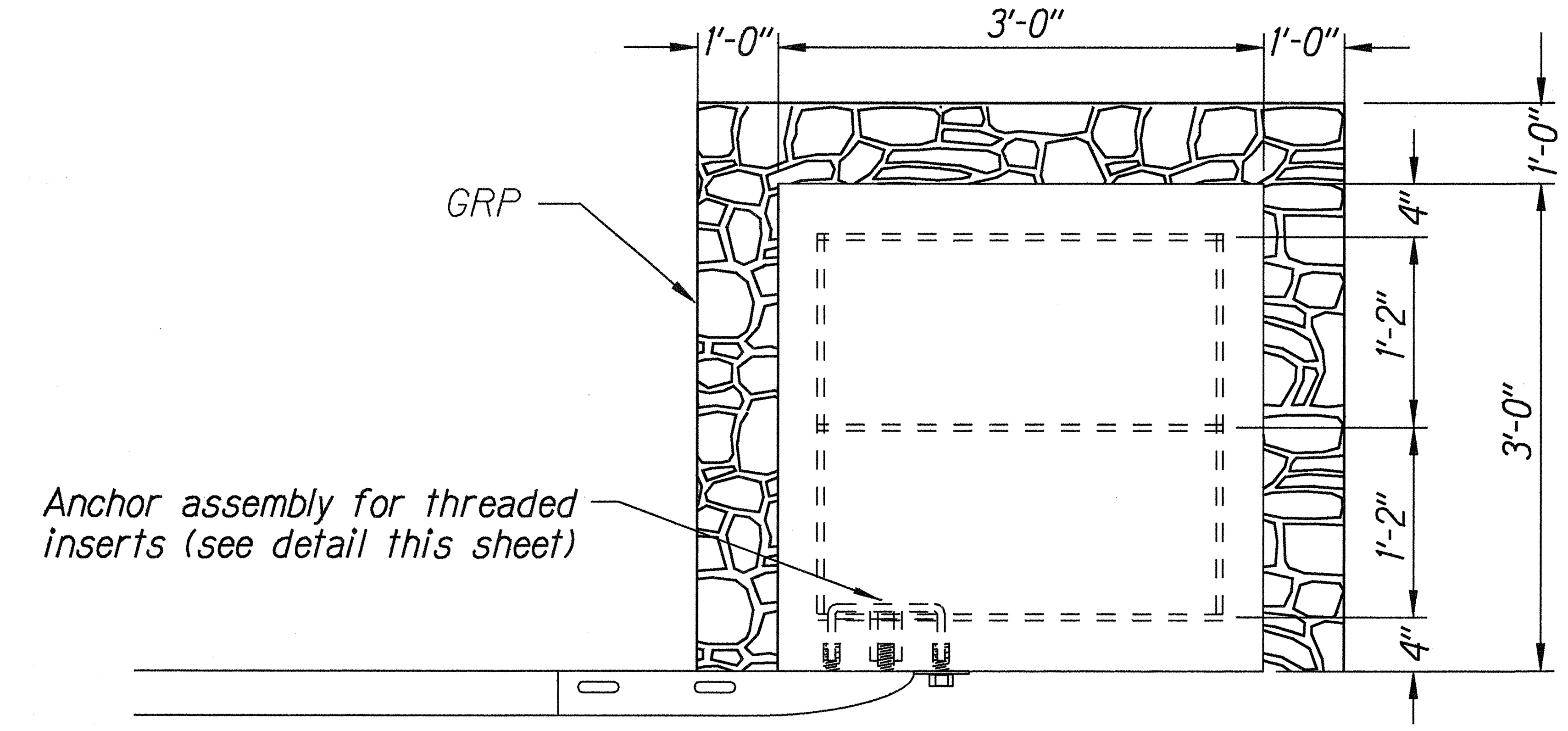


Elevation

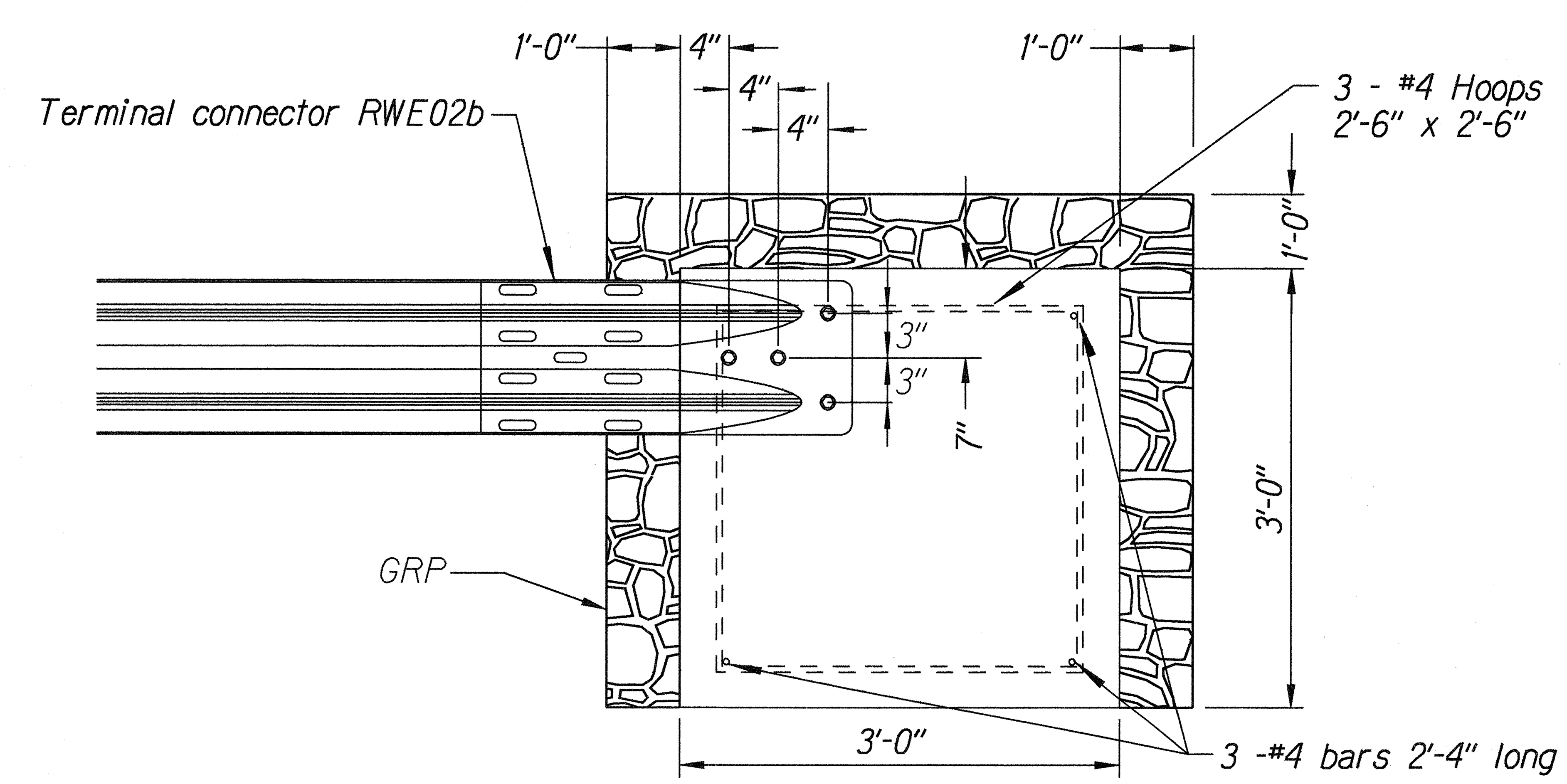
STRONG POST W-BEAM GUARDRAIL



ANCHOR ASSEMBLY
CONCRETE BLOCK ANCHOR



Plan



Elevation

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

BACKSLOPE ANCHOR TERMINAL END ANCHORAGE DETAILS
MODIFIED TYPE "A-1" FLARE

Note:

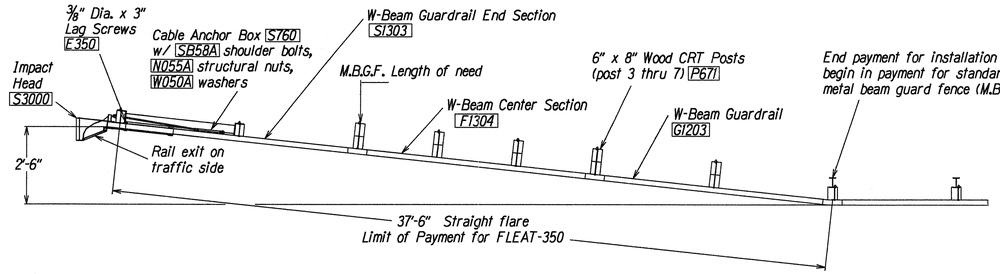
All fasteners, posts, blocks and rail elements shall conform to the latest edition and amendments of "A Guide to Standardized Highway Barrier Rail Hardware," a report prepared and approved by the AASHTO-AGCARTBA Joint Cooperative Committee.

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

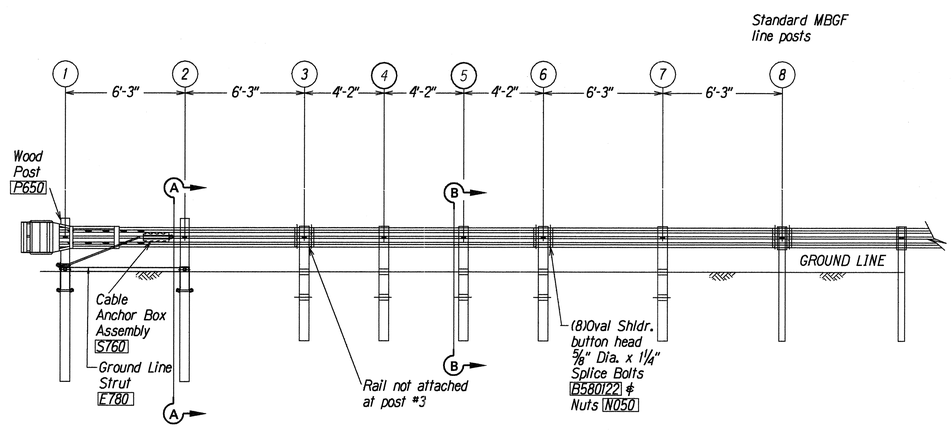
MODIFIED TYPE "A-1" FLARE

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS TO
KALOKO-HONOKŌHAU NATIONAL HISTORICAL PARK
PROJECT NO. FLH-019-1(26)

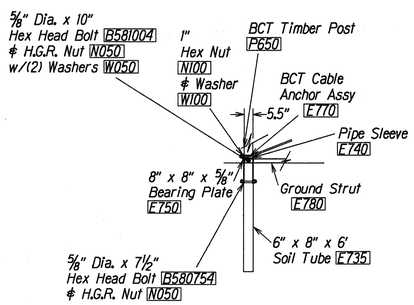
Scale: none Date: Aug., 1999



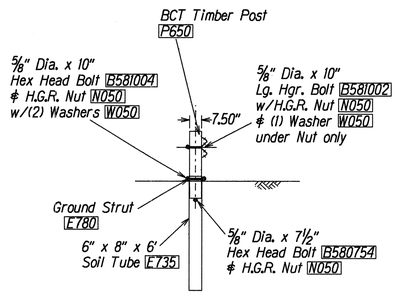
PLAN



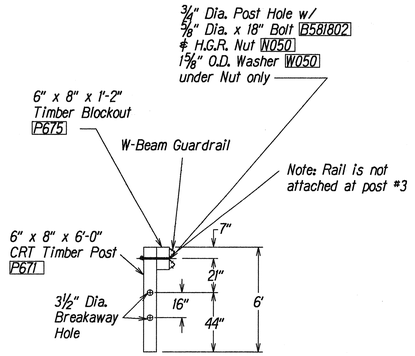
ELEVATION



PARTIAL VIEW OF POST 1



SECTION A-A
at Post #2



SECTION B-B
typical @ Post 3 - 7

GENERAL NOTES

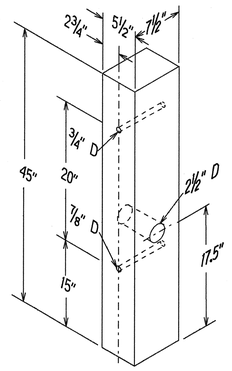
1. Wood posts are required with the fleat.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The soil tube shall not protrude more than 4" above ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
4. The soil tubes may be driven with an approved driving head. They shall not be driven with the wood post in the tube. If the soil 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. 2½" 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. The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.
8. For curb installations, the soil tubes and posts shall be installed at the proper ground elevation behind the curb. The posts will require field drilling new holes to accommodate the rail to the post connecting bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed if directed by the engineer.

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	31	46

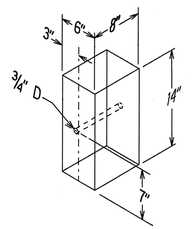
ITEM NO.	QTY	BILL OF MATERIALS
S3000	1	IMPACT HEAD
F1303	1	W-BEAM GUARDRAIL END SECTION, 12 GA.
F1304	1	W-BEAM GUARDRAIL CENTER SEC., 12 GA.
G1203	1	W-BEAM GUARDRAIL, 12 GA.
S730	2	*FOUNDATION SOIL TUBE, 6" x 8" x 6'
E740	1	PIPE SLEEVE
E750	1	BEARING PLATE, 8" x 8" x 5/8"
S760	1	CABLE ANCHOR BOX
E770	1	BCT CABLE ANCHOR ASSEMBLY
E780	1	GROUND STRUT
P650	2	5.5" x 7.5" x 45" WOOD POSTS
P671	5	6" x 8" x 6' WOOD CRT POST
P675	5	6" x 8" x 14" TIMBER BLOCKOUT
		HARDWARE
B580122	24	5/8" Dia. x 1 1/4" SPLICE BOLT
B580754	2	5/8" Dia. x 7 1/2" HEX BOLT
B581004	2	5/8" Dia. x 10" HEX BOLT
B581002	1	5/8" Dia. x 10" H.G.R. BOLT (POST 2 ONLY)
B581802	5	5/8" Dia. x 18" H.G.R. BOLT (POST 3-7)
N050	34	5/8" Dia. H.G.R. NUT (SPLICE 24, SOIL TUBES 2, STRUT 2, POST 2, & POST 3 THRU 7, 5)
W050	10	5/8" Dia. H.G.R. WASHER
N100	2	1" ANCHOR CABLE HEX NUT
W100	2	1" ANCHOR CABLE WASHER
E350	2	3/8" x 3" LAG SCREW
SB58A	8	CABLE ANCHOR BOX SHOULDER BOLTS
N055A	8	½" A325 STRUCTURAL NUTS
W050A	16	1 1/16" OD X 9/16" ID A325 STR. WASHER

Foundation Tube Options For Posts 1 & 2

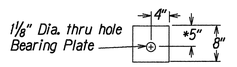
*6'-0" Split Foundation Tubes S730
*6'-0" Solid Foundation Tubes E731
*5'-0" Foundation Tubes S735 W/Soil Plates SP600
*4'-6" Foundation Tubes E735 W/Soil Plates SP600



POSTS 1 & 2



TIMBER BLOCKOUT



*for bearing plate placement, the 5" side should be installed up

BEARING PLATE E750

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

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

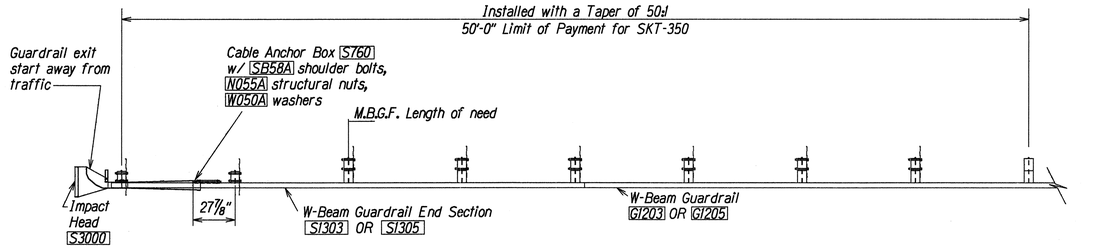
FLEAT-350
FLARED ENERGY ABSORBING TERMINAL

QUEEN KA'AHUMANU HIGHWAY
GUARDRAIL AND SHOULDER IMPROVEMENTS
PROJECT NO. FLH-019-1(26)

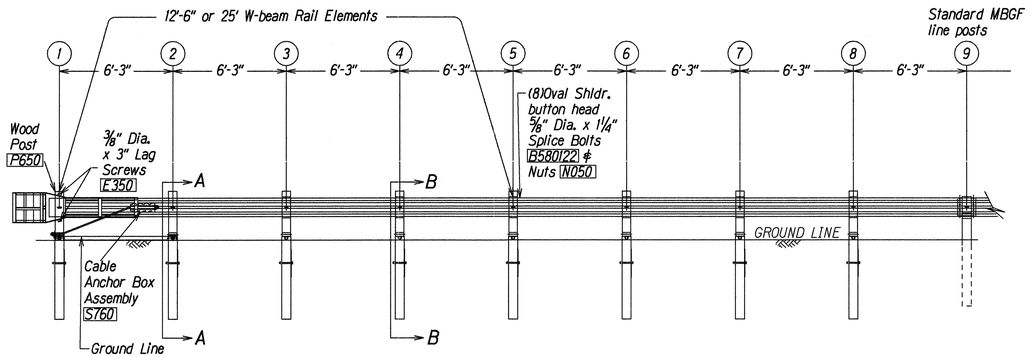
Scale: As Shown Date: Aug., 1999

SHEET No. 13 OF 15 SHEETS

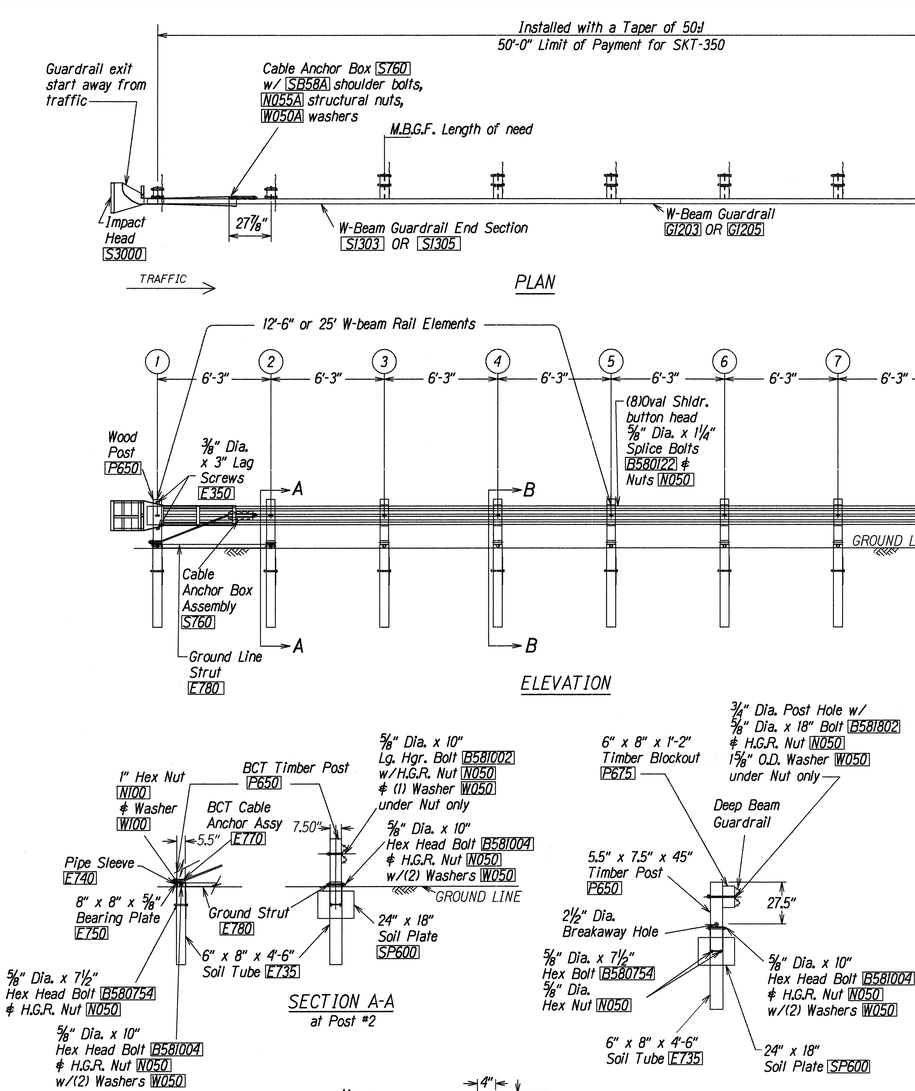
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	32	46



PLAN

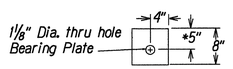


ELEVATION



SECTION A-A
at Post #2

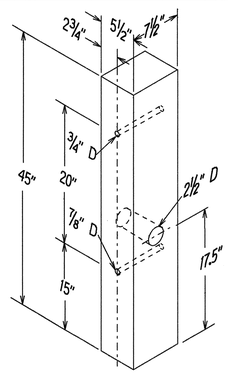
SECTION B-B
typical @ Post 3 - 8



*for bearing plate placement, the 5" side should be installed up

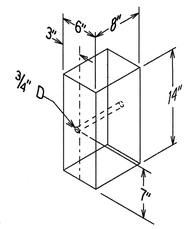
BEARING PLATE E750

PARTIAL VIEW OF POST 1



POSTS 1 thru 8 P650

All measurements should be taken from bottom of post



TIMBER BLOCKOUT P675

**not supplied by Road Systems.

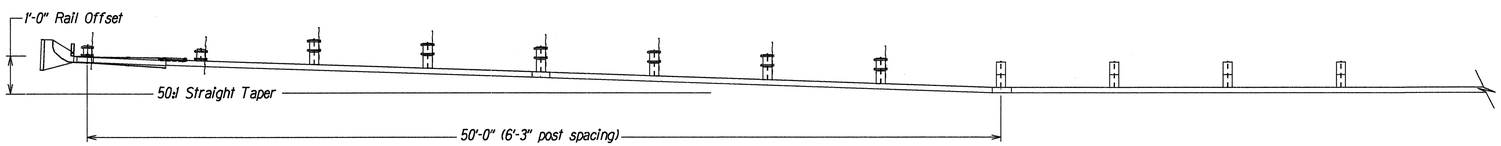
GENERAL NOTES:

1. Wood posts are required with the Sequential Kinking Terminal.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. When the Sequential Kinking Terminal is selected as the end treatment for MBGF installation, the MBGF shall be flared at a rate of 50:1 to prevent the impact head from encroaching on the shoulder.
4. The soil tube shall not protrude more than 4" above ground (measured along a 5' cord). Site grading may be necessary to meet this requirement. Soil tubes shall be installed for all wood posts.
5. The soil tubes may be driven with an approved driving head. They shall not be driven with the wood post in the tube. If the soil tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent settlement.

ITEM NO.	QTY	BILL OF MATERIALS
S3000	1	IMPACT HEAD
SI303/SI305	1	W-BEAM GUARDRAIL END SECTION 12 GA. 12.5' or 25'
GI203/GI205	3/1	W-BEAM GUARDRAIL, 12 GA., 12.5' or 25'
E735	8	FOUNDATION SOIL TUBE, 6" x 8" x 4'-6"
SP600	8	SOIL PLATE, 24" x 18" x 1/4"
E740	1	PIPE SLEEVE
E750	1	BEARING PLATE, 8" x 8" x 5/8"
S760	1	CABLE ANCHOR BOX
E770	1	BCT ANCHOR CABLE
E780	1	GROUND STRUT
P650	8	5.5" x 7.5" x 45" WOOD POSTS
P675	6	6" x 8" x 14" TIMBER BLOCKOUT
E3151	1	**IMPACT HEAD OBJECT MARKER (Not Shown)
		HARDWARE
B580122	16 / 32	5/8" Dia. x 1 1/4" SPLICE BOLT
B580754	16	5/8" Dia. x 7 1/2" HEX BOLT
B581004	8	5/8" Dia. x 10" HEX BOLT
B581002	1	5/8" Dia. x 10" H.G.R. BOLT (POST 2 ONLY)
B581802	6	5/8" Dia. x 18" H.G.R. BOLT (POST 3-8)
N050	47/63	5/8" Dia. H.G.R. NUT (SPLICE 16 / 32, SOIL TUBES 22, STRUT 2, POST 2-8, 7)
W050	23	5/8" Dia. H.G.R. WASHER
N100	2	1" ANCHOR CABLE HEX NUT
W100	2	1" ANCHOR CABLE WASHER
E350	2	3/8" x 3" LAG SCREW
SB58A	8	CABLE ANCHOR BOX SHOULDER BOLTS
N055A	8	1/2" A325 STRUCTURAL NUTS
W050A	16	1 1/16" OD X 5/16" ID A325 STR. WASHER

GENERAL NOTES: (continued)

6. 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 wil lbe field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
7. 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.
8. The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks.
9. A special site evaluation should be considered prior to using the Sequential Kinking Terminal where there is less than 25' between the outlet side of the Sequential Kinking Terminal and any adjacent driving lane.



TYPICAL FLARE CONFIGURATION

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY X	
	TRACED BY	
NOTE BOOK REVISED BY	QUANTITIES BY X	
No. dgn	CHECKED BY	

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

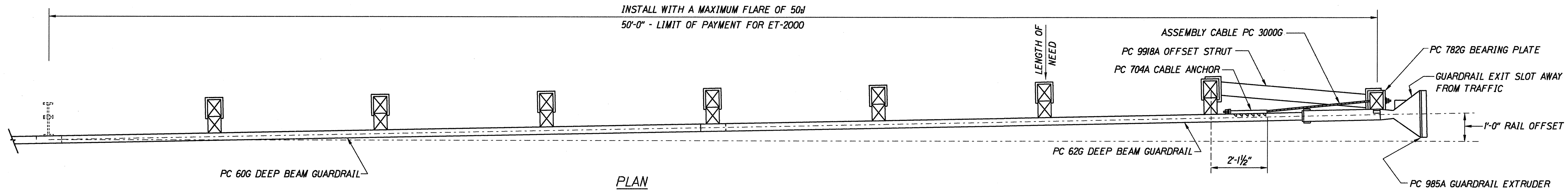
SKT-350
SEQUENTIAL KINKING TERMINAL

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS
PROJECT NO. FLH-019-1(26)

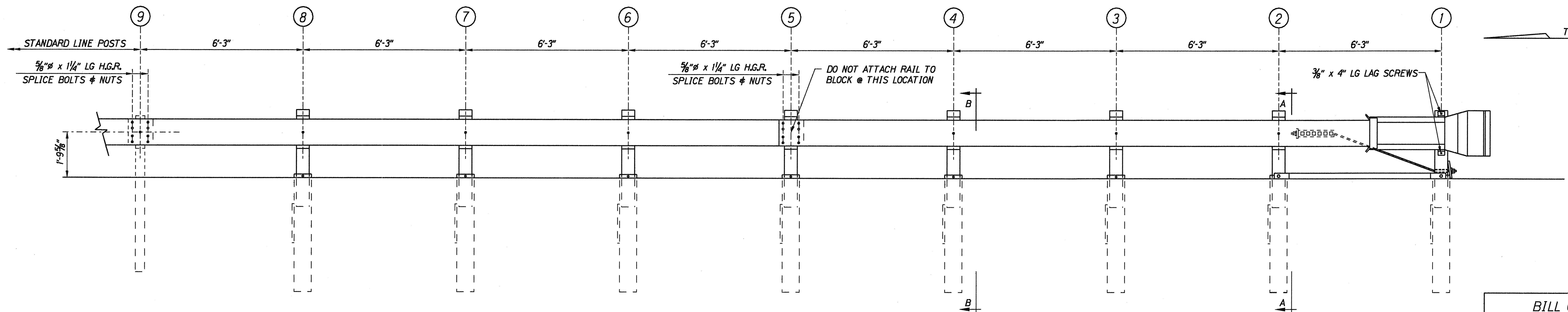
Scale: As Shown Date: Aug., 1999

SHEET No. 14 OF 15 SHEETS

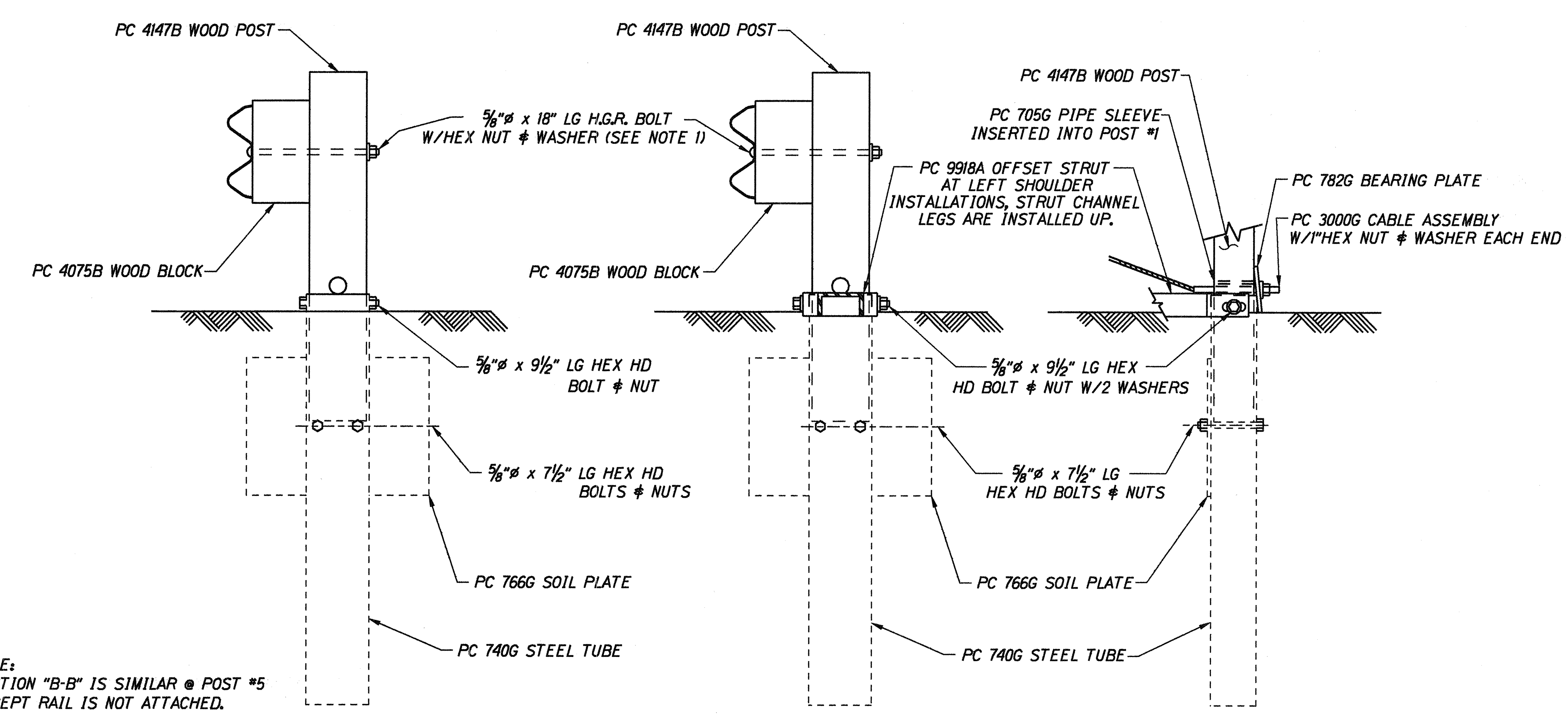
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAI'I	HAW.	FLH-019-1(26)	2000	33	46



PLAN



ELEVATION



NOTE:
SECTION "B-B" IS SIMILAR @ POST #5 EXCEPT RAIL IS NOT ATTACHED.

SECTION "B-B"
(TYP @ POSTS #3, 4, 6, 7 & 8)

SECTION "A-A"
(@ POST #2)

PARTIAL VIEW @ POST #1

NOTE: THE ⅝" FLAT WASHER IS USED UNDER THE NUT, BEHIND THE POST ONLY. NO WASHER IS USED AT THE RAIL.

BILL OF MATERIAL

PC	QTY	DESCRIPTION
60G	1	12/25/6'3/S (GUARDRAIL)
62G	1	12/25/6'3/S ANC (GUARDRAIL)
704A	1	CABLE ANCHOR BRACKET
705G	1	2" x 5½" PIPE
740G	8	4'6 TUBE SLEEVE
766G	8	¼" x 18" x 24" SOIL PLATE
782G	1	⅝" x 8" x 8" BEARING PLATE
985A	1	ET-2000 EXTRUDER
3000G	1	CABLE ¾x 6'6
3300G	11	⅝" WASHER
3340G	47	⅝" HEX NUT
3360G	16	⅝"ø x 1¼" SPLICE BOLT
3478G	16	⅝"ø x 7½" HEX HD BOLT
3497G	8	⅝"ø x 9½" HEX HD BOLT
3580G	7	⅝"ø x 18" POST BOLT
3900G	2	1" WASHER
3910G	2	1" HEX NUT
4075B	7	WD BLOCK 1'2 6" x 8" DR
4147B	8	WD 3'9 POST 5½x 7½
4228G	2	⅜"ø x 4" LAG SCREW
9918A	1	6'3 STRUT

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

STATE OF HAWAI'I
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ET-2000 - OPTION "A"

QUEEN KA'AHUMANU HIGHWAY
INTERSECTION IMPROVEMENTS TO
KALOKO-HONOKOHAU NATIONAL HISTORICAL PARK
PROJECT NO. FLH-019-1(26)

Scale: Noted　Date: Aug., 1999

SHEET No. 15 OF 15 SHEETS