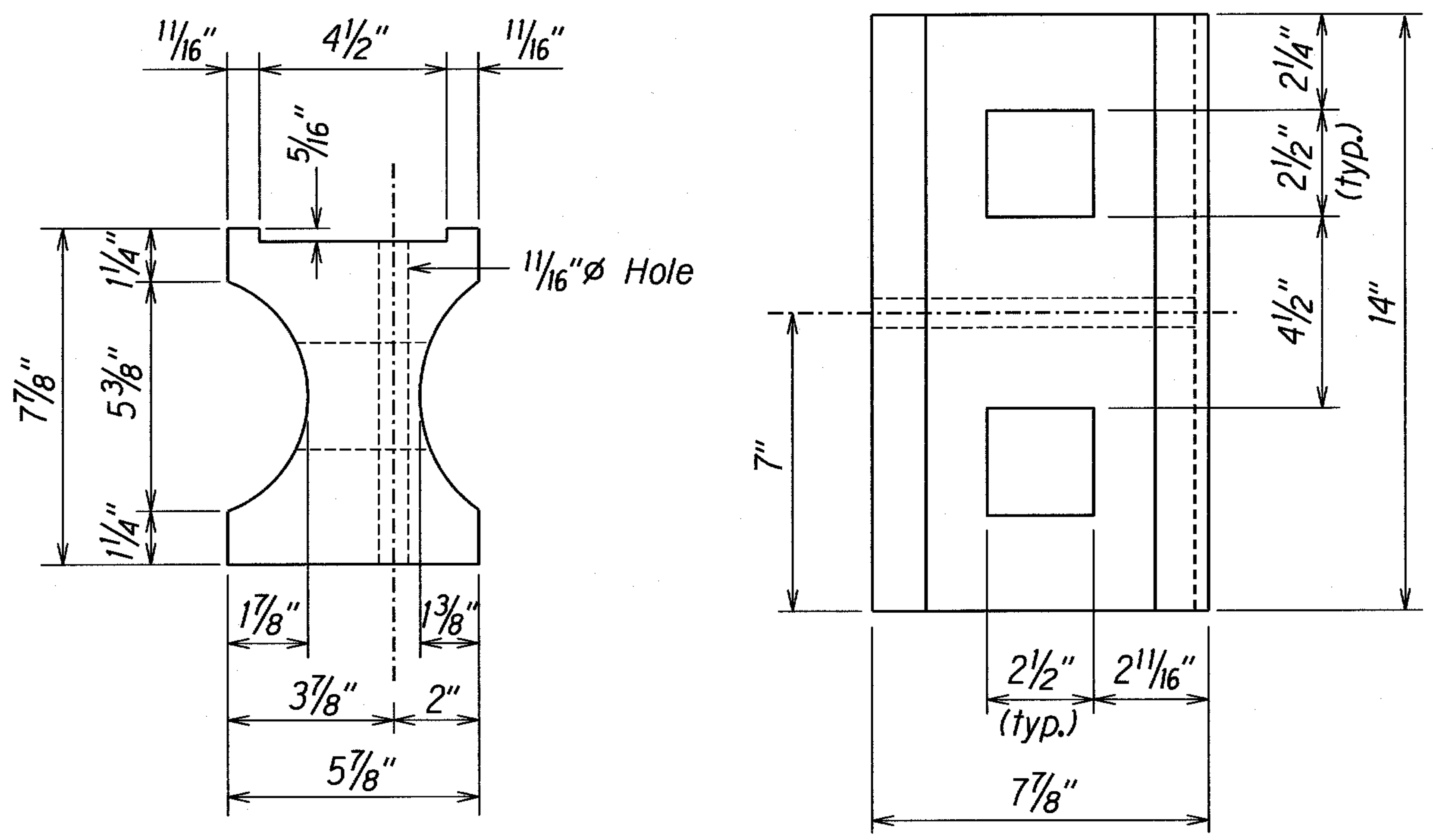
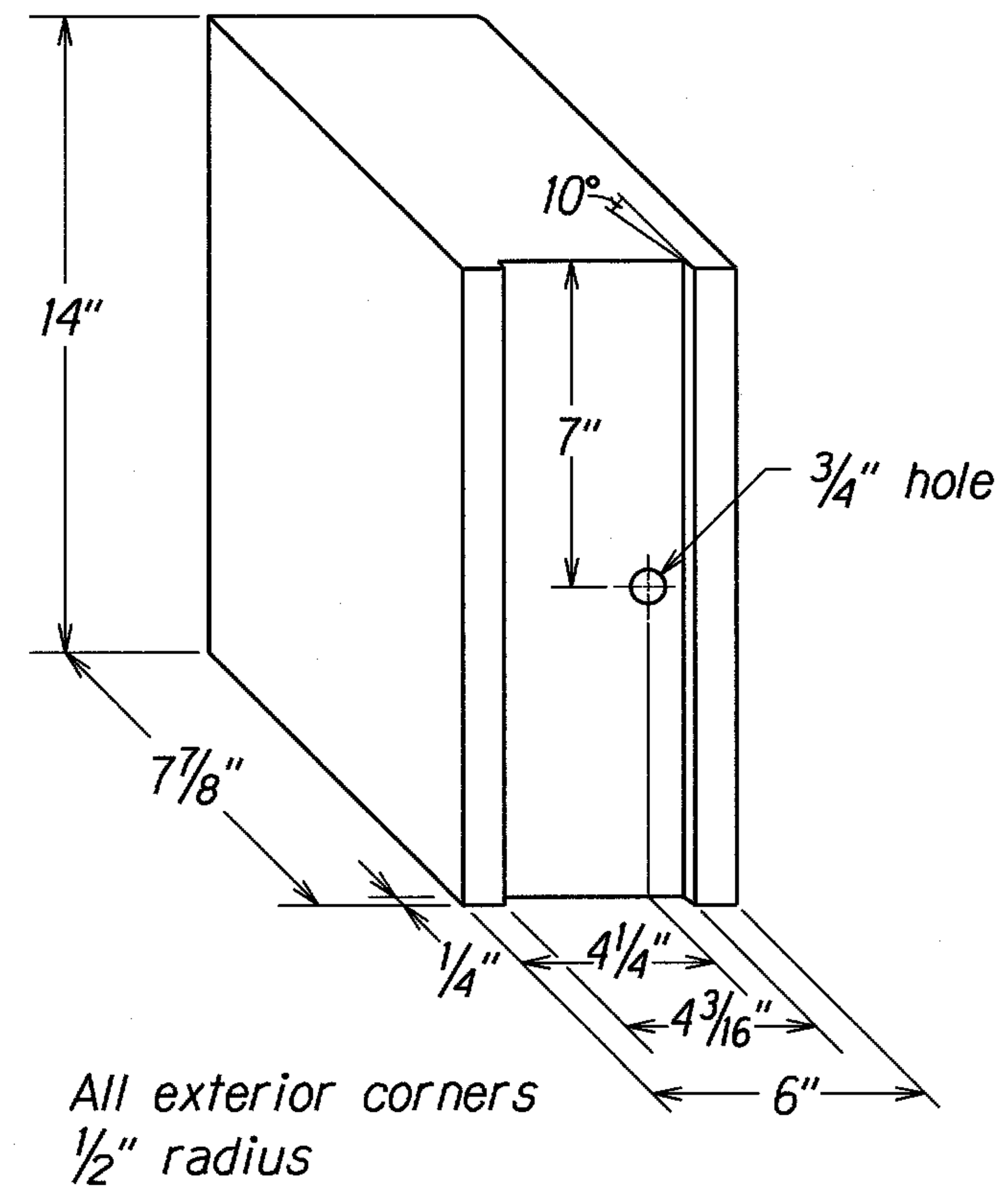
FED. ROAD DIST. NO.	STATE	FED. AID. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-083-1(42)	2009	32	121



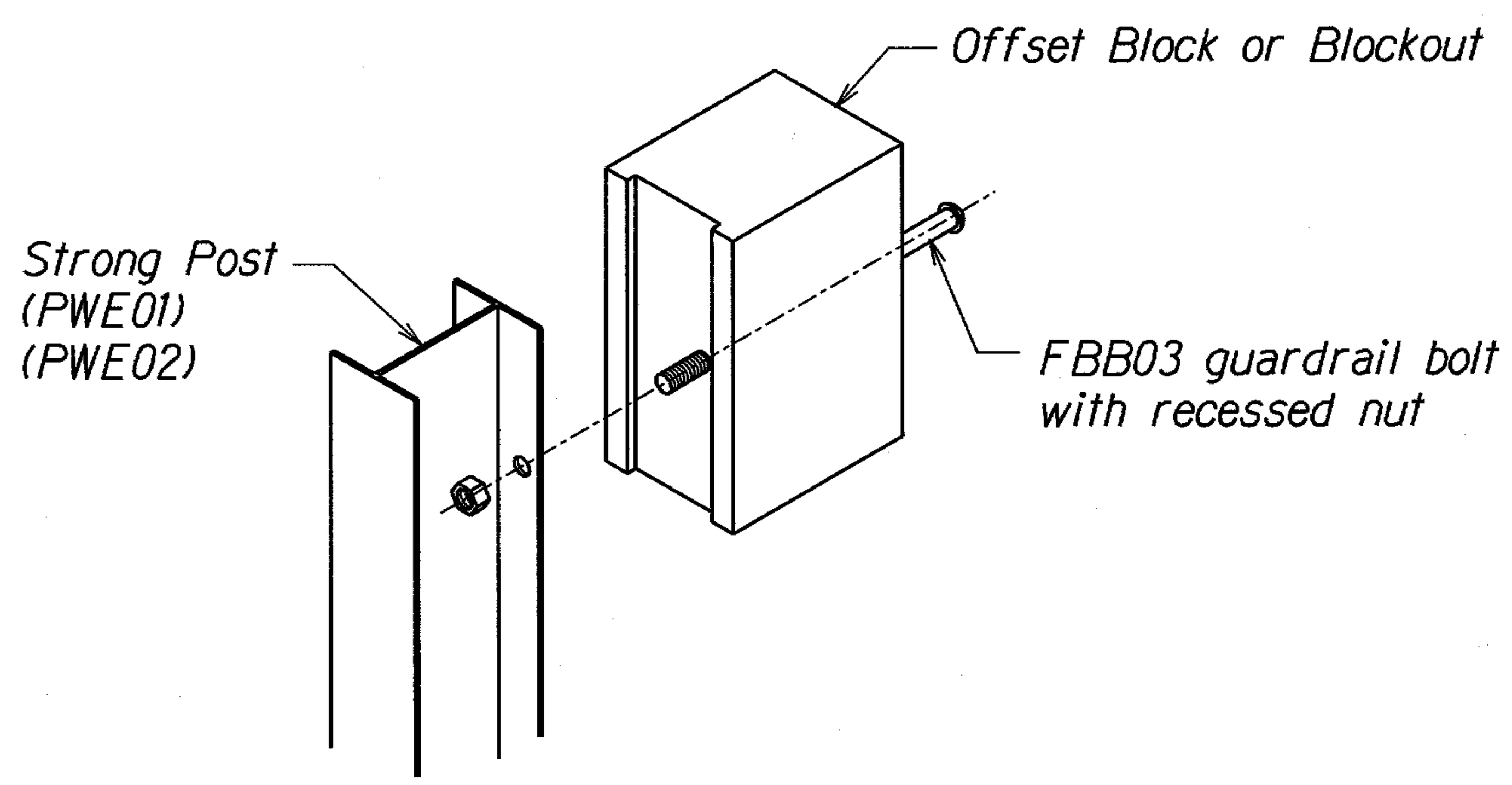
TOP

SIDE

RECYCLED PLASTIC BLOCKOUT (TYPE I)

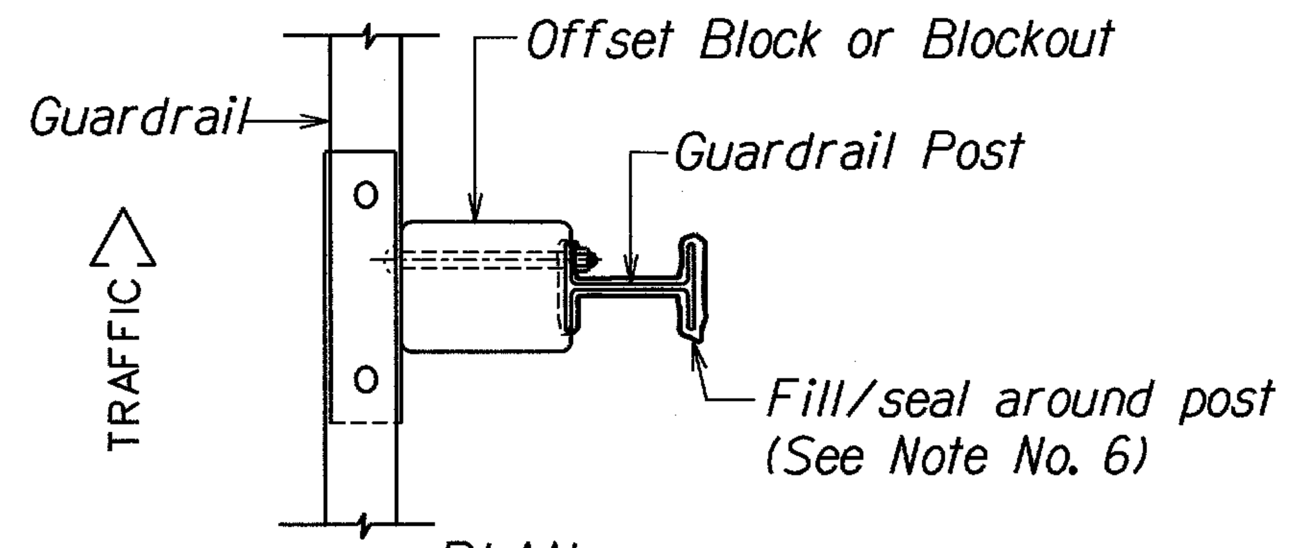


RECYCLED POLYETHYLENE OFFSET BLOCK (TYPE II)



Exploded View
(Rail and washer not shown)

STEEL POST AND BLOCK DETAIL

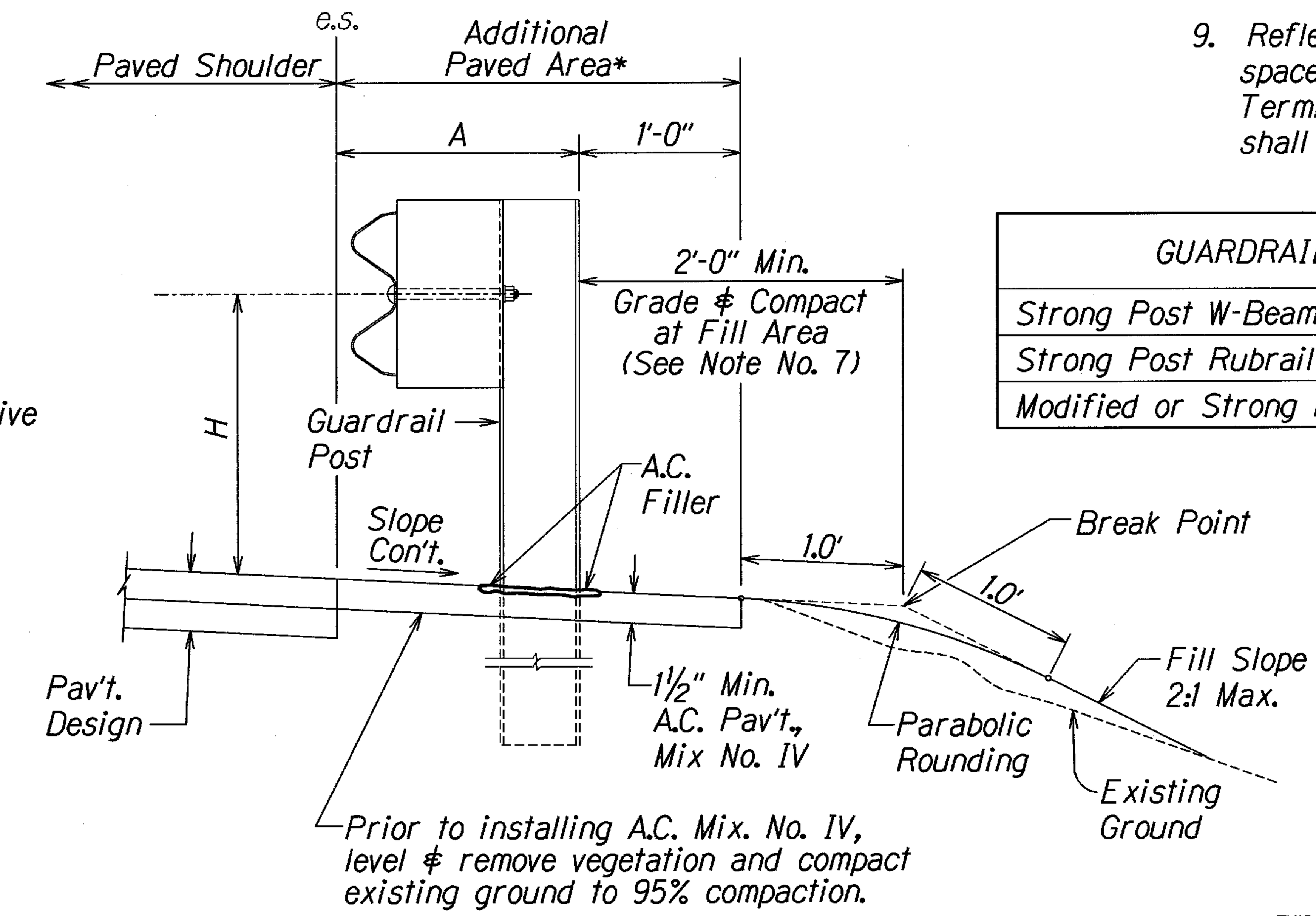


PLAN

GENERAL NOTES

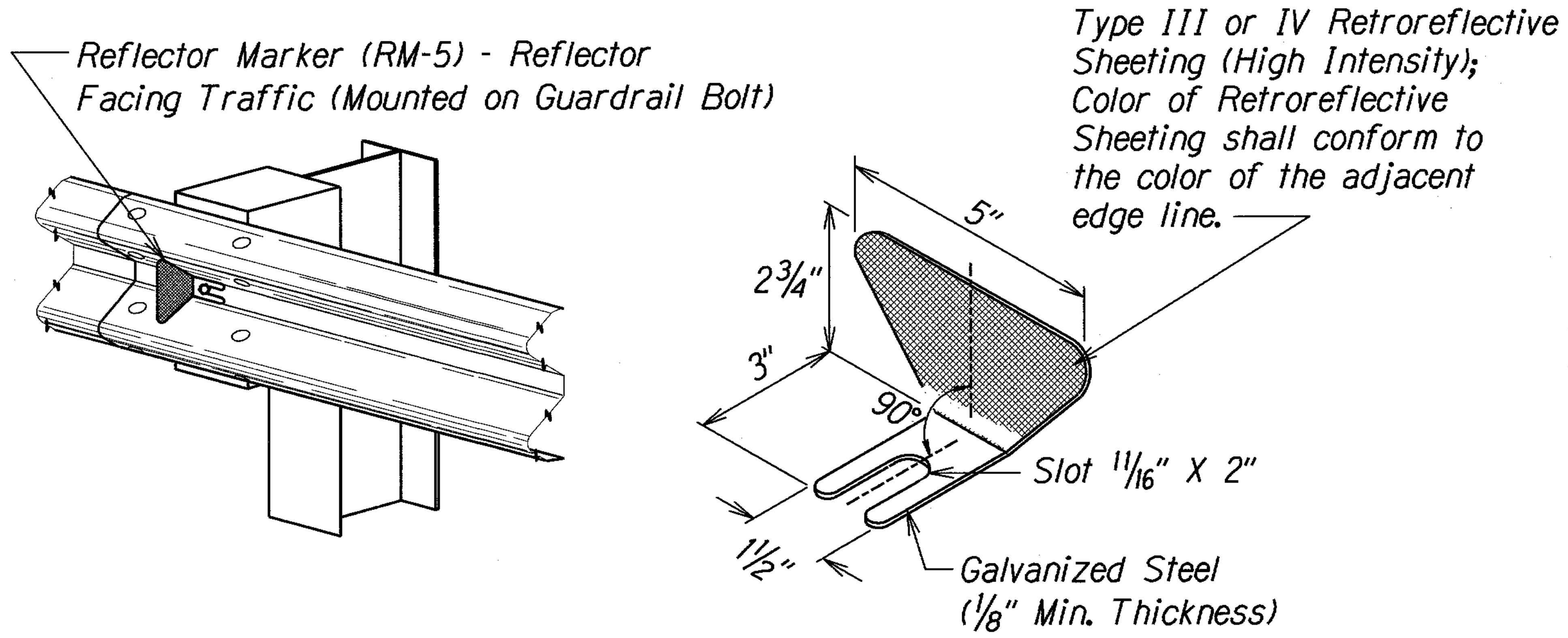
1. All hardware, posts and fasteners shall be hot-dip zinc coated galvanized after fabrication. No punching, drilling or cutting will be permitted after galvanizing.
2. Where conditions require, special post lengths in increments of 6 inches may be specified.
3. All fasteners, posts, and rail elements (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	DIMENSION 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"



ELEVATION

TYPICAL GUARDRAIL INSTALLATION



REFLECTOR MARKER (RM-5) DETAIL AND TYPICAL INSTALLATION

MINGXUN DING
LICENSED PROFESSIONAL ENGINEER
NO. 9248-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE

4/30/16
EXPIRATION DATE OF LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GUARDRAIL DETAILS & NOTES

KAMEHAMEHA HIGHWAY - REPLACEMENT OF SOUTH PUNALUU STREAM BRIDGE
Federal Aid Project No. BR-083-1(42)
Scale: NTS
Date: May 2009

SHEET No. C32 OF 40 SHEETS

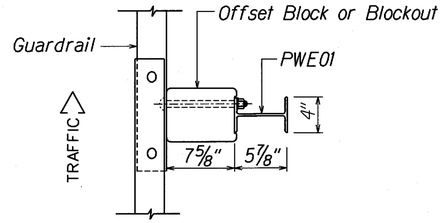
ORIGINAL PLAN	SURVEY PLOTTED BY
	DRAWN BY
	TRACED BY
NOTE BOOK	DESIGNED BY
	QUANTITIES BY
No.	CHECKED BY

DATE

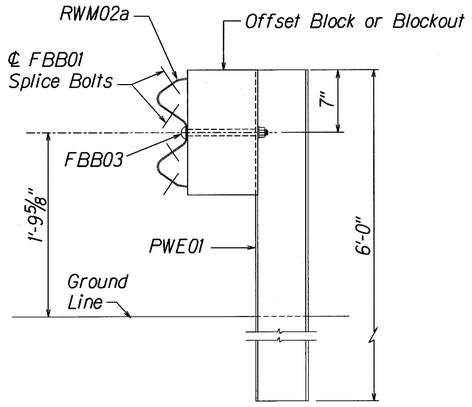
td:ruby/guardrail/te50rev.dgn (standard plan TE-50 r09/01/00)

r12/31/03

FED. ROAD DIST. NO.	STATE	FED. AID. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-083-1(42)	2009	33	121



PLAN

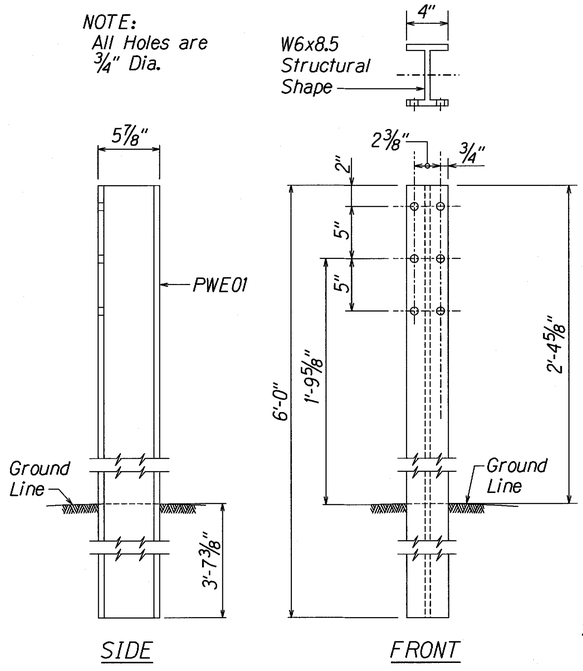


ELEVATION

STRONG POST W-BEAM GUARDRAIL

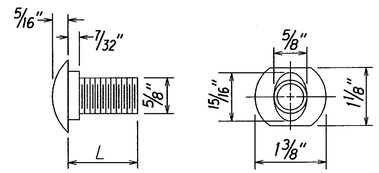
(SGR04a)

NOTE:
All Holes are
3/4" Dia.

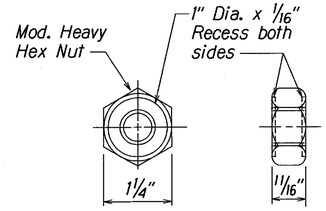


SIDE FRONT

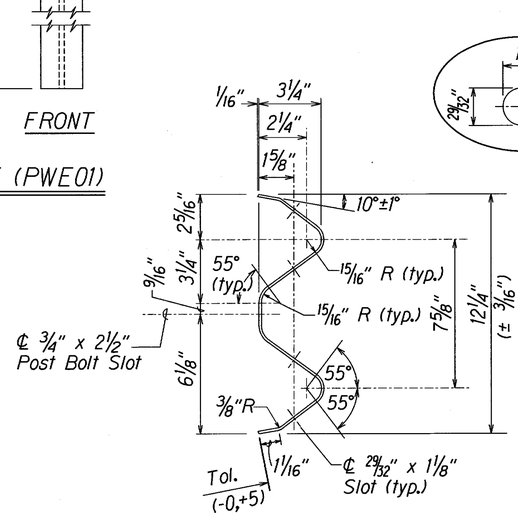
W-BEAM STRONG POST (PWE01)



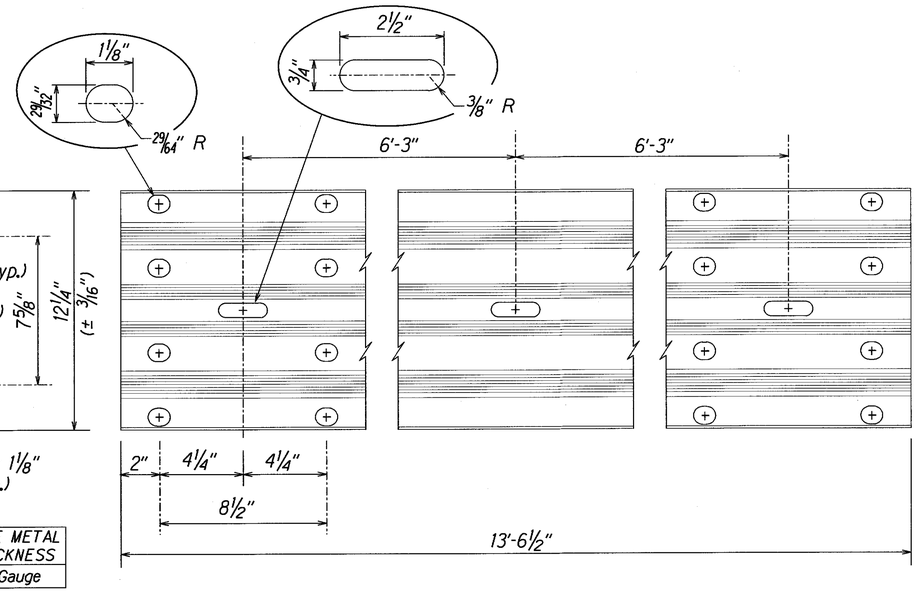
DESIGNATOR	L
FBB01	1 3/8"
FBB02	2"
FBB03	10"



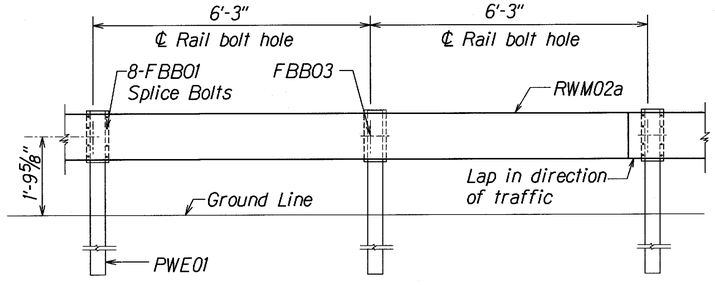
GUARDRAIL BOLTS AND RECESSED NUT



DESIGNATOR	BASE METAL THICKNESS
RWM02a	12 Gauge



2 SPACE W-BEAM GUARDRAIL (RWM02a)



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.

rti/01/05 tdl:ruby/guardrail/wbeamsp.dgn (standard plan TE-50 103/06/87)

MINGXUN DING
LICENSED PROFESSIONAL ENGINEER
NO. 9246-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE 4/30/16 EXPIRATION DATE OF LICENSE

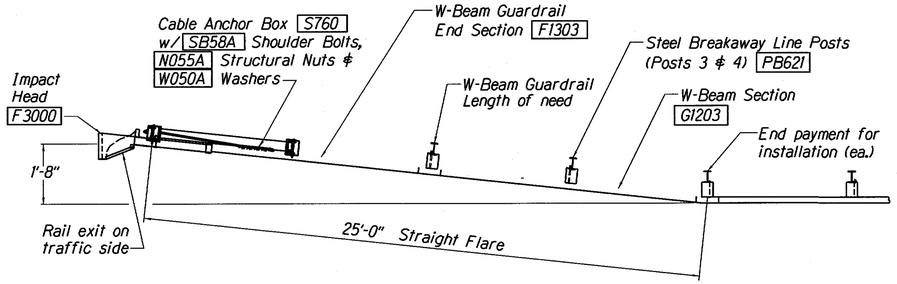
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRONG POST W-BEAM GUARDRAIL

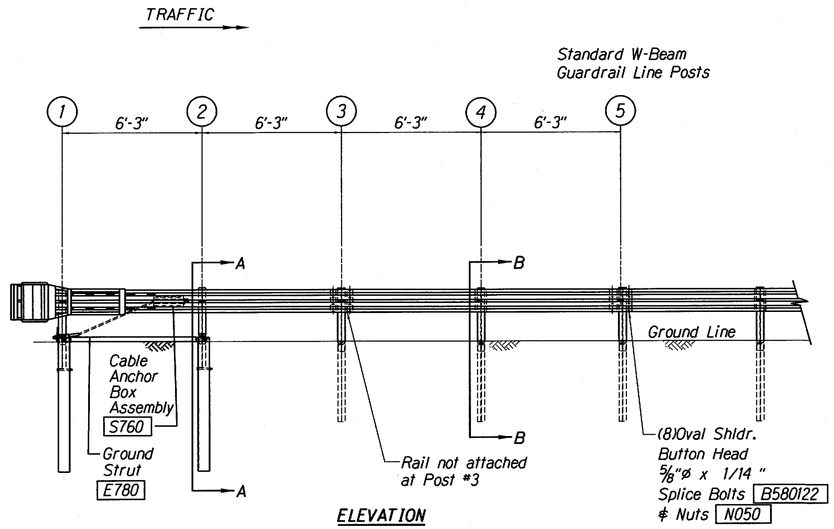
KAMEHAMEHA HIGHWAY - REPLACEMENT
OF SOUTH PUNALUU STREAM BRIDGE
Federal Aid Project No. BR-083-1(42)

Scale: NTS Date: May 2009

SHEET No. C33 OF 40 SHEETS



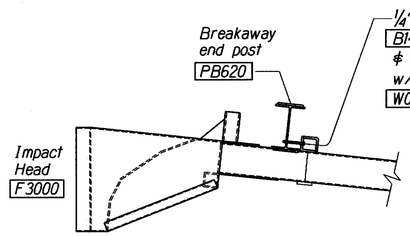
PLAN



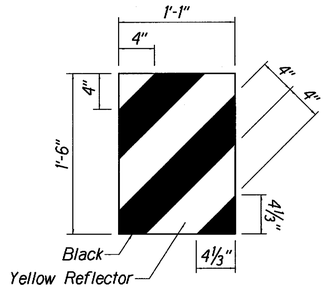
ELEVATION

GENERAL NOTES:

1. Breakaway steel posts are required with the FLEAT Terminal.
2. All bolts, nuts, cable asemblies, 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 post in the tube. If the soil tubes are placed in dirlled 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. (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.



IMPACT HEAD CONNECTING DETAIL

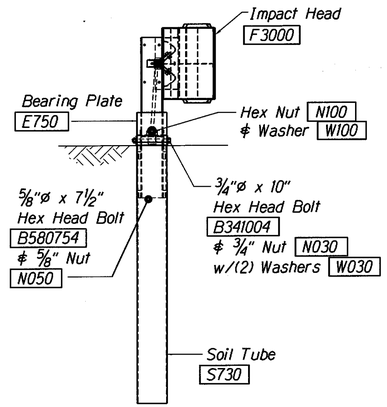


IHRM(R) IMPACT HEAD REFLECTOR MARKER INSERT DETAIL

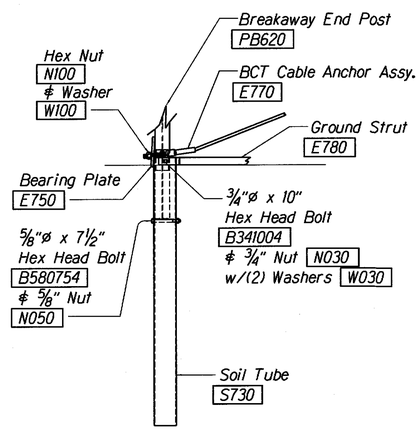
FED. ROAD DIST. NO.	STATE	FED. AID. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-083-1(42)	2009	34	121

ITEM NO.	QTY.	BILL OF MATERIALS
F3000	1	IMPACT HEAD
G1203	1	W-BEAM GUARDRAIL END SECTION, 12 GA.
F1304	1	W-BEAM GUARDRAIL CENTER SECTION, 12 GA.
S730	2	*FOUNDATION SOIL TUBE, 6" x 8" x 6'-0"
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
PB620	2	BREAKAWAY END POST
PB621	3	BREAKAWAY LINE POST
	2	RECYCLED PLASTIC BLOCKOUT OR OFFSSET BLOCK
	1	IMPACT HEAD REFLECTOR MARKER - IHRM(R) OR (L)
		HARDWARE
B580122	17	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	3	5/8" Dia. x 10" H.G.R. BOLT (POSTS 3 & 4)
N030	2	3/4" Dia. HEX NUT
N050	21	5/8" Dia. H.G.R. NUT (SPLICE 16, SOIL TUBES 2, POSTS 2, 1; POSTS 3 & 4, 3)
W030	4	3/4" I.D. WASHER
W050	3	H.G.R. 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

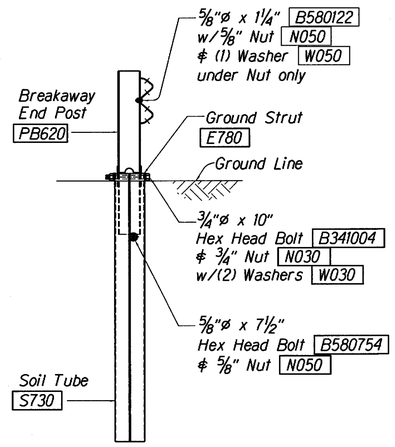
Foundation Tube Options For Posts 1 & 2
*6'-0" Split Foundation Tube S730
*6'-0" Solid Foundation Tube E731
*5'-0" Foundation Tube S735 W/Soil Plate SP600
*4'-6" Foundation Tube E735 W/Soil Plate SP600



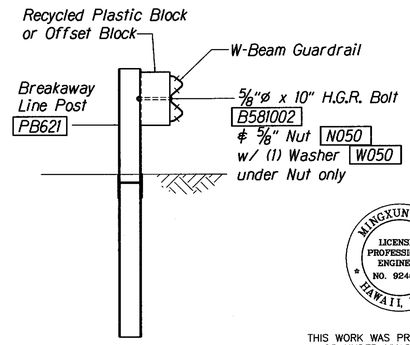
FRONT VIEW OF POST 1



PARTIAL VIEW OF POST 1



SECTION A-A
at Post #2



SECTION B-B
Typical @ Post 3 & 4
Note: Rail not Bolted @ Post 3

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

FLEAT TL-2
FLARED ENERGY ABSORBING TERMINAL

KAMEHAMEHA HIGHWAY - REPLACEMENT OF SOUTH PUNALUU STREAM BRIDGE
Federal Aid Project No. BR-083-1(42)

Scale: NTS Date: May 2009

SHEET No. C34 OF 40 SHEETS

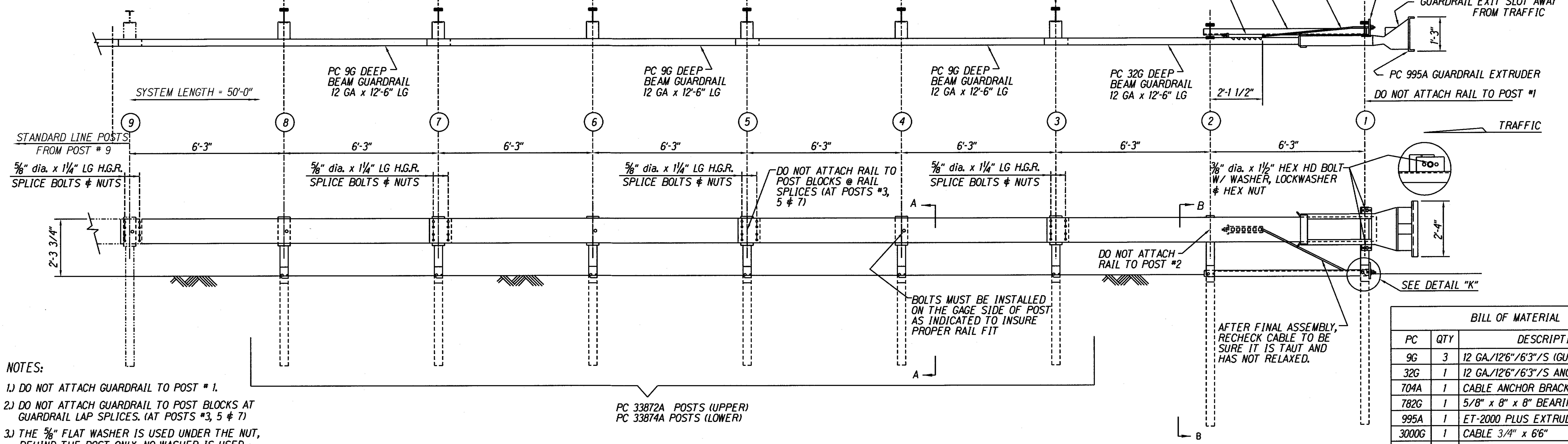
ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY | TRACED BY | DESIGNED BY | QUANTITIES BY | CHECKED BY | DATE | NOTE BOOK | No.

td\r\uby\guardrail\TL-2\fltsl2us.dgn

r8/12/02

FED. ROAD DIST. NO.	STATE	FED. AID. PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-083-1(42)	2009	35	121

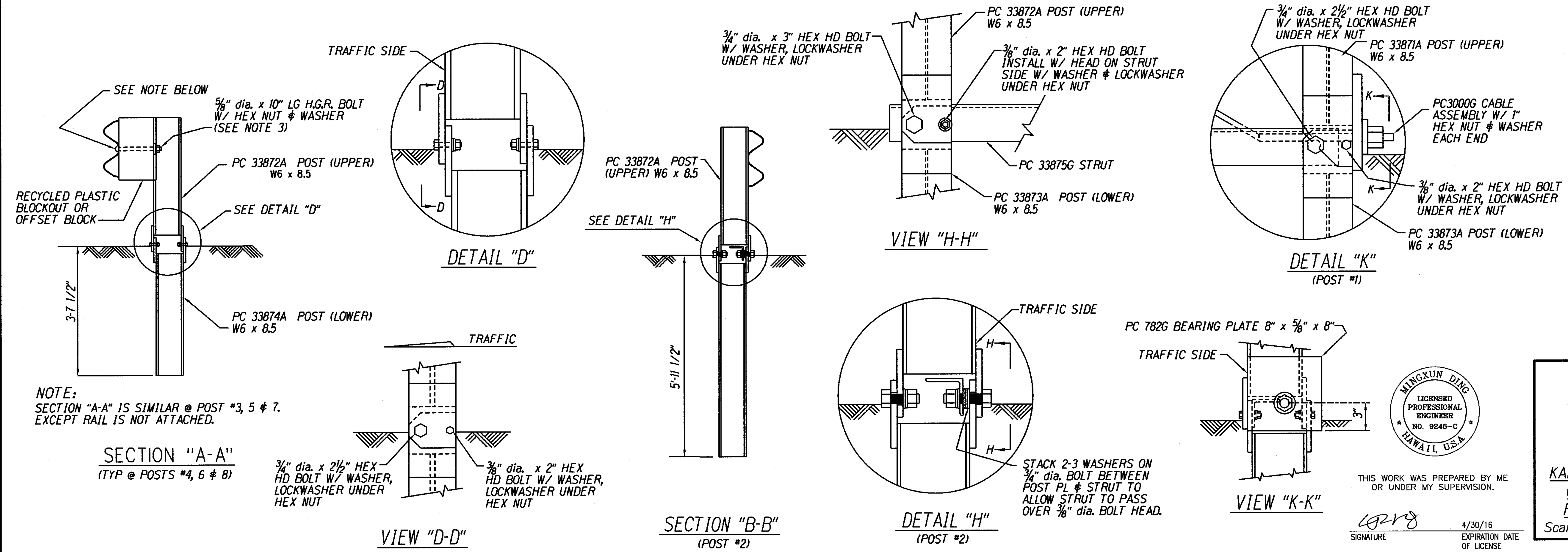
NOTE:
INSTALL RAIL PARALLEL TO ROADWAY EDGE LINE. WHEN TAPER IS REQUIRED BY DESIGN ENGINEER, A 50:1 TAPER OVER THE LENGTH OF SYSTEM IS ALLOWABLE.



NOTES:
1.) DO NOT ATTACH GUARDRAIL TO POST # 1.
2.) DO NOT ATTACH GUARDRAIL TO POST BLOCKS AT GUARDRAIL LAP SPLICES. (AT POSTS #3, 5 & 7)
3.) THE 5/8" FLAT WASHER IS USED UNDER THE NUT, BEHIND THE POST ONLY. NO WASHER IS USED AT THE RAIL.
4.) 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



MINGXUN DING
LICENSED PROFESSIONAL ENGINEER
NO. 9246-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE
4/30/16
EXPIRATION DATE OF LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ET-2000 PLUS

KAMEHAMEHA HIGHWAY - REPLACEMENT OF SOUTH PUNALUU STREAM BRIDGE
Federal Aid Project No. BR-083-1(42)

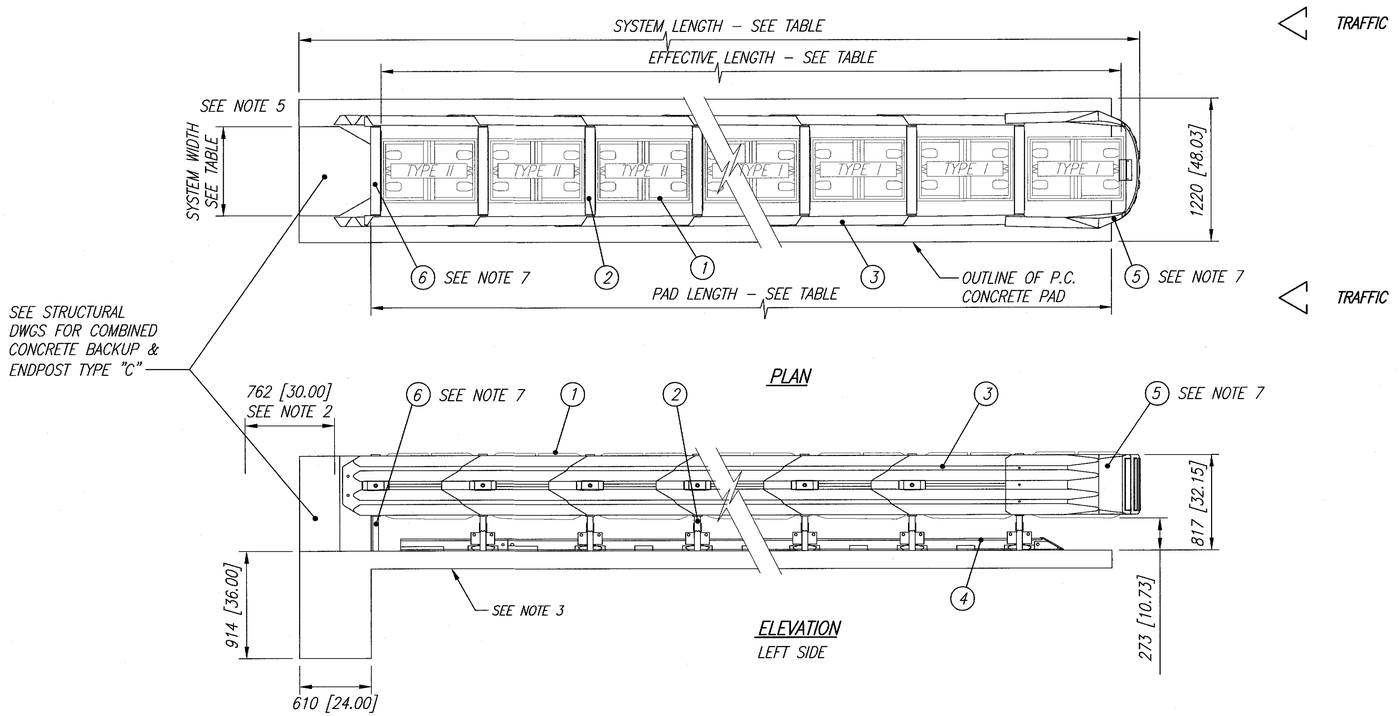
Scale: None   Date: May 2009

SHEET No. C35 OF 40 SHEETS

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

8/1/20 tdl/rubi/guardrail/et2000.dgn

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-083-1(42)	2009	36	121



NOTES:

1. IN COMPLIANCE WITH THE AASHTO 2006 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE.
2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO SLIDE REARWARD UPON IMPACT 762 [30.00] MIN.
3. QUADGUARD SYSTEM IS INSTALLED OVER STRUCTURAL BRIDGE DECK AND STRUCTURAL SLABS AND WING WALLS. SEE STRUCTURAL DRAWINGS.
4. SEE THE "QUADGUARD SYSTEM PRODUCT MANUAL", FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (888) 323-6374.
5. WHERE NECESSARY, THE CUSTOMER SHALL SUPPLY AN ADEQUATE TRANSITION FROM THE QUADGUARD SYSTEM TO THE OBJECT BEING SHIELDED.
6. UNITS OF MEASUREMENT ARE MILLIMETERS [INCHES], UNLESS OTHERWISE NOTED.
7. BACKUP AND NOSE ASSEMBLIES NOT INCLUDED IN MODEL NUMBER. ORDER SEPARATELY.
8. THE NUMBER OF BAYS INDICATED IN THE TABLE IS BASED ON CALCULATED VALUES TO ENSURE ADEQUATE SYSTEM CAPACITY TO DISSIPATE THE LONGITUDINAL IMPACT ENERGY OF A 2000 kg VEHICLE TRAVELING AT THE SPEED INDICATED.

△ 9. THE SIX BAY SYSTEM HAS BEEN FULLY TESTED AT 100 km/h UNDER THE FULL 8 TEST MATRIX OF NCHRP 350 TL-3. SYSTEMS LONGER THAN SIX BAYS SHALL ALSO BE CAPABLE OF MEETING THE OCCUPANT RISK CRITERIA AS RECOMMENDED IN NCHRP 350 FOR VEHICLES WEIGHING 2000 kg IMPACTING HEAD ON AT THE SPEED INDICATED IN THE TABLE.

* G = GREY or Y = YELLOW

BAYS	610[24] WIDTH MODEL#	762[30] WIDTH MODEL#	915[36] WIDTH MODEL#	SYSTEM LENGTH m	SYSTEM LENGTH ft-in	EFFECTIVE LENGTH m	EFFECTIVE LENGTH ft-in	PAD LENGTH m	PAD LENGTH ft-in	MAX DESIGN SPEED km/h [MPH]	# OF CARTRIDGES TYPE I	# OF CARTRIDGES TYPE II
1	QS2401*	QS3001*	QS3601*	2.59	[8'-6"]	1.73	[5'-8"]	1.68	[5'-6"]	40 [25]	2	0
2	QS2402*	QS3002*	QS3602*	3.51	[11'-6"]	2.64	[8'-8"]	2.59	[8'-6"]	60 [37]	2	1
3	QS2403*	QS3003*	QS3603*	4.42	[14'-6"]	3.56	[11'-8"]	3.51	[11'-6"]	70 [44]	3	1
4	QS2404*	QS3004*	QS3604*	5.33	[17'-6"]	4.47	[14'-8"]	4.42	[14'-6"]	80 [50]	3	2
5	QS2405*	QS3005*	QS3605*	6.25	[20'-6"]	5.38	[17'-8"]	5.33	[17'-6"]	90 [56]	4	2
6	QS2406*	QS3006*	QS3606*	7.16	[23'-6"]	6.30	[20'-8"]	6.25	[20'-6"]	△ 100 [62]	4	3
7	QS2407*	QS3007*	QS3607*	8.08	[26'-6"]	7.21	[23'-8"]	7.16	[23'-6"]	△ 105 [65]	4	4
8	QS2408*	QS3008*	QS3608*	8.99	[29'-6"]	8.13	[26'-8"]	8.08	[26'-6"]	△ 110 [68]	4	5
9	QS2409*	QS3009*	QS3609*	9.91	[32'-6"]	9.04	[29'-8"]	8.99	[29'-6"]	△ 115 [71]	4	6
10	QS2410*	QS3010*	QS3610*	10.82	[35'-6"]	9.96	[32'-8"]	9.91	[32'-6"]	△ 120 [75]	5	6
11	QS2411*	QS3011*	QS3611*	11.73	[38'-6"]	10.87	[35'-8"]	10.82	[35'-6"]	△ 120 [75]	5	7
12	QS2412*	QS3012*	QS3612*	12.65	[41'-6"]	11.79	[38'-8"]	11.74	[38'-6"]	△ 120 [75]	5	8

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

MINGXUN DING
LICENSED PROFESSIONAL ENGINEER
NO. 9246-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE

4/30/16
EXPIRATION DATE OF LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

QUADGUARD SYSTEM
W/ CONCRETE BACKUP

KAMEHAMEHA HIGHWAY – REPLACEMENT OF SOUTH PUNALUU STREAM BRIDGE
Federal Aid Project No. BR-083-1(42)

Scale: As Shown Date: May 2009

SHEET No. C36 OF 40 SHEETS