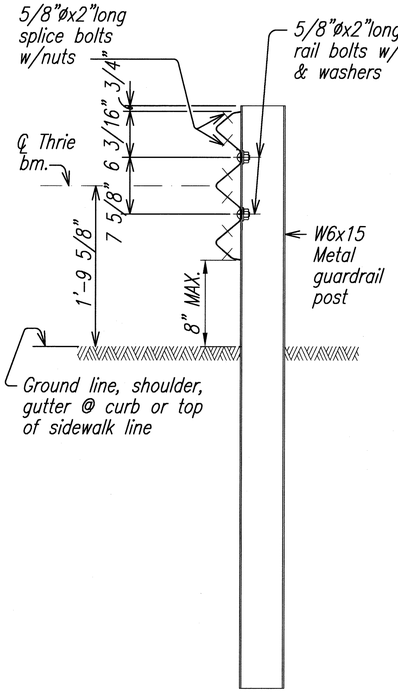
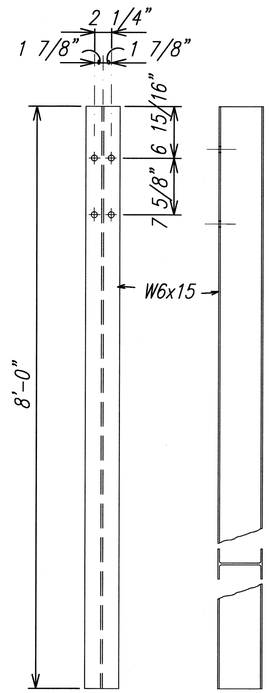
FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-030-1(39)	2008	73	194



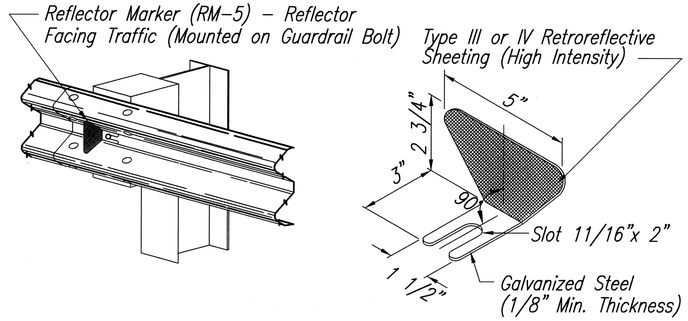
TYPICAL SECTION METAL GUARDRAIL ON METAL POST WITHOUT METAL SPACER BLOCK

Scale: NTS



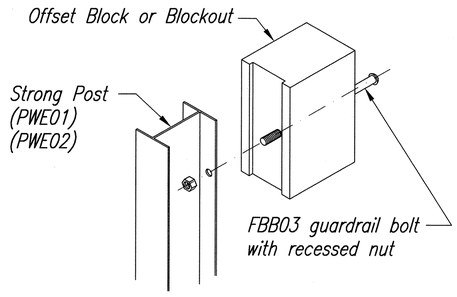
POST DETAILS

Scale: NTS



REFLECTOR MARKER (RM-5) DETAIL AND TYPICAL INSTALLATION

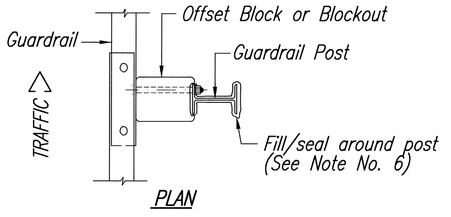
N.T.S.



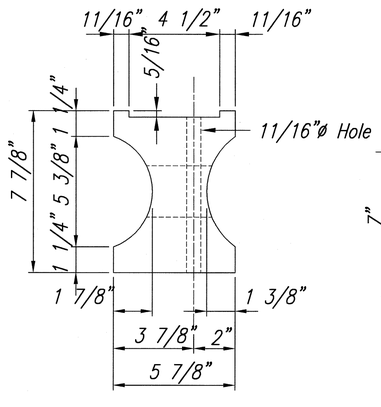
Exploded View
(Rail and washer not shown)

STEEL POST AND BLOCK DETAIL

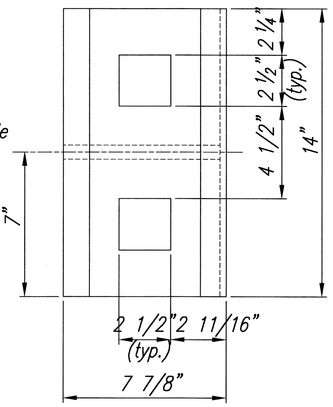
N.T.S.



PLAN



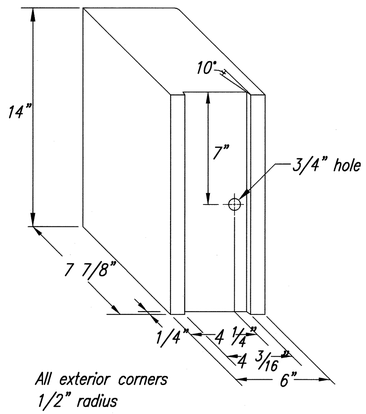
TOP



SIDE

RECYCLED PLASTIC BLOCKOUT (TYPE I)

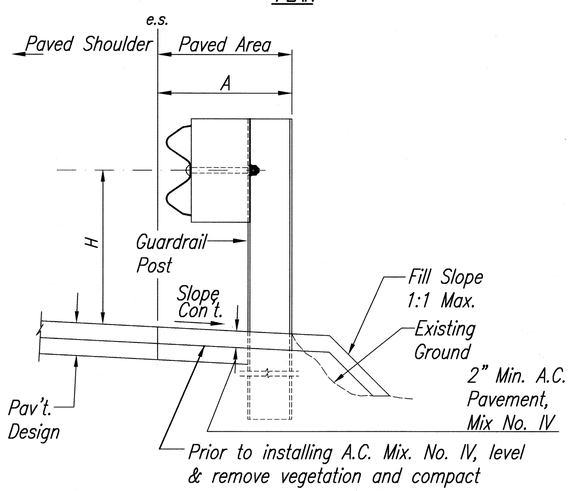
N.T.S.



All exterior corners 1/2" radius

RECYCLED POLYETHYLENE OFFSET BLOCK (TYPE II)

N.T.S.



ELEVATION

TYPICAL GUARDRAIL INSTALLATION

N.T.S.

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.
10. All new guardrail systems (system consist of total length of guardrail including both end treatments) shall include the additional paved area.

GUARDRAIL TYPE	DIMENSION	
	H	A
Strong Post with W-Beam	1'-9 5/8 "	1'-6"

ALAN Y. TOMITA LICENSED PROFESSIONAL ENGINEER NO. 4129-C HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GUARDRAIL DETAILS AND NOTES

Honoapiilani Highway Widening
Lahainaluna Road to Aholo Road
Project No. STP-030-1(39)

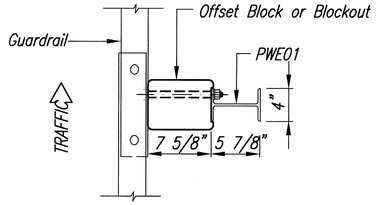
Scale: As Shown Date: October 2008

SHEET No. 1 OF 6 SHEETS

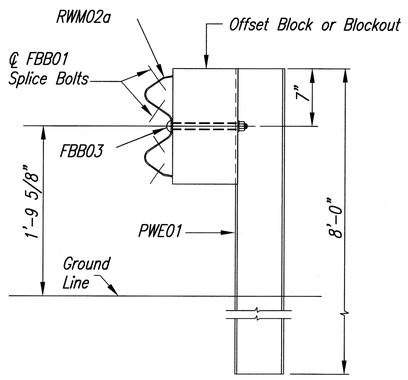
ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY | TRACED BY | DESIGNED BY | QUANTITIES BY | CHECKED BY | DATE
NOTE BOOK | No.

PLOT DATE: 23-29-2008 @ 01:22 pm
LAST UPDATE: 47-14-2008 @ 03:47 pm
PATH/FILENAME: P:\Projects\Oahu-Hwy\Honoapiilani Highway Widening\Lahainaluna\Working Drawings\Proj. Num Revised 1-22-08 (DWL FINAL)\Civil - Final\13a-GUARDRAIL_DETAILS1 alt 73.dwg

FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-030-1(39)	2008	74	194

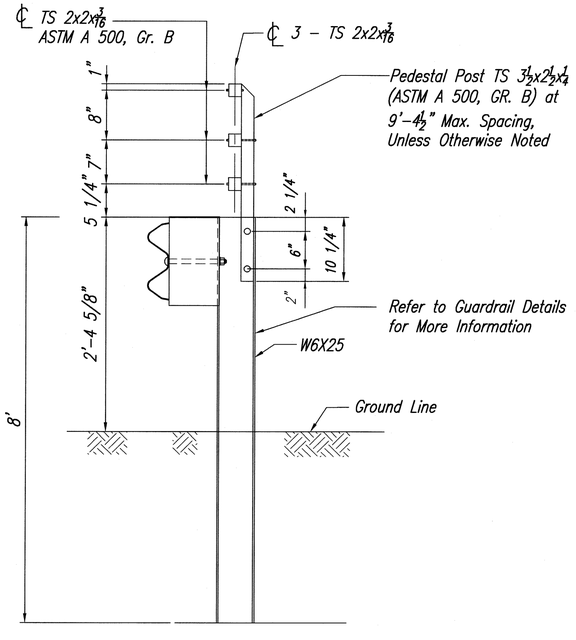


PLAN



ELEVATION

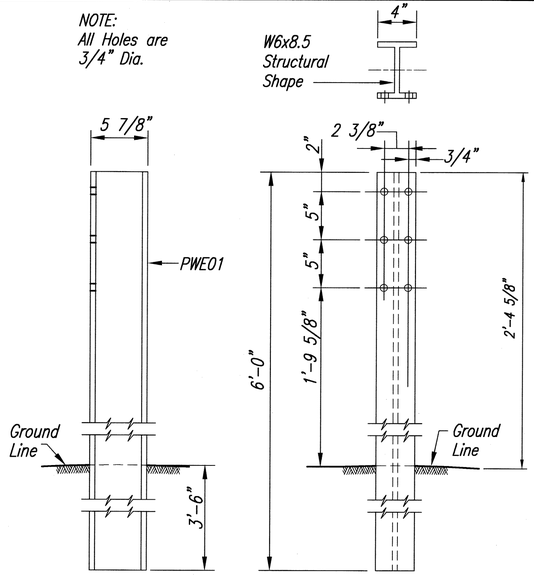
STRONG POST W-BEAM GUARDRAIL (SGR04a)
N.T.S.



ELEVATION

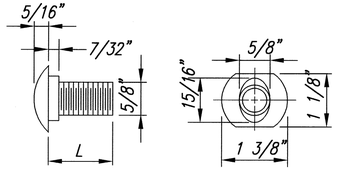
STRONG POST W-BEAM GUARDRAIL WITH PEDESTAL POST
N.T.S.

NOTE:
All Holes are 3/4" Dia.

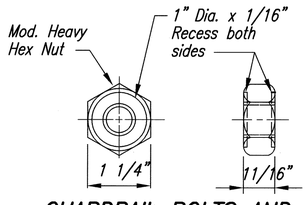


SIDE FRONT

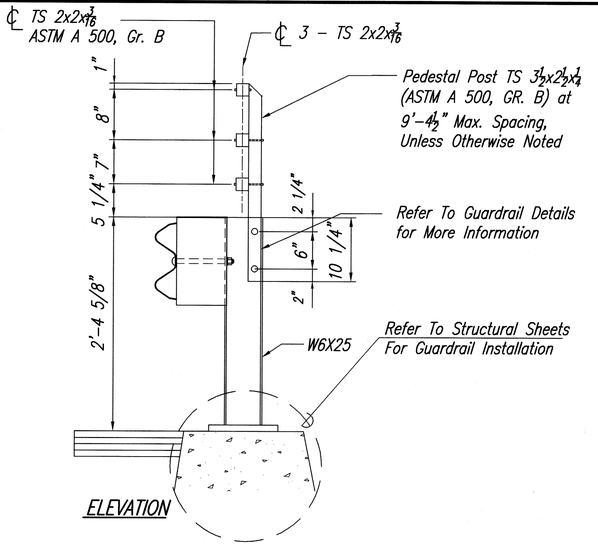
STRONG POST W-BEAM (PWE01)
N.T.S.



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

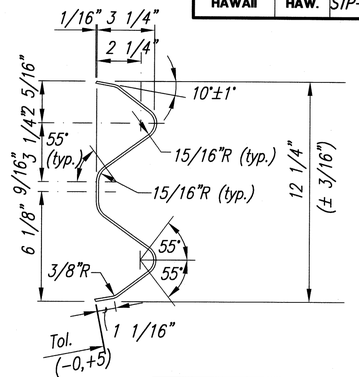


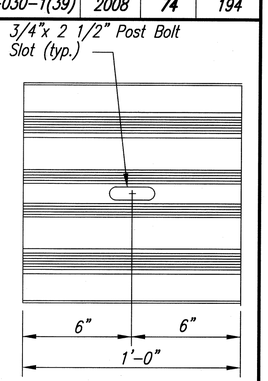
GUARDRAIL BOLTS AND RECESSED NUT
N.T.S.



ELEVATION

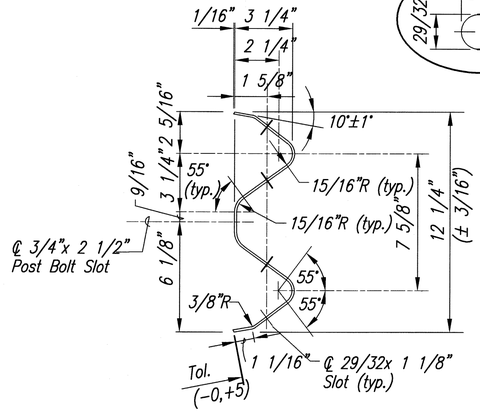
W-BEAM GUARDRAIL WITH PEDESTAL POST (ON RETAINING WALL)
N.T.S.

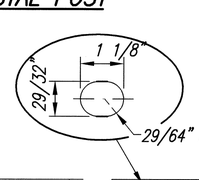


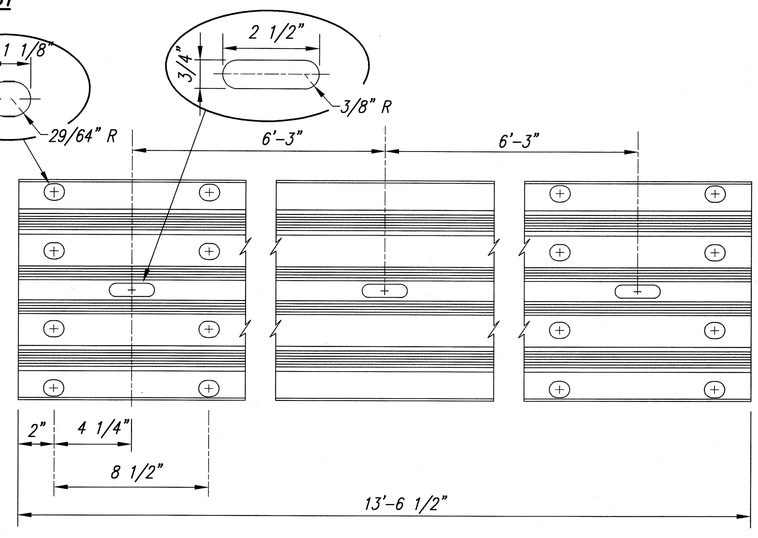


DESIGNATOR	BASE METAL THICKNESS
RWB01a	12 Gauge

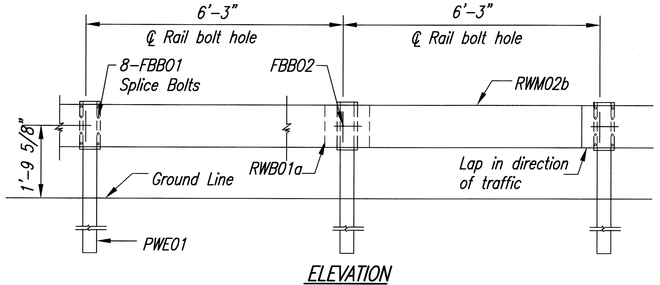
W-BEAM BACK-UP-PLATE (RWB01a)
N.T.S.







2 SPACE W-BEAM GUARDRAIL (RWM02a)
N.T.S.



ELEVATION

STRONG POST W-BEAM GUARDRAIL WITH RECYCLED OFFSET BLOCK OR PLASTIC BLOCKOUT
N.T.S.

DESIGNATOR	BASE METAL THICKNESS
RWM02a	12 Gauge

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NO. 4129-C
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THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GUARDRAIL DETAILS

Honoapiilani Highway Widening
Lahainaluna Road to Aholo Road
Project No. STP-030-1(39)

Scale: As Shown Date: October 2008

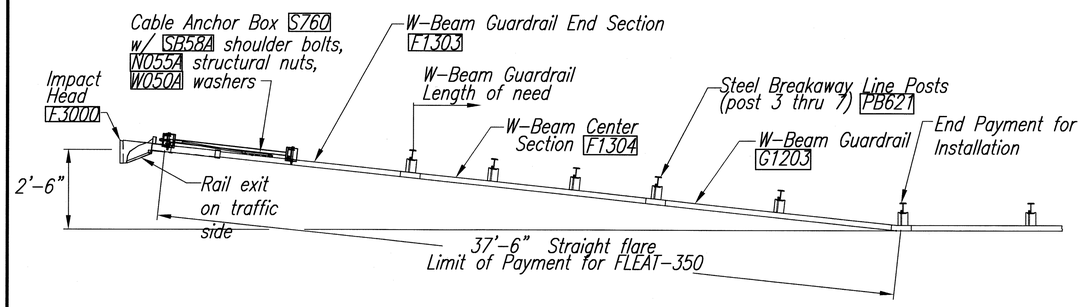
SHEET No. 2 OF 6 SHEETS

74

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

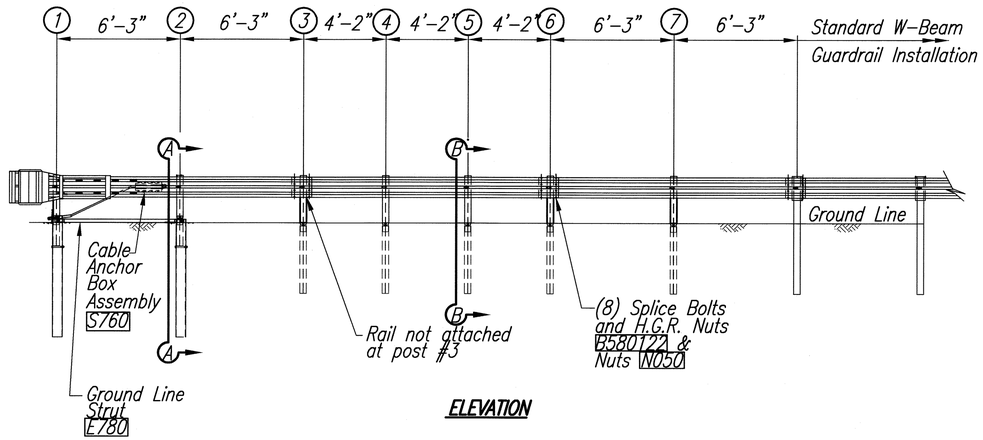
PLOT DATE: 24-29-2008 @ 01:26 pm
LAST UPDATE: 07-06-2008 @ 11:07 am
PATH/FILENAME: P:\Projects\Dot-Hwy\Honoapiilani Highway Widening\Dwg\Working Drawings\Proj. Num Revised 1-22-08 (CIVIL FINAL)\Civil - Final\13b-GUARDRAIL_DETAILS2 plot 74.dwg

FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-030-1(39)	2008	75	194

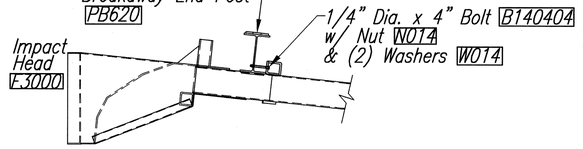


PLAN

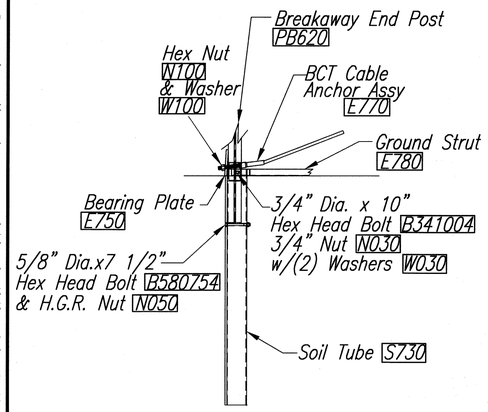
TRAFFIC →



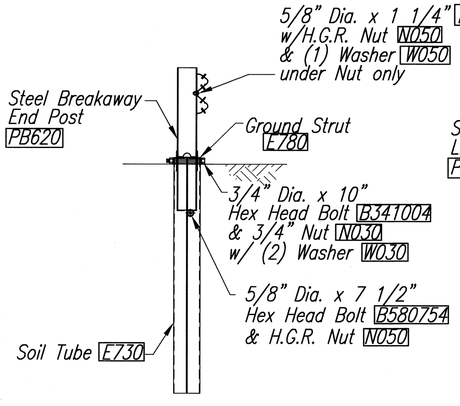
ELEVATION



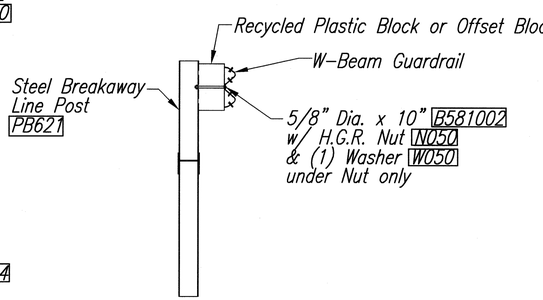
IMPACT HEAD CONNECTING DETAIL



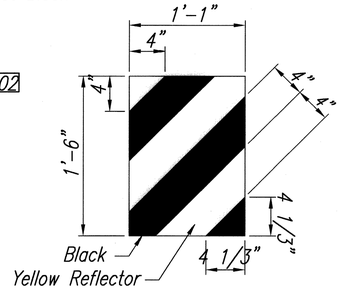
PARTIAL VIEW OF POST 1



SECTION A-A
(@ Post #2)



SECTION B-B
(Typical @ Post 3 - 7)
NOTE: RAIL NOT BOLTED @ POST #3



IHRM(R)
IMPACT HEAD REFLECTOR
MARKER INSERT
DETAIL

GENERAL NOTES

1. Breakaway 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 should not be driven with the post in the tube. If the tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent settlement.
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.
F1304	1	W-BEAM GUARDRAIL CENTER SECTION, 12 GA.
G1203	1	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.x10" H.G.R. BOLT (POST 3 THRU 7)
N050	32	5/8" Dia. H.G.R. NUT (SPLICE 24, SOIL TUBES 2, POST 2 THRU 7, 6)
N030	2	3/4" Dia. HEX NUT
W050	6	H.G.R. WASHER
W030	4	3/4" ID WASHER
N100	2	1" ANCHOR CABLE HEX NUT
W100	2	1" ANCHOR CABLE WASHER
B140404	2	1/4" x 4" HEX BOLT
N014	2	1/4" HEX NUT
W014	4	1/4" WASHER
SB58A	8	CABLE ANCHOR BOX SHOULDER BOLT
N055A	8	1/2" A325 STRUCTURAL NUT
W050A	16	1 1/16" OD x 9/16" ID A325 STR. WASHER

Foundation Tube Options For Posts 1 & 2

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

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GUARDRAIL DETAILS

Honoapiilani Highway Widening
Lahainaluna Road to Aholo Road
Project No. STP-030-1(39)

Scale: As Shown Date: October 2008

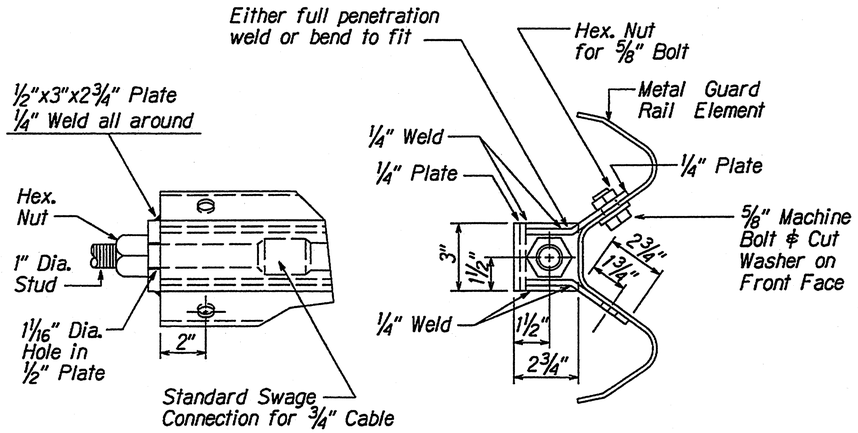
SHEET No. 3 OF 6 SHEETS

75

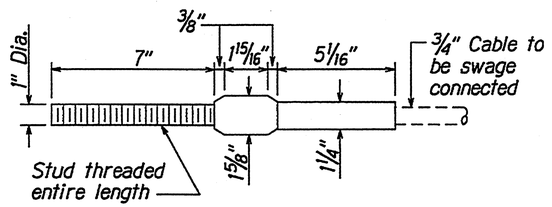
ORIGINAL PLAN
SURVEY PLOTTED BY ____ DATE ____
DRAWN BY " "
TRACED BY " "
DESIGNED BY " "
QUANTITIES BY " "
CHECKED BY " "
NOTE BOOK ____
No. ____

PATH/FILENAME: P:\Projects\Oahu-Hwy\Honoapiilani Highway Widening\Geo\Working Drawings\Proj. Num Revised 1-22-08 (DWL FINAL)\Drwl - Final\13h-GUARDRAIL_DETAILS1.srt 75.dwg
LAST UPDATE: 08-06-2008 @ 11:08 am
PLOT DATE: 31-29-2008 @ 01:31 pm

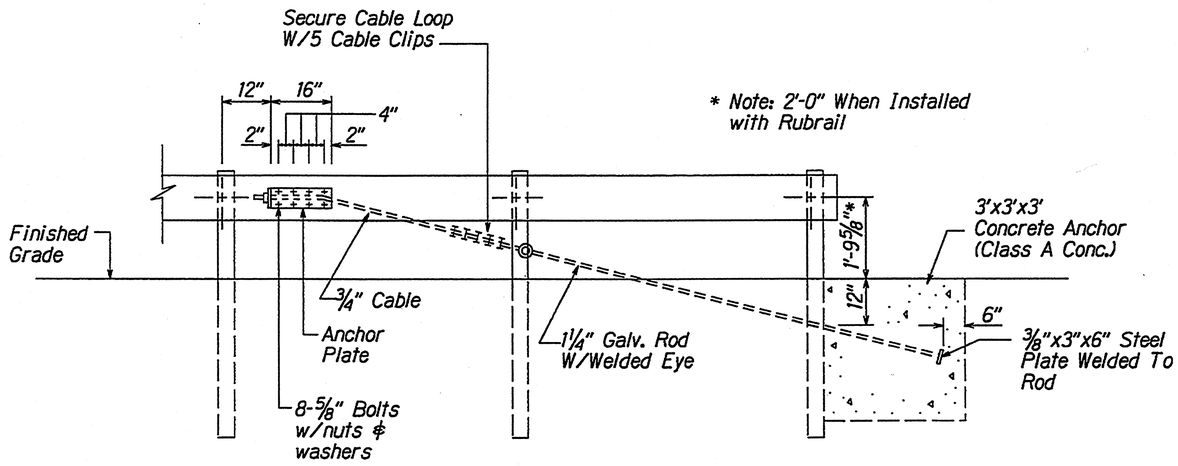
FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-030-1(39)	2008	76	~~195~~ 194



ANCHOR PLATE DETAILS

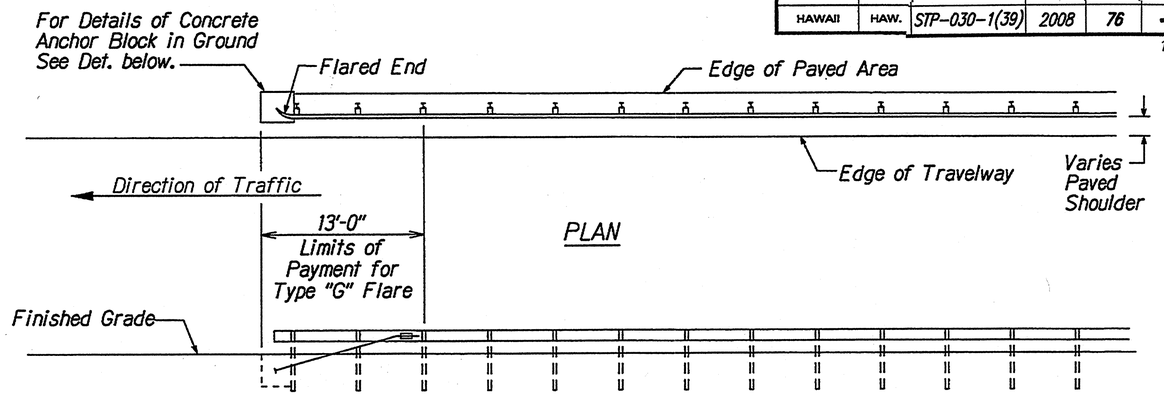


STANDARD SWAGED FITTING AND STUD



ANCHOR BLOCK DETAIL

1. 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) for 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.

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

MISCELLANEOUS GUARDRAIL DETAILS

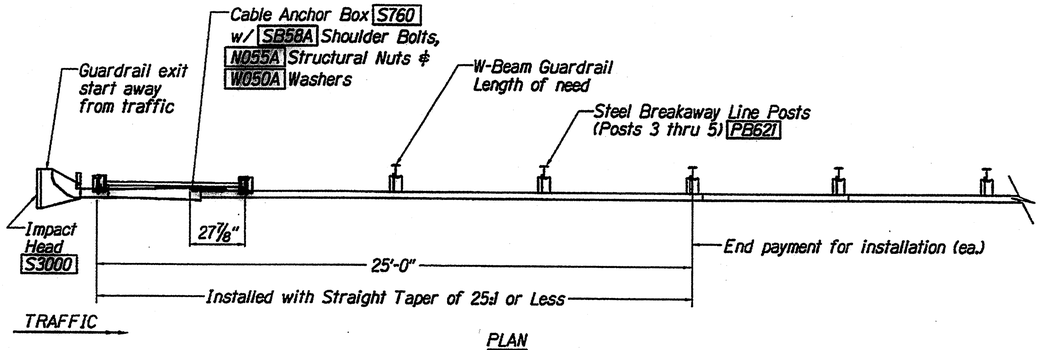
Honoapiilani Highway Widening
Lahainaluna Road to Aholo Road
Project No. STP-030-1(39)

Scale: NTS Date: October 2008 ~~February 2009~~

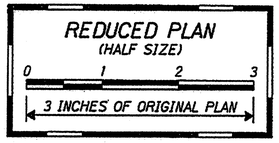
SHEET No. 4 OF 6 SHEETS

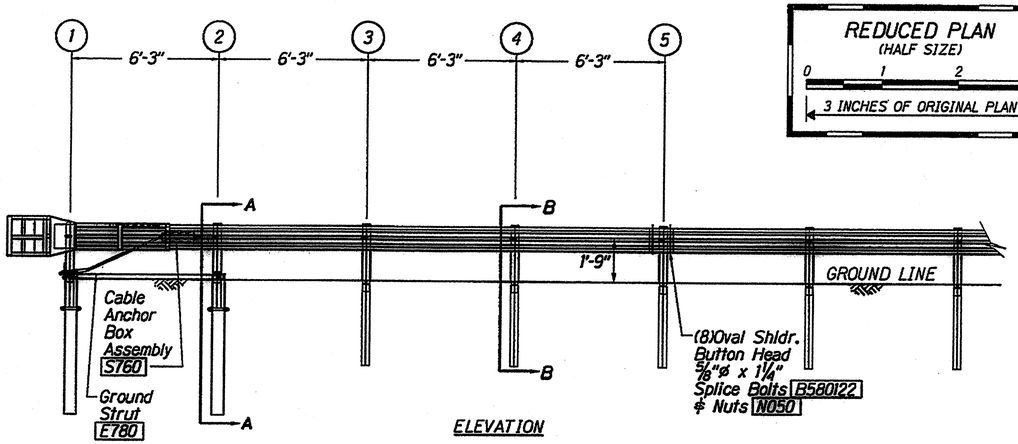
ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY X | TRACED BY X | DESIGNED BY X | QUANTITIES BY | CHECKED BY | DATE X | NOTES BOOK | No.

r3/13/02 tdl:ruby/guardrail/te59revd.dgn (standard plan TE-59 rit/03/89)

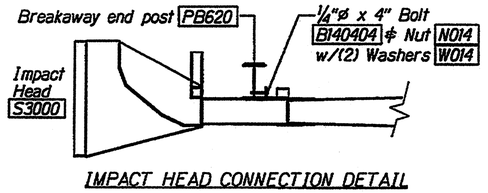


PLAN

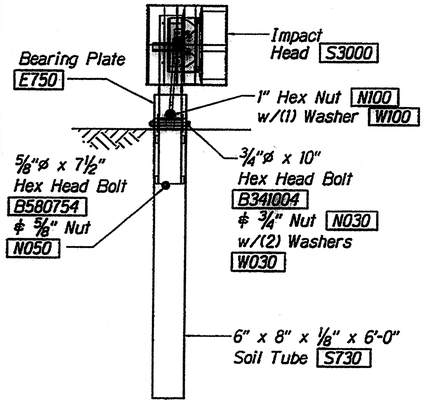




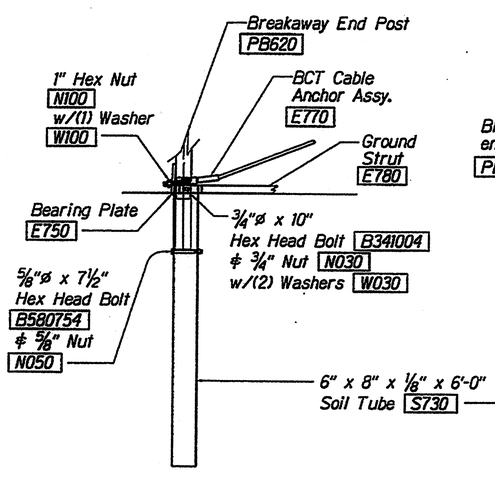
ELEVATION



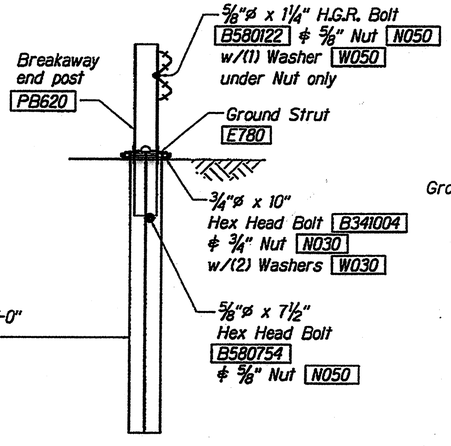
IMPACT HEAD CONNECTION DETAIL



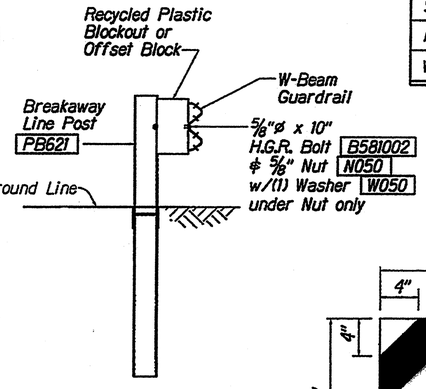
FRONT VIEW OF POST 1



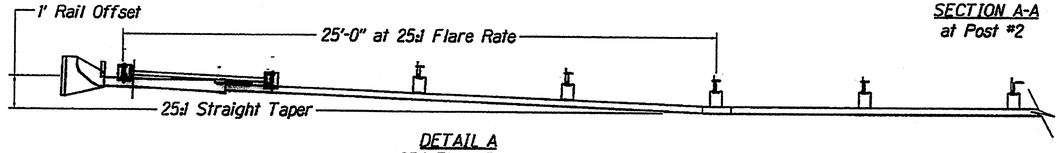
PARTIAL VIEW OF POST 1



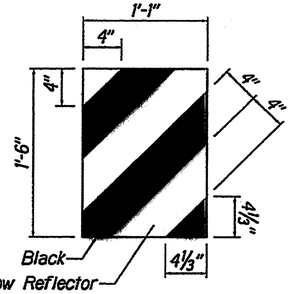
SECTION A-A
at Post #2



SECTION B-B
Typical @ Post 3 thru 5



DETAIL A
25:1 Flare Rate



IHRM(R)
IMPACT HEAD REFLECTOR MARKER INSERT DETAIL

GENERAL NOTES:

1. Breakaway steel 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 W-beam guardrail installation, the SKT will be flared at a rate of 25:1 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.
5. 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 drilled holes, the backfill material must be satisfactorily compacted to prevent settlement.
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. 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.
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. 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.
9. (R) or (L) indicates right or left Impact Head Reflector Marker (IHRM). Providing and installing of IHRM shall be considered incidental to end treatment.
10. The stripes for IHRM shall slope downward at an angle of 45° towards the side of the end treatment that traffic is to pass.

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-030-1(39)	2008	77	~~195~~ 194

BILL OF MATERIALS

ITEM NO.	QTY.	
S3000	1	IMPACT HEAD
S1303/ S1305	1	W-BEAM GUARDRAIL END SECTION 12 ga. 12.5' or 25'
G1203	1/0	W-BEAM GUARDRAIL, 12 GA, 12.5'
S730	2	*FOUNDATION SOIL TUBE, 6" X 8" X 6'-0"
E750	1	BEARING PLATE
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
	3	RECYCLED PLASTIC BLOCKOUTS OR OFFSET BLOCKS
	1	IMPACT HEAD REFLECTOR MARKER - IHRM(R) OR (L)
		HARDWARE
B580122	9/17	⅝" Dia. x 1 ¼" SPLICE BOLT, POST 2
B580754	2	⅝" Dia. x 7 ½" HEX BOLT
B341004	2	¾" Dia. x 10" HEX BOLTS
B581002	3	⅝" Dia. x 10" H.G.R. BOLT (POSTS 3 THRU 5)
N050	14/22	⅝" Dia. H.G.R. NUT (SPLICE 8/16, SOIL TUBES 2, POSTS 2 THRU 5,4)
N030	2	¾" Dia. HEX NUT
W050	4	H.G.R. WASHER
W030	4	¾" ID WASHER
N100	2	1" ANCHOR CABLE HEX NUT
W100	2	1" ANCHOR CABLE WASHER
B140404	2	¼" x 4" HEX BOLT
N014	2	¼" HEX NUT
W014	4	¼" WASHER
SB58A	8	CABLE ANCHOR BOX SHOULDER BOLT
N055A	8	½" 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

DIANE Y. KODAMA LICENSED PROFESSIONAL ENGINEER No. 6666-C HAWAII, U.S.A.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

SKT-S-TL2-2
SEQUENTIAL KINKING TERMINAL

Honoapiilani Highway Widening
Lahainaluna Road to Aholo Road
Project No. STP-030-1(39)

Scale: As Shown Date: ~~February 2008~~ October 2008

SHEET No. 5 OF 6 SHEETS

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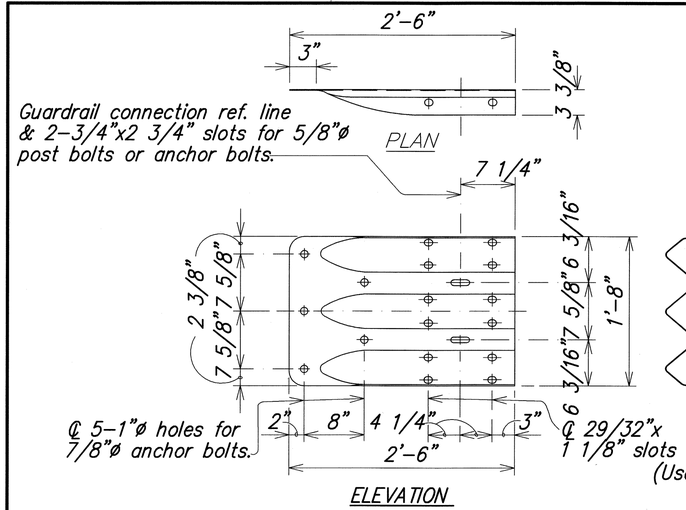
ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY X | TRACED BY | DESIGNED BY X | QUANTITIES BY | CHECKED BY | DATE X | NOTE BOOK dd.x No. dd.pn

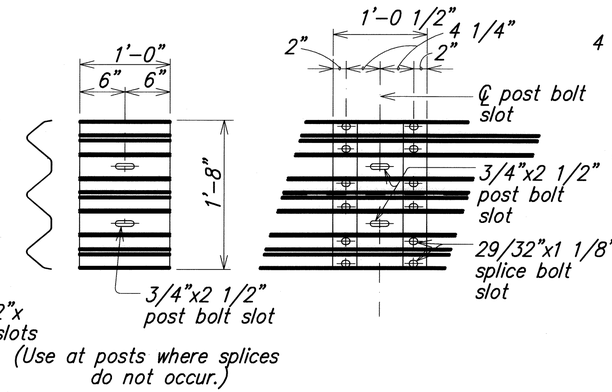
td1:ruby/guardrail/TL-2/sktsil2.2usdgn
3/28/01

FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-030-1(39)	2008	78	195



TERMINAL CONNECTOR

Scale: NTS

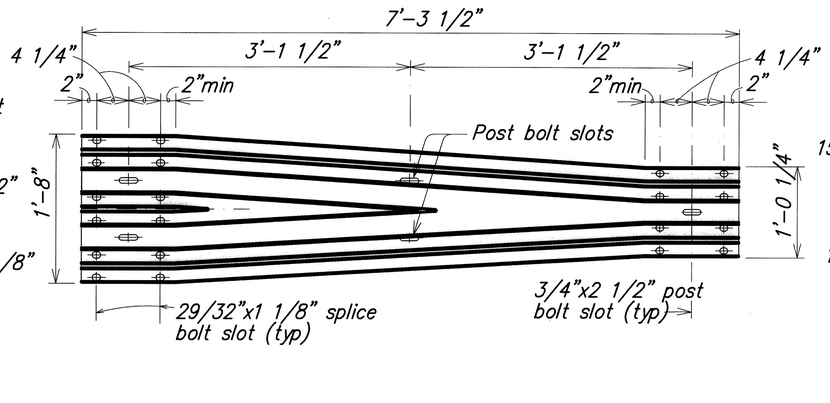


BACKUP PLATE

Scale: NTS

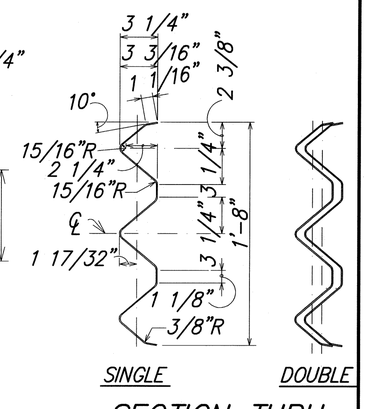
RAIL SPLICE

Scale: NTS



TRANSITION SECTION

Scale: NTS



SECTION THRU RAIL ELEMENT

Scale: NTS

NOTES:

A. The work necessary to connect guardrail to concrete end post shall include all labor, materials, tools, equipment and incidentals necessary to complete the work and will not be paid for separately.

B. Lap terminal connector and rail element in direction of traffic to prevent snagging.

C. All anchor bolts shall be high strength bolts conforming to the requirements of ASTM 325 and Standard Specification, Section 713.04.

D. Anchor bolt length shall be such that a snug fit of the elements and full thread engagement plus 1/4" (max) is attained.

E. "Terminal Connector", "Transition Section" and thrie beam shall be fabricated from 10gauge steel conforming to the requirements of AASHTO M 180, Type II, Class B.

F. "Terminal Connector" and standard spacer, including all anchor bolts, cap PL, nuts and washers, shall be hot-dip galvanized after fabrication.

G. Cap PL shall be fabricated from ASTM A 36.

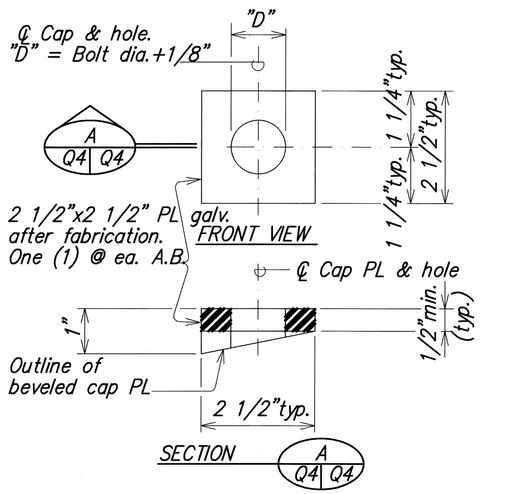
H. First 25'-0" of guardrail adjoining "Terminal Connector" shall be galvanized steel and supports spaced as shown on the detail drawings. This section of rail shall be placed on tangent to end post or parallel to roadway, unless conditions at site renders it impossible to do so. Flare point to be determined in field.

I. Double (nest 1st panel) thrie beam elements at all end post connections, except on highways with one-way traffic pattern, use single thrie beam elements at end post on trailing end only.

J. Where double (nested) beam occur, 12" "Back-up Plate" not required.

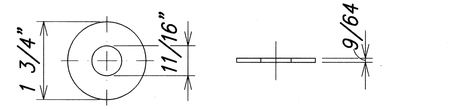
K. Heads of through anchor bolts shall be placed on the traffic side of the rail.

L. All steel shapes, rails and plates shall conform to ASTM A 36 specifications.



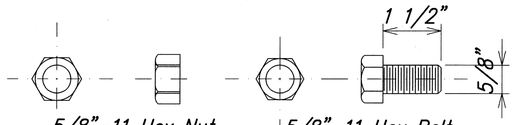
CAP (BEARING) PLATE DETAIL

Scale: NTS



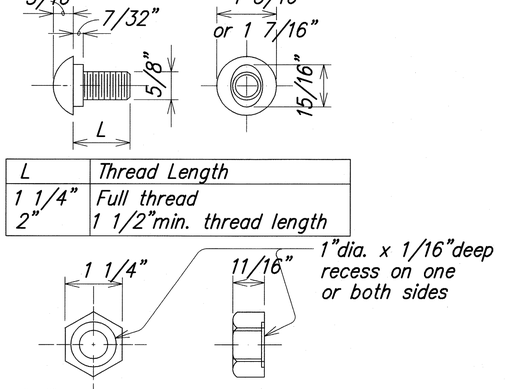
STEEL WASHER FOR 5/8"ø BOLT

Scale: NTS



5/8"ø HEX BOLT & NUT

Scale: NTS



5/8"ø BUTTON HEAD BOLT & RECESS NUT

Scale: NTS

ALAN Y. TOMITA
LICENSED PROFESSIONAL ENGINEER
NO. 4129-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GUARDRAIL DETAILS

Honoapiilani Highway Widening
Lahainaluna Road to Aholo Road
Project No. STP-030-1(39)

Scale: As Shown Date: February 2008

SHEET No. 6 OF 6 SHEETS

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

PLOT DATE: 31-29-2008 @ 01:31 pm
FILE/FILENAME: P:\Projects\Oahu-Hwy\Honoapiilani Highway Widening\Hwy Widening Drawings\Proj. Num Revised 1-23-08 (DWL PWA)\Dist - Fed\13A-GUARDRAIL_DETAILS-Thrie Beam SHT 78.dwg LAST UPDATE: 08-06-2008 @ 11:08 am