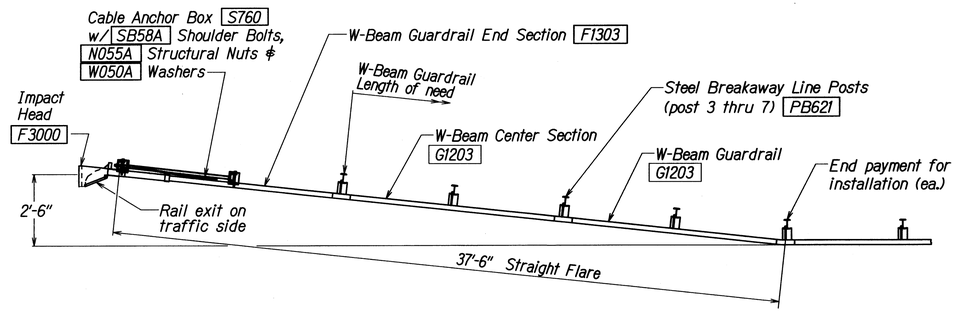
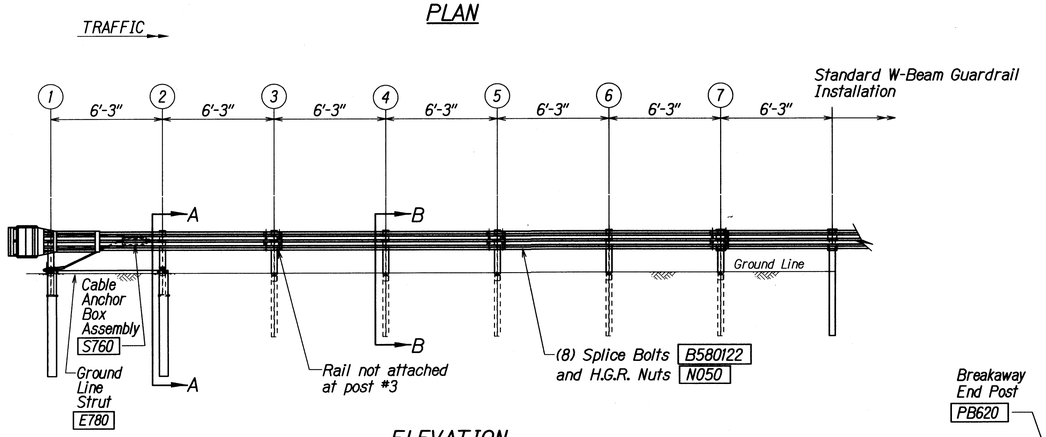
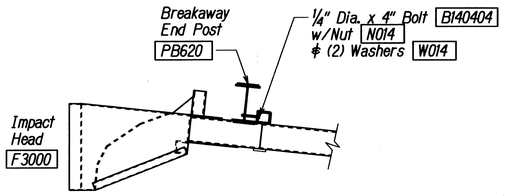


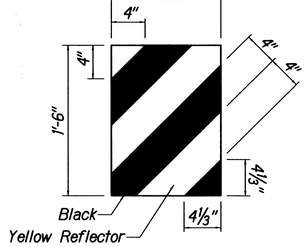
PLAN



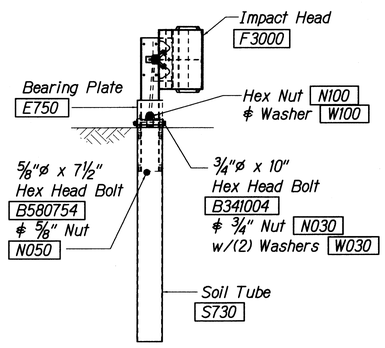
ELEVATION



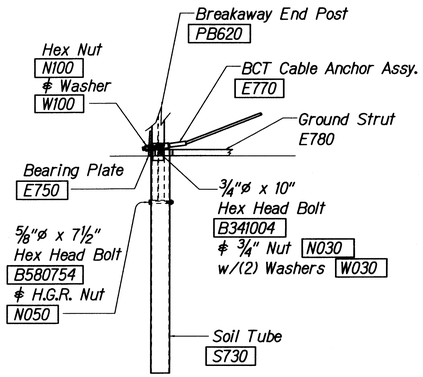
IMPACT HEAD CONNECTING DETAIL



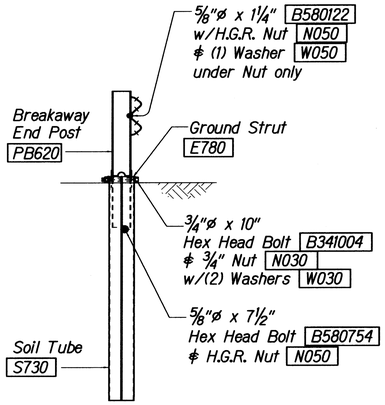
IHRM(R)
IMPACT HEAD REFLECTOR
MARKER INSERT
DETAIL



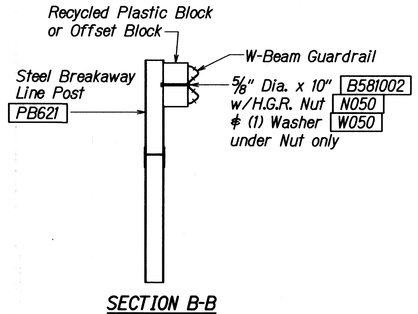
FRONT VIEW OF POST 1



PARTIAL VIEW OF POST 1



SECTION A-A
at Post #2



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

GENERAL NOTES

1. Breakaway steel posts are required with the FLEAT Terminal.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The soil tubes shall not protrude more than 4" above ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
4. The soil tubes may be driven with an approved driving head. Soil tubes shall not be driven with the post in the tube. If the tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent settlement.
5. When rock is encountered during excavation, a 12" Dia. post hole, 20" deep may be used if approved by the engineer. Granular material will be placed in the bottom of the hole approx. 2 ½" 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.

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-0900(073)	2010	10	38

ITEM NO.	QTY.	BILL OF MATERIALS
F3000	1	IMPACT HEAD
F1303	1	W-BEAM GUARDRAIL END SECTION, 12 GA.
G1203	2	W-BEAM GUARDRAIL, 12 GA.
S730	2	*FOUNDATION SOIL TUBE, 6" x 8" x 72"
E750	1	BEARING PLATE
S760	1	CABLE ANCHOR BOX
E770	1	BCT CABLE ANCHOR ASSEMBLY
E780	1	GROUND STRUT
PB620	2	STEEL BREAKAWAY END POST
PB621	5	STEEL BREAKAWAY LINE POST
	5	RECYCLED PLASTIC BLOCKOUT OR OFFSET BLOCK
	1	IMPACT HEAD REFLECTOR MARKER - IHRM(R) OR (L)
		HARDWARE
B580122	25	5/8" Dia. x 1¼" SPLICE BOLT, POST #2
B580754	2	5/8" Dia. x 7½" HEX BOLT
B341004	2	¾" Dia. x 10" HEX BOLT
B581002	5	5/8" Dia. x 10" H.G.R. BOLT (POST 3 THRU 7)
N050	32	5/8" Dia. H.G.R. NUT (SPLICE 24, SOIL TUBES 2, POST 2 THRU 7, 8)
N030	2	¾" Dia. HEX NUT
W050	6	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 Tubes S730
*6'-0" Solid Foundation Tubes E731
*5'-0" Foundation Tubes S735 W/Soil Plates SP600
*4'-6" Foundation Tubes E735 W/Soil Plates SP600

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

FLEAT-350

FLARED ENERGY ABSORBING TERMINAL

KULA HWY. RESURF. Haakakai Brid. towards Old Lower Kula Rd.
HONOAPIILANI HIGHWAY RESURFACING
Kapoli St. to Kaheawa Wind Farm Access Rd.
Federal-Aid Project No. STP-0900(073)

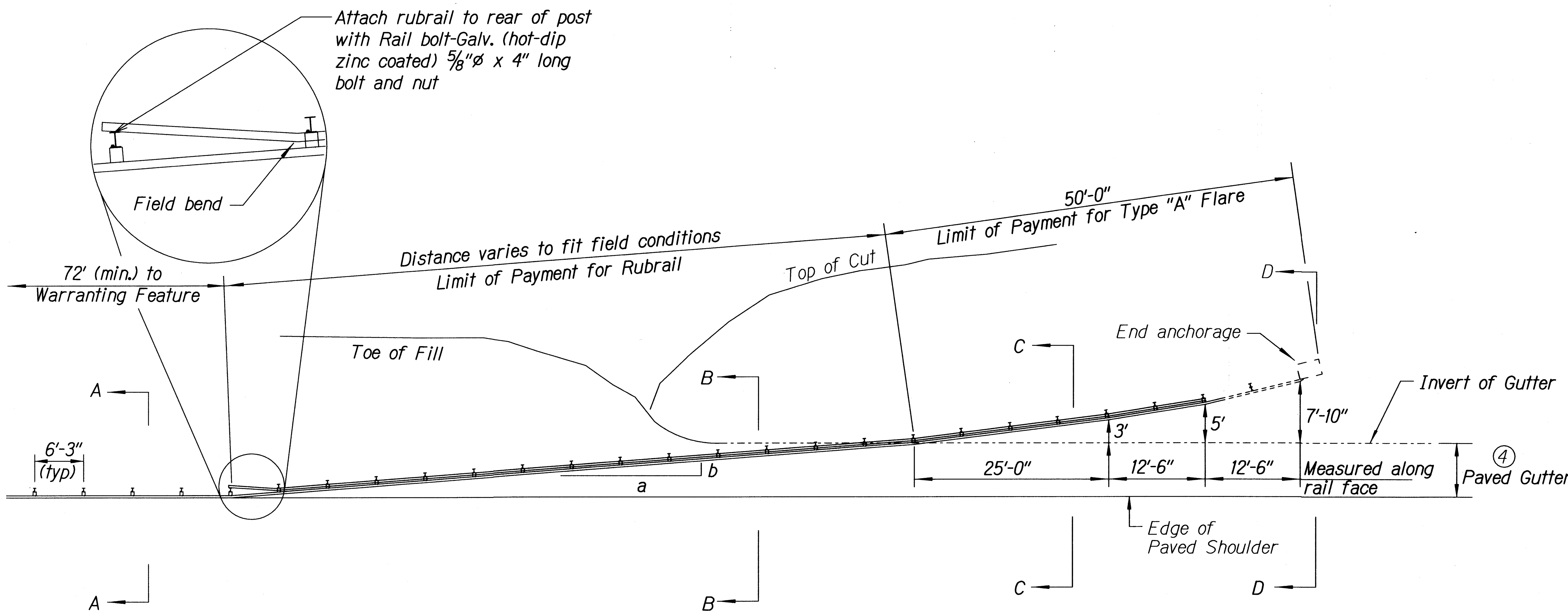
Not to Scale — Date: July, 2009

SHEET No. 1 OF 5 SHEETS

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

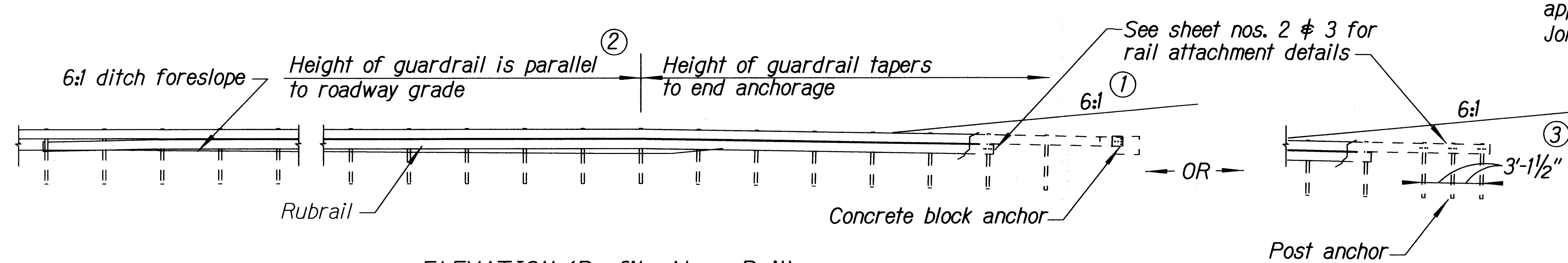
tdl-tdy/guardrail/fleat350.dgn (standard plan TE-61 rll/03/09 & TE-62 r09/01/87)
8/12/02

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-0900(073)	2010	11	38

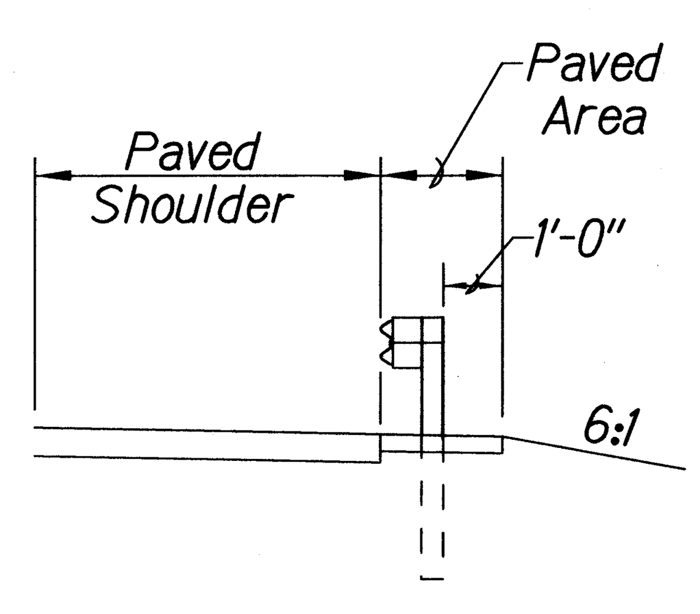


PLAN

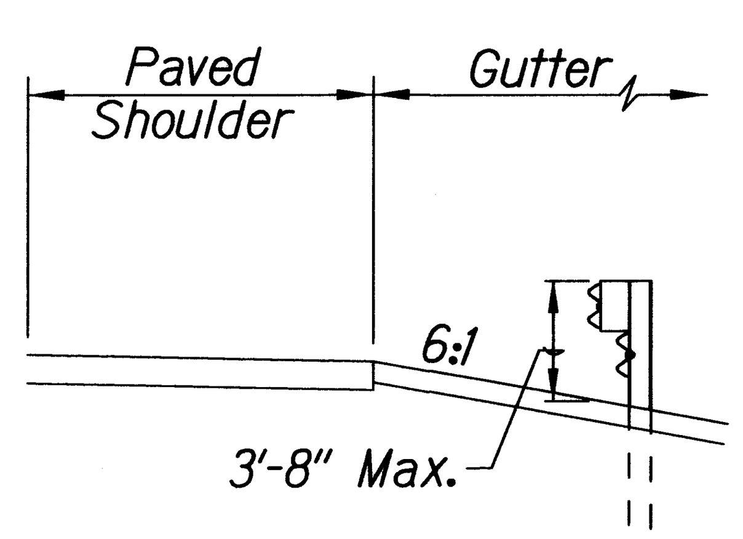
Design speed mph	a:b
68	15:1
62	13:1
56	12:1
50	11:1
43	10:1
37	9:1
31	7:1



ELEVATION (Profile Along Rail)

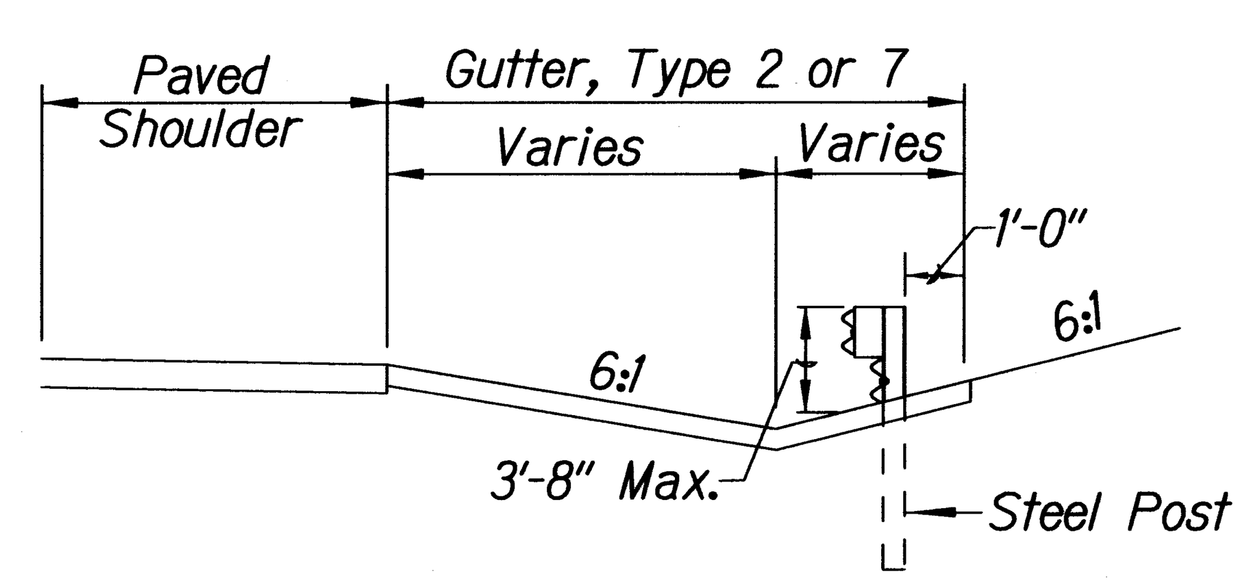


Section A-A



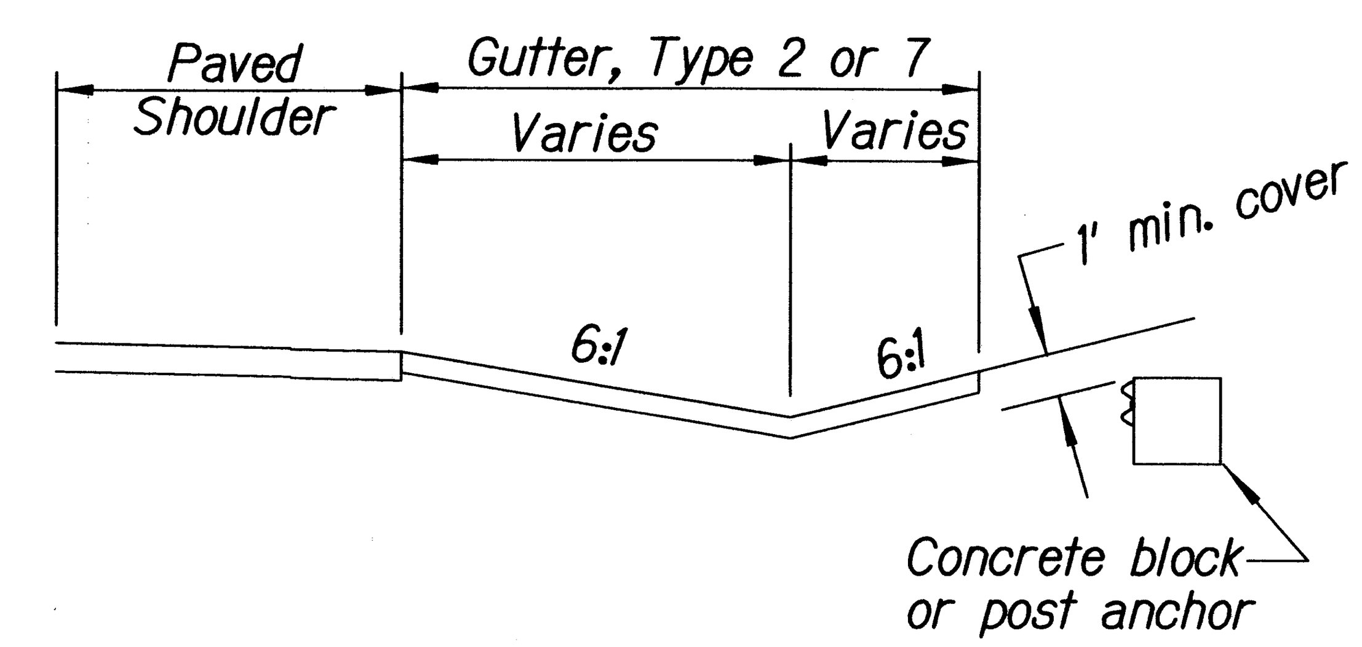
Section B-B

(With Rubrail)



Section C-C

(With Rubrail)



General Notes

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

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

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

r8/21/01 td:\rub\guardrail\r6grveditch.dgn (standard plan TE-58 07/01/86, TE-59 r11/03/89 & TE-60 07/01/86)

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

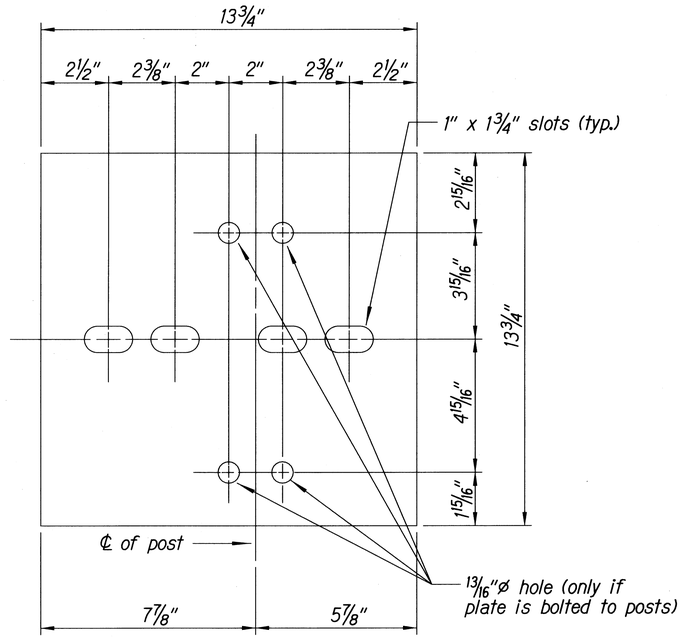
TYPE "A" FLARE

KULA HIGHWAY RESURFACING
Haakakai Bridge towards Old Lower Kula Rd. and
HONOAPIILANI HIGHWAY RESURFACING
Kapoli St. to Kaheawa Wind Farm Access Rd.
Federal-Aid Project No. STP-0900(073)

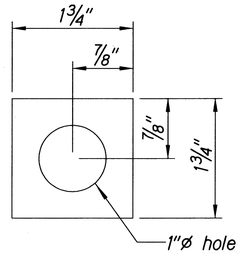
Scale: NTS   Date: July, 2009

SHEET No. 2 OF 5 SHEETS

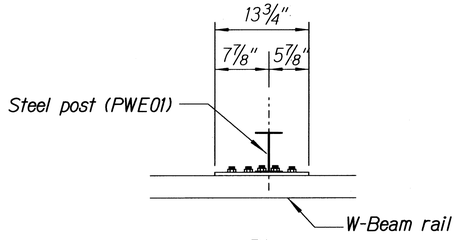
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-0900(073)	2010	12	38



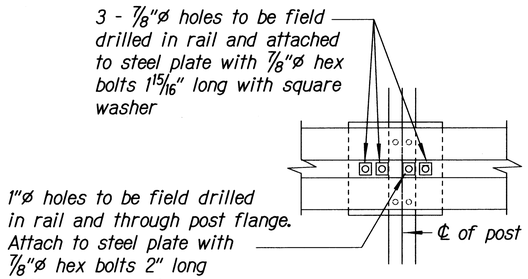
Steel Plate - ½"
(Hot-dip Zinc Coated Galvanized Welded or Bolted to Post)



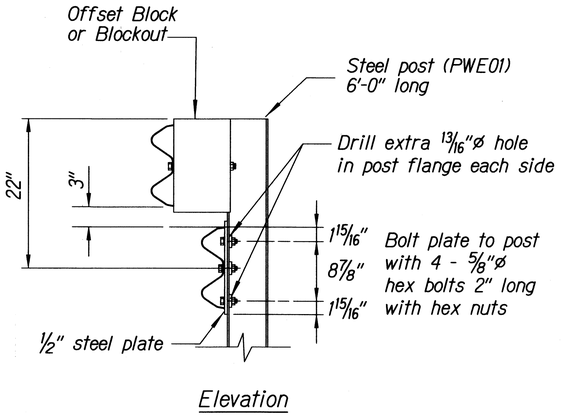
Square Washer
(3/16" Thick - Hot-dip Zinc Coated Galvanized)



Plan

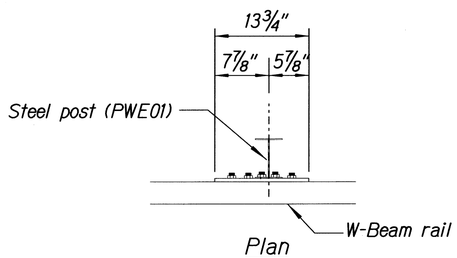


Front View

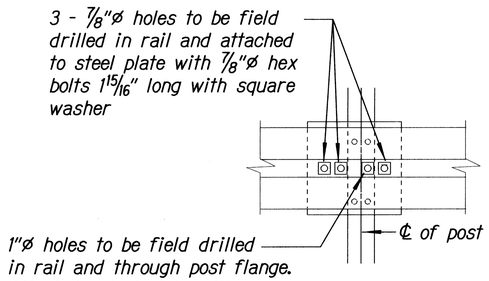


Elevation

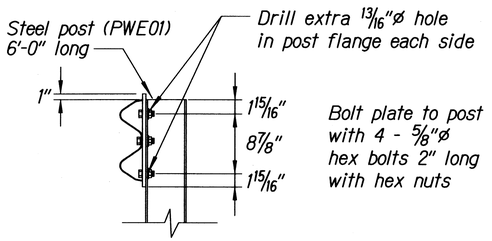
RUBRAIL ANCHOR DETAILS



Plan



Front View



Elevation

POST ANCHOR DETAILS

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

Note:

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

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

standard plan TE-58 07/01/86, TE-59 rlt/03/89 & TE-60 07/01/86)
r3/01/99 tdl:/uby/guardrail/p4det2.dgn

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

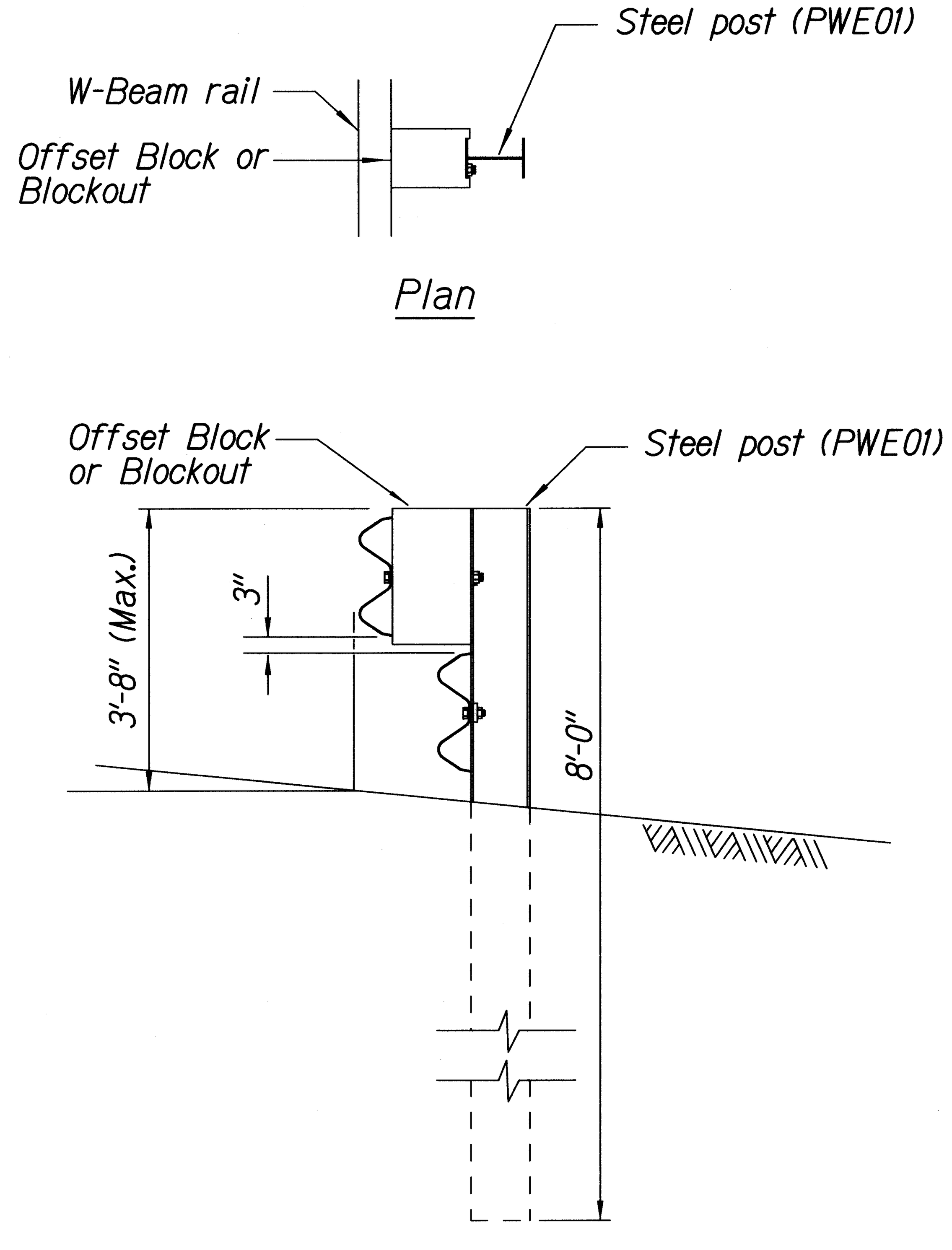
TYPE "A" FLARE

KULA HIGHWAY RESURFACING
Haakakai Bridge towards Old Lower Kula Rd. and
HONOAPIILANI HIGHWAY RESURFACING
Kapoli St. to Kaheawa Wind Farm Access Rd.
Federal-Aid Project No. STP-0900(073)

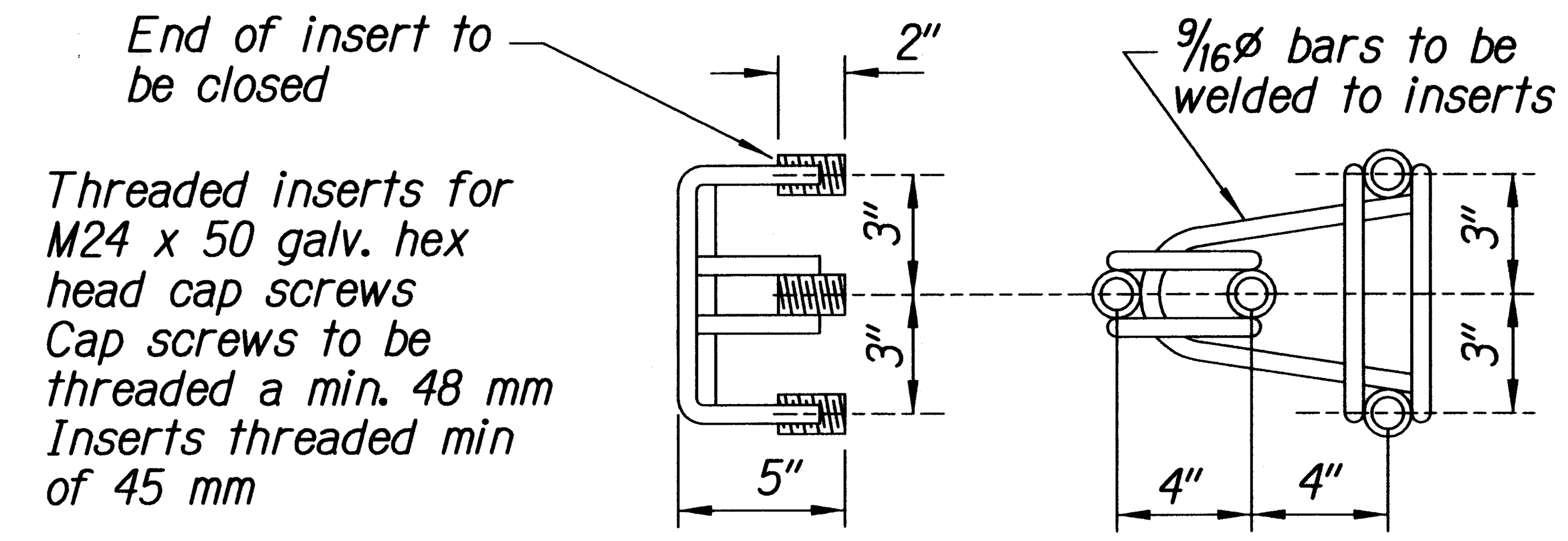
Scale: NTS Date: July, 2009

SHEET No. 3 OF 5 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-0900(073)	2010	13	38



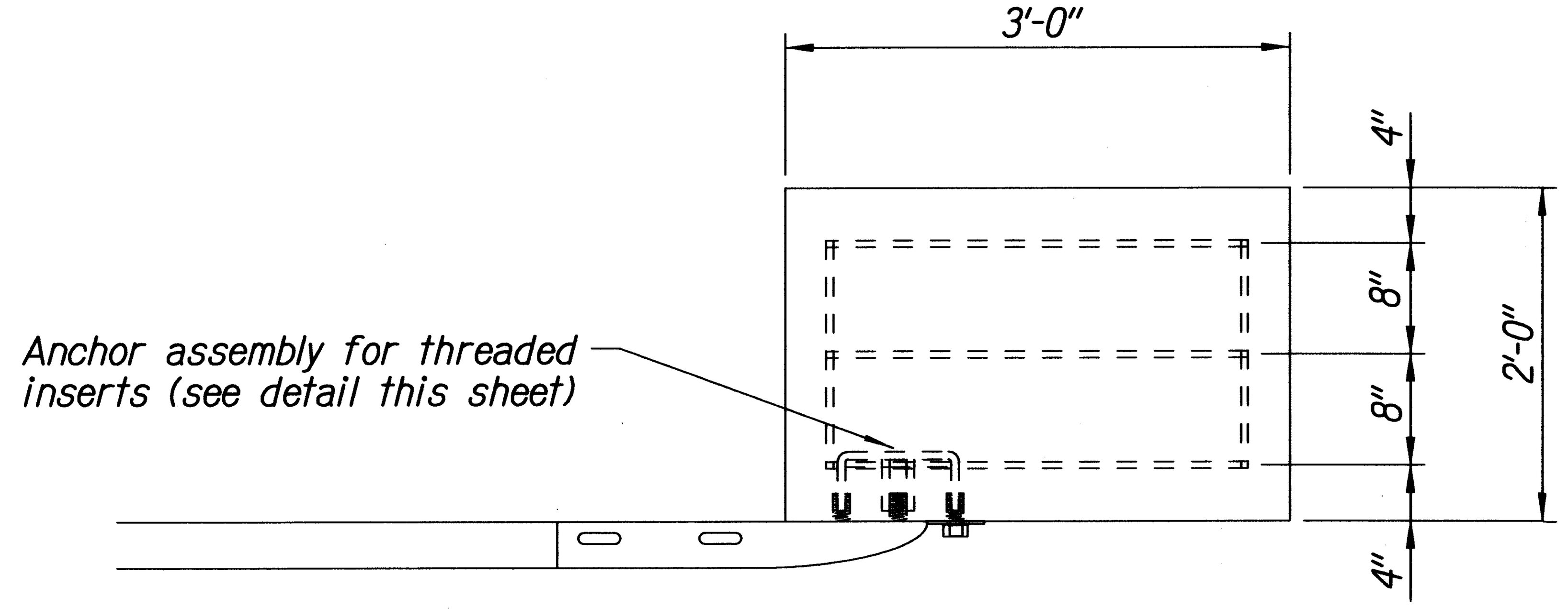
STEEL POST GUARDRAIL WITH RUBRAIL



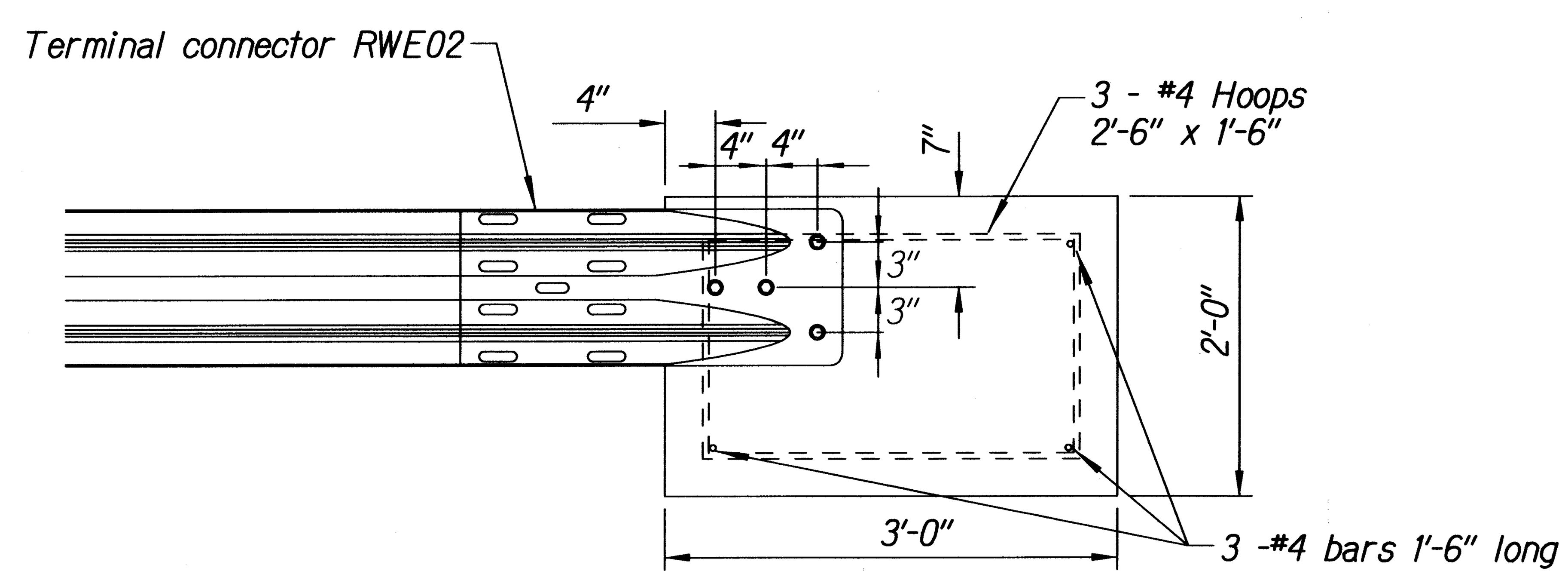
ANCHOR ASSEMBLY
CONCRETE BLOCK ANCHOR

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.



Plan



Elevation

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

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

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPE "A" FLARE

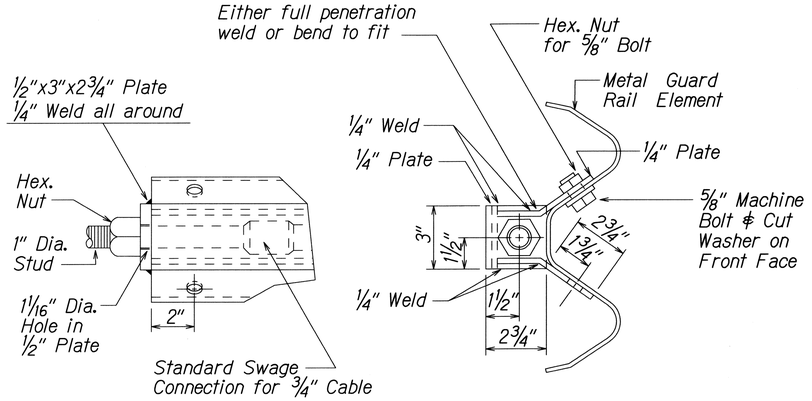
KULA HIGHWAY RESURFACING
Haakakai Bridge towards Old Lower Kula Rd. and
HONOAPIILANI HIGHWAY RESURFACING
Kapoli St. to Kaheawa Wind Farm Access Rd.
Federal-Aid Project No. STP-0900(073)
Scale: NTS   Date: July, 2009

SHEET No. 4 OF 5 SHEETS

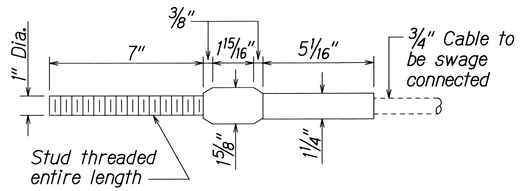
ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY X | TRACED BY | DESIGNED BY X | QUANTITIES BY | CHECKED BY | DATE | NOTE BOOK | dd/x.x | No. X.dgn

r3/01/99 tdt.ruby/guardrail/g4defl.dgn (standard plan TE-58 07/01/86, TE-59 r11/03/89 & TE-60 07/01/86)

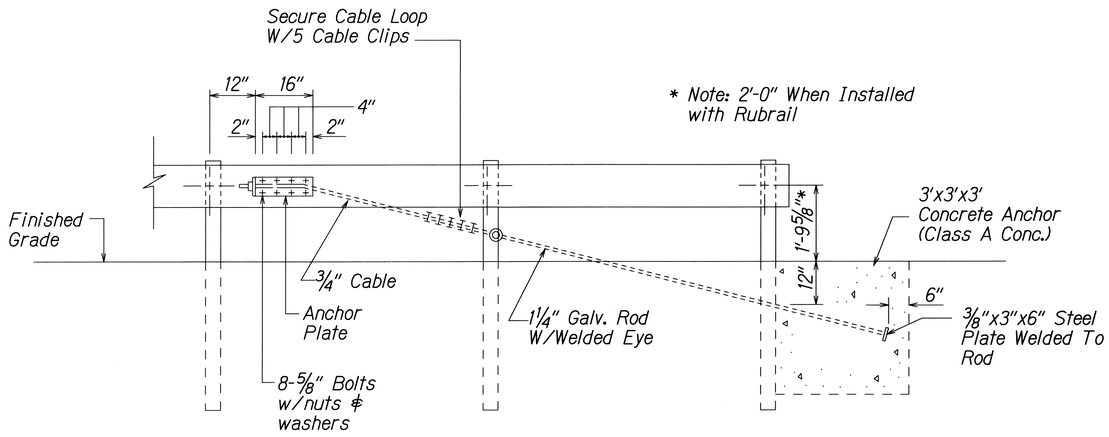
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-0900(073)	2010	ADD13S-1	38



ANCHOR PLATE DETAILS

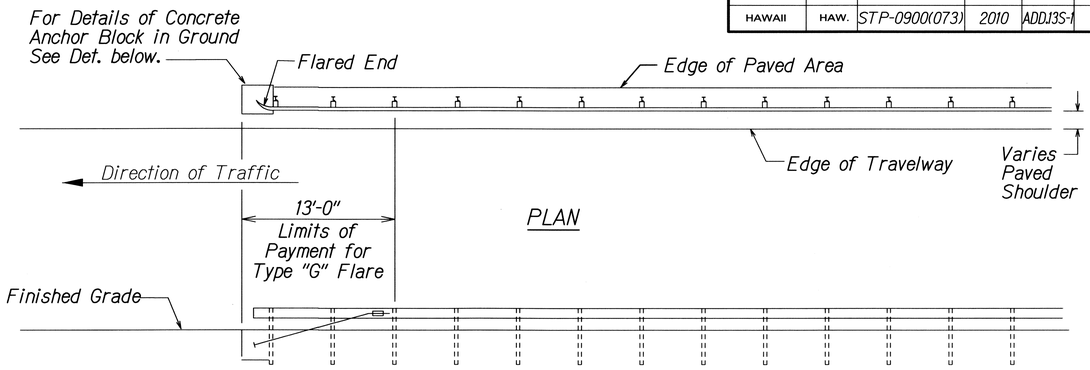


STANDARD SWAGED FITTING AND STUD



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) of the guardrail shall follow the latest edition of AASHTO'S Roadside Design Guide (currently, Table 5.6 - Suggested Flare Rate for Barrier Design, page 5-21, Jan. 1996 edition).

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

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

DATE	REVISION
6-6-11	Added Guardrail Detail Sheet.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPE "G" FLARED END TERMINAL

KULA HWY. RESURF. Haakakai Brid. towards Old Lower Kula Rd.
HONOAPIILANI HIGHWAY RESURFACING
Kapoli St. to Kaheawa Wind Farm Access Rd.
Federal-Aid Project No. STP-0900(073)

Not to Scale Date: July, 2009

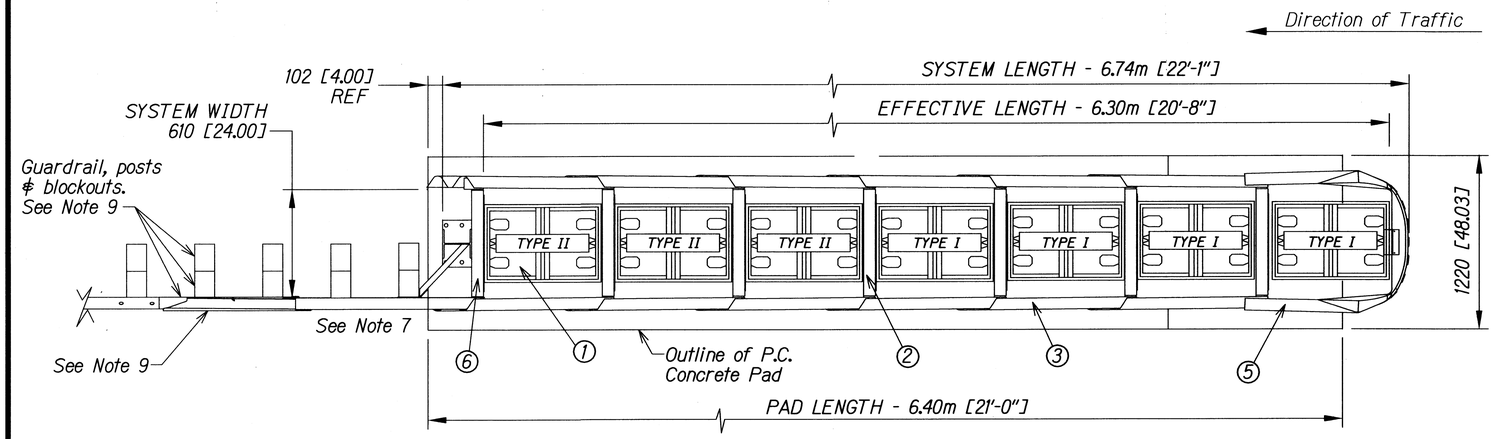
SHEET No. 1 OF 1 SHEETS

ADD. 13S-1

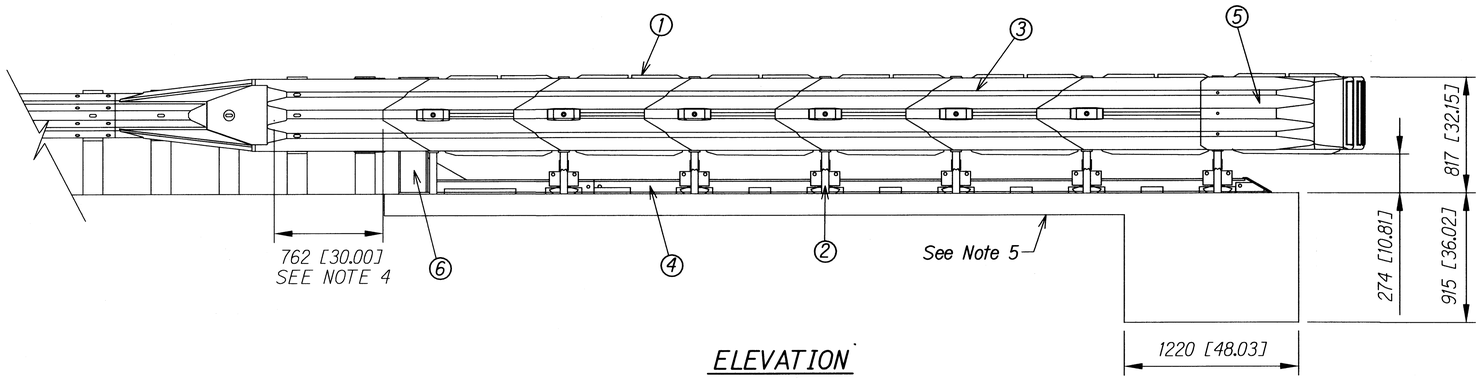
ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY | TRACED BY | DESIGNED BY | QUANTITIES BY | CHECKED BY | DATE | NOTE BOOK | N.

3/13/02 tdl:uby/guardrail/te59rev.dgn (standard plan TE-59 11/03/89)

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	STP-0900(073)	2010	14	38



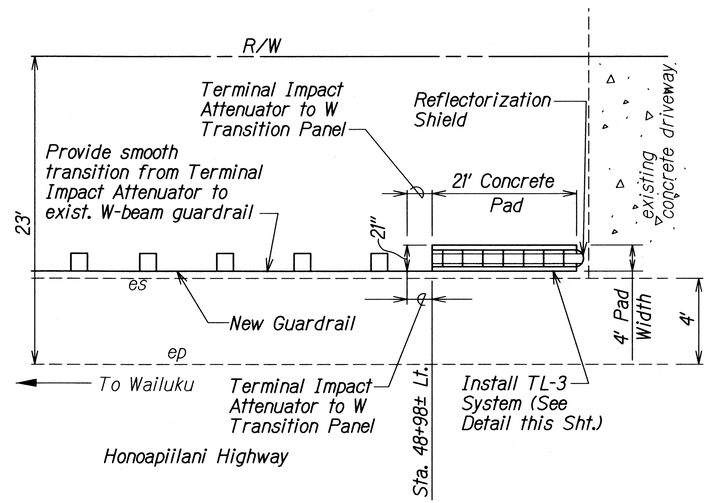
PLAN



ELEVATION

TERMINAL IMPACT ATTENUATOR SYSTEM W/ TENSION STRUT BACKUP

Not To Scale



DETAIL PLAN
TERMINAL IMPACT ATTENUATOR SYSTEM
HONOAPIILANI HIGHWAY @ STA. 48+98± LT.

Not To Scale

NOTES:

1. The Terminal Impact Attenuator System shall be installed per manufacturer's recommendations.
2. Units of measurement are mm (inches in '[]') unless otherwise noted.
3. In compliance with the AASHTO 2002 roadside design guide, manufacturer recommends removal of all curbs and islands within 50 feet in front and as far back of the system to ensure proper impact performance.
4. Provision shall be made for rear fender panels to slide rearward upon impact 762 [30.00] min.
5. 6" min. reinforced 4000 psi P.C. concrete pad (measuring 1220 [48.03] wide by 9.14 m [21'-0"] long) or 8" min. non-reinforced 4000 psi P.C. concrete roadway, (measuring at least 3.66 m [12'-0"] wide by 15.24 m [21'-0"] long).
6. See the Product Manual for a description of its impact performance characteristics and design limitations before placing a system at a given site.
7. Where necessary, the customer shall supply an adequate transition from the terminal impact attenuator system to the object being shielded.
8. The six bay terminal impact attenuator system has been fully tested at 100 km/h under the full 8 test matrix of NCHRP 350 TL-3.
9. W-beam guardrail, posts, blockouts, transition assemblies, nose assemblies and related fasteners shall be included as part of the installation of the system and considered incidental to Item No. 693.0100 - Terminal Impact Attenuator.

KEY

1. Crash Cushion Cartridge
2. Diaphragm
3. Fender Panel
4. Monorail
5. Nose Assembly
6. Backup

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

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TERMINAL IMPACT ATTENUATOR SYSTEM W/ TENSION STRUT BACKUP DETAIL

KULA HWY. RESURF. Haakakai Brid. towards Old Lower Kula Rd.
HONOAPIILANI HIGHWAY RESURFACING
Kapoli St. to Kaheawa Wind Farm Access Rd.
Federal-Aid Project No. STP-0900(073)

Scale: As Shown Date: July, 2009

SHEET No. 5 OF 5 SHEETS