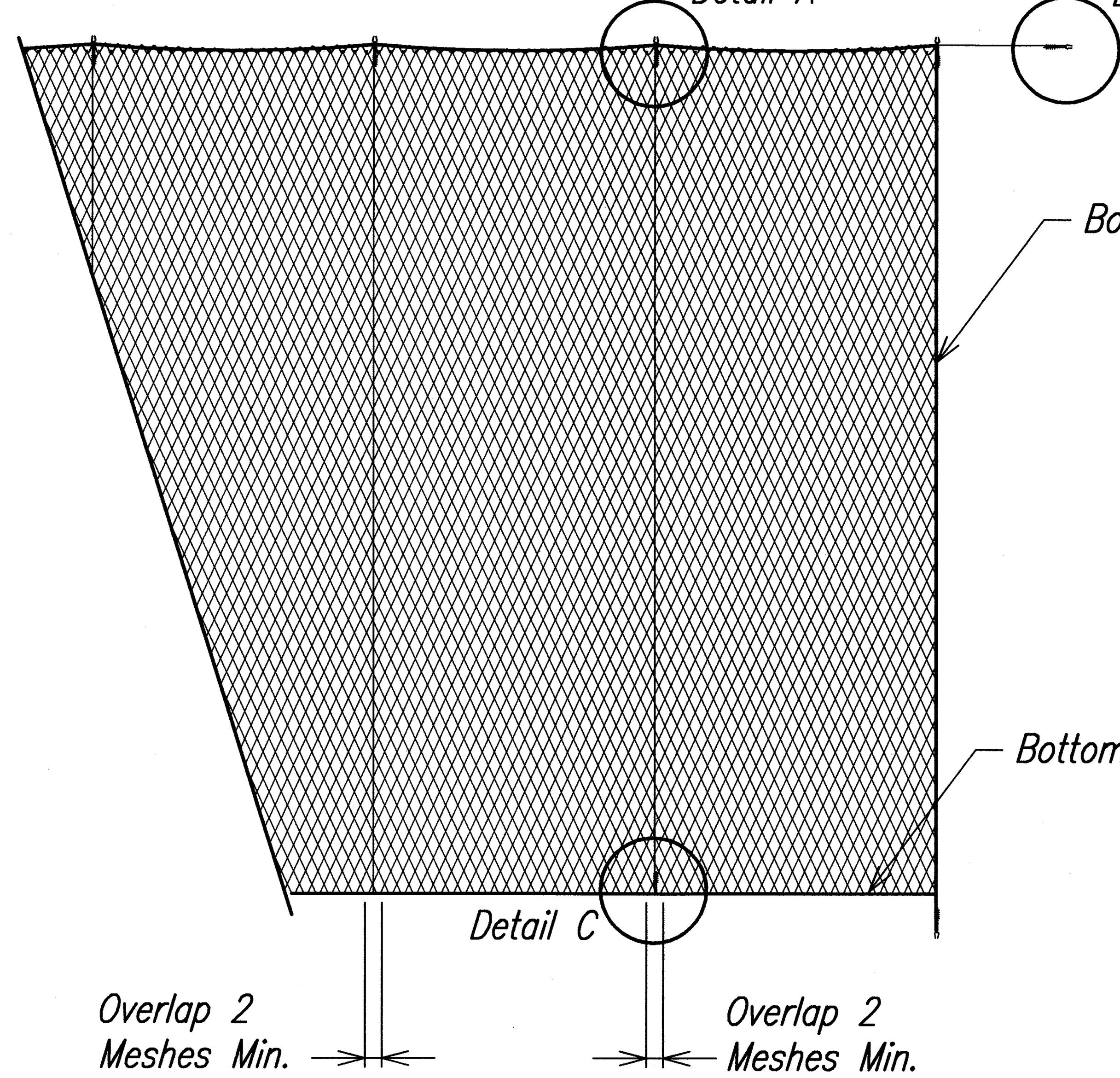
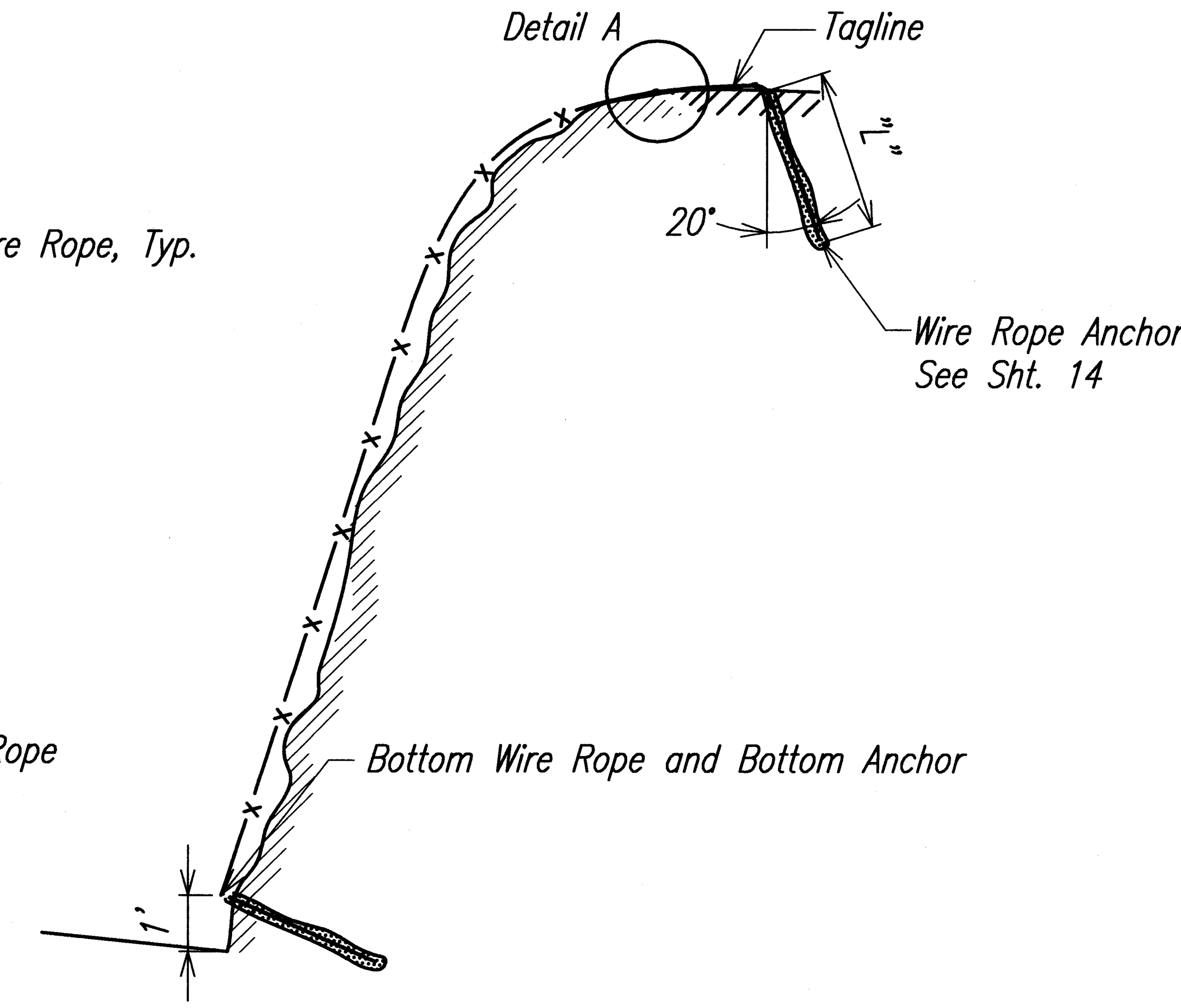
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	9	89



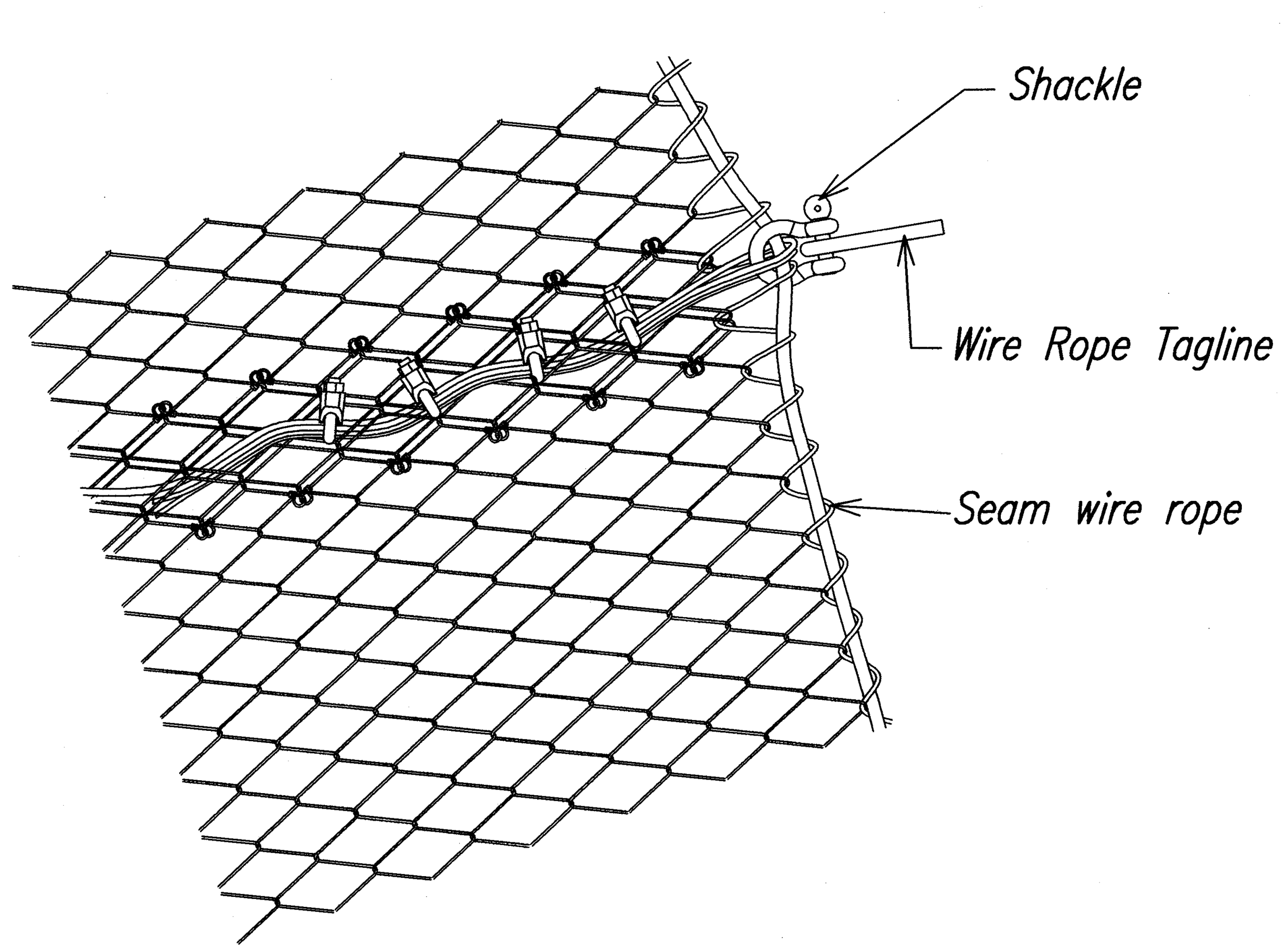
MESH LAYOUT
Not to Scale



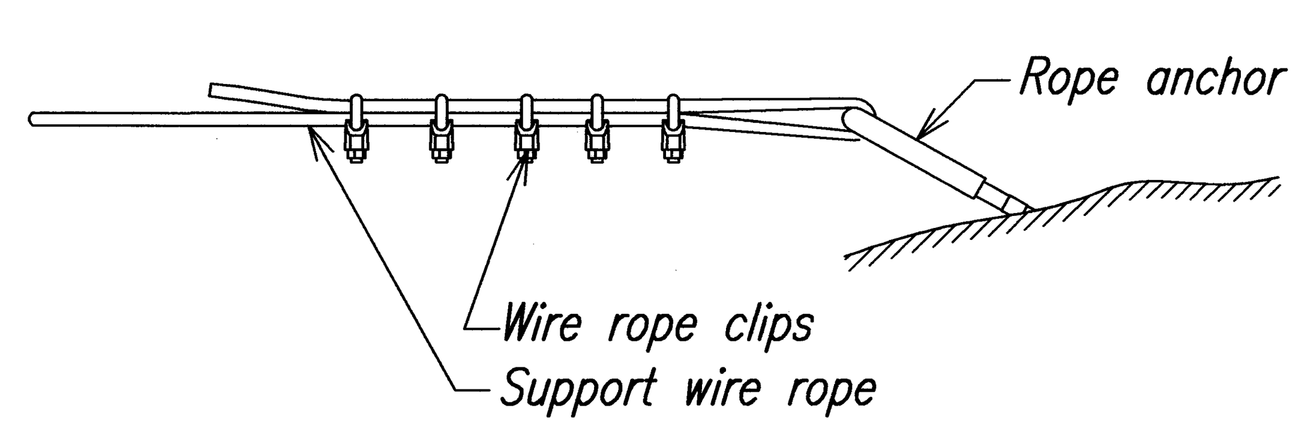
DRAPED MESH SECTION
Not to Scale

Draped Mesh Anchor Schedule			
Location	Ground Type	Minimum Embement Length "L"	Maximum Spacing
Top of Slope	Bedrock	10 feet	20 feet
Top of Slope	Soil	20 feet	20 feet
Bottom of Slope	All Types	10 feet	50 feet

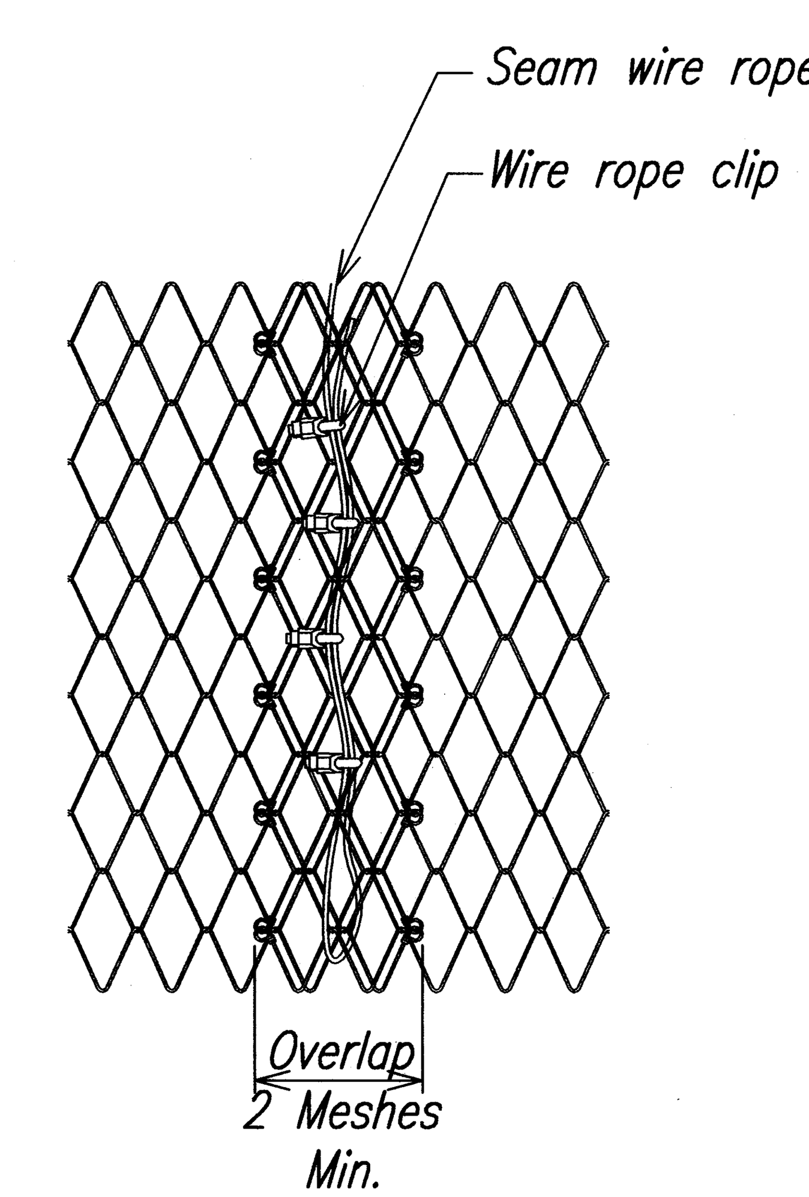
TYPICAL DRAPED MESH DETAILS
Not to Scale



DETAIL A
Not to Scale



DETAIL B
Not to Scale

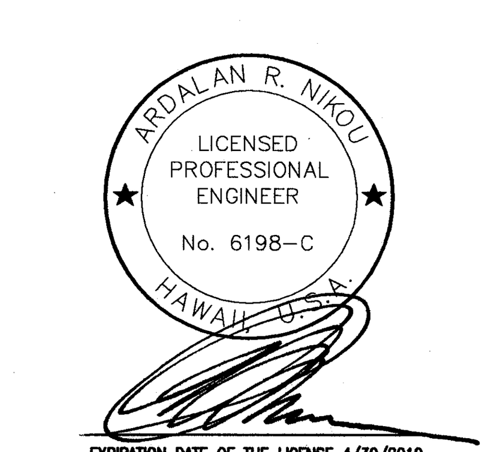


DETAIL C
Not to Scale

Notes:

1. Details shown here are for general guidance. Contractor shall follow the manufacturer's authorized design drawings and installation guidelines.

AECOM



EXPIRATION DATE OF THE LICENSE 4/30/2010
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

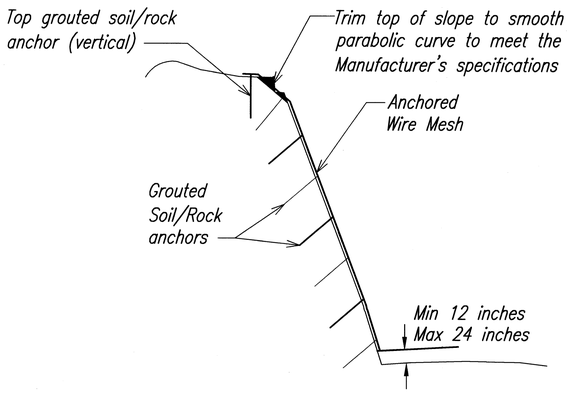
TYPICAL DETAILS
DRAPED WIRE MESH SYSTEM
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

Scale: As Noted Date: December, 2009

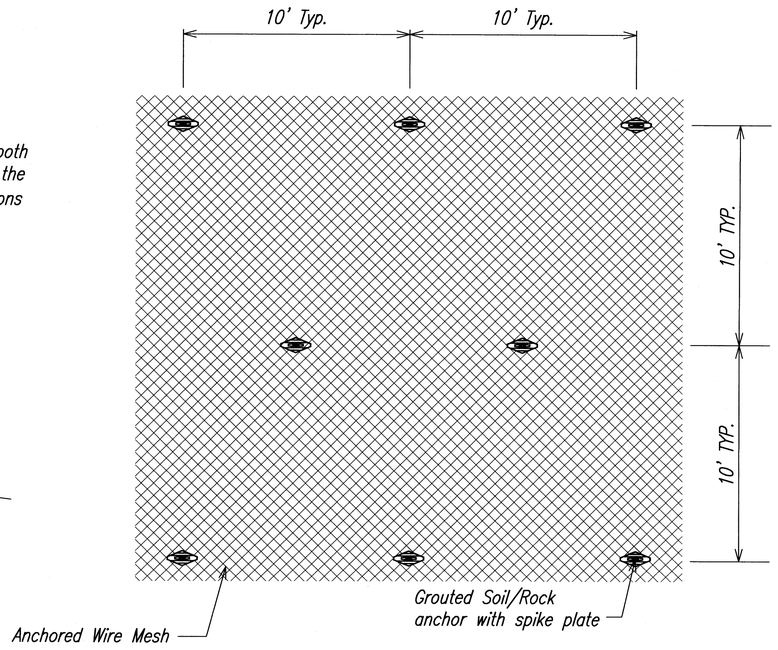
SHEET No. 1 OF 13 SHEETS

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

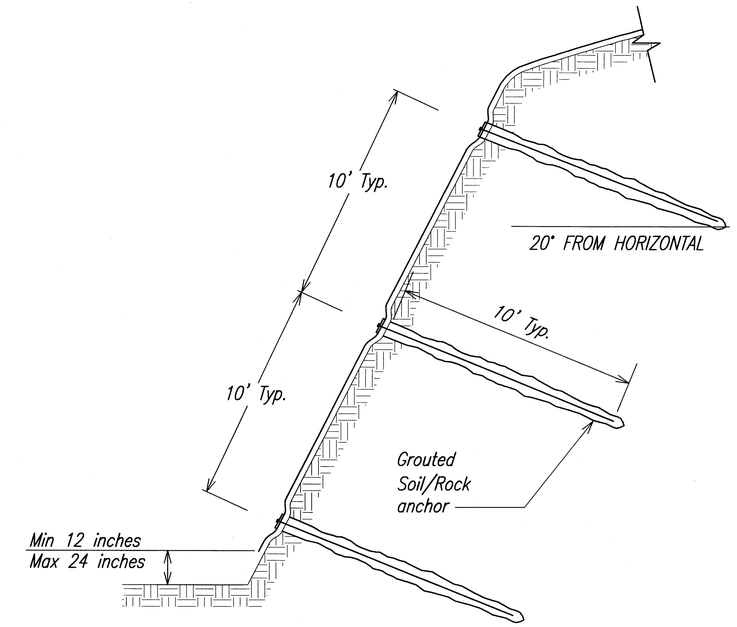
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	10	89



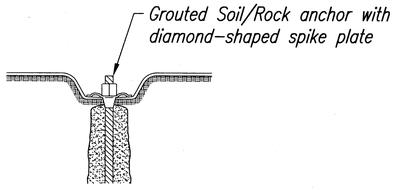
TYPICAL SECTION



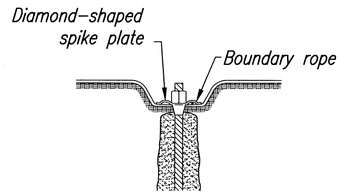
ELEVATION (TYP.)



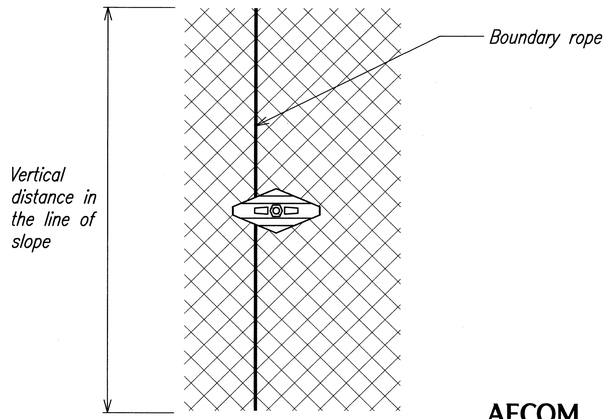
SECTION (TYP.)



Grouted Soil/Rock anchor and spike plate



Grouted Soil/Rock anchor and spike plate with horizontal boundary rope



Grouted soil/rock anchor and spike plate with vertical boundary rope

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

PATH/FILENAME: P:\DT\10603-001 Earthquake Permanent Repairs\04 PS&E\01 Drawings\10 anchored wire mesh details.dgn SET UPDATE: 10-15-2009 @ 01:16 pm PLOT DATE: 31-DEC-2010 @ 08:31 am

AECOM

ABDALLAH R. NIKOU
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THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

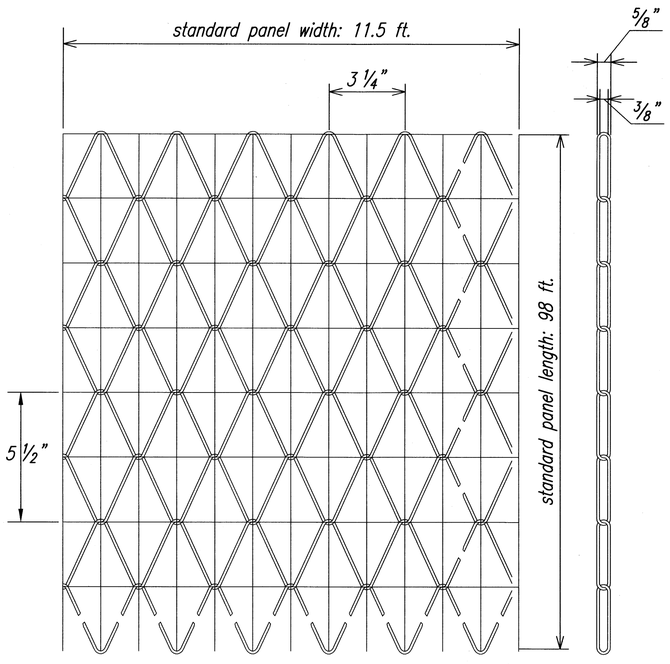
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPICAL DETAILS
ANCHORED WIRE MESH SYSTEM
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

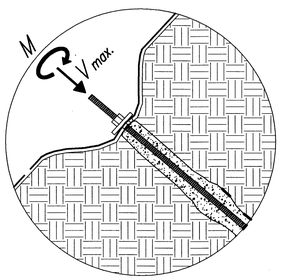
Scale: As Noted Date: December, 2009

SHEET No. 2 OF 13 SHEETS

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	11	89



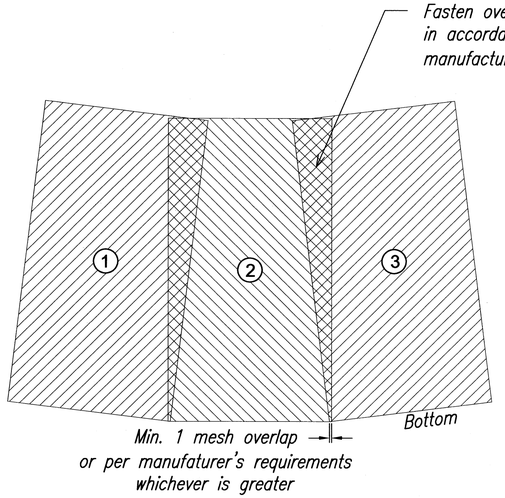
WIRE MESH PANEL (TYP.)



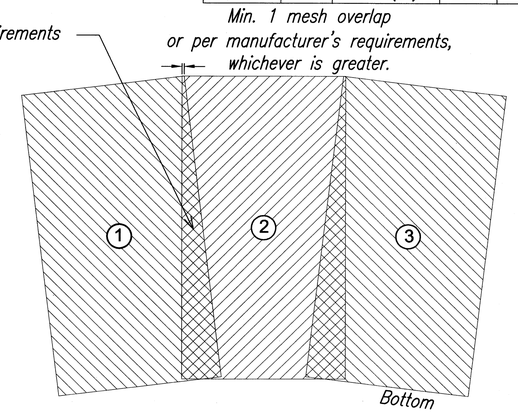
TENSIONING THE ANCHORED WIRE MESH SYSTEM

LOAD TABLE

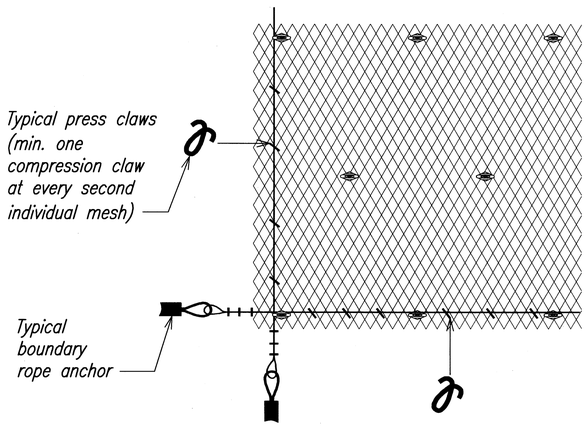
GROUTED ANCHOR	FORCE (V)	REQUIRED TORQUE (M)
d =1 1/4"	6.7 kips	2,850 ft-lbs



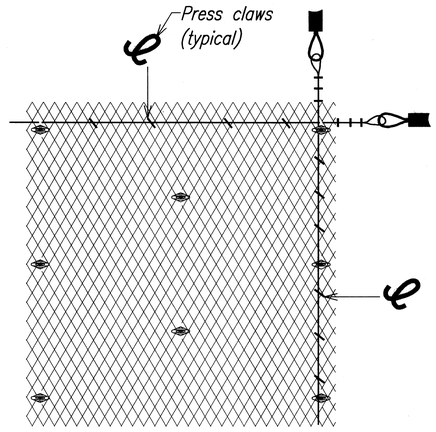
MESH OVERLAP FOR CONVEX SLOPE



MESH OVERLAP FOR CONCAVE SLOPE



BOUNDARY ROPE AT THE BOTTOM AND SIDE OF ANCHORED WIRE MESH SYSTEM



BOUNDARY ROPE AT THE TOP AND SIDE OF ANCHORED WIRE MESH SYSTEM

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPICAL DETAILS
ANCHORED WIRE MESH SYSTEM
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

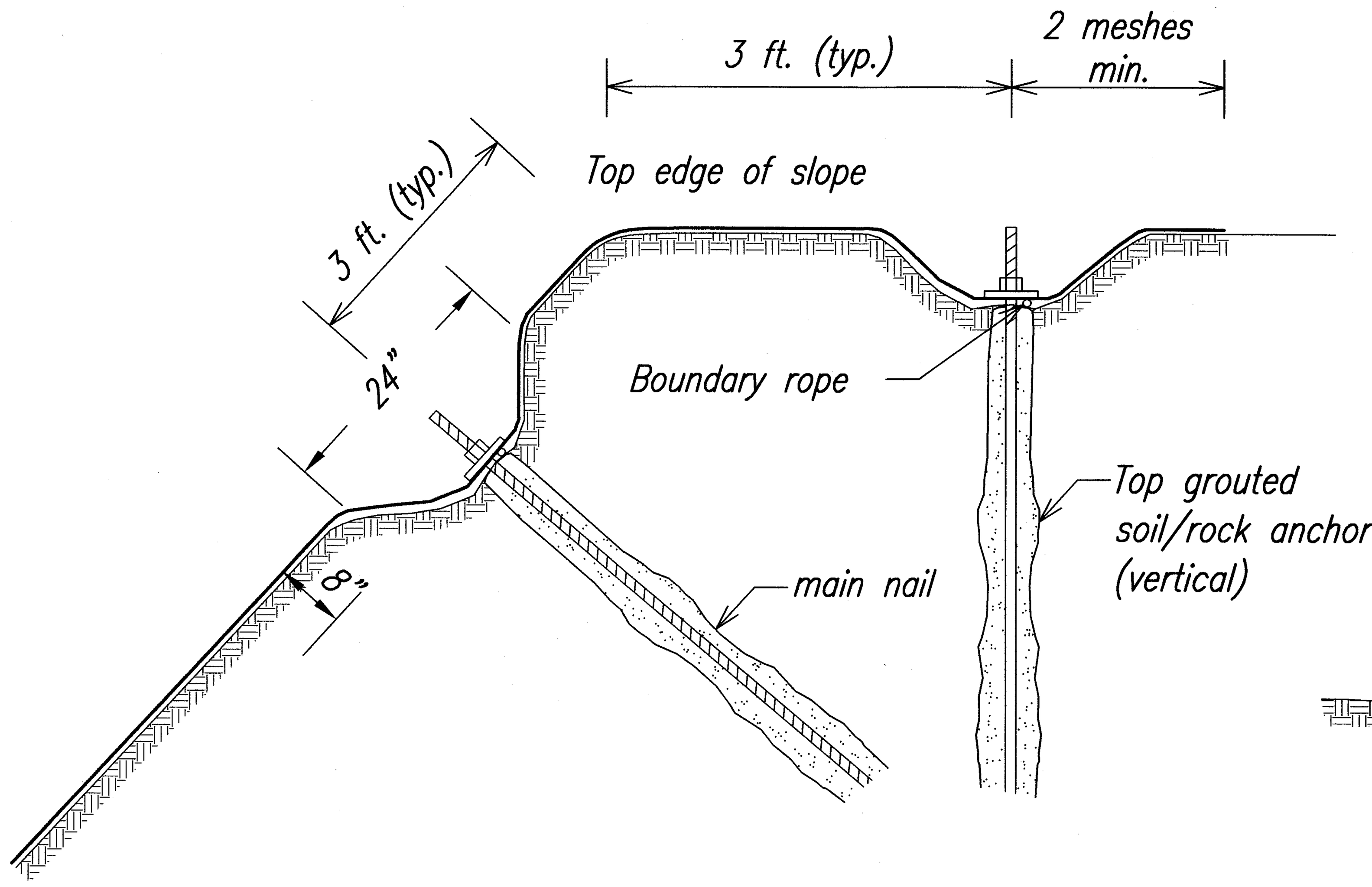
Scale: As Noted Date: December, 2009

SHEET No. 3 OF 13 SHEETS

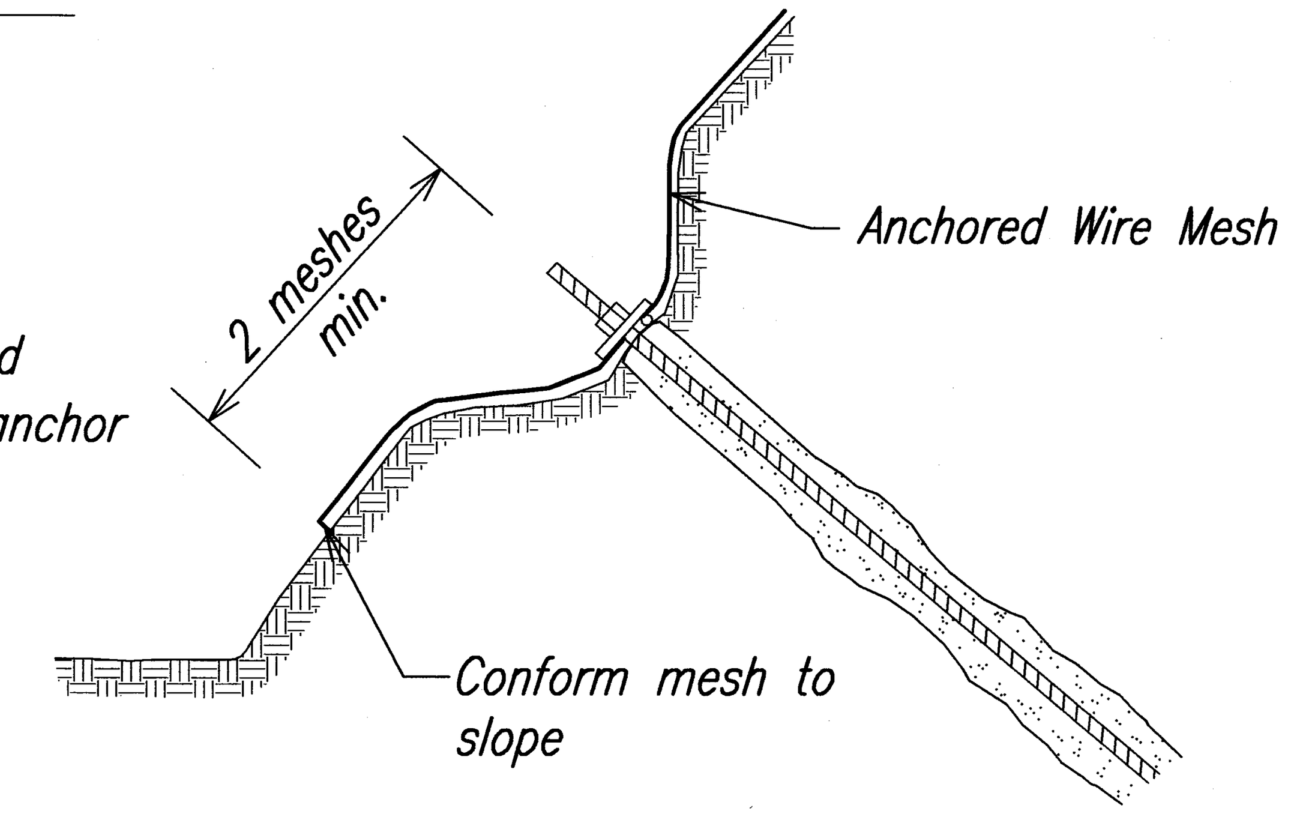
ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	
	TRACED BY	
NOTE BOOK	DESIGNED BY	
	QUANTITIES BY	
No.	CHECKED BY	

PATH/FILENAME: P:\DT\100333-001 Earthquake Permanent Repairs\04 PS&E\01 Drawings\11 anchored wire mesh details.dwg ST UPDATE: 10-15-2009 @ 01:10 pm PLOT DATE: 31-DEC-2010 @ 08:31 am

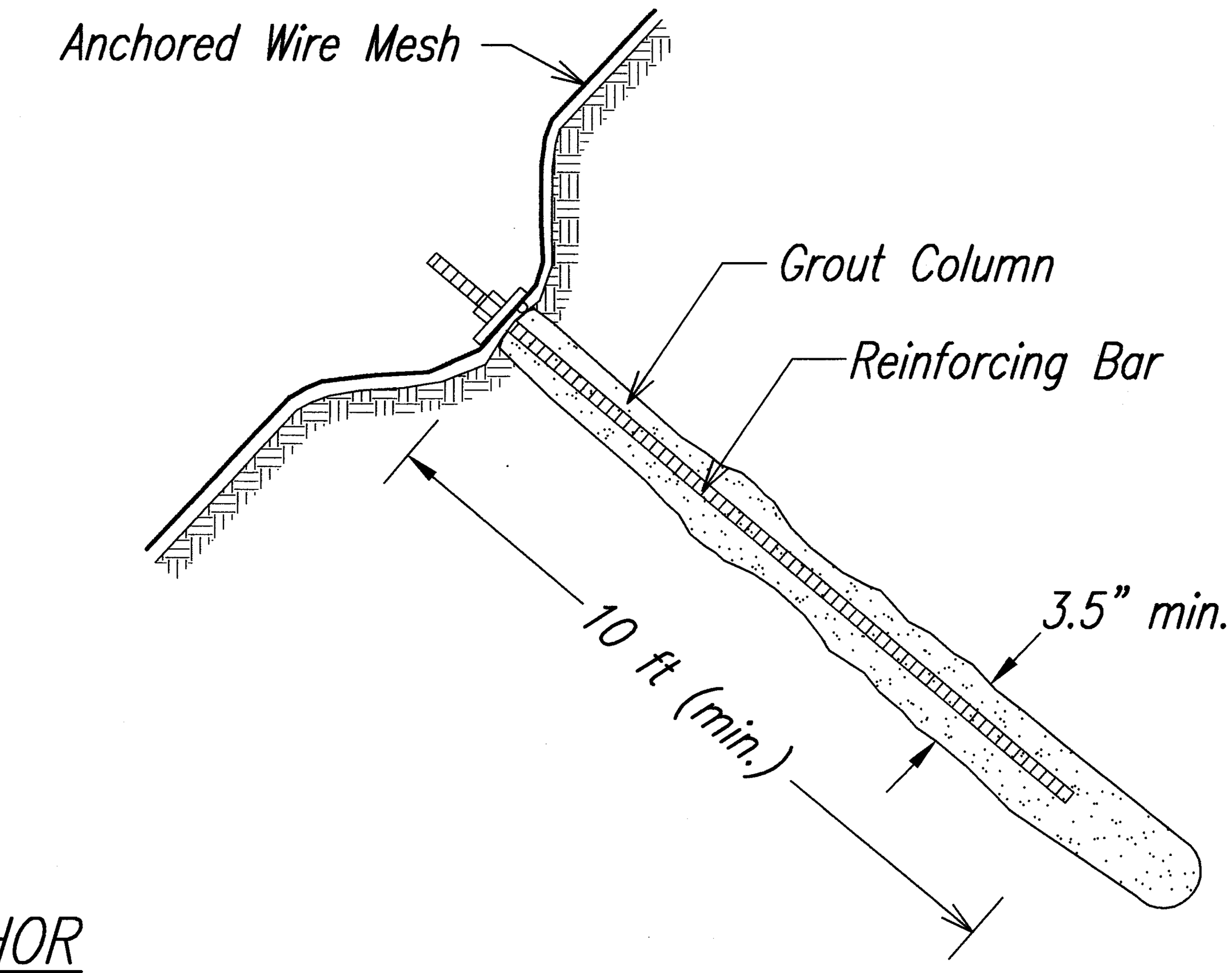
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	12	89



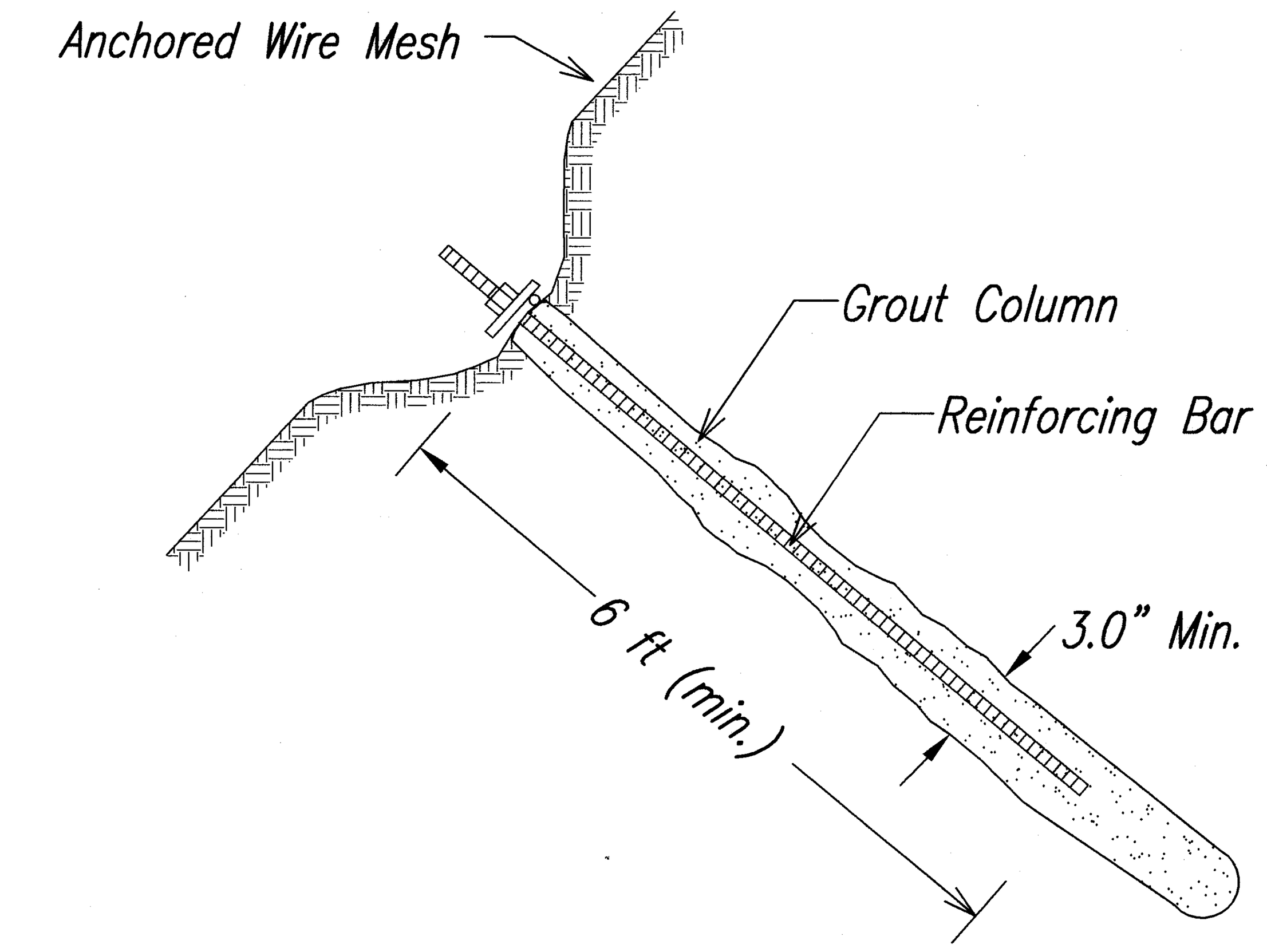
DELL OR DEPRESSION AROUND GROUTED ANCHOR AT TOP EDGE OF ANCHORED WIRE MESH



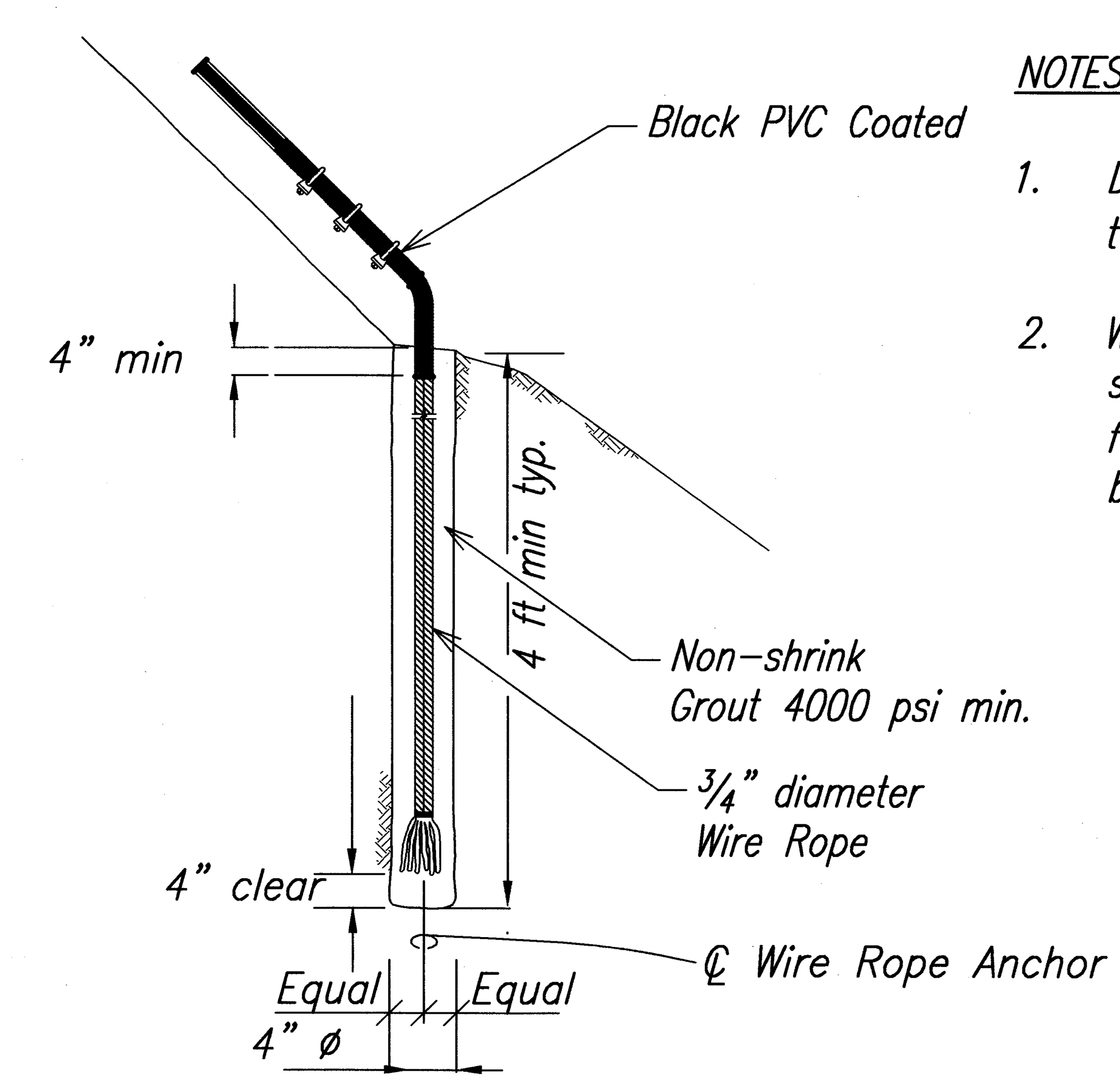
DELL OR DEPRESSION AROUND GROUTED ANCHOR AT BOTTOM EDGE OF ANCHORED WIRE MESH



GROUTED SOIL/ROCK ANCHOR (TYP.)



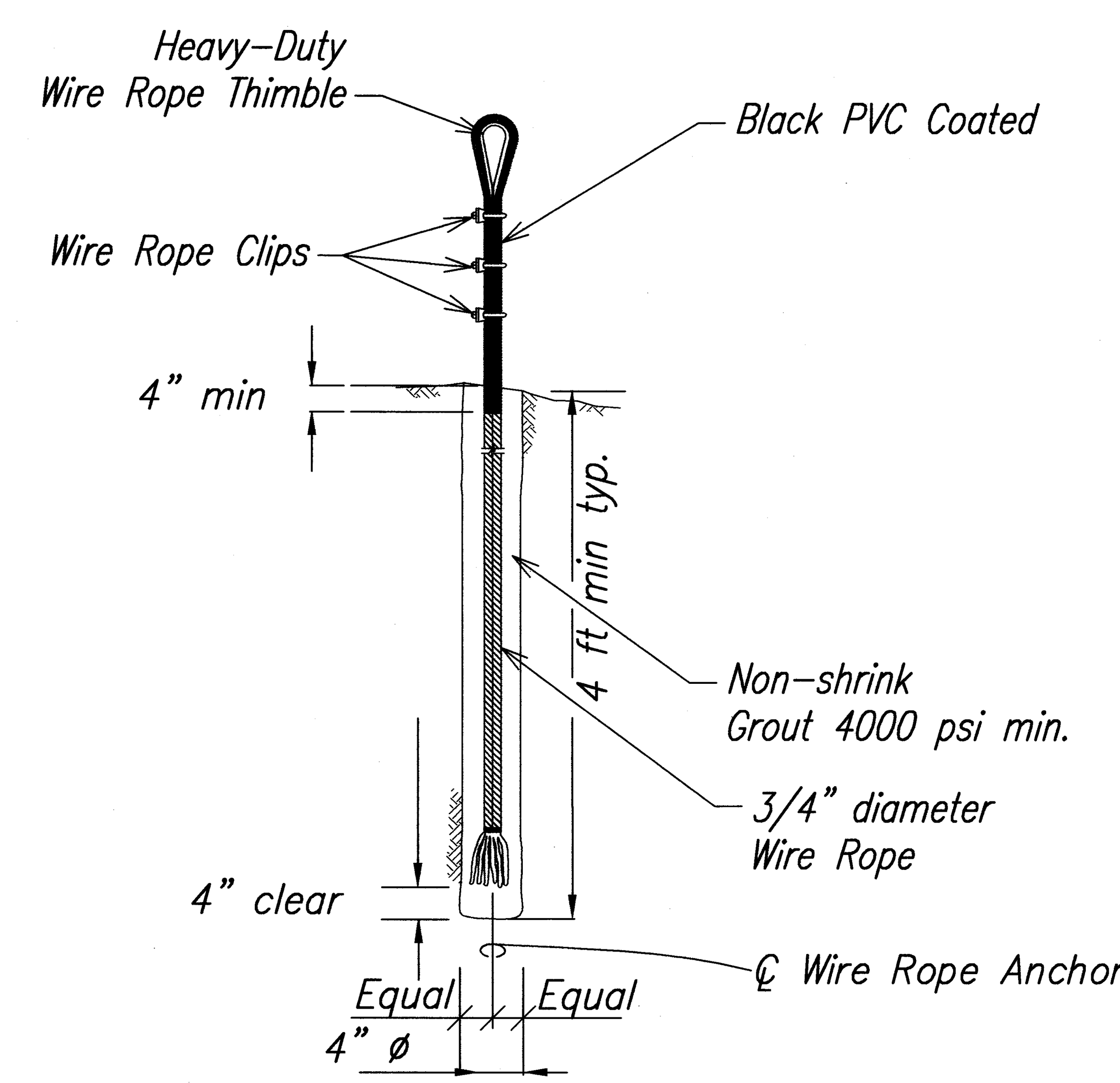
SUPPLEMENTAL (SHORT) ANCHOR (TYP.)



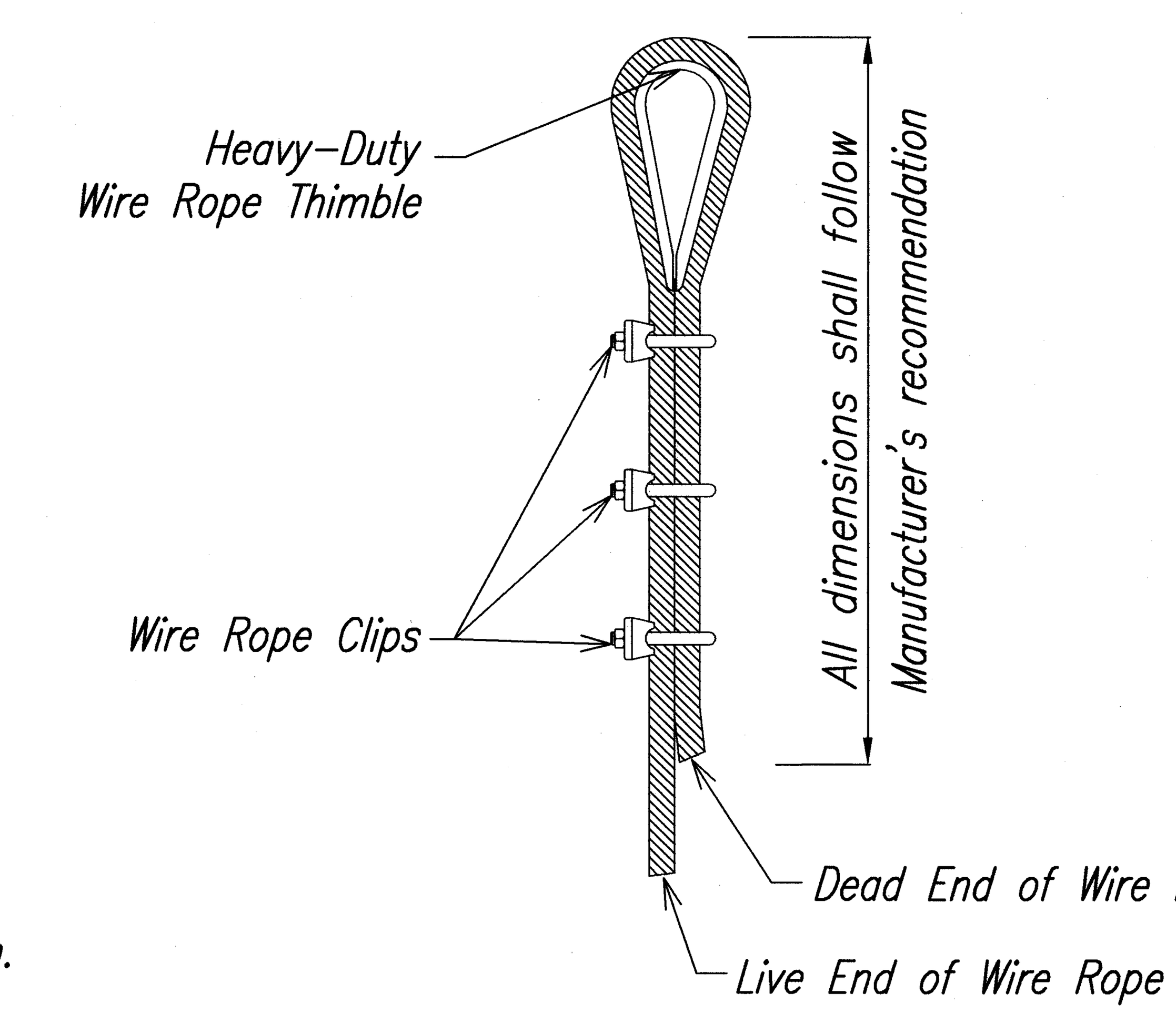
BOUNDARY ROPE ANCHOR (Side View)

NOTES:

1. Drill 4" min. dia. anchor holes to a minimum depth of 4'.
2. Wire rope anchor ends shall be splayed with one wire rope clip fastened 2" above the splaying before grouting.



BOUNDARY ROPE ANCHOR (Front View)



WIRE ROPE CLIP LOOP

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

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ARDALAN R. NIKOU
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EXPIRATION DATE OF THE LICENSE 4/30/2010
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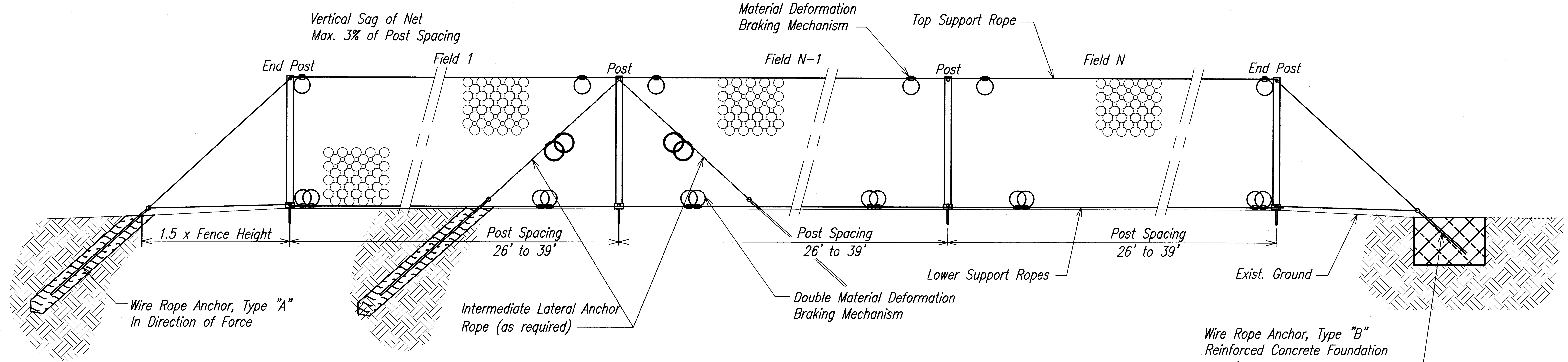
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

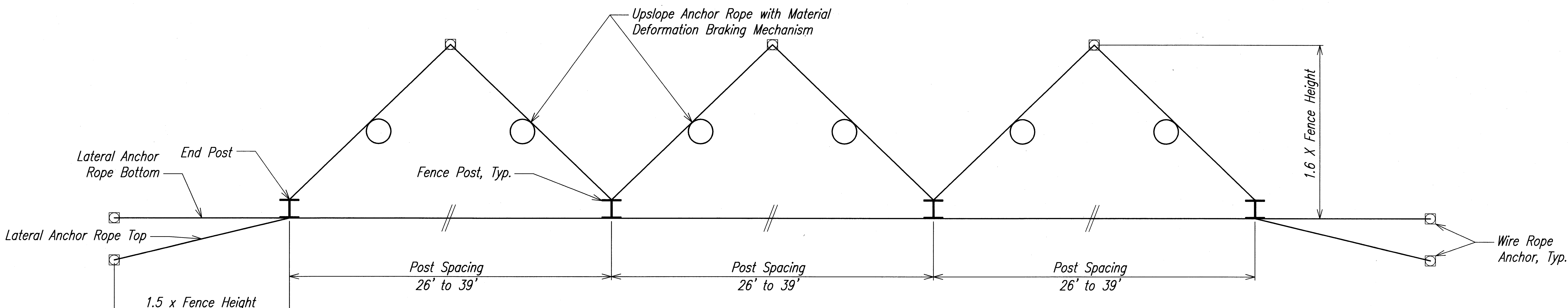
TYPICAL DETAILS
ANCHORED WIRE MESH SYSTEM
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS
AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

Scale: As Noted   Date: December, 2009

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	13	89



ELEVATION
Not to Scale



LAYOUT OF ANCHOR POINTS - PLAN
Not to Scale

Notes:

1. Details shown here are for general guidance. Contractor shall follow the manufacturer's authorized design drawings and details.
2. Contractor shall provide rockfall protection fence shop drawings for approval to the Engineer. Shop drawings shall be reviewed and stamped by an Engineer licensed in the state of Hawaii.
3. Contractor shall submit all calculations and design details for foundations and anchoring to the Engineer for approval prior to start of construction.

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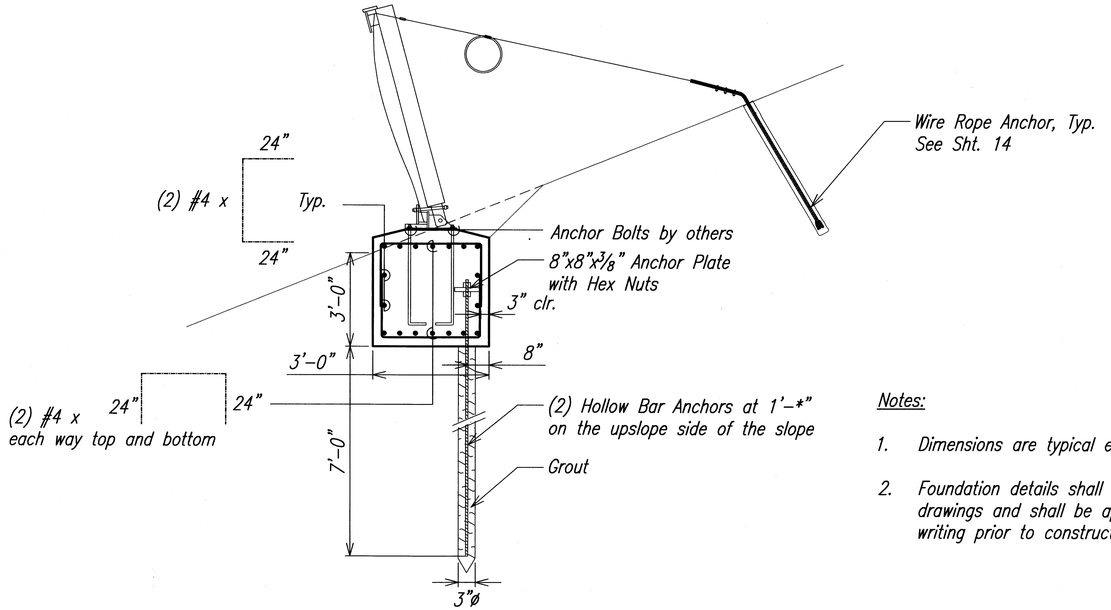
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPICAL DETAILS
ROCKFALL IMPACT BARRIER SYSTEM
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS
AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

Scale: As Noted   Date: December, 2009

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	14	89

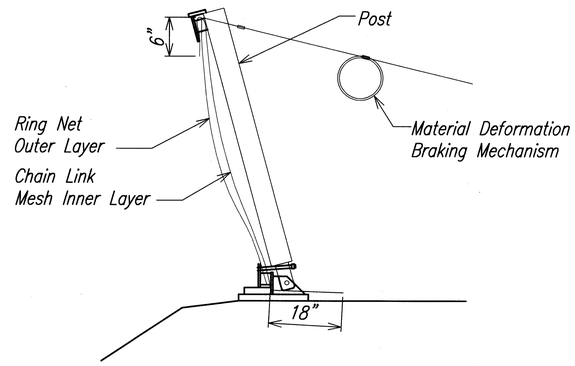


POST FOUNDATION

Not to Scale

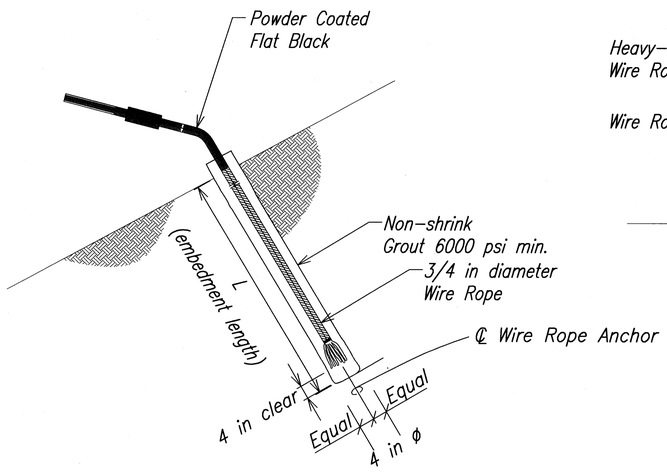
Notes:

1. Dimensions are typical each way.
2. Foundation details shall be provided on the shop drawings and shall be approved by the engineer in writing prior to construction.

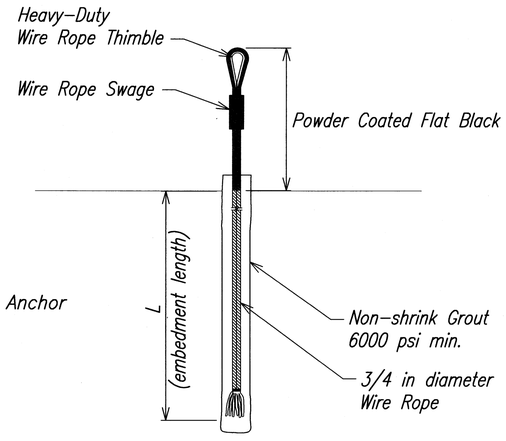


MESH DETAILS

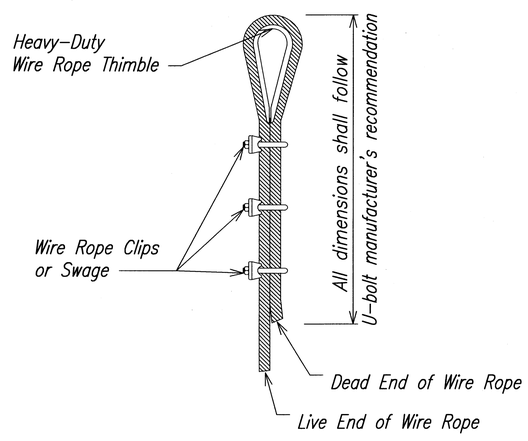
Not to Scale



Side View



Front View



TYPICAL WIRE ROPE ANCHOR

Not to Scale

Notes:

1. The required pullout capacity of each anchor shall be 133% of the working load.
2. Drill 4" min. dia. anchor holes to the required depth.
3. Wire rope anchor ends shall be splayed with one wire rope clip fastened 2" above the splaying before setting in concrete.
4. Install PVC Centralizers at 4'-0" on center, with one centralizer no further than 1'-0" from the bottom of the anchor. Securely fasten the Centralizers to the anchor prior to inserting into the bore hole.

AECOM

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EXPIRATION DATE OF THE LICENSE 4/30/2010
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPICAL DETAILS

IMPACT BARRIER & WIRE ROPE ANCHOR DET.
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS
AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

Scale: As Noted Date: December, 2009

SHEET No. 6 OF 13 SHEETS

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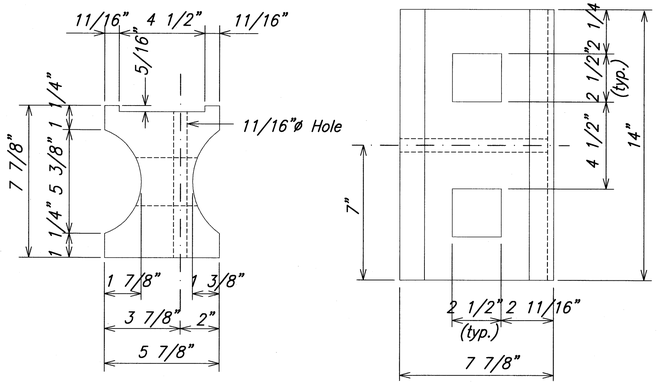
No.	QUANTITIES BY	
	CHECKED BY	

PATH/FILENAME: P:\DTS_10603-001 Earthquake Permanent Repairs\04 PS&E\01 Drawings\14 Impact barrier and wire rope anchor.dgn PLOT DATE: 31-DEC-2010 @ 08:31 am
PLOT DATE: 18-15-2009 @ 02:48 pm

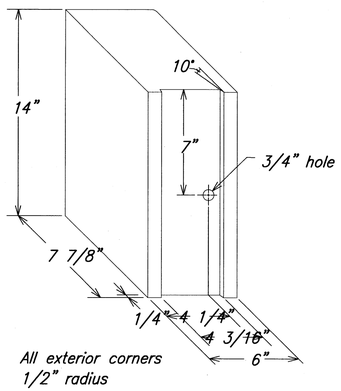
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	15	89



TOP SIDE

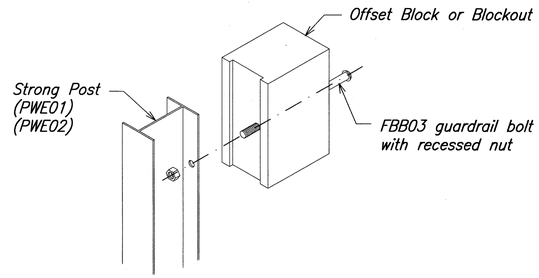
RECYCLED PLASTIC BLOCKOUT (TYPE I)

N.T.S.



RECYCLED POLYETHYLENE OFFSET BLOCK (TYPE II)

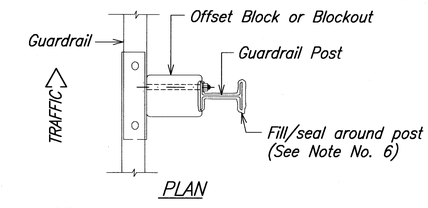
N.T.S.



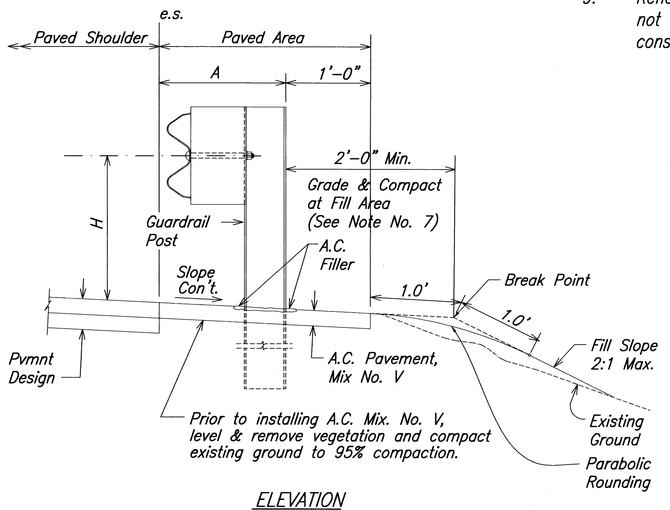
Exploded View
(Rail and washer not shown)

STEEL POST AND BLOCK DETAIL

N.T.S.



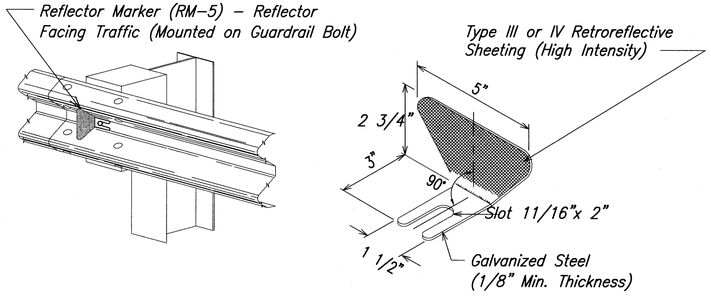
PLAN



ELEVATION

TYPICAL GUARDRAIL INSTALLATION

N.T.S.



REFLECTOR MARKER (RM-5) DETAIL AND TYPICAL 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.*

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

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

PATH/FILENAME: P:\DTI\10603-00F Earthquake Permanent Repairs\04 PS&E\01 Drawings\13 guardrail details 1.dwg LAST UPDATE: 03-15-2009 @ 02:39 pm PLOT DATE: 31-05-2010 @ 08:31 am

AECOM

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EXPIRATION DATE OF THE LICENSE 4/30/2010
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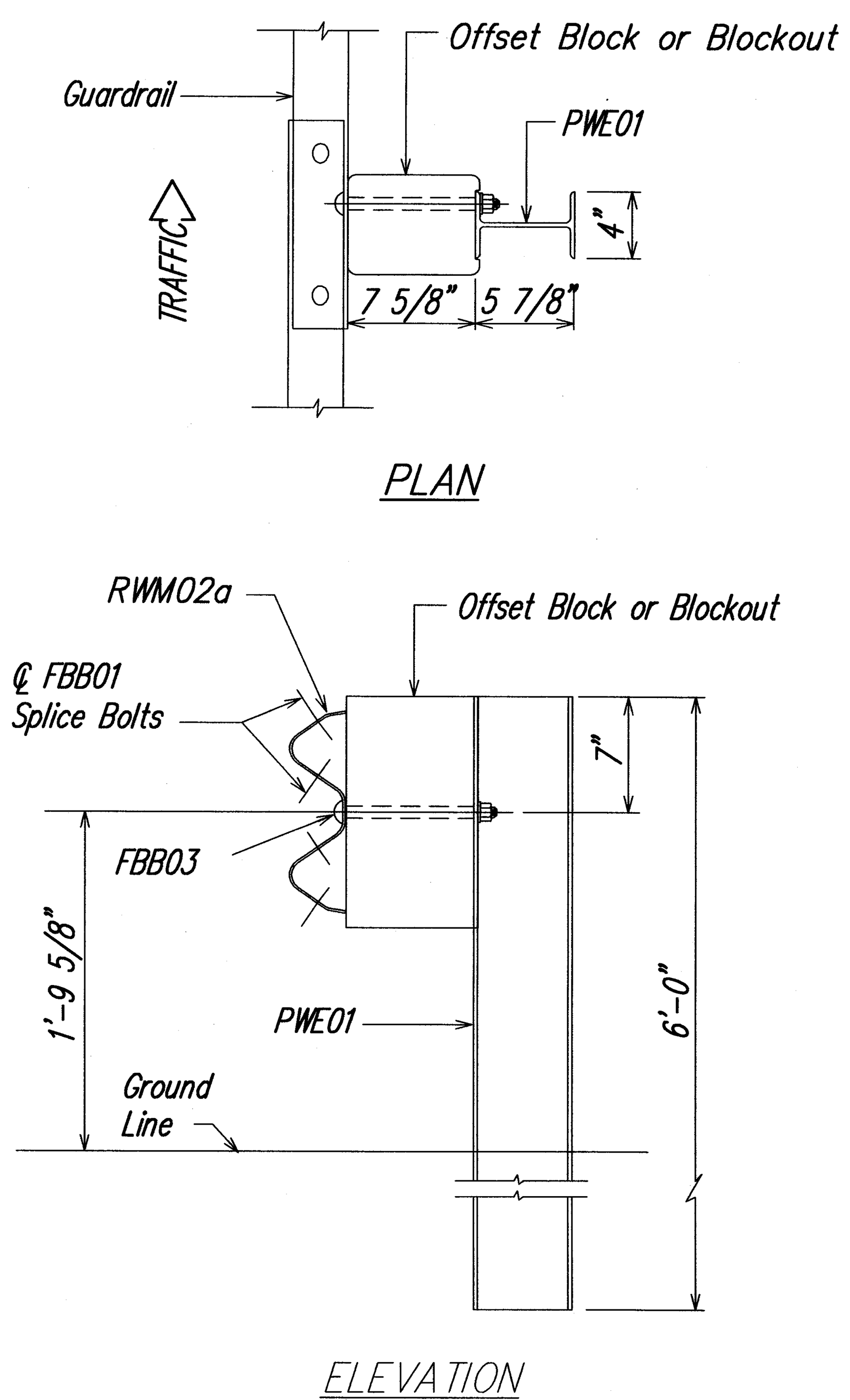
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPICAL DETAILS
MISCELLANEOUS GUARDRAIL DETAILS
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

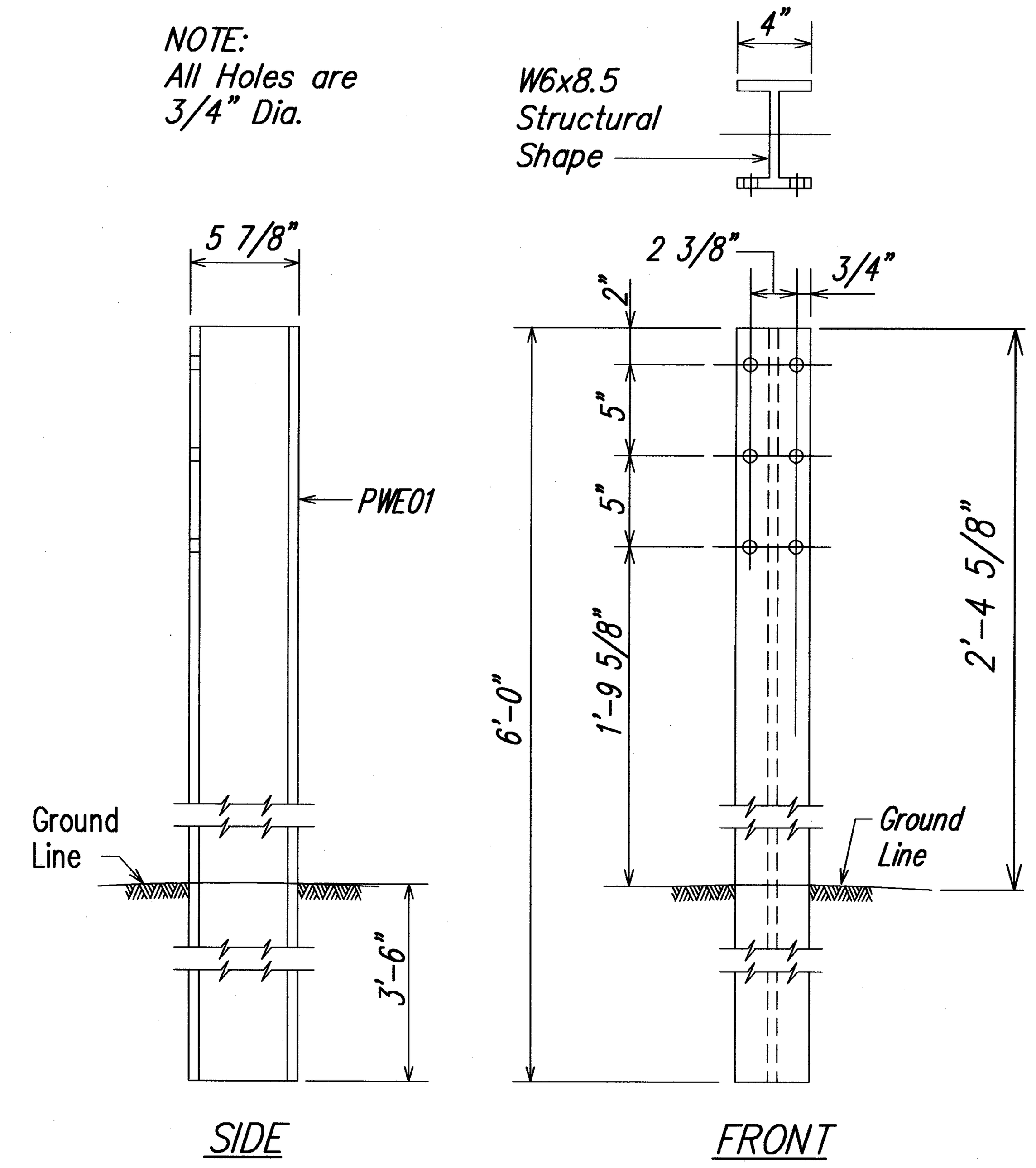
Scale: As Noted Date: December, 2009

SHEET No. 7 OF 13 SHEETS



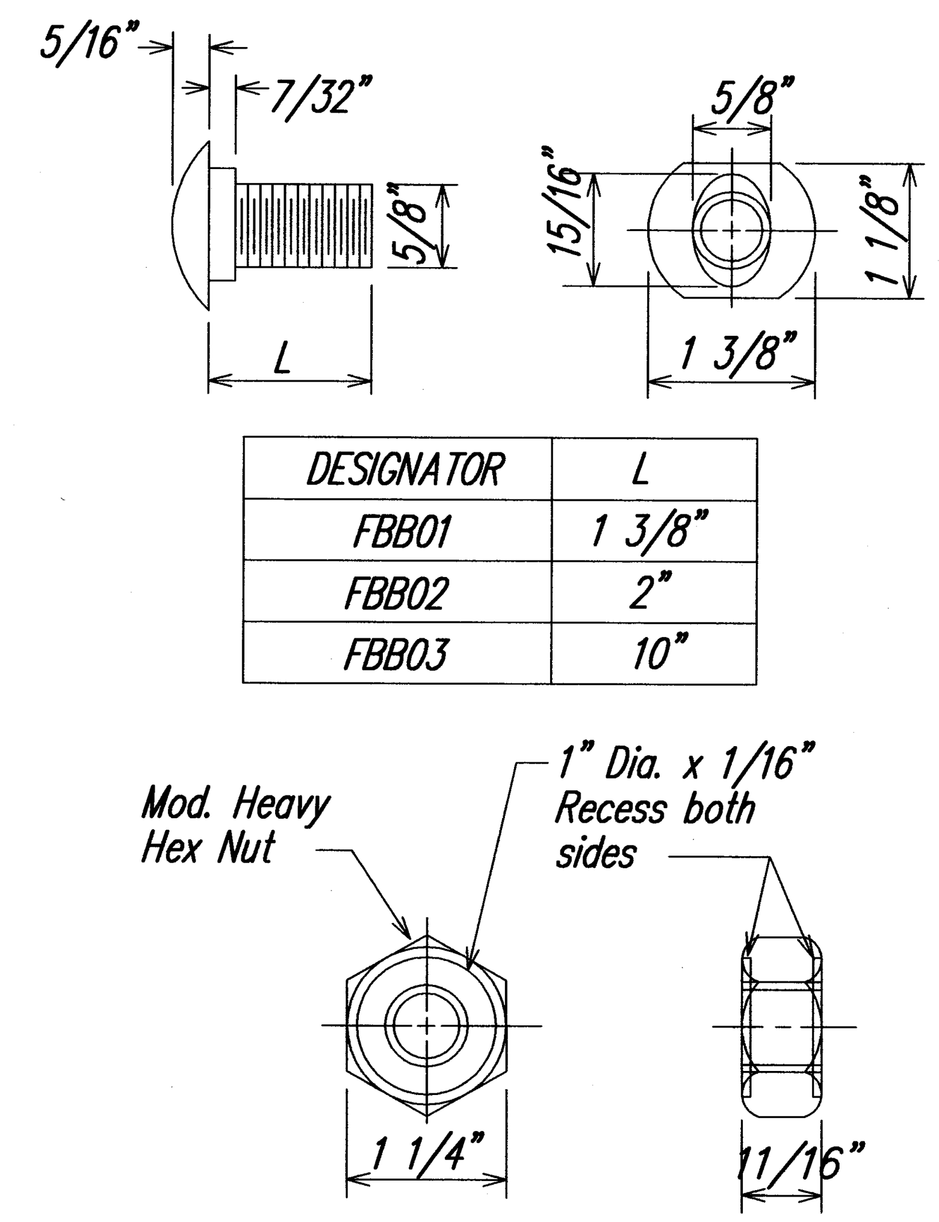
STRONG POST W-BEAM GUARDRAIL (SGR04a)

N.T.S.



W-BEAM STRONG POST (PWE01)

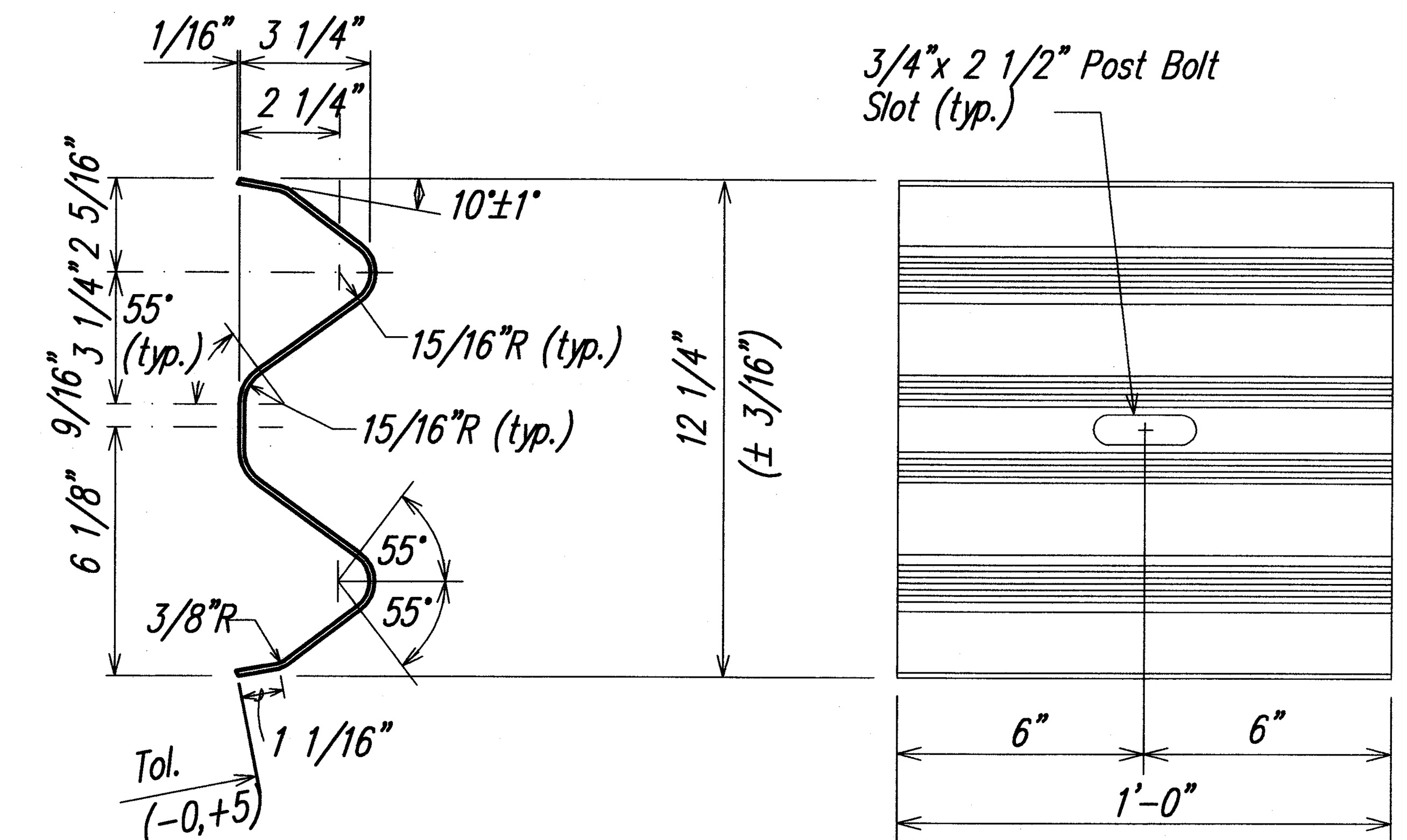
N.T.S.



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

GUARDRAIL BOLTS AND RECESSED NUT

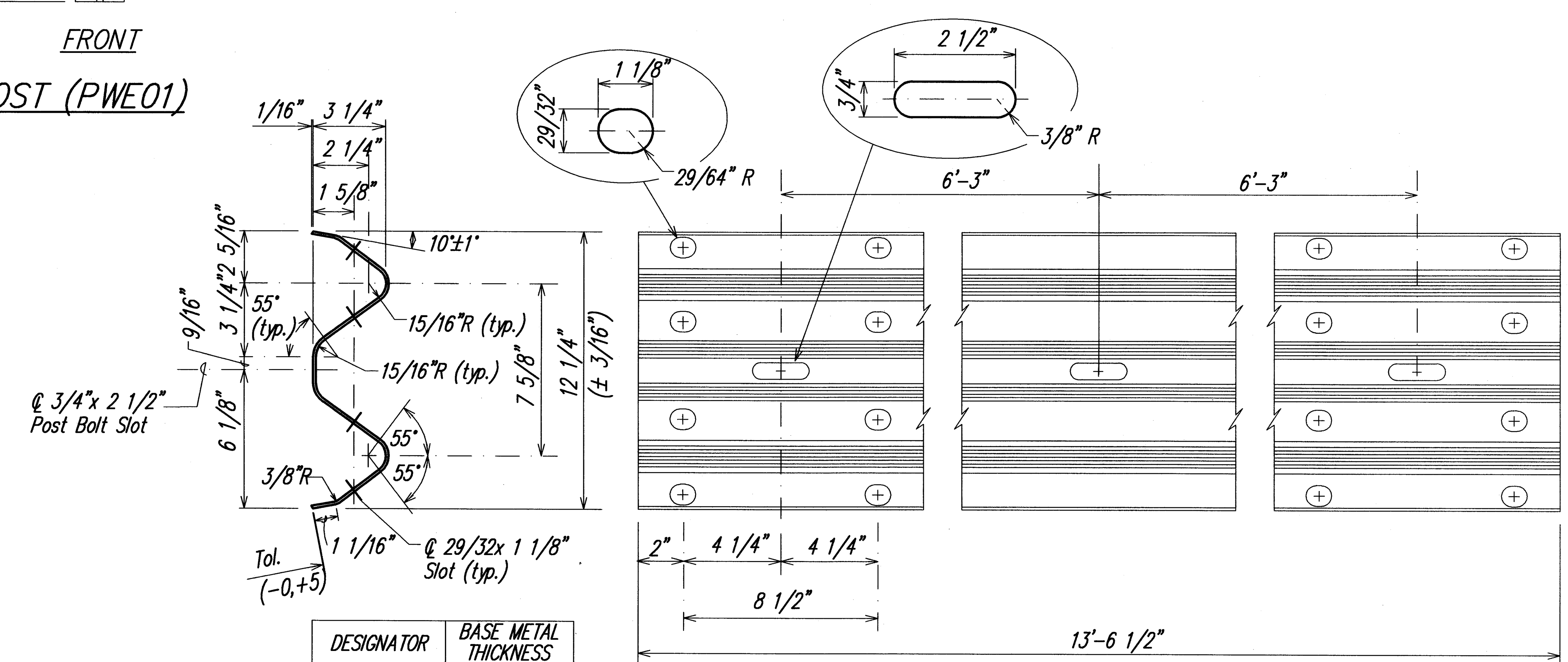
N.T.S.



DESIGNATOR	BASE METAL THICKNESS
RWB01a	12 Gauge

W-BEAM BACK-UP-PLATE (RWB01a)

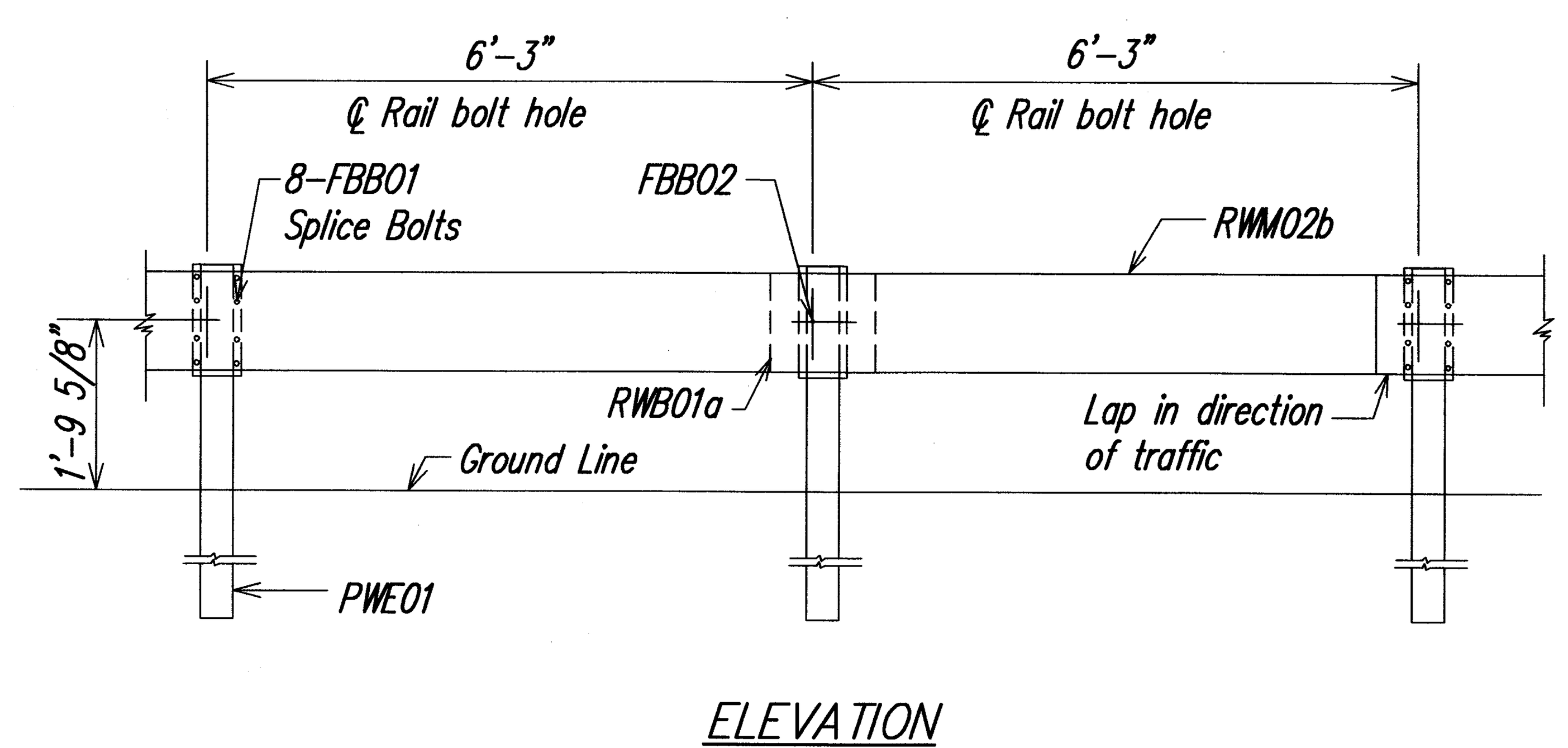
N.T.S.



DESIGNATOR	BASE METAL THICKNESS
RWM02a	12 Gauge

2 SPACE W-BEAM GUARDRAIL (RWM02a)

N.T.S.



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

N.T.S.

AECOM

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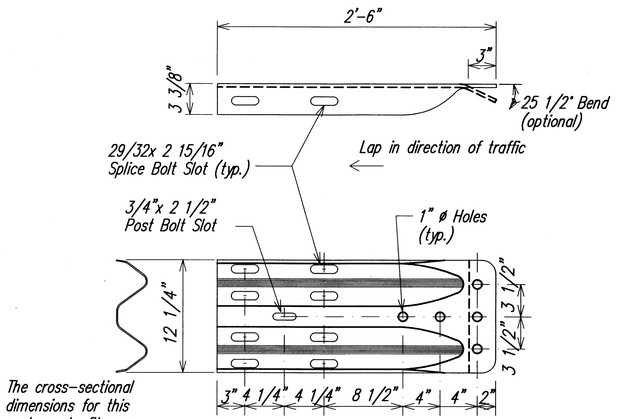
TYPICAL DETAILS
MISCELLANEOUS GUARDRAIL DETAILS
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

Scale: As Noted
Date: December, 2009

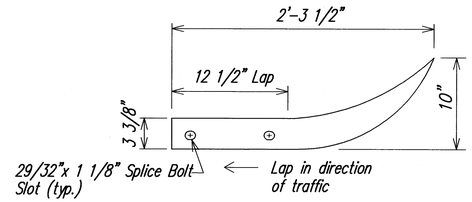
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	17	89



The cross-sectional dimensions for this part are to fit over part RWM02a on the approach end and under part RWM02a on the trailing end.

DESIGNATOR	BASE METAL THICKNESS
RWE02b	10 Gauge

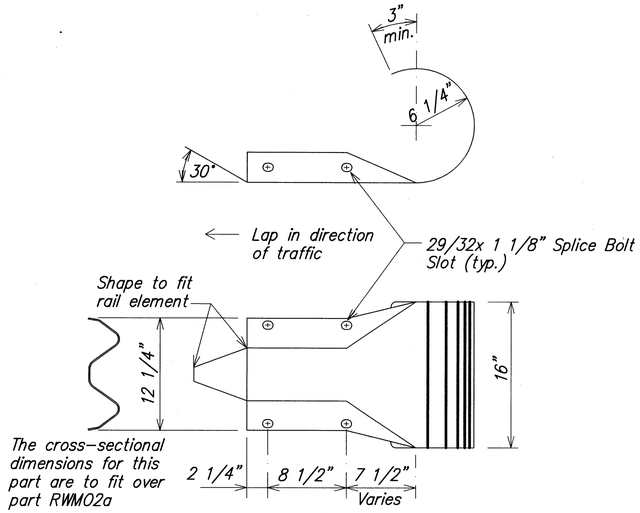
W-BEAM TERMINAL CONNECTOR (RWE02b)
N.T.S.



The cross-sectional dimensions for this part are to fit over part RWM02a on the approach end and under part RWM02a on the trailing end.

DESIGNATOR	BASE METAL THICKNESS
RWE01a	12 Gauge

W-BEAM END SECTION (FLARED RWE01a)
N.T.S.



The cross-sectional dimensions for this part are to fit over part RWM02a

DESIGNATOR	BASE METAL THICKNESS
RWE03a	12 Gauge

W-BEAM END SECTION (ROUNDED RWE03a)
N.T.S.

GUARDRAIL SCHEDULE

MILE POST	STATION		OFFSET TO EP	END TREATMENT			
	BEGIN	END		LEAD	RADIUS	TRAIL	RADIUS
12.9	103+99.50	105+54.20	10'	MODIFIED A	--	TYPE G	30'
26.1	76+44.00	77+60.00	3.5'	MODIFIED A	--	MODIFIED A	--
45.0	768+71.00	776+62.00	8'	MODIFIED A	--	MODIFIED A	--
45.3	758+20.00	761+64.50	8'	MODIFIED A	--	TYPE G	

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

PATH/FILENAME: P:\DT\108033-00T Earthquake Permanent Repairs\04 PS&E\01 Drawings\17 guardrail details 3.dwg LAST UPDATE: 02-13-2009 @ 02:52 pm PLOT DATE: 12-08-2010 @ 08:32 am

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EXPIRATION DATE OF THE LICENSE 4/30/2010
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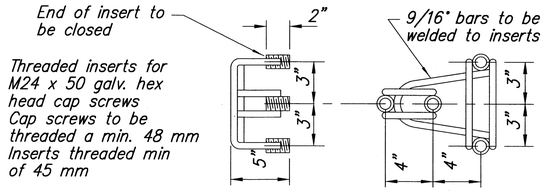
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPICAL DETAILS
MISC. GUARDRAIL DETAILS & SCHEDULE
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

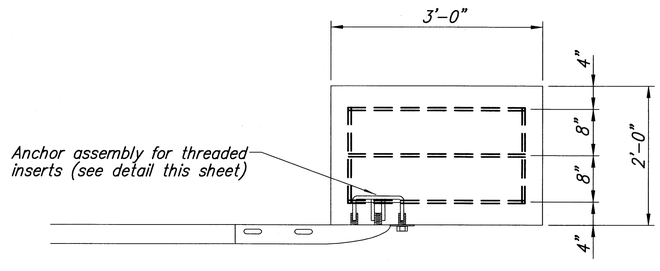
Scale: As Noted Date: December, 2009

SHEET No. 9 OF 13 SHEETS

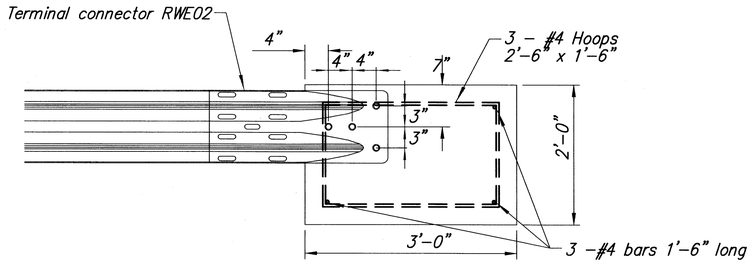
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	18	89



ANCHOR ASSEMBLY
CONCRETE BLOCK ANCHOR



Plan

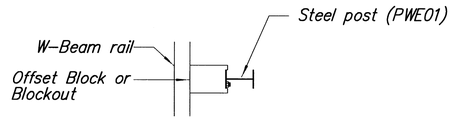


Elevation

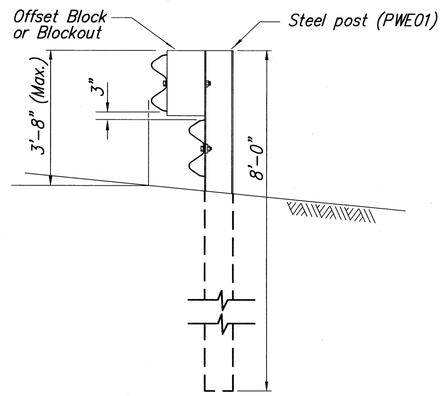
CONCRETE BLOCK ANCHOR
(2' X 2' X 3')

TYPE "A" FLARE END TERMINAL BACKSLOPE END ANCHORAGE DETAILS

Not To Scale



Plan



Elevation

STEEL POST GUARDRAIL RUBRAIL DETAIL

Not To Scale

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.

AECOM

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EXPIRATION DATE OF THE LICENSE 4/30/2010
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TYPICAL DETAILS
MISCELLANEOUS GUARDRAIL DETAILS
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

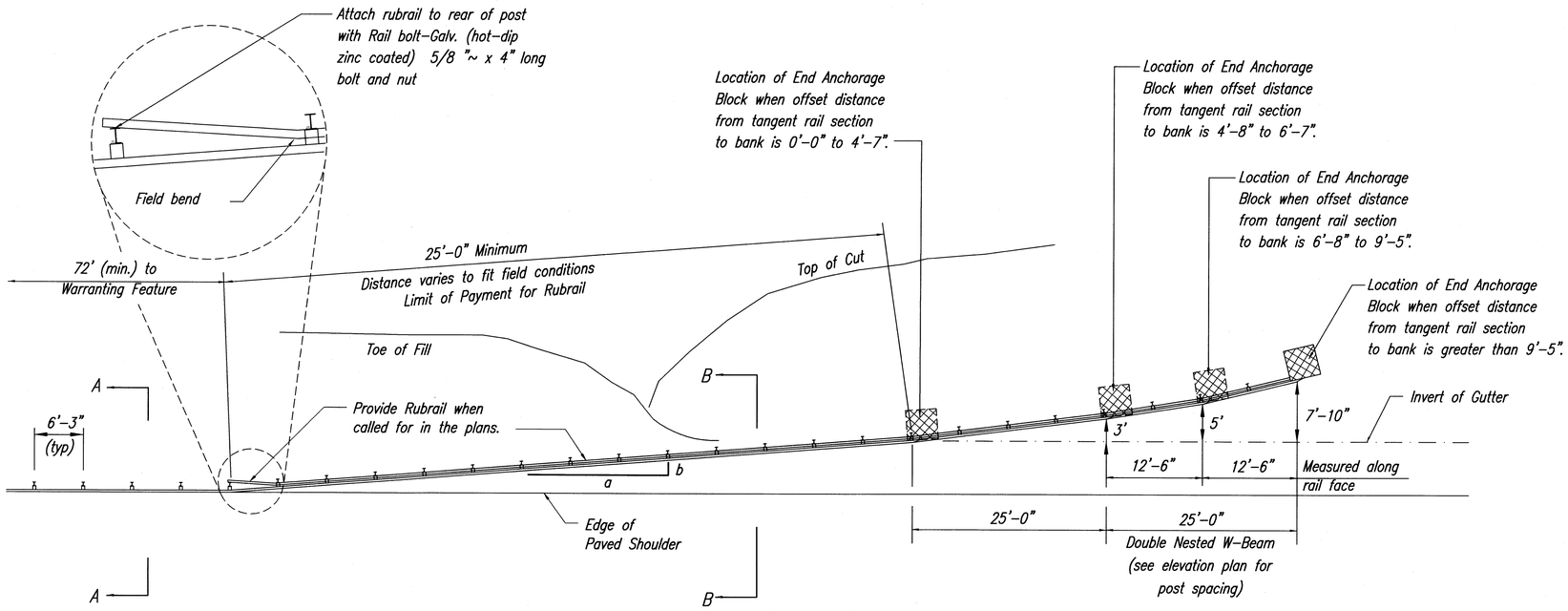
Scale: As Noted Date: December, 2009

SHEET No. 10 OF 13 SHEETS

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

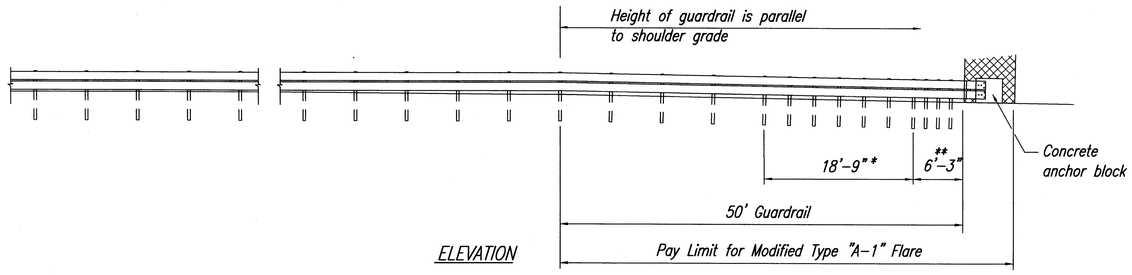
PATH/FILENAME: P:\ER\10633-001 Earthquake Permanent Repairs\04 PS&E\01 Drawings\L9 guardrail details 4.dwg LAST UPDATE: 12-15-2009 @ 02:52 pm PLOT DATE: 12-16-2010 @ 08:32 am

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	19	89



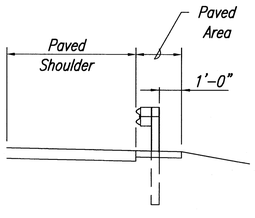
PLAN

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

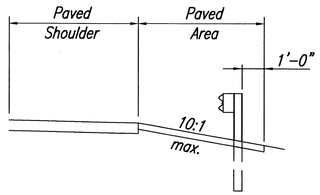


ELEVATION

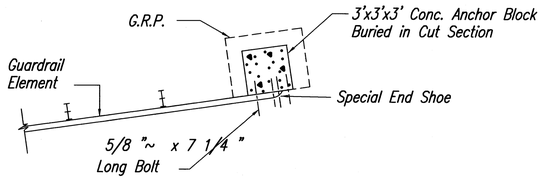
* Posts at 3'-1 1/2 " o.c.
** Posts at 1'-6 3/4 " o.c.



SECTION A-A



SECTION B-B



PLAN - ANCHOR BLOCK IN CUT SECTION

ANCHOR BLOCK IN CUT SECTION

General Notes:

1. All posts are 6'-0" in length within the 50'-0" pay limit for the Modified Type "A" Flare without rubrail.
2. Whenever swales or a change in grade is encountered within the 50'-0" pay limit for the Modified Type "A" Flare, a rubrail shall be installed and all posts shall have a minimum embedment of 4'-0". Post lengths shall be adjusted to provide the minimum embedment.
3. 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 and HDOT's Statewide Guideline for Permanent Highway Safety Hardware.
4. Limit of payment for Modified Type "A" Flare shall be 50'-0" from End Shoe including Rubrail (when applicable), Anchor Block and GRP work.
5. Excavation, Anchor Block, Backfill and GRP work shall be considered incidental to the Modified Type "A" Flare.

MODIFIED TYPE "A" FLARE END TERMINAL

Not To Scale

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PATH/FILENAME: P:\ET\08033-001 Earthquake Permanent Repairs\04 PS&E\01 Drawings\19 guardrail details 3.dwg LAST UPDATE: 04-15-2009 @ 02:54 pm PLOT DATE: 23-06-2010 @ 08:32 am

AECOM

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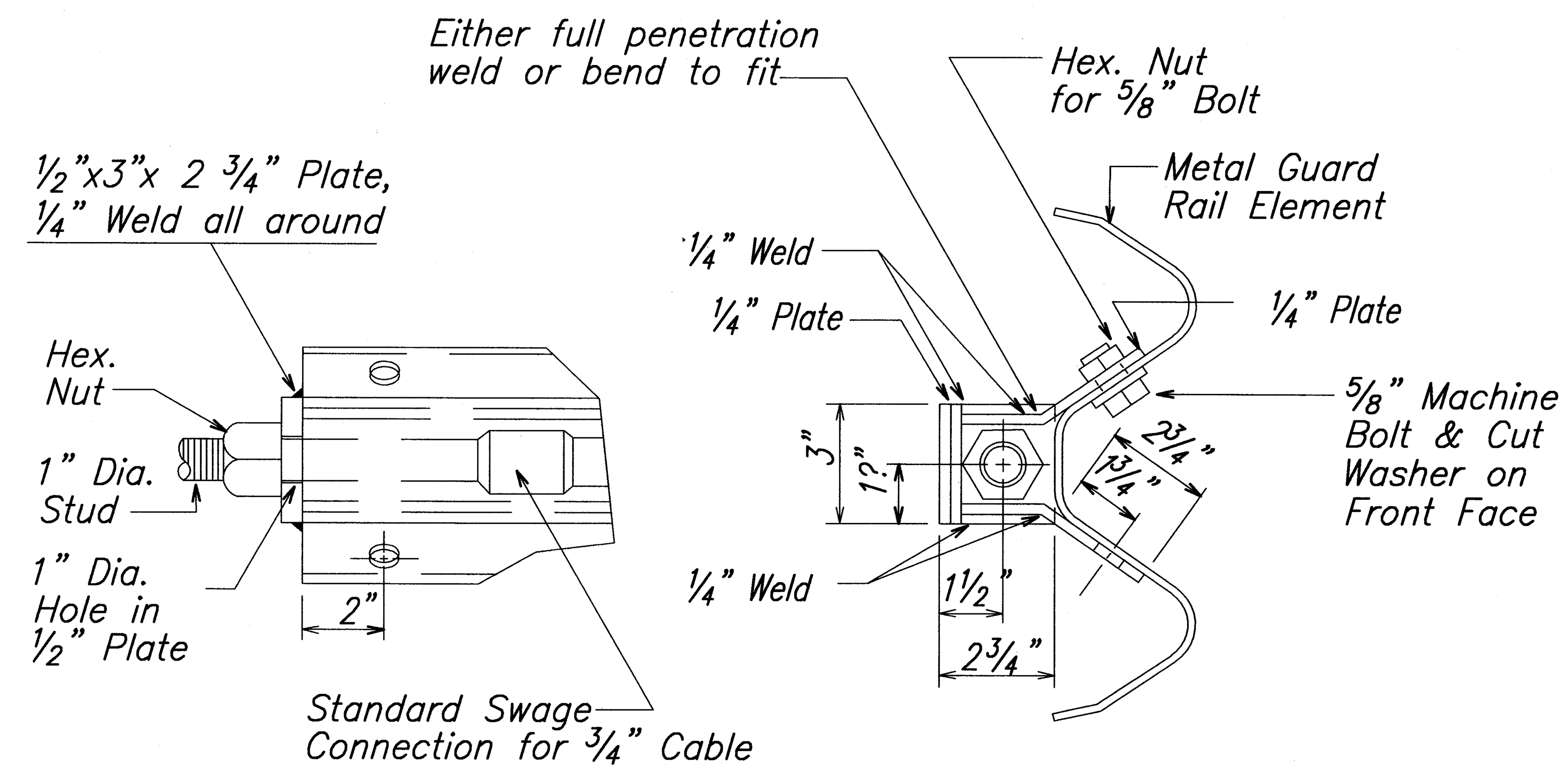
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

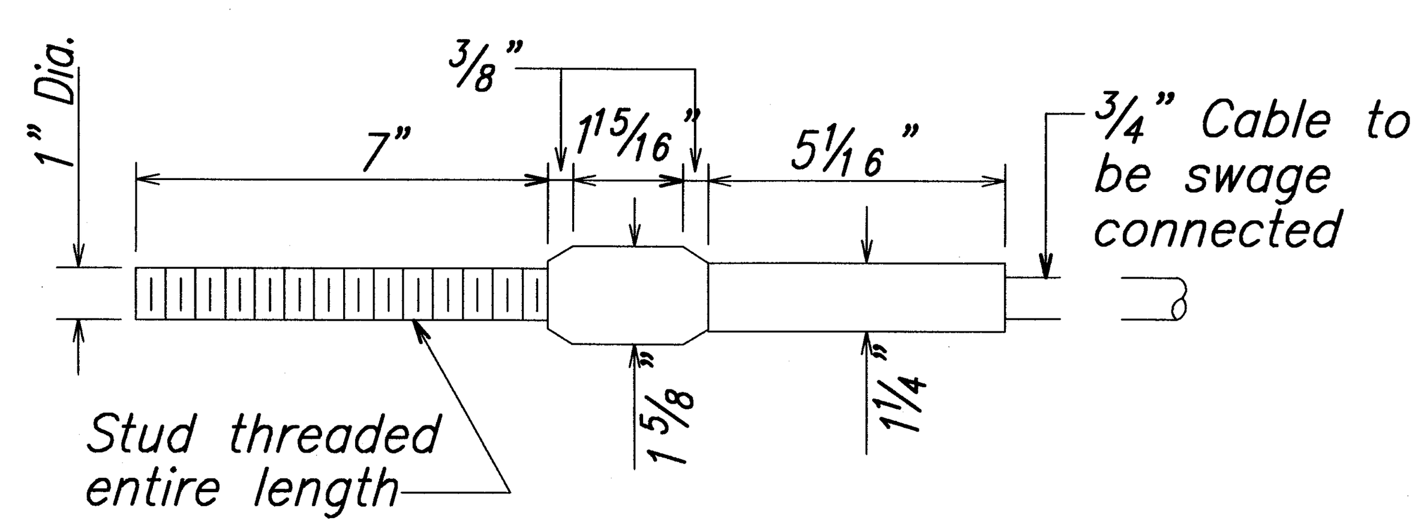
TYPICAL DETAILS
MODIFIED TYPE "A" FLARE END TERMINAL
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS
AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

Scale: As Noted Date: December, 2009

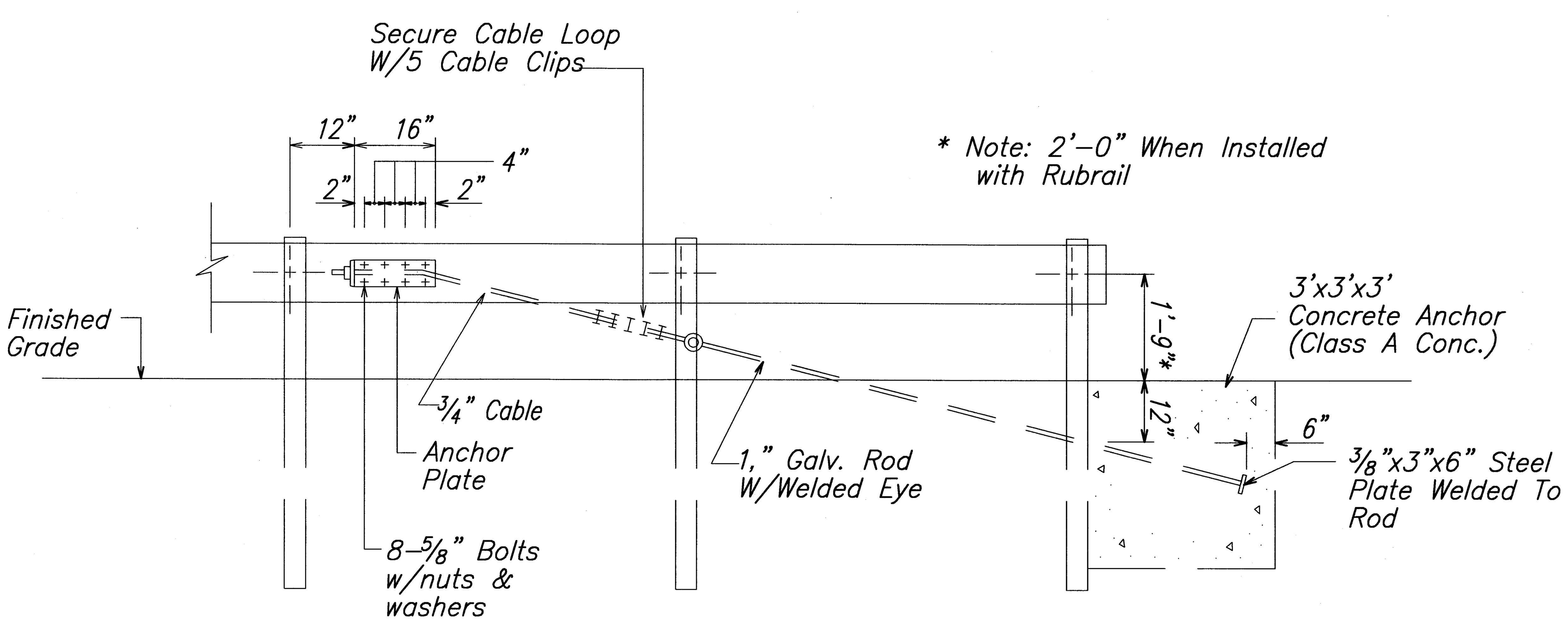
SHEET No. 11 OF 13 SHEETS



ANCHOR PLATE DETAILS

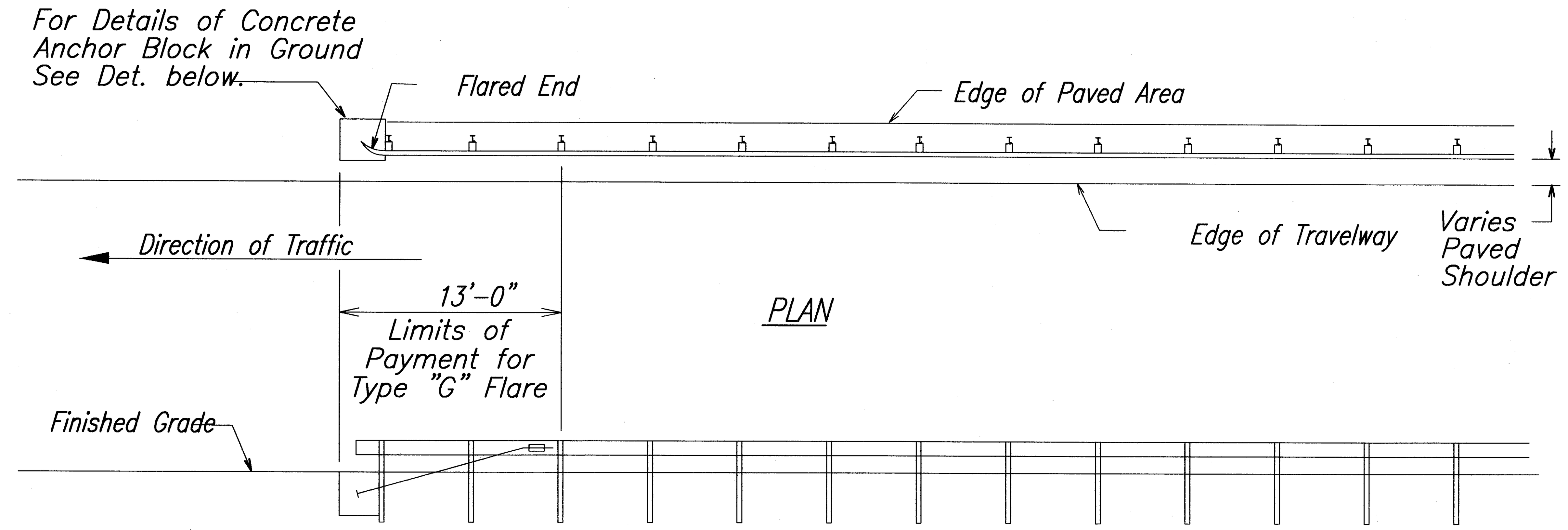


STANDARD SWAGED FITTING
AND STUD



ANCHOR BLOCK DETAIL

* Concrete, G.R.P., excavation, anchor rod and miscellaneous appurtenances necessary to anchor the guardrail ends shall be incidental to guardrail system.



ELEVATION

TYPE "G" FLARE END TERMINAL

Not To Scale

Notes:

1. 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.

2. 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).

3. 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.

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

AECOM

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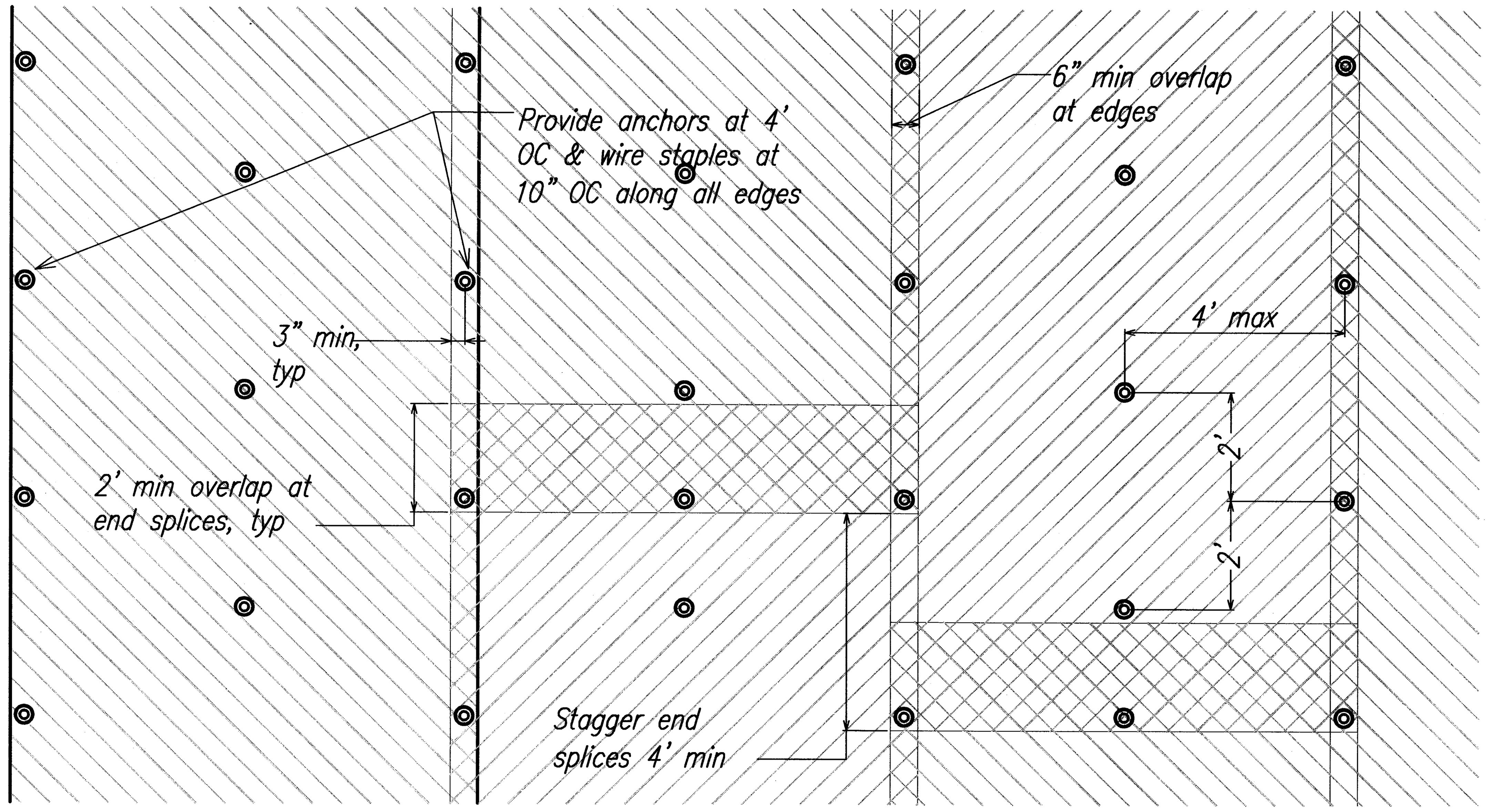
HIGHWAYS DIVISION

TYPICAL DETAILS
TYPE "G" FLARE END TERMINAL
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS
AT VARIOUS LOCATIONS
F.A. Project No. ER-15(21)

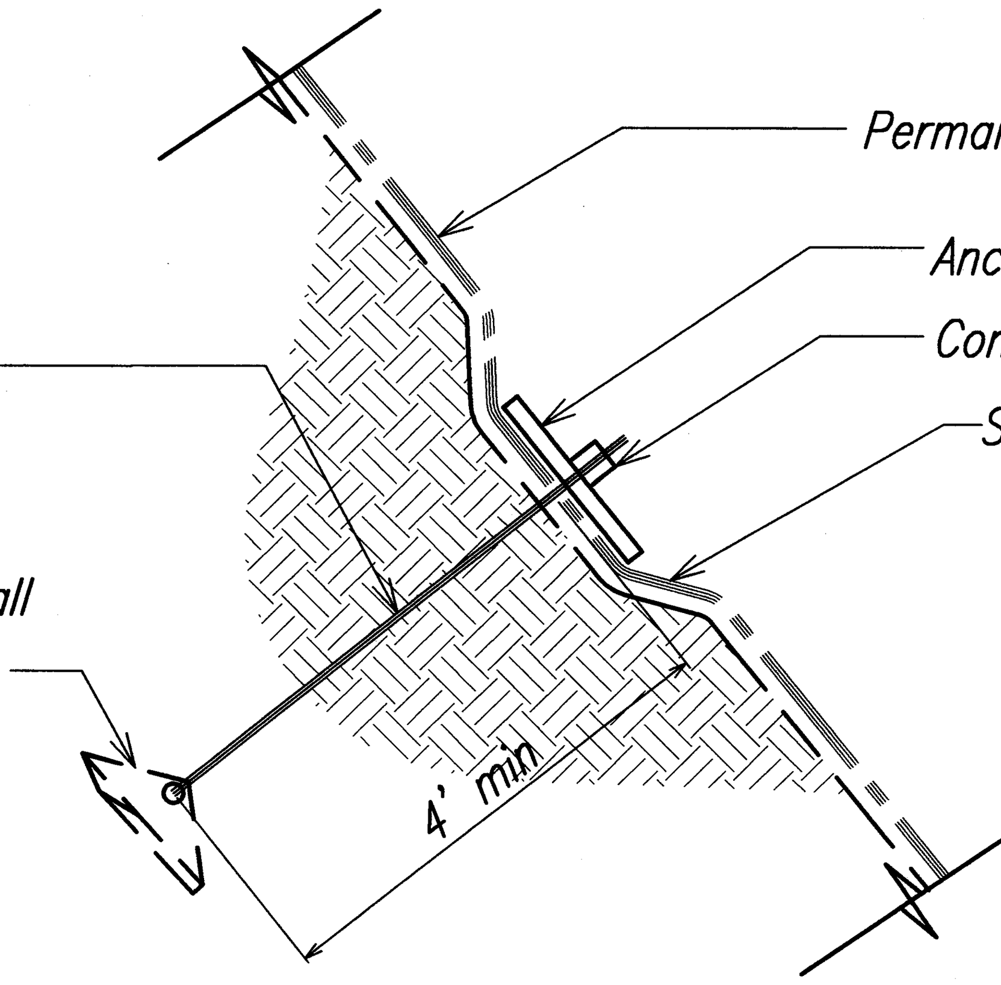
Scale: As Noted Date: December, 2009

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

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	ER-15(21)	2010	21	89



ANCHOR\MAT LAYOUT



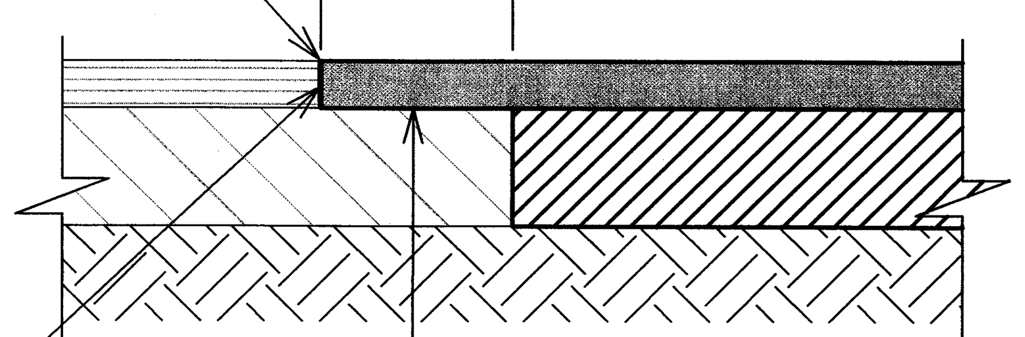
Notes:

1. Secure all erosion mat edges with mechanical earth anchors at 4 feet on center and 8 gauge wire staples at 10 inches on center.

MECHANICAL EARTH ANCHORS

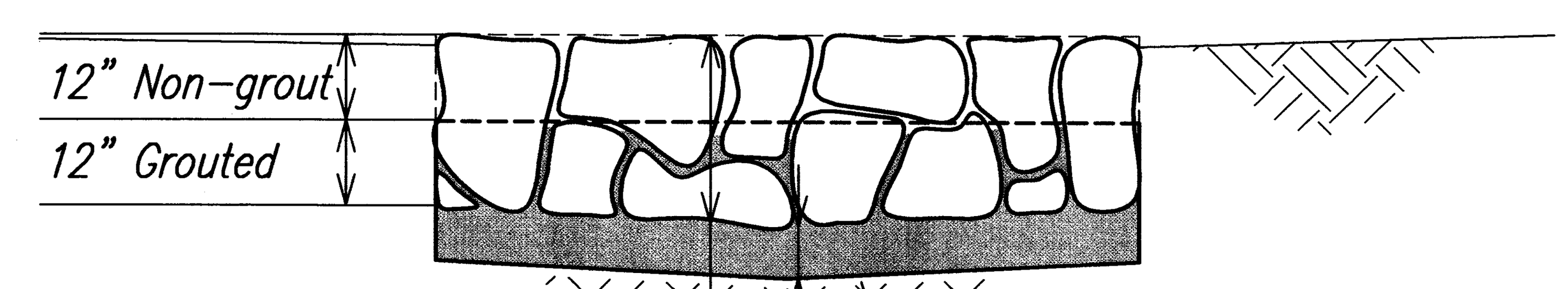
ANCHORED EROSION MAT DETAILS

Not To Scale



PAVEMENT CONNECTION DETAIL

Not To Scale



Note:
Excavation and Grouting Shall be considered Incidental to Item No. 611.0100 Hand-laid Riprap

HAND-LAID RIPRAP DETAIL

Not To Scale

AECOM

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TYPICAL DETAILS
MISCELLANEOUS DETAILS
EMERGENCY EARTHQUAKE ROCKFALL REPAIRS AT VARIOUS LOCATIONS
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