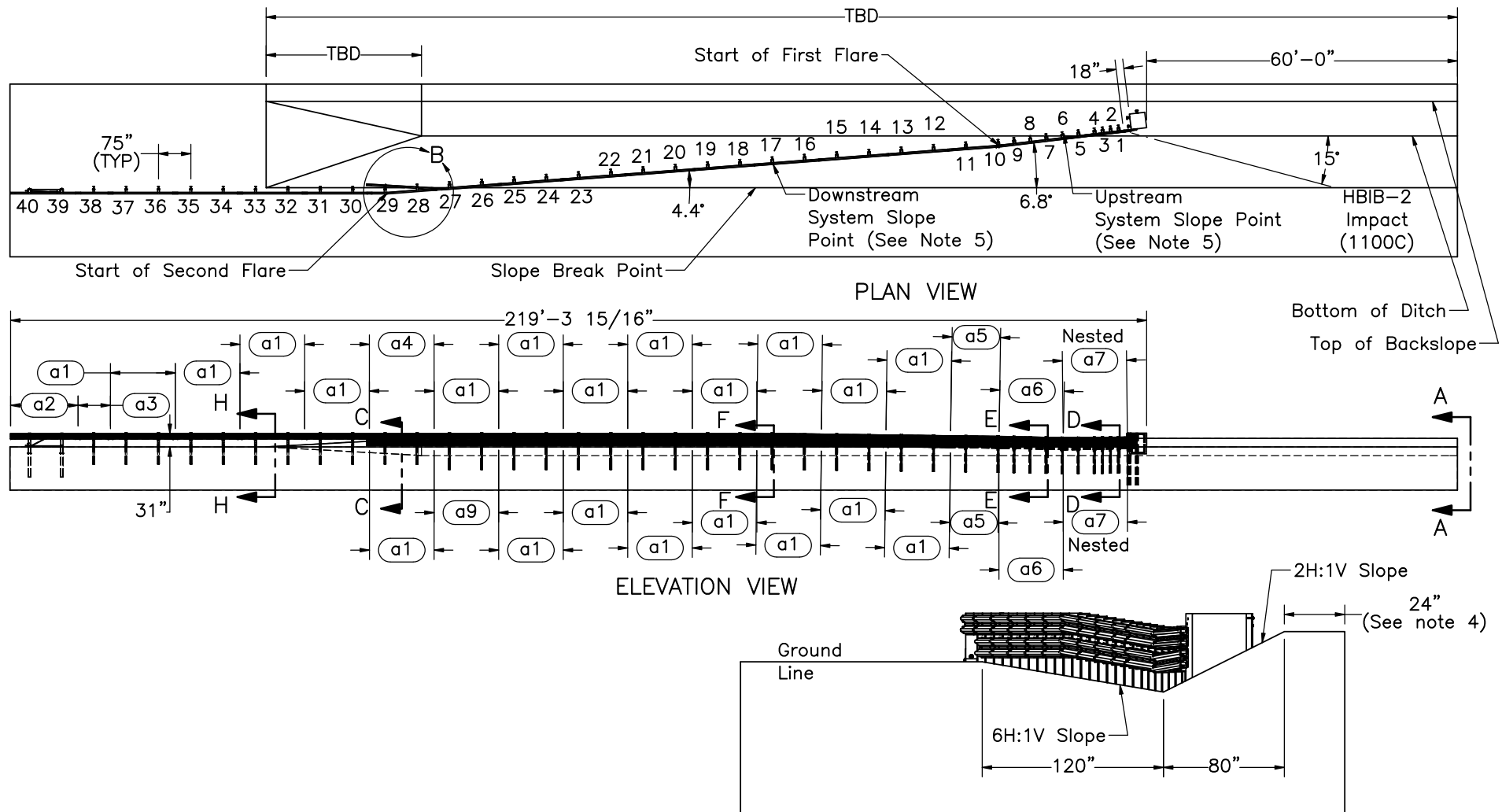




- Note:
- (1) Test no. HBIB-2 shall be performed according to modified test designation no. 3-32 using MASH 2016 criteria.
 - (2) Impact location for test no. HBIB-2 is 18" downstream from the downstream edge of the anchor block along the rail.
 - (3) Impact angle is respect to tangent portion of system between post nos. 30 and 40.
 - (4) Width of backstop plateau extends for 2' behind system before transitioning back to the nominal ground line.
 - (5) System has linear slope up out of ditch between post nos. 6-17.
 - (6) Nested W-beam section (part a5) at anchor block placed beneath W-beam terminal connector (part a8) at splice locations in accordance with traffic flow.
 - (7) Downstream end of nested W-beam sections (part a5) sandwich upstream end of adjacent W-beam section (part a6) at splice location in accordance with traffic flow.



Midwest Roadside
Safety Facility

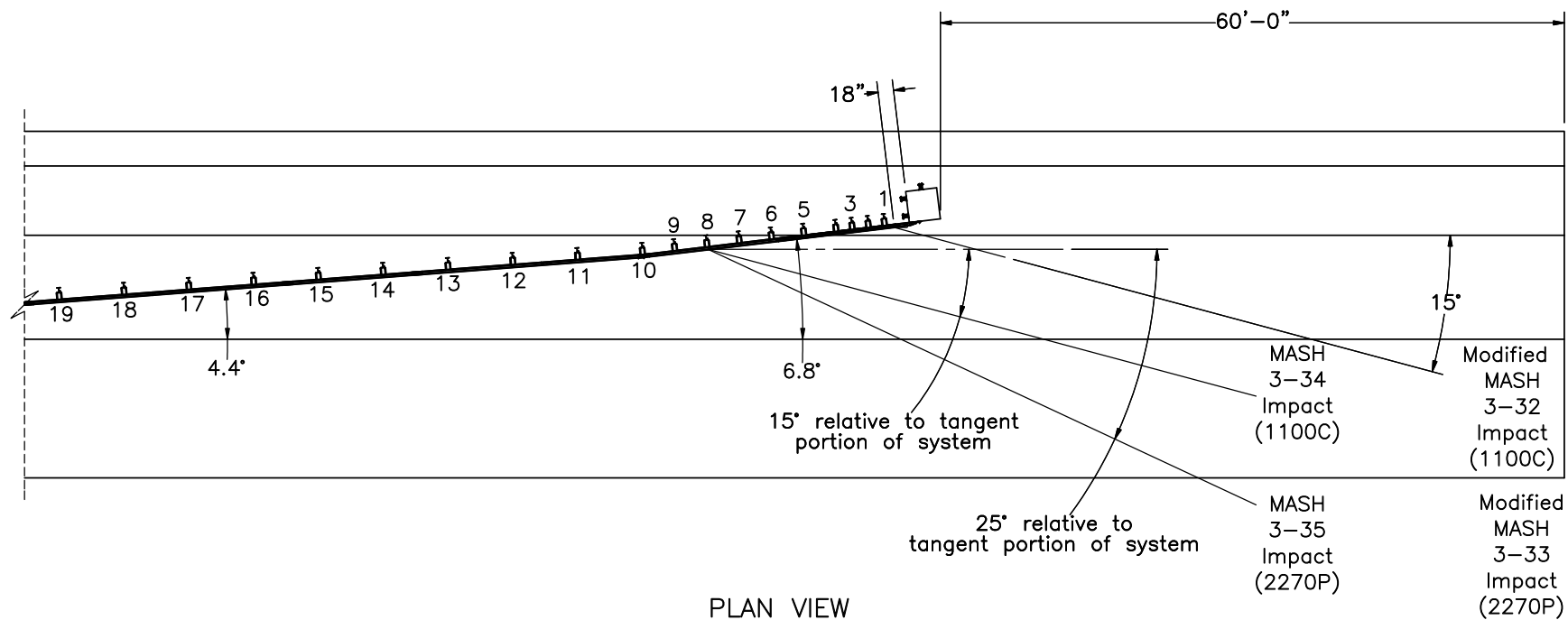
Hawaii Buried in Backslope
Test No. HBIB-2

System Layout

DWG. NAME.
HBIB-2_R15

SCALE: 1:350
UNITS: in.

SHEET:
1 of 32
DATE:
8/25/2025
DRAWN BY:
JJO/MM/SR
W/TJC
REV. BY:
KAL/CSS/J
CH/AML



MASH Test No.	Test Vehicle	Impact Condition	
		Speed (mph)	Angle
Modified 3-32	1100C	62	15°
Modified 3-33	2270P	62	15°
3-34	1100C	62	15°
3-35	2270P	62	25°

- Notes:
- (1) Location of test 3-35 are approximate and subject to change.
 - (2) Impact angle is with respect to tangent portion of system between post nos. 30 and 40.



Midwest Roadside
Safety Facility

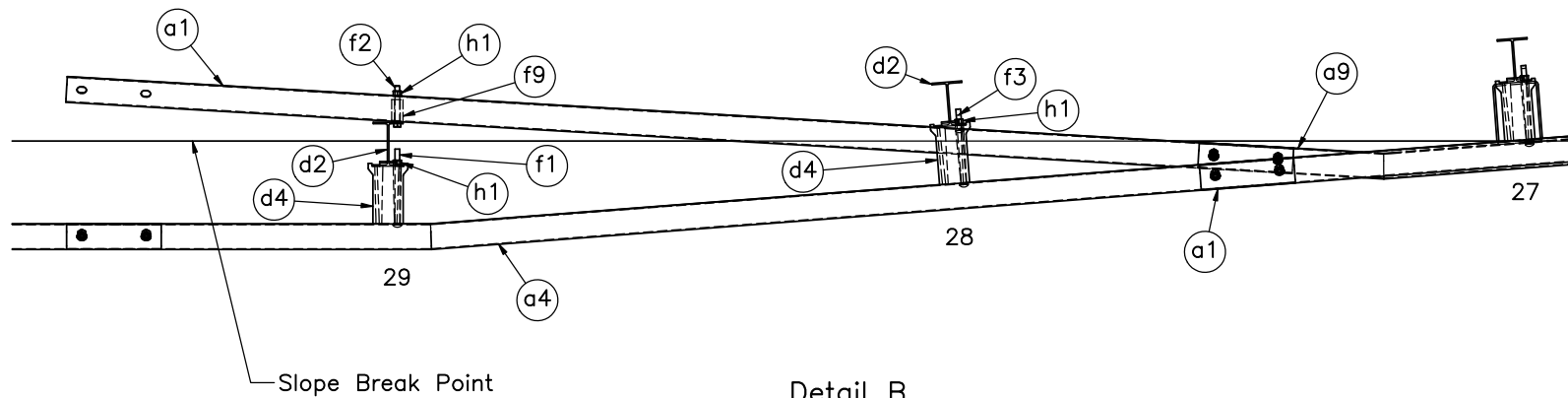
Hawaii Buried in Backslope
Test No. HBIB-2

Tentative Impact Locations

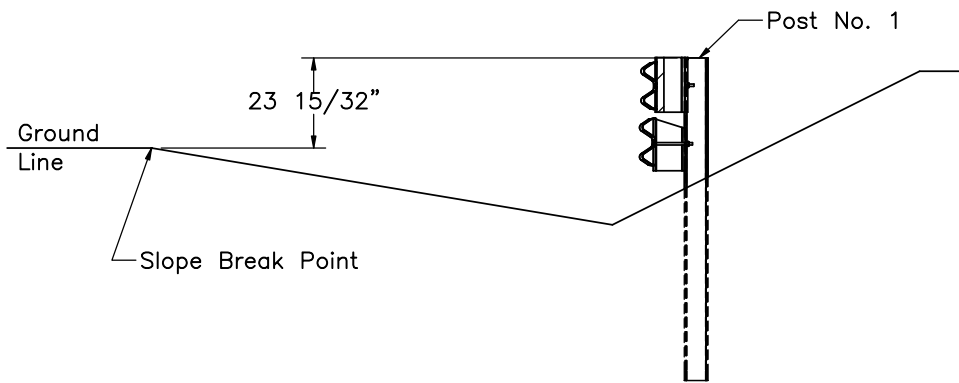
DWG. NAME.
HBIB-2_R15

SCALE: 1:200
UNITS: in.

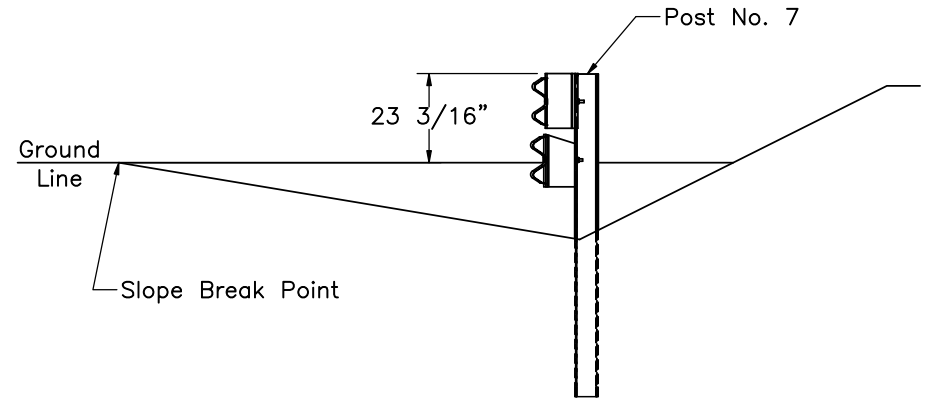
SHEET:
2 of 32
DATE:
8/25/2025
DRAWN BY:
JJC/MM/SR
W/TJC
REV. BY:
KAL/CSS/J
CH/AML



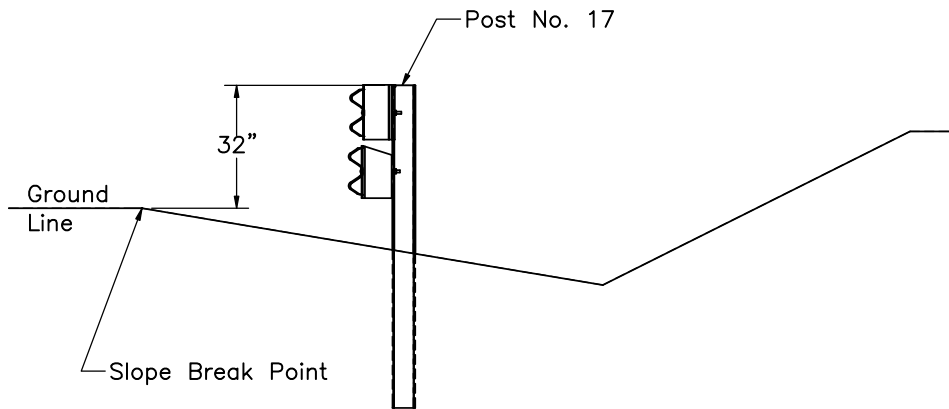
	Hawaii Buried in Backslope		SHEET: 3 of 32
	Test No. HBIB-2		DATE: 8/25/2025
Midwest Roadside Safety Facility	Detail B View		DRAWN BY: JJQ/MM/SR W/TJC
	DWG. NAME: HBIB-2_R15	SCALE: 1:25 UNITS: in.	REV. BY: KAL/CSS/J CH/AML



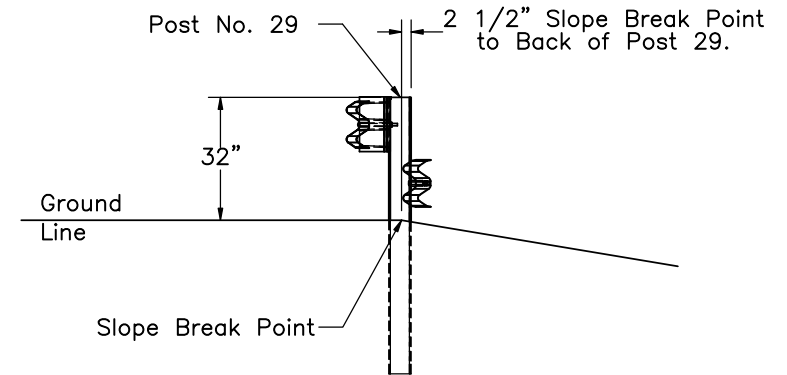
SECTION D-D



SECTION E-E



SECTION F-F



SECTION C-C

- Note: (1) Post heights are measured from the Ground Line to the center back of the post.
- (2) The top of the upper W-beam rail is located 1" below the top of the post and blockout at each post location. The lower W-beam is located 3" below the bottom of the upper W-beam.



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Ground Cross Sections

DWG. NAME:
HBIB-2_R15

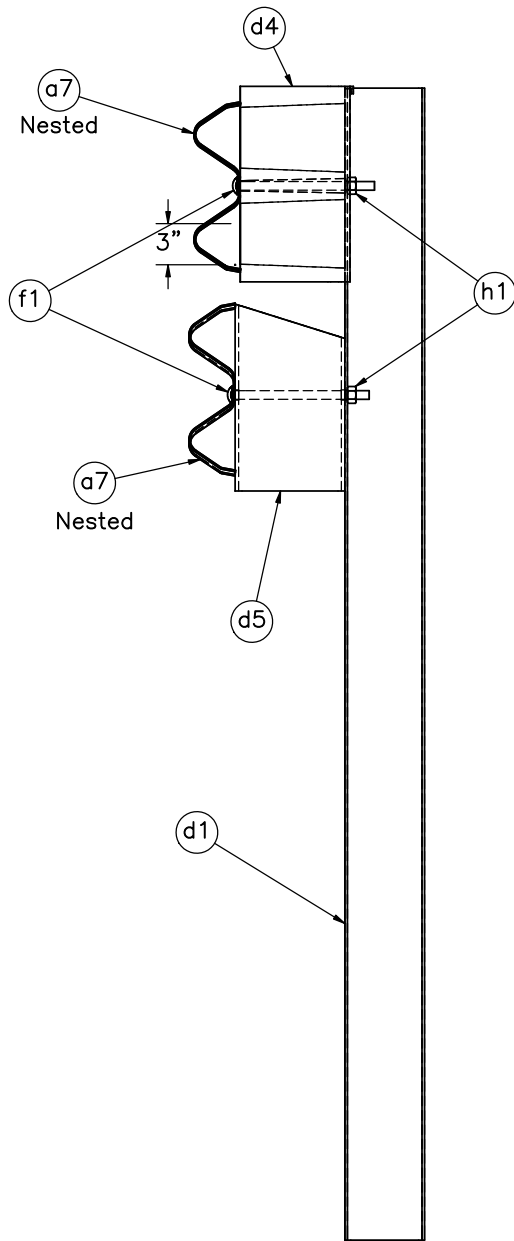
SCALE: 1:50
UNITS: in.

SHEET:
4 of 32

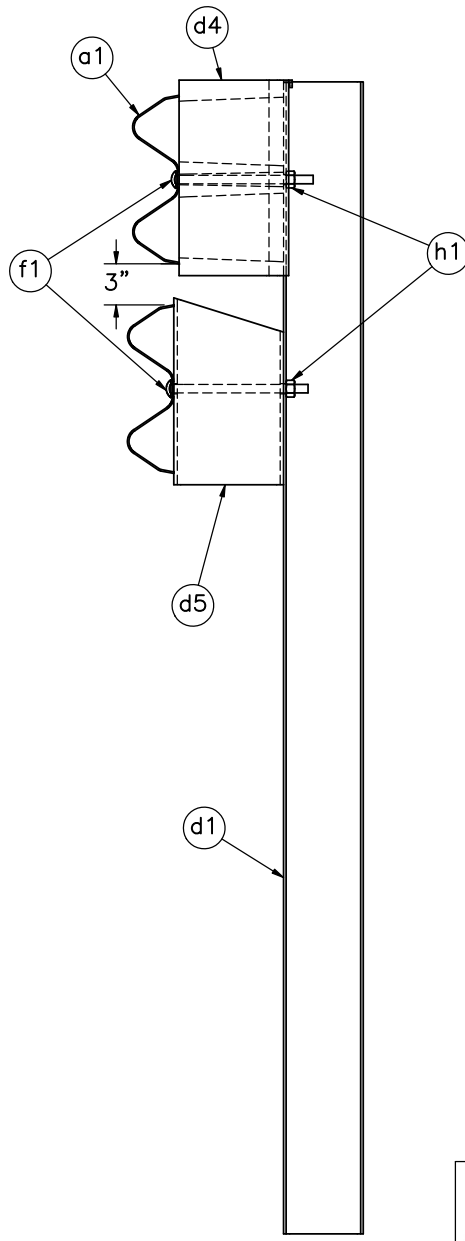
DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

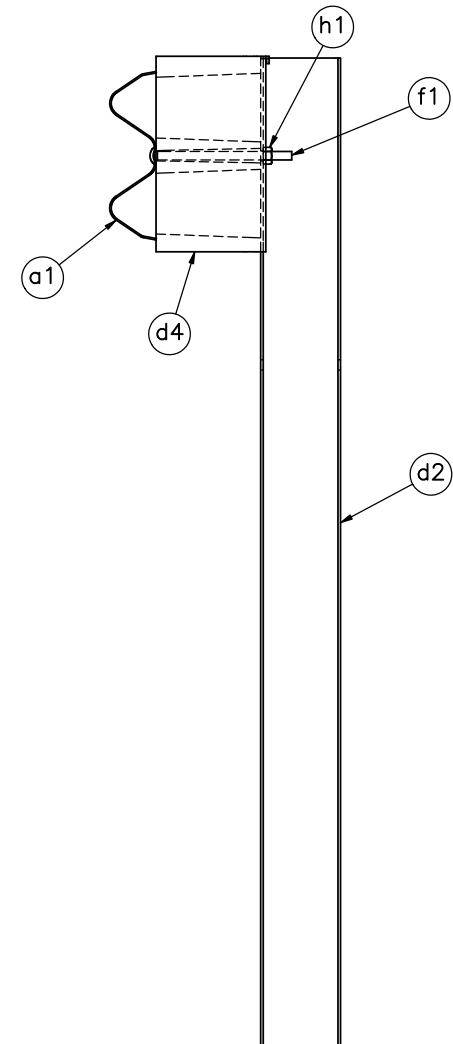
REV. BY:
KAL/CSS/J
CH/AML



SECTION M-M
Post No. 1-6



Post No. 7-27



SECTION H-H
Post No. 28-38

Note: (1) 3" Gap between bottom of top rail and top of Rub rail, Posts 1-27



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Post Nos. 1-38 Details

DWG. NAME.
HBIB-2_R15

SCALE: 1:14
UNITS: in.

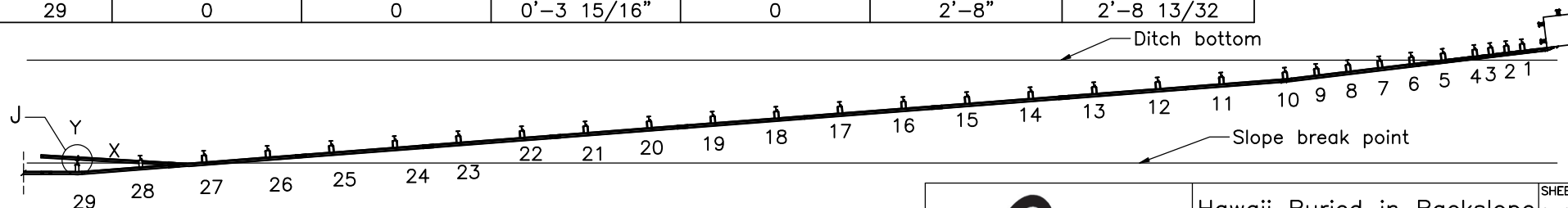
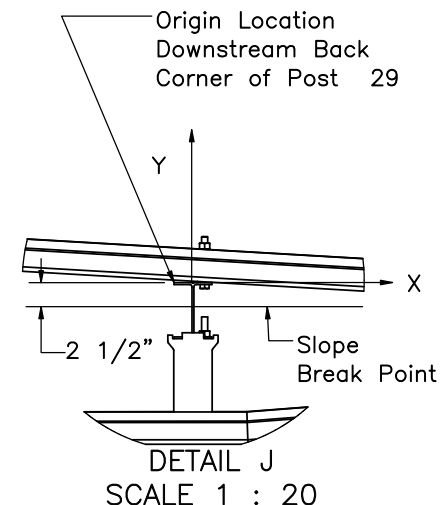
SHEET:
5 of 32

DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML

Post Locations						
Post No.	Downstream Back Corner of Post		Upstream Back Corner of Post		Top of the post to ground line	Top of the Back Side Centerline Post to Ditch
	X	Y	X	Y		
1	141'-6 5/8'	11'-9 63/64"	141'-10 35/64"	11'-10 29/64"	1'-11 15/32"	2'-7 1/8"
2	140'-0 1/64	11'-7 49/64"	140'-3 59/64"	11'-8 15/64"	1'-11 9/32"	2'-8 1/8"
3	138'-5 25/64"	11'-5 33/64"	138'-9 19/64"	11'-5 63/64	1'-10 29/32"	2'-8 3/4"
4	136'-10 25/32"	11'-3 19/64"	137'-2 11/16"	11'-3 49/64"	1'-10 51/64"	2'-9 25/32"
5	133'-9 35/64"	10'-10 13/16"	134'-1 29/64"	10'-11 19/64"	1'-10 27/64"	2'-11 19/32"
6	130'-8 5/16"	10'-6 23/64"	131'-0 7/32"	10'-6 53/64	1'-10 5/16"	3'-1 29/32"
7	127'-7 5/64"	10'-1 57/64"	127'-10 63/64"	10'-2 23/64"	1'-11 1/16"	3'-4 31/32"
8	124'-5 27/32"	9'-9 7/16"	124'-9 3/4"	9'-9 29/32"	1'-11 13/16"	3'-7 25/32"
9	121'-4 39/64"	9'-4 61/64"	121'-8 33/64"	9'-5 7/16"	2'-0 35/64"	3'-7 27/32"
10	118'-3 29/32"	9'-0 45/64"	118'-7 53/64"	9'-1"	2'-1 19/64"	3'-7 27/32"
11	112'-1"	8'-6 15/16"	112'-4 15/16"	8'-7 15/64"	2'-2 1/4"	3'-7 27/32"
12	105'-10 23/64"	8'-1 3/16"	106'-2 9/32	8'-1 31/64"	2'-3 13/64"	3'-7 27/32"
13	99'-7 37/64"	7'-7 7/16"	99'-11 33/64	7'-7 47/64"	2'-4 5/32"	3'-7 27/32"
14	93'-4 13/16"	7'-1 11/16"	93'-8 47/64"	7'-1 63/64"	2'-5 1/8"	3'-7 7/8"
15	87'-2 3/64"	6'-7 15/16"	87'-5 61/64"	6'-8 15/64"	2'-6 5/64"	3'-7 27/32"
16	80'-11 9/32'	6'-2 3/16"	81'-3 13/64	6'-2 31/64"	2'-7 3/64"	3'-7 7/8"
17	74'-8 1/2"	5'-8 27/64"	75'-0 27/64	5'-8 23/32	2'-8"	3'-7 27/32"
18	68'-5 23/32"	5'-2 43/64"	68'-9 41/64"	5'-2 31/32"	2'-8"	3'-6 15/16"
19	62'-2 15/16"	4'-8 29/32"	62'-6 55/64"	4'-9 7/32"	2'-8"	3'-5 29/32"
20	56'-0 5/32"	4'-3 5/32"	56'-4 3/32"	4'-3 29/64	2'-8"	3'-5"
21	49'-9 3/8"	3'-9 13/32"	50'-1 5/16"	3'-9 45/64"	2'-8"	3'-4 1/32"
22	43'-6 19/32"	3'-3 21/32"	43'-10 17/32"	3'-3 61/64"	2'-8"	3'-3 1/32"
23	37'-3 13/16"	2'-9 29/32"	37'-7 3/4"	2'-10 13/64"	2'-8"	3'-2 3/32"
24	31'-1 3/64"	2'-4 9/64"	31'-4 31/32"	2'-4 29/64"	2'-8"	3'-1 5/32"
25	24'-10 9/32"	1'-10 25/64"	25'-2 13/64"	1'-10 11/16"	2'-8"	3'-3/16"
26	18'-7 18/32"	1' 4 41/64"	18'-11 13/32"	1'-4 15/16"	2'-8"	2'-11 7/32"
27	12'-4 45/64"	0-10 7/8"	12'-8 5/8"	0'-11 3/16"	2'-8"	2'-10 1/4"
28	6'-1 29/32"	0-5 9/64"	6'-5 27/32"	0'-5 29/64"	2'-8"	2'-9 9/32"
29	0	0	0'-3 15/16"	0	2'-8"	2'-8 13/32



- Note: (1) Post x,y,z dimensions are measured from downstream back corner of post 29. Vertical dimensions are from the top of the front slope break point to the top of the post.
- (2) Post no. 17 through No. 29 do not change in height from the top of the post to the ground line.



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Post Location Layout

DWG. NAME.
HBIB-2_R15

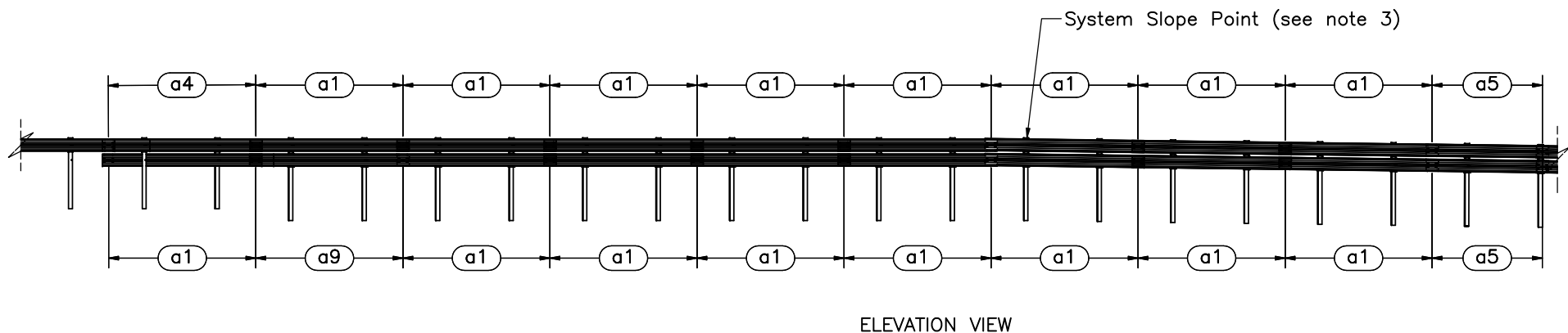
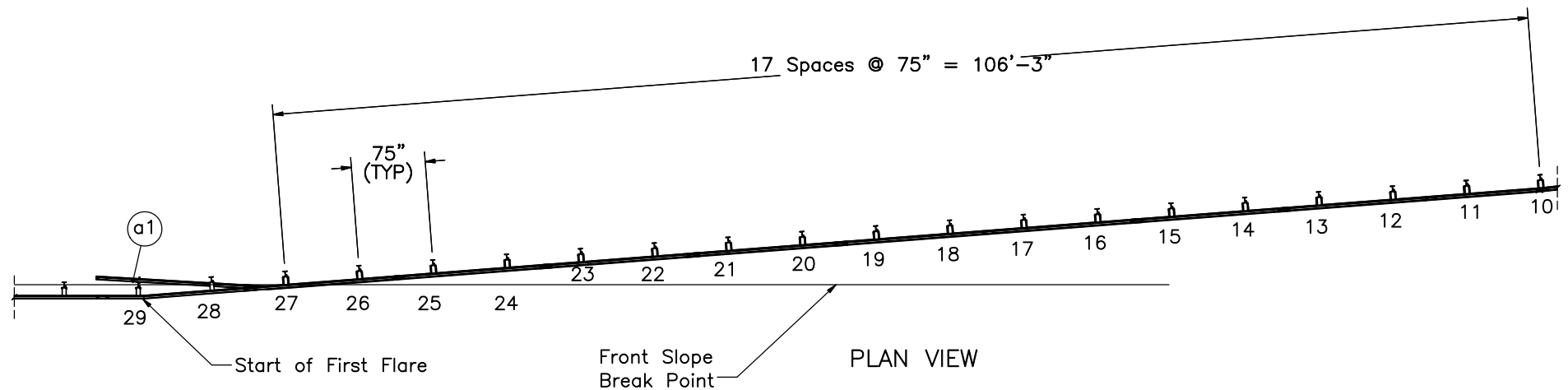
SCALE: 1:185
UNITS: in.

SHEET:
6 of 32

DATE:
8/25/2025

DRAWN BY:
JJC/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



- Notes:
- (1) Elevation view is normal to the front face of the first flared rail.
 - (2) Downstream end of nested W-beam sections (part a5) sandwich upstream end of adjacent W-beam section (part a6) at splice location in accordance with traffic flow.
 - (3) System slopes with ditch between post nos. 6–17. Vertical slope will be accomplished by offsetting the vertical angles of the W-beam rails at splice locations.



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

First Flare Details

DWG. NAME.
HBIB-2_R15

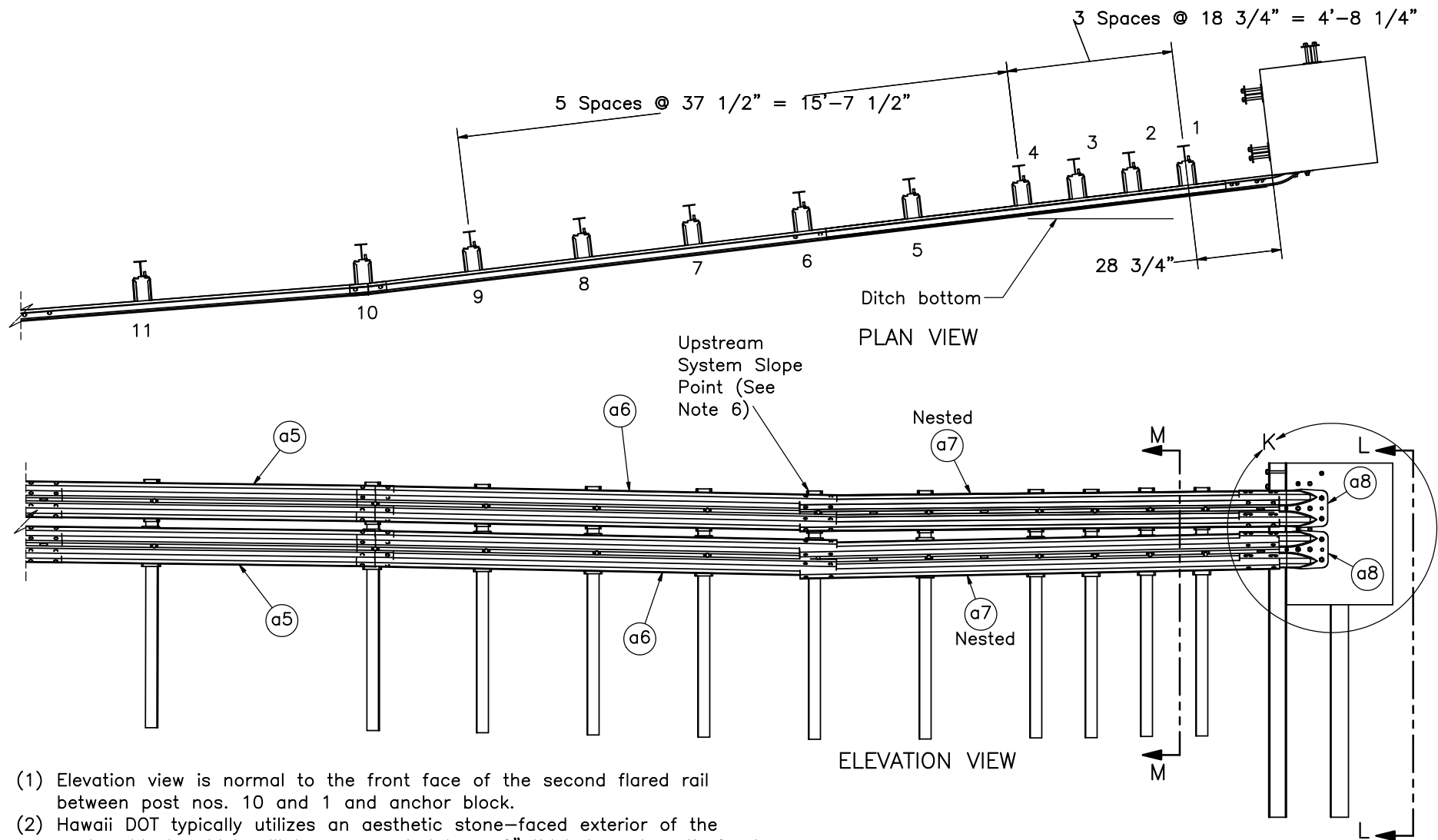
SCALE: 1:160
UNITS: in.

REV. BY:
KAL/CSS/J
CH/AML

SHEET:
7 of 32

DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC



- Notes:
- (1) Elevation view is normal to the front face of the second flared rail between post nos. 10 and 1 and anchor block.
 - (2) Hawaii DOT typically utilizes an aesthetic stone-faced exterior of the anchor block, which will be represented by a 6" thick low-strength fascia, which is to be added to the upstream, top, and downstream surfaces of the concrete anchor block. The fascia can be low-strength concrete, low-aggregate sandy concrete, or grout mixture.
 - (3) To set anchor block follow process described in note 3 on sheet no. 10.
 - (4) Nested W-beam sections (part a5) at anchor block placed beneath W-beam terminal connector (part a8) at splice locations in accordance with traffic flow.
 - (5) Downstream end of nested W-beam sections (part a5) sandwich upstream end of adjacent W-beam section (part a6) at splice location in accordance with traffic flow.
 - (6) System slopes vertically with ditch between post nos. 6-17. Vertical slope will be accomplished by offsetting the vertical angles of the W-beam rails at splice locations.



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Second Flare Details

DWG. NAME.
HBIB-2_R15

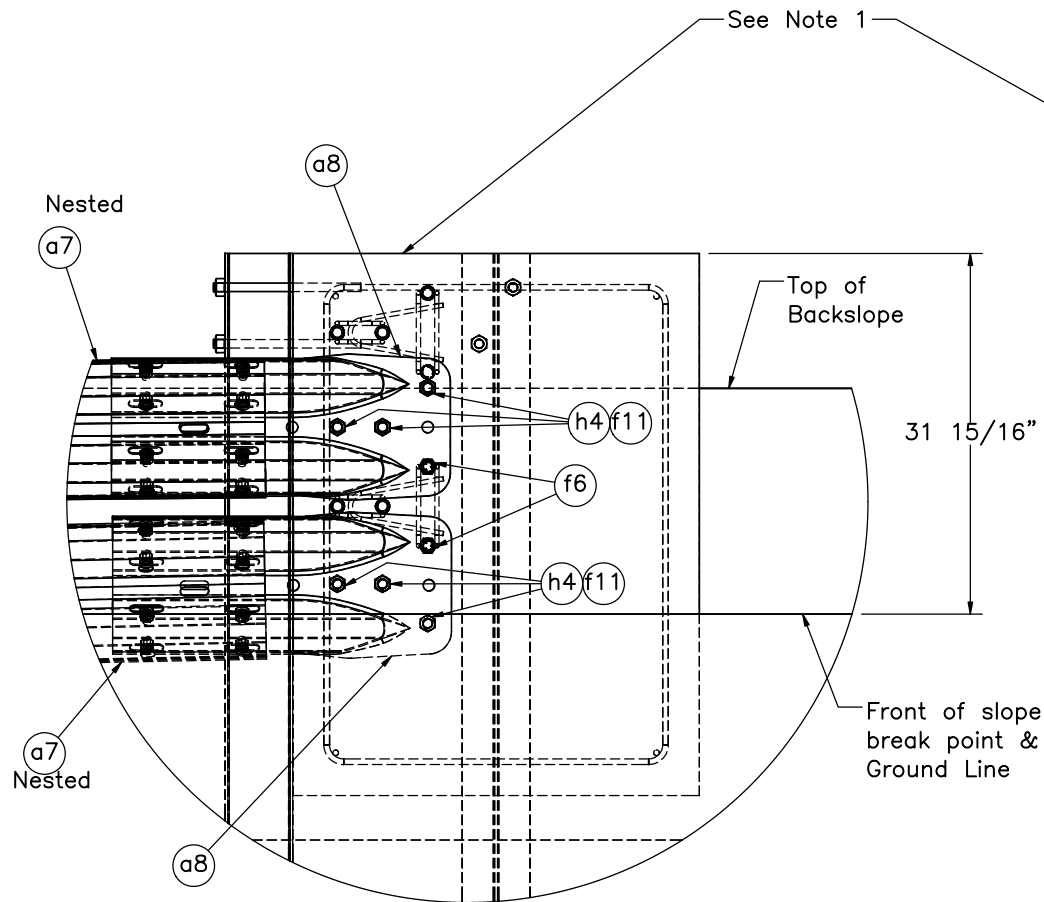
SCALE: 1:50
UNITS: in.

SHEET:
8 of 32

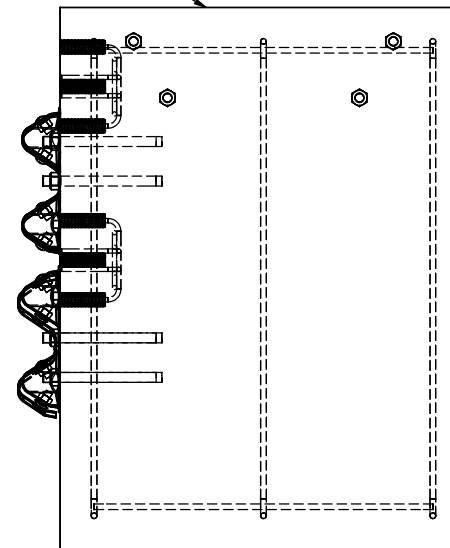
DATE:
8/25/2025

DRAWN BY:
JJO/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



DETAIL K



SECTION L-L
(See Notes 2 & 3)

- Notes: (1) Hawaii DOT typically utilizes an aesthetic stone-faced exterior of the anchor block, which will be represented by a 6" thick low-strength fascia, which is to be added to the upstream, top, and downstream surfaces of the concrete anchor block. The fascia can be low-strength concrete, low-aggregate sandy concrete, or grout mixture.
- (2) View is normal to concrete block, backslope is shown at an angle.
- (3) Anchor block is reused from test no. HBIB-1. One of the anchor ferrules from the anchor block will be reused; the threaded connections between the W-beam end shoes and anchor block will be post-installed thread rods.



Midwest Roadside
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Hawaii Buried in Backslope
Test No. HBIB-2

End Section Installation Details

DWG. NAME.
HBIB-2_R15

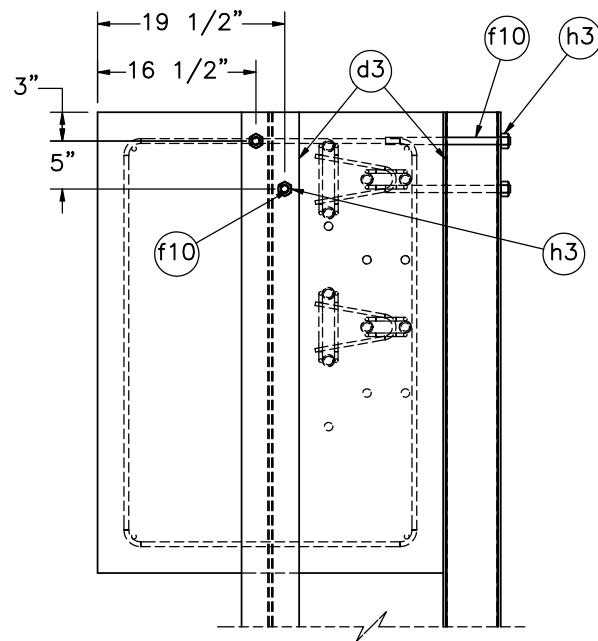
SCALE: 1:17
UNITS: in.

SHEET:
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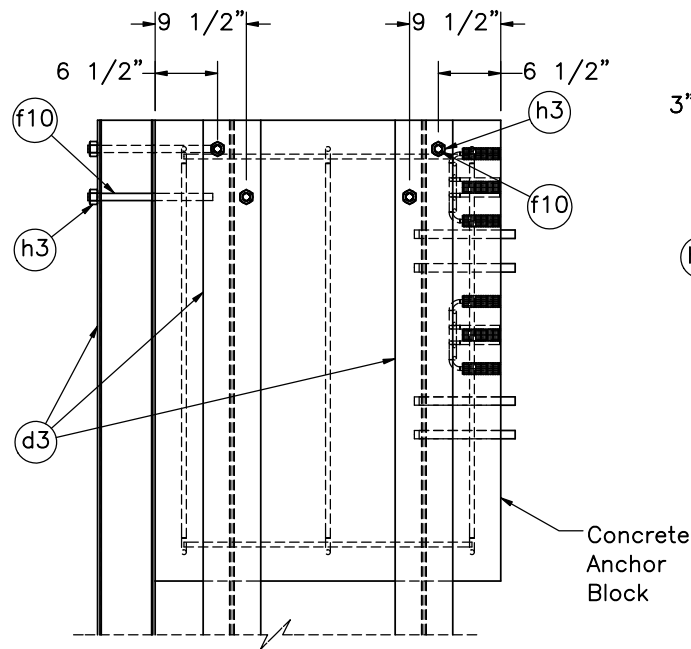
DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

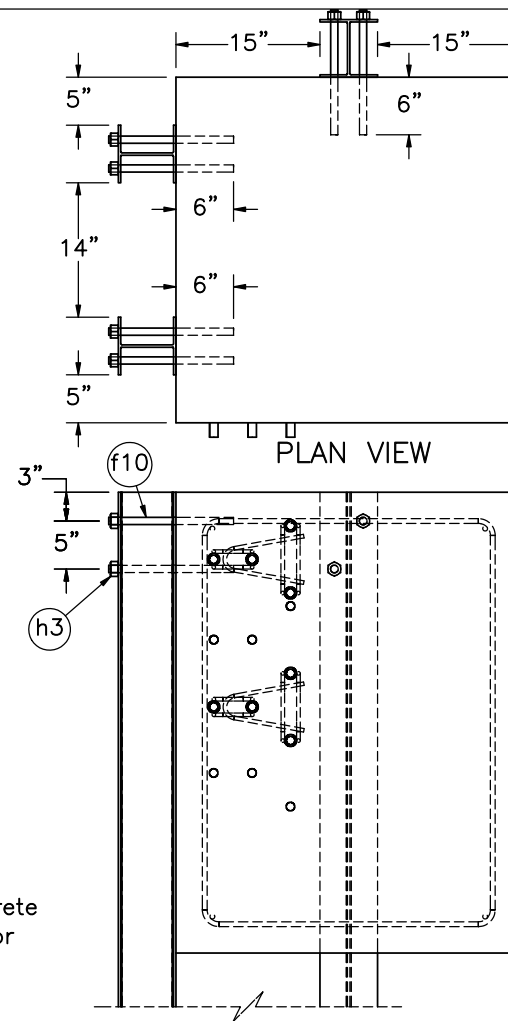
REV. BY:
KAL/CSS/J
CH/AML



BACKSIDE VIEW



PROFILE VIEW



ELEVATION VIEW

- Notes:
- (1) Ground line hidden for clarity.
 - (2) Hawaii DOT typically utilizes an aesthetic stone-faced exterior of the anchor block, which will be represented by a 6" thick low-strength fascia, which is to be added to the upstream, top, and downstream surfaces of the concrete anchor block. The fascia can be low-strength concrete, low-aggregate sandy concrete, or grout mixture.
 - (3) To set the anchor block use the following process:
 - (1) Set block.
 - (2) Drive post using post extender to flush with top surface of block.
 - (3) Drill through.
 - (4) Epoxy install threaded rods using a chemical epoxy adhesive with a minimum bond strength of 1,450 psi (part j1).
 - (5) Add aesthetic surface treatment.
 - (6) Pour aesthetic grout/rock/concrete surface on outside surface of block.



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Post to Anchor Connection
Details

DWG. NAME:
HBIB-2_R15

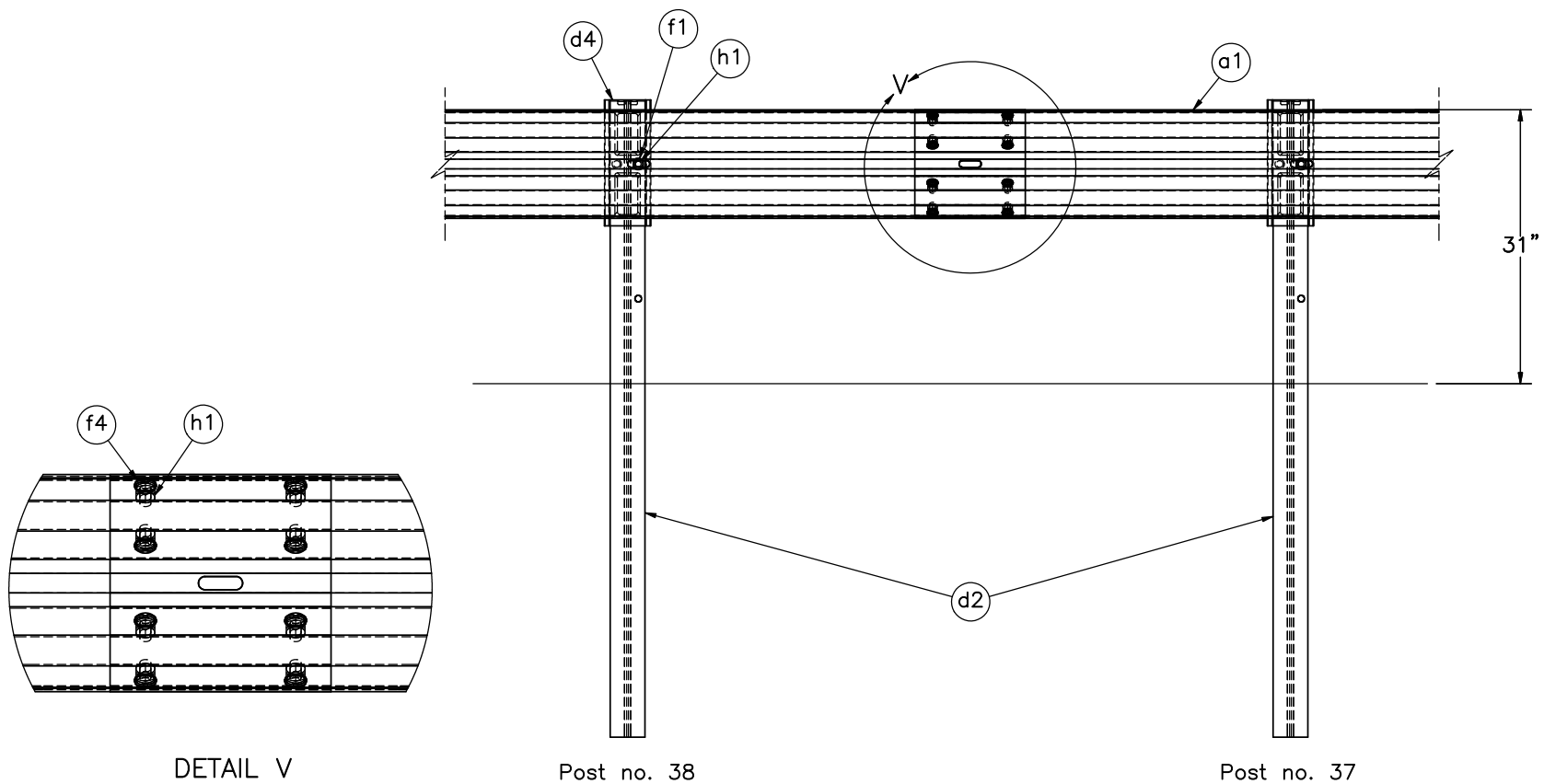
SCALE: 1:20
UNITS: in.

SHEET:
10 of 32

DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



- Note:
- (1) Guardrail bolts (part f1) on the upstream side of the web.
 - (2) Guardrail bolts (part f4) may be used in place of guardrail bolts (part f3) in nested W-beam splices if the nut can be fully threaded (dependent on thickness of stacked guardrail layers).



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Splice Detail

DWG. NAME.
HBIB-2_R15

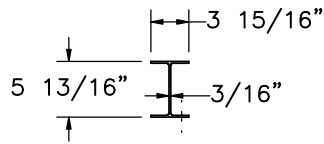
SCALE: 1:20
UNITS: in.

SHEET:
11 of 32

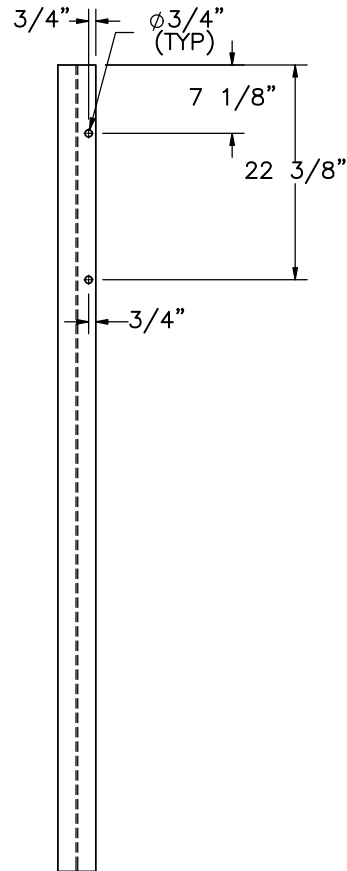
DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



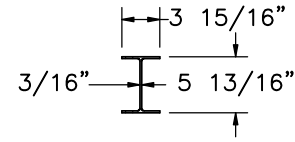
PLAN VIEW



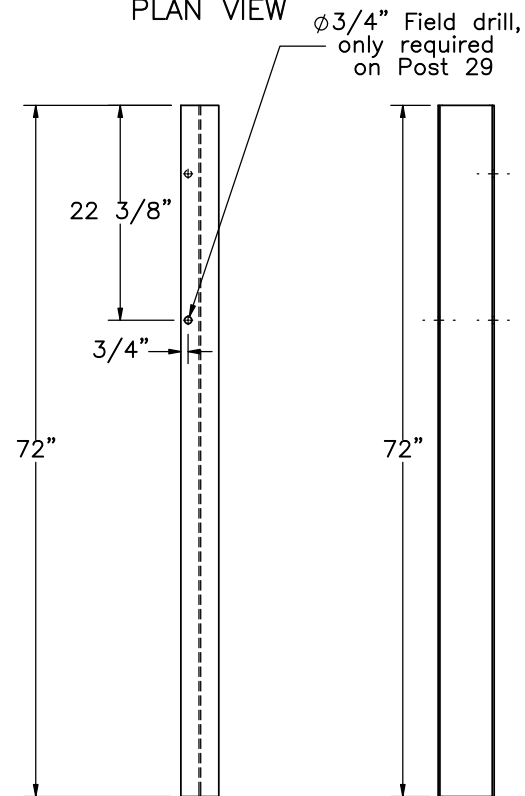
ELEVATION VIEW

Part d1

PROFILE VIEW

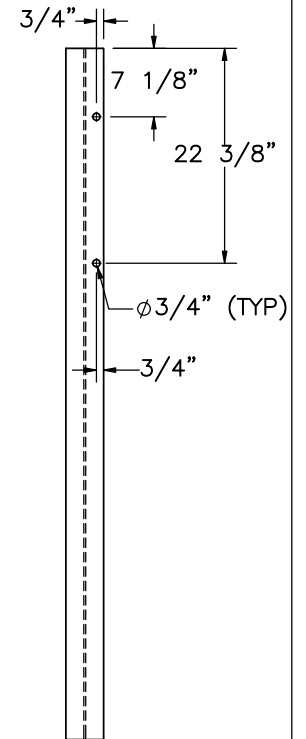


PLAN VIEW



REAR VIEW

PROFILE VIEW
Part d2



ELEVATION VIEW



Midwest Roadside
Safety Facility

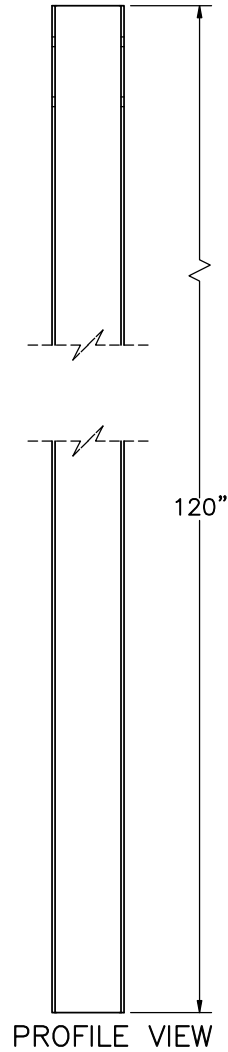
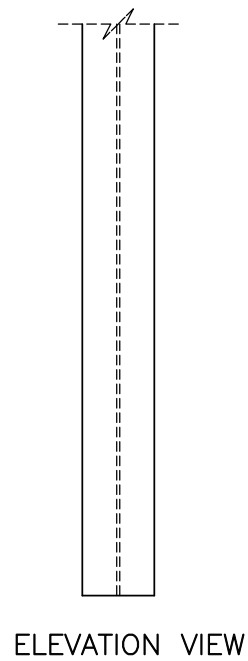
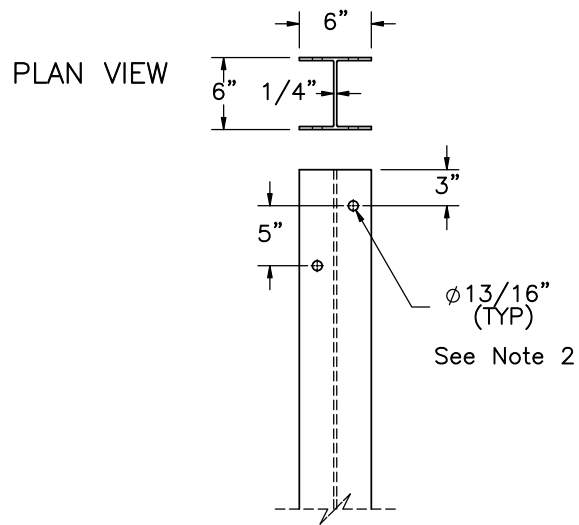
Hawaii Buried in Backslope
Test No. HBIB-2

Post Components

DWG. NAME.
HBIB-2_R15

SCALE: 1:20
UNITS: in.

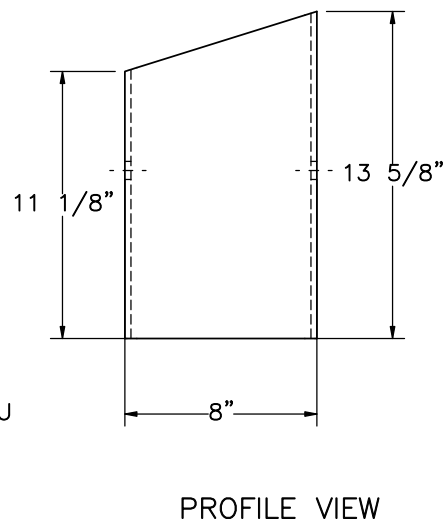
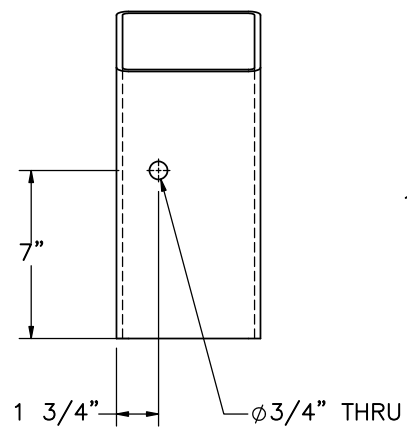
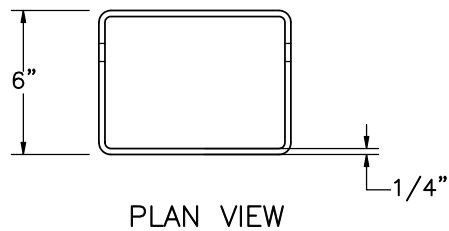
SHEET:
12 of 32
DATE:
8/25/2025
DRAWN BY:
JJQ/MM/SR
W/TJC
REV. BY:
KAL/CSS/J
CH/AML



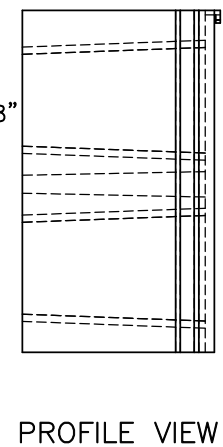
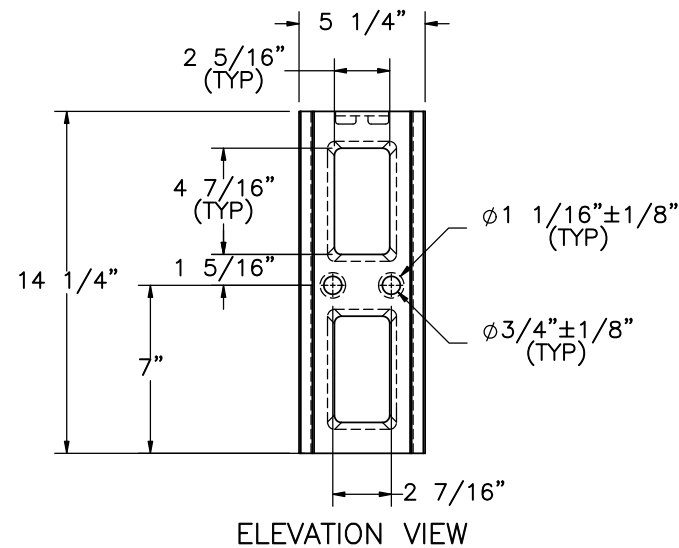
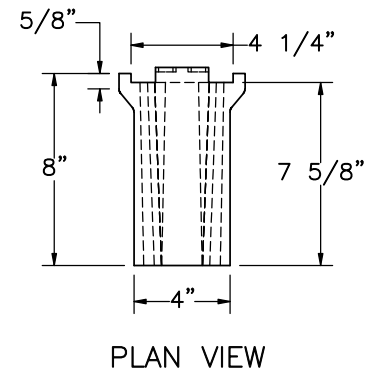
Part d3

- Notes: (1) Views shown for post on non-traffic side of anchor block.
(2) Holes are field drilled

	Hawaii Buried in Backslope Test No. HBIB-2		SHEET: 13 of 32
	Anchor Post Details		DATE: 8/25/2025
Midwest Roadside Safety Facility	DWG. NAME: HBIB-2_R15		DRAWN BY: JJQ/MM/SR W/TJC
	SCALE: 1:16 UNITS: in.		REV. BY: KAL/CSS/J CH/AML

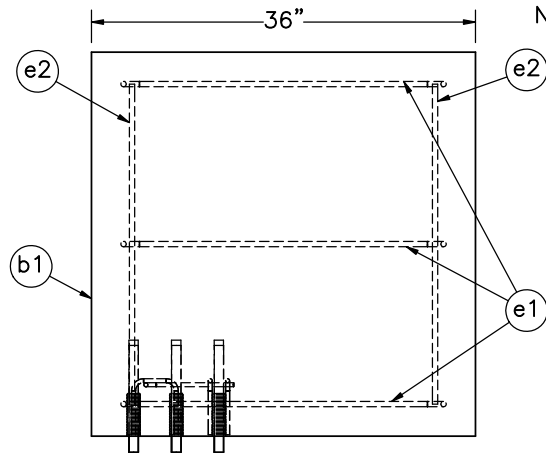


Part d5

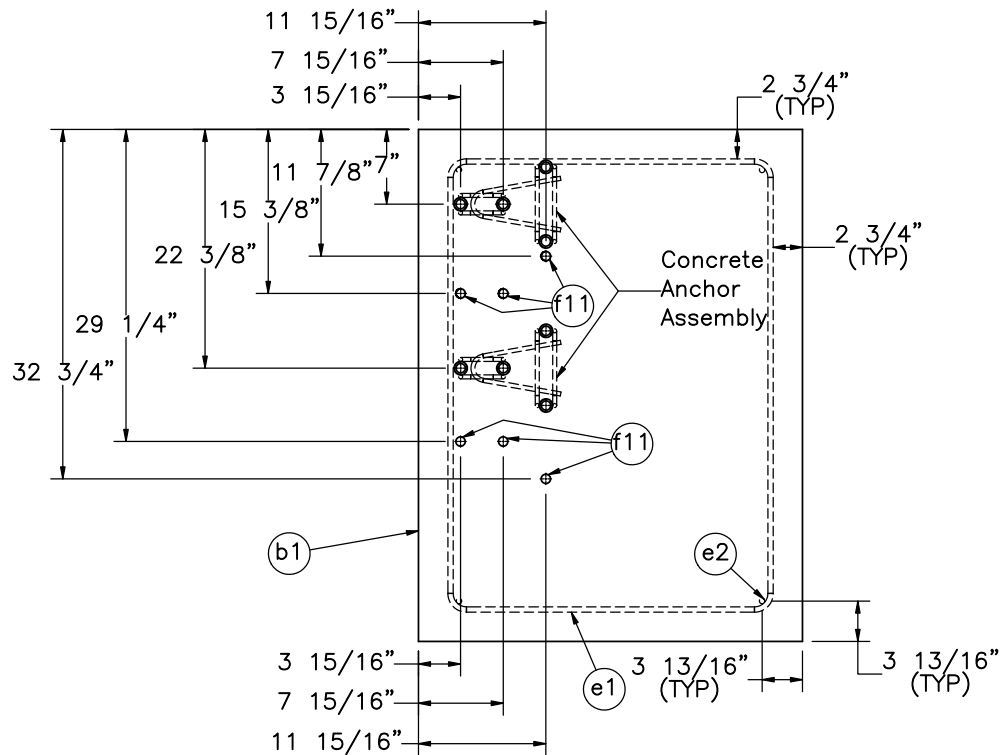


Part d4

	Hawaii Buried in Backslope Test No. HBIB-2		SHEET: 14 of 32
	Tapered Blockout Details		DATE: 8/25/2025
Midwest Roadside Safety Facility	DWG. NAME: HBIB-2_R15		DRAWN BY: JJQ/MM/SR W/TJC
	SCALE: 1:8 UNITS: in.		REV. BY: KAL/CSS/J CH/AML

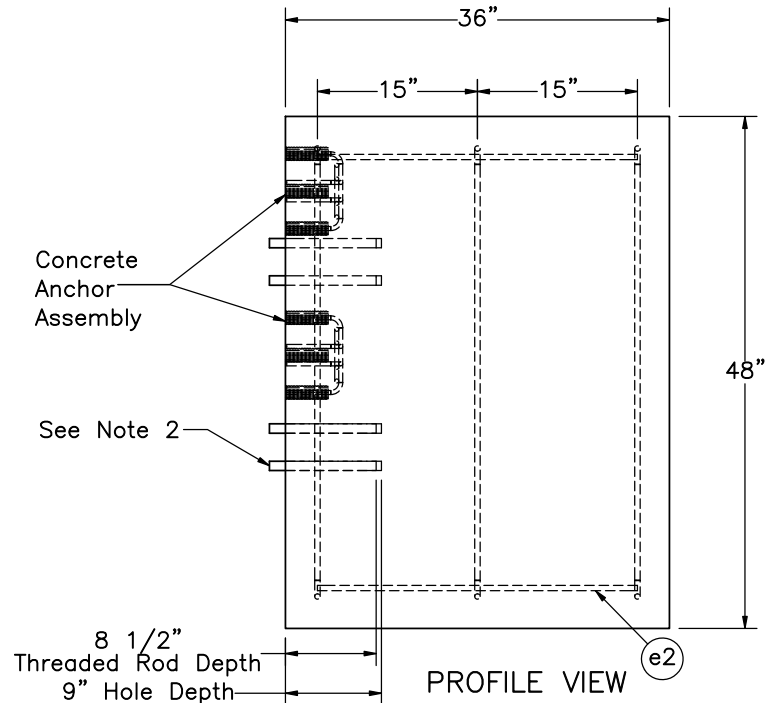


PLAN VIEW



ELEVATION VIEW

- Notes:
- (1) Once anchor is installed field drill additional holes for anchoring posts.
 - (2) Epoxy install threaded rods using a chemical epoxy adhesive with a minimum bond strength of 1,450 psi (part j1).
 - (3) Hawaii DOT typically utilizes an aesthetic stone-faced exterior of the anchor block, which will be represented by a 6" thick low-strength fascia, which is to be added to the upstream, top, and downstream surfaces of the concrete anchor block. The fascia can be low-strength concrete, low-aggregate sandy concrete, or grout mixture.
 - (4) Anchor block is reused from test no. HBIB-1. One of the ferrules from the anchor block will be reused; the threaded connections between the W-beam end shoes and anchor block will be post-installed threaded rods.



PROFILE VIEW



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Concrete Anchor Details

DWG. NAME.
HBIB-2_R15

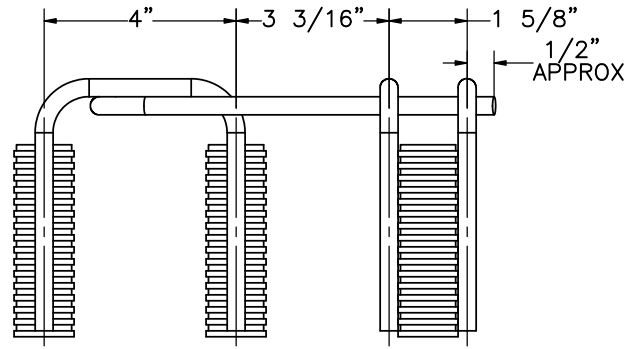
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SHEET:
15 of 32

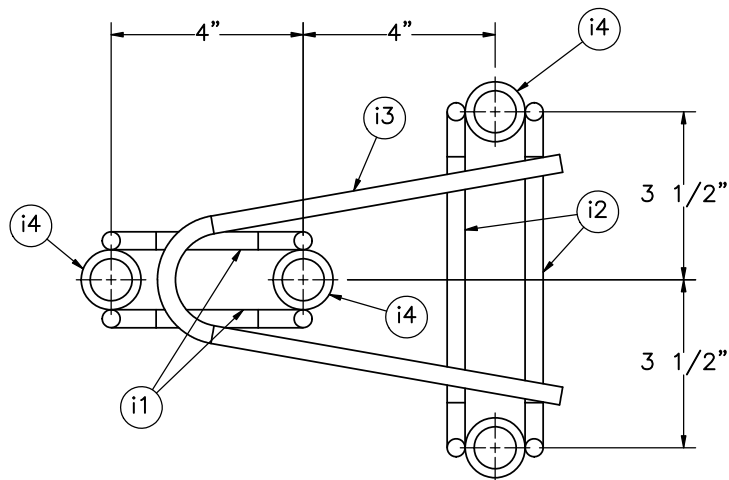
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8/25/2025

DRAWN BY:
JJO/MM/SR
W/TJC

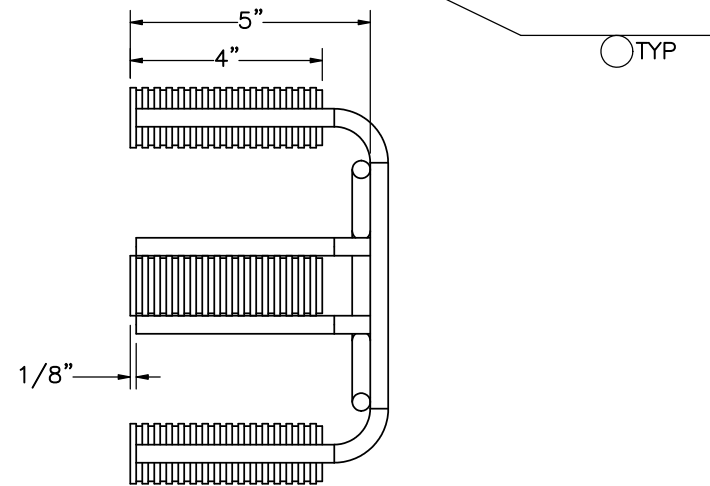
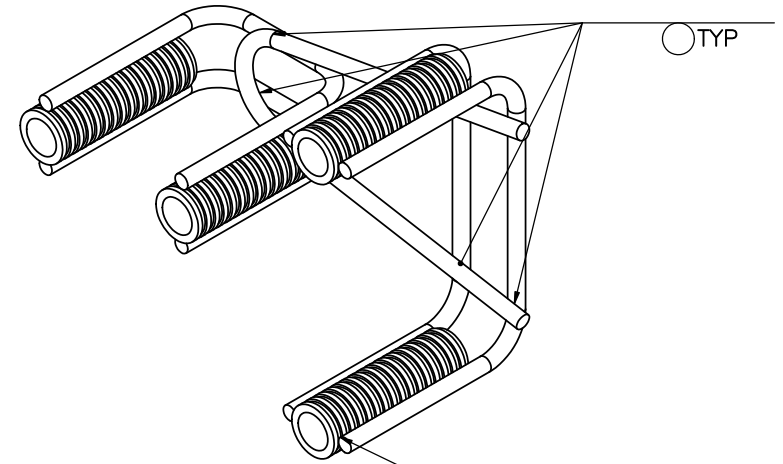
REV. BY:
KAL/CSS/J
CH/AML



PLAN VIEW



ELEVATION VIEW



PROFILE VIEW

Note: Ferrule and threaded fasteners shown for connection to concrete anchor block. Alternative anchorages may include cast or post-installed threaded rods or bolts. Details of alternative anchor blocks not shown here.

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	2	Concrete Anchor	—	—
i4	4	7/8 Dia. Threaded Ferrule	—	—
i1	2	3/4" Dia. Wire Strut, 13 3/8" Long Unbent	Min. Tensile Strength = 100,000 psi	AASHTO M111
i3	1	3/8" Dia. Wire Strut, 18" Long Unbent	Min. Tensile Strength = 100,000 psi	AASHTO M111
i2	2	3/8" Dia. Wire Strut, 16 3/8" Long Unbent	Min. Tensile Strength = 100,000 psi	AASHTO M111



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Concrete Anchor Insert
Assembly

DWG. NAME.
HBIB-2_R15

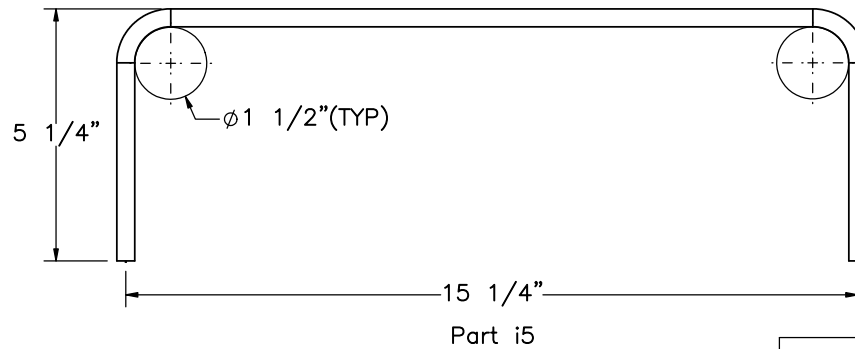
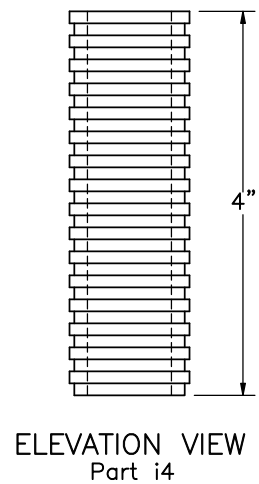
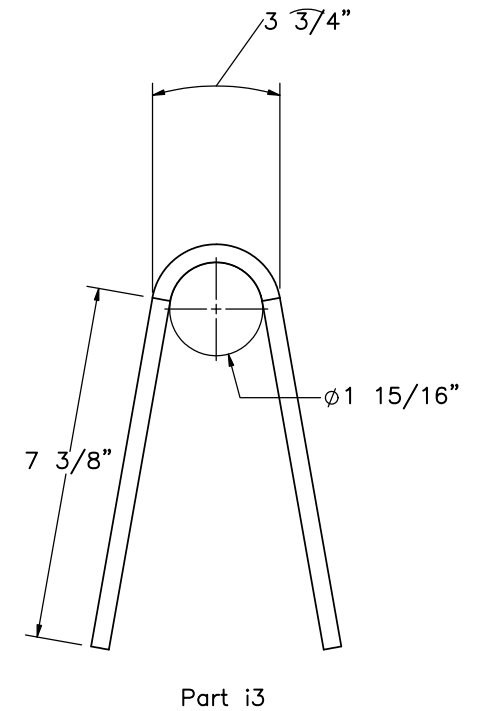
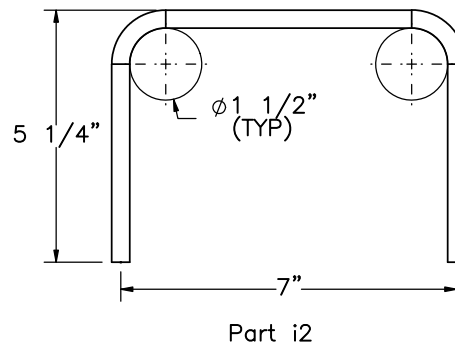
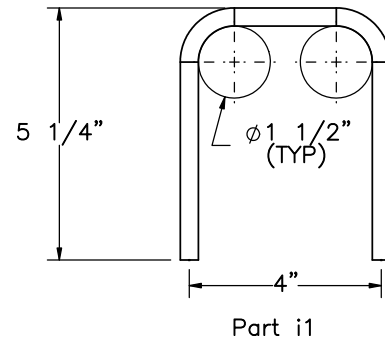
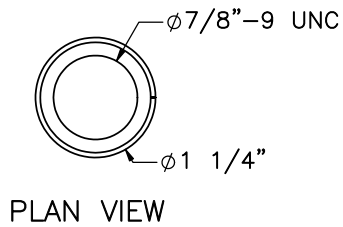
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UNITS: in.

SHEET:
16 of 32

DATE:
8/25/2025

DRAWN BY:
JJO/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



Bill of Bars					
Bar	QTY (Per Anchor)	Bar Size	Length	Material	Treatment
i1	2	#3	13 3/8"	Min. Tensile Strength = 100,000 psi	AASHTO M111
i2	2	#3	16 3/8"	Min. Tensile Strength = 100,000 psi	AASHTO M111
i3	1	#3	18"	Min. Tensile Strength = 100,000 psi	AASHTO M111



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Insert Component Details

DWG. NAME:
HBIB-2_R15

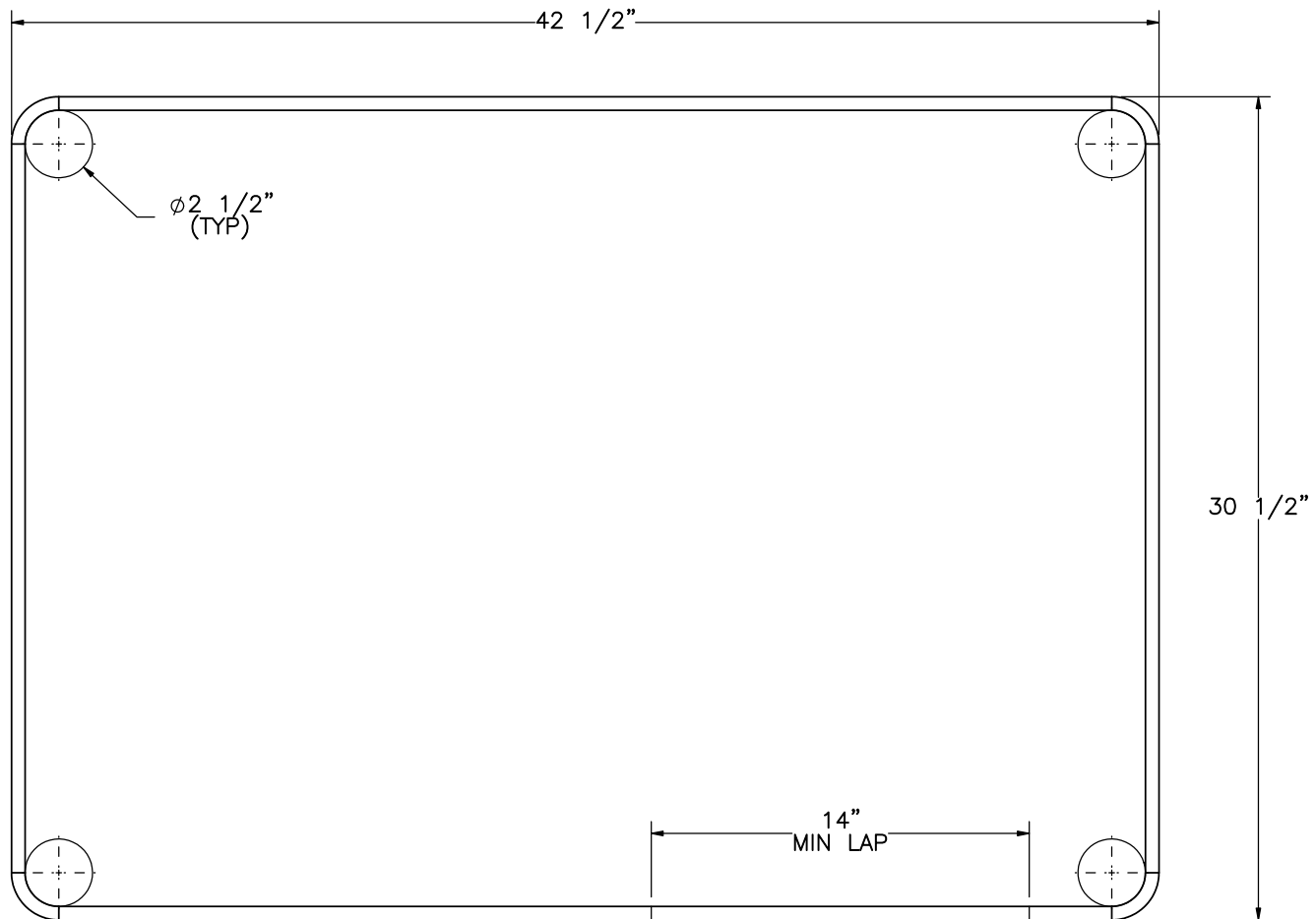
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SHEET:
17 of 32

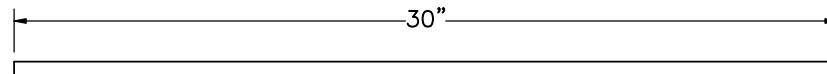
DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



Part e1



Part e2



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Rebar Details

DWG. NAME.
HBIB-2_R15

SCALE: 1:7
UNITS: in.

SHEET:
18 of 32

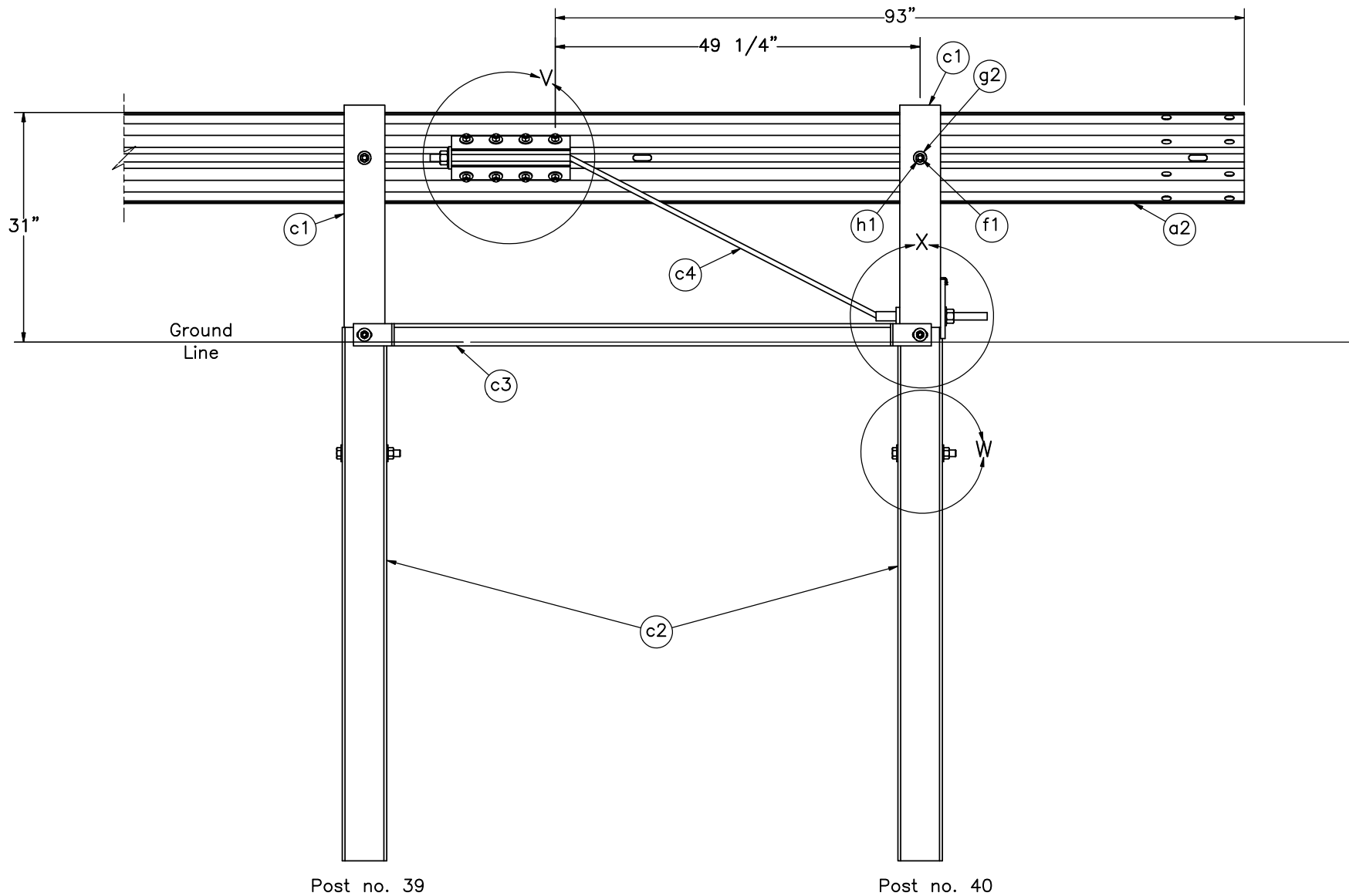
DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML

Bill of Bars

Bar	QTY	Size	Length	Material	Treatment
e1	3	#4	170"	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)
e2	4	#4	30"	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)



END SECTION DETAIL
BACKSIDE

MWRSF

Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

End Section Detail

DWG. NAME.
HBIB-2_R15

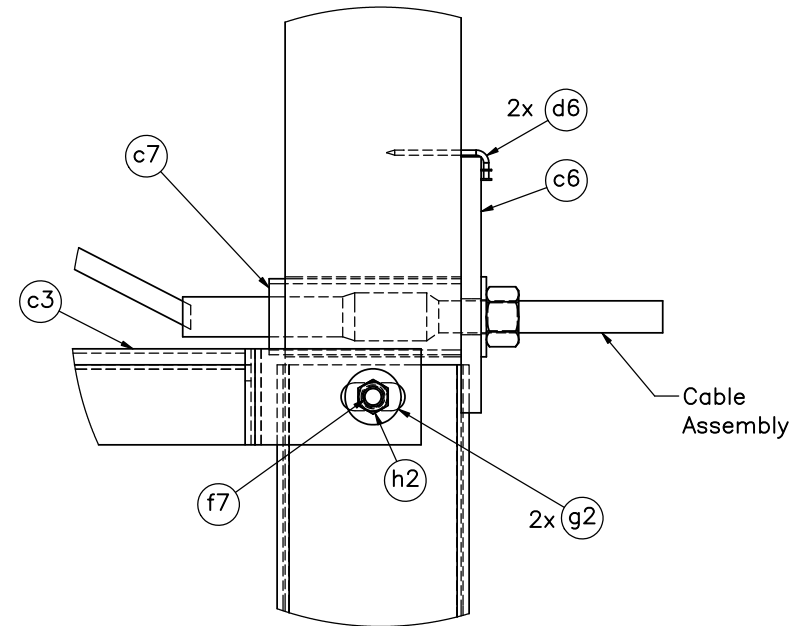
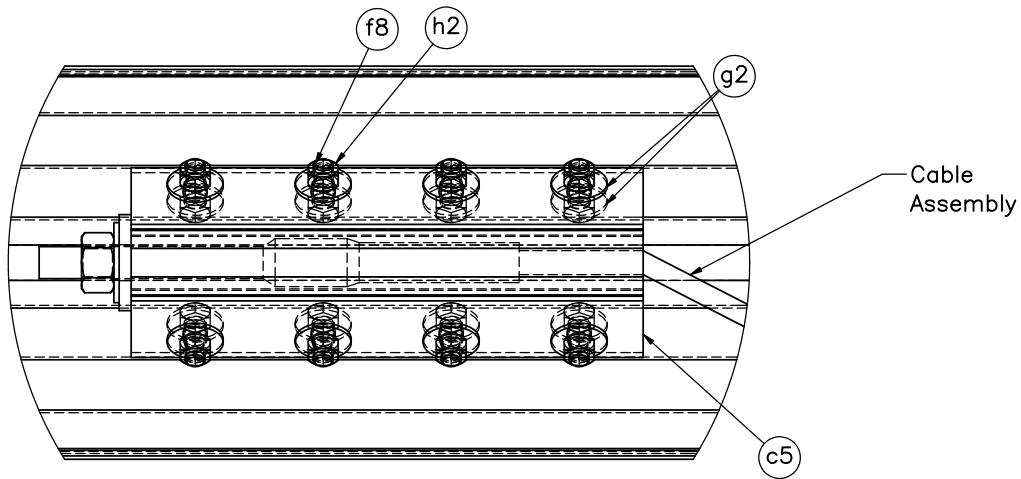
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SHEET:
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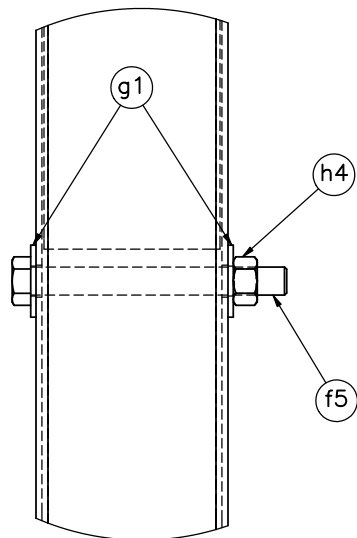
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8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML

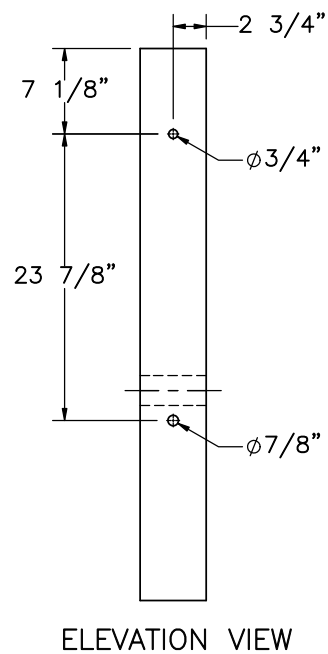
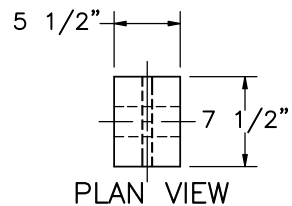


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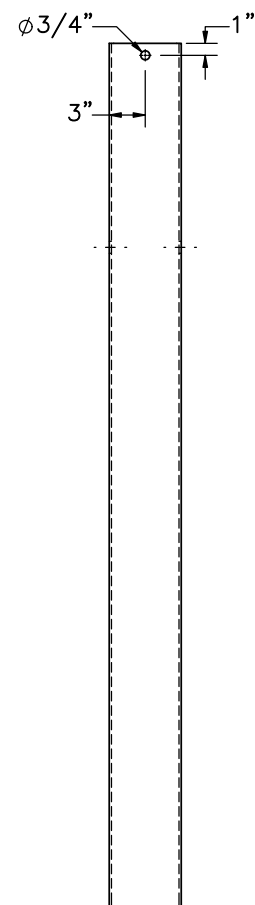
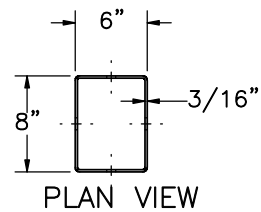
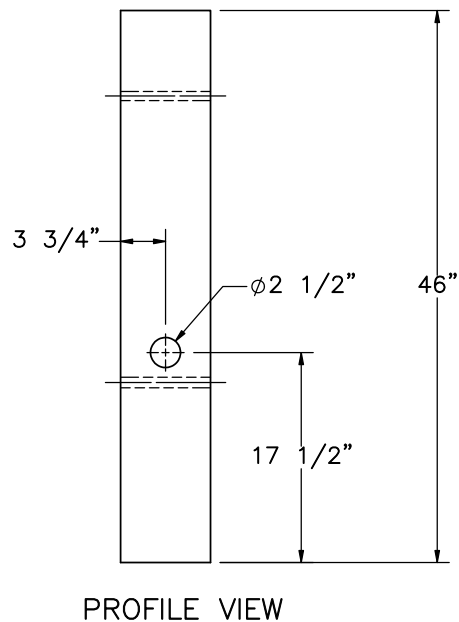


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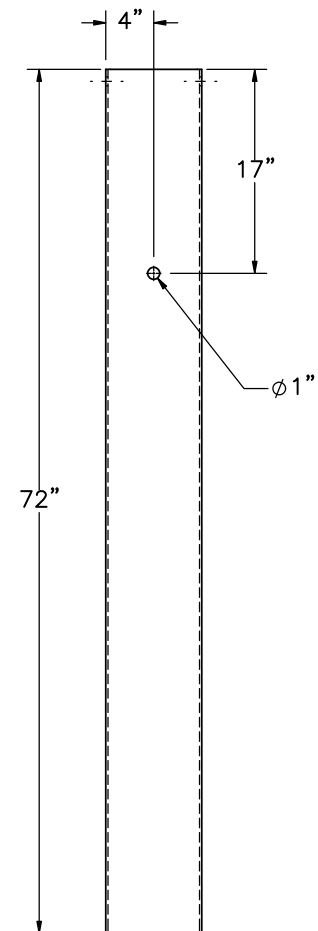
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	DATE: 8/25/2025		DRAWN BY: JJQ/MM/SR W/TJC
Midwest Roadside Safety Facility	BCT Anchor Details		REV. BY: KAL/CSS/J CH/AML
DWG. NAME: HBIB-2_R15	SCALE: 1:6 UNITS: in.		



Part c1



Part c2



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

BCT Timber Post and
Foundation Tube Details

DWG. NAME.
HBIB-2_R15

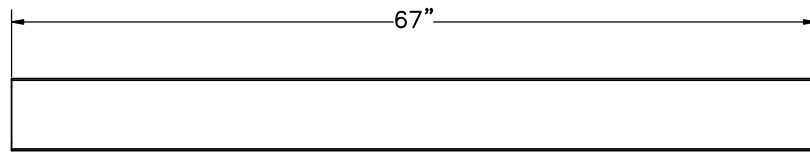
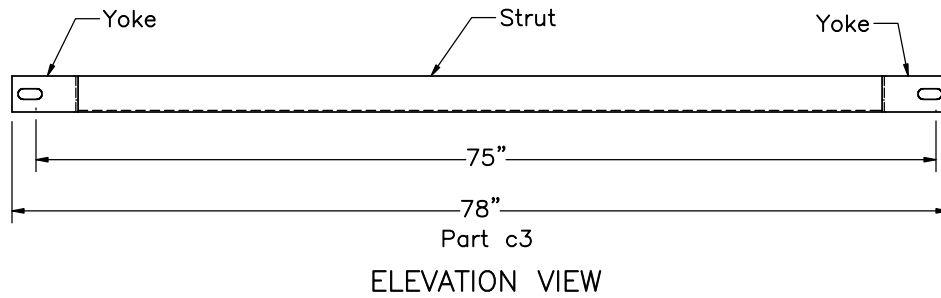
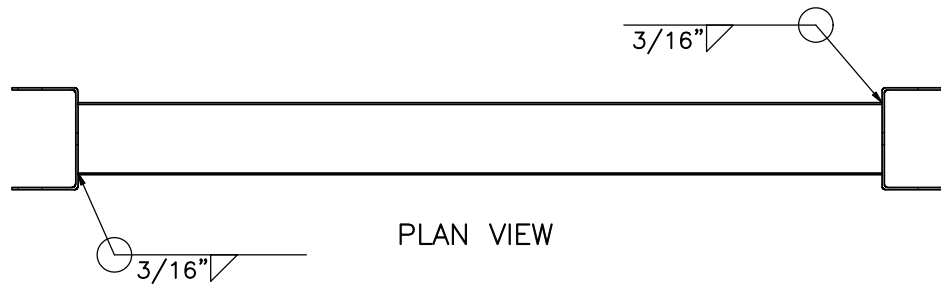
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DATE:
8/25/2025

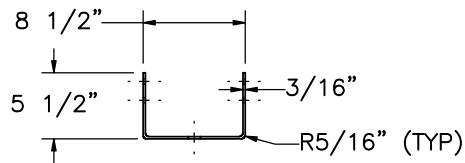
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JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML

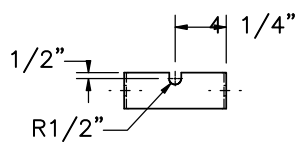


ELEVATION VIEW

6"x3" 10 Gauge Strut

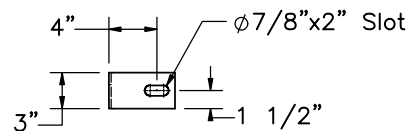


PLAN VIEW

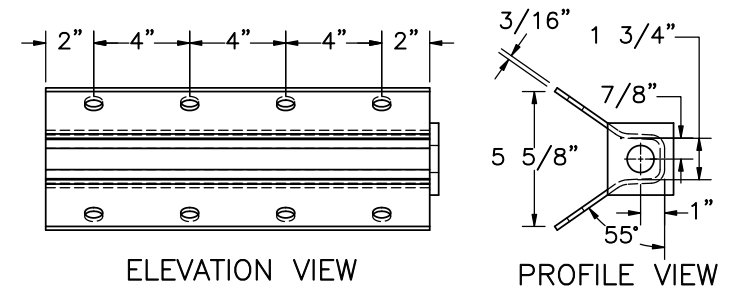
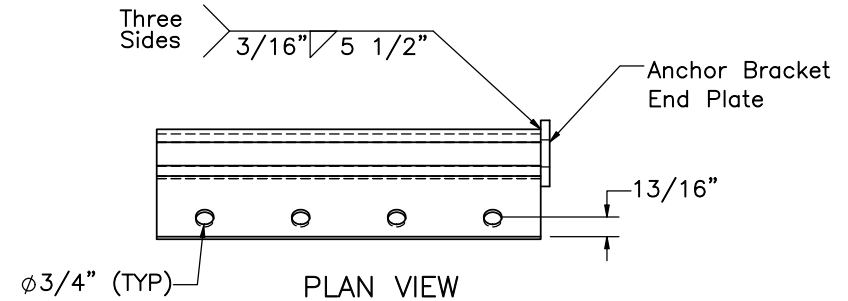


ELEVATION VIEW

Yoke Channel

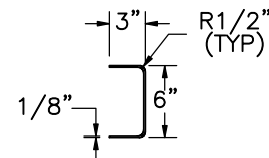


PROFILE VIEW

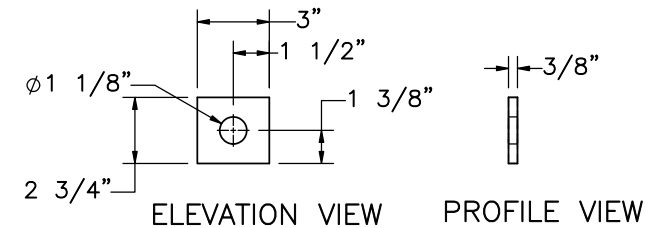


Part c5

SCALE 1:8



PROFILE VIEW



Anchor Bracket End Plate

SCALE 1:8



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Ground Strut Details

DWG. NAME.
HBIB-2_R15

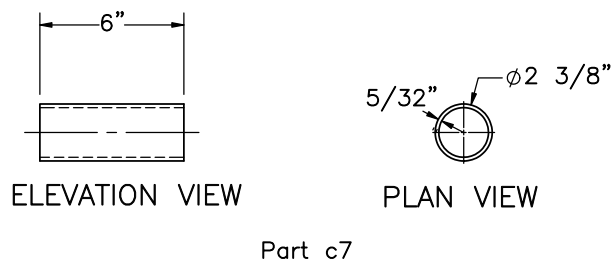
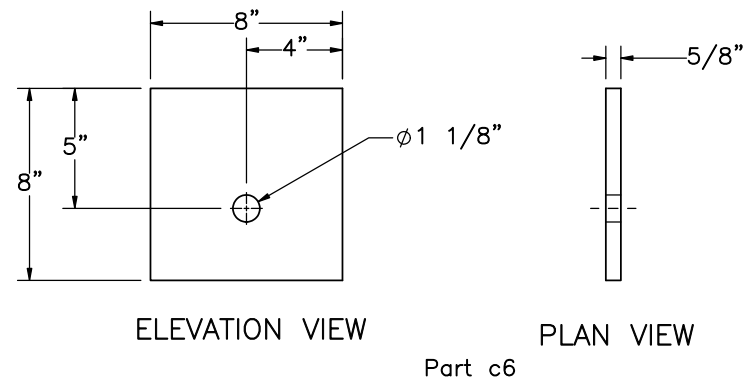
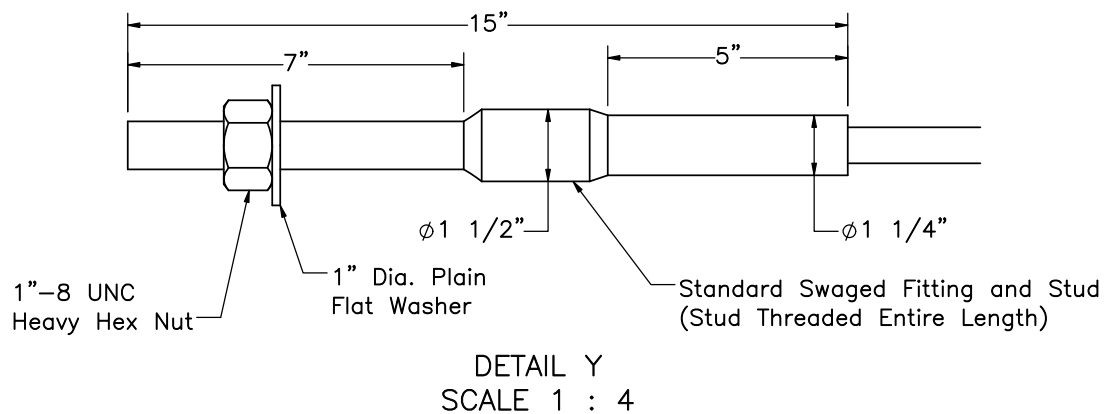
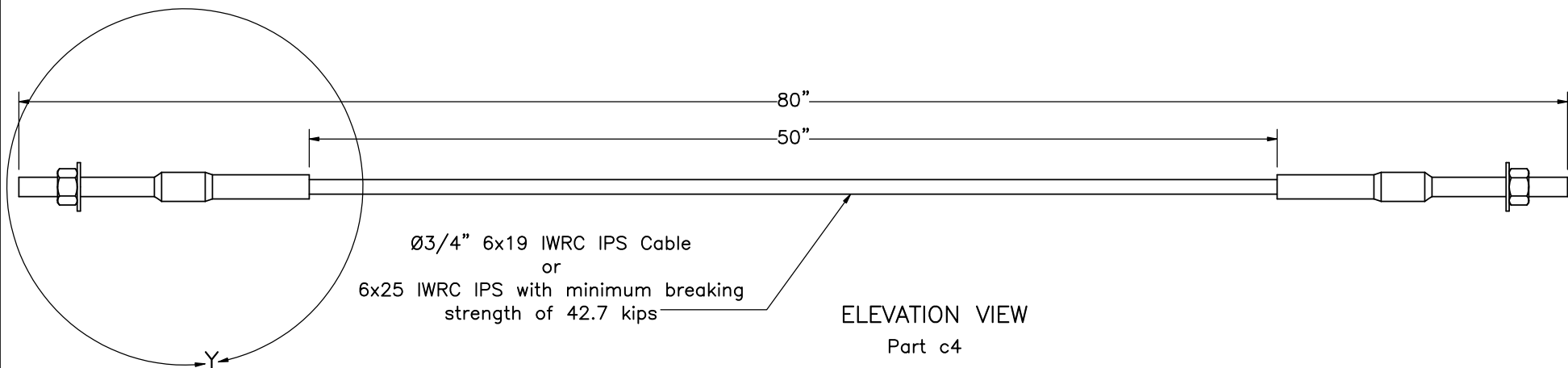
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UNITS: in.

SHEET:
22 of 32

DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

BCT Anchor Cable

DWG. NAME.
HBIB-2_R15

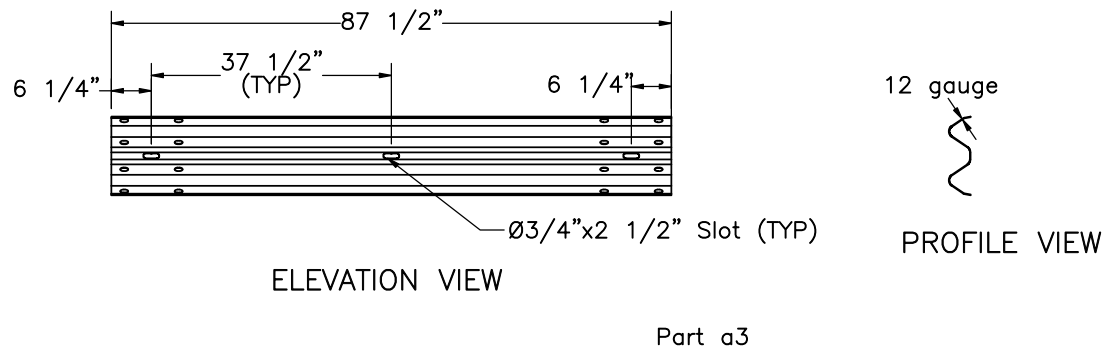
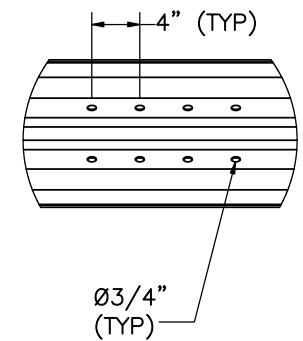
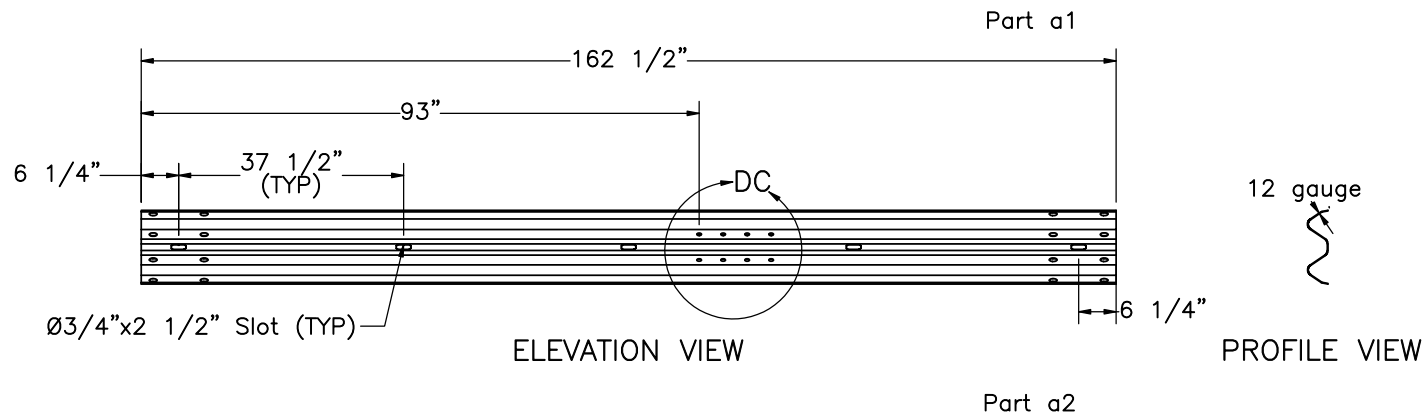
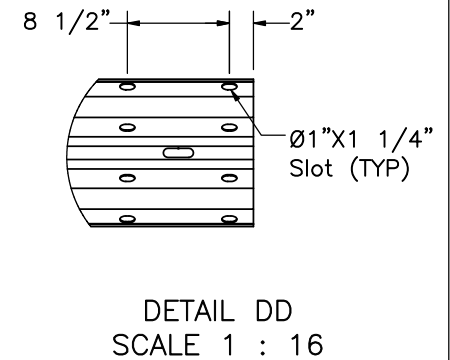
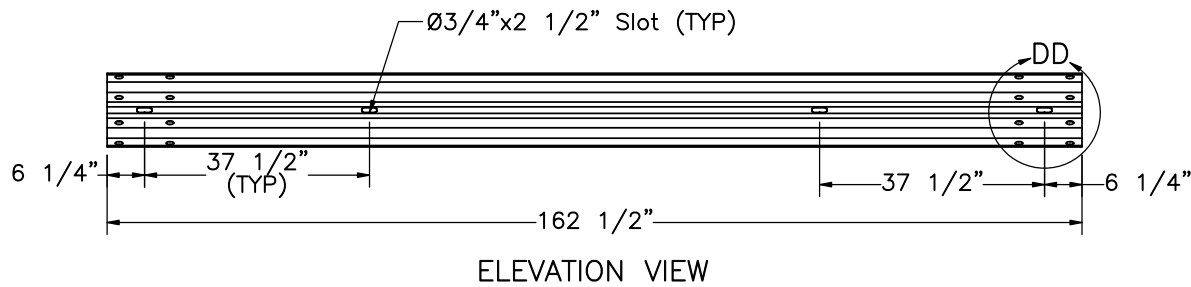
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SHEET:
23 of 32

DATE:
8/25/2025

DRAWN BY:
JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Guardrail Section Details

DWG. NAME.
HBIB-2_R15

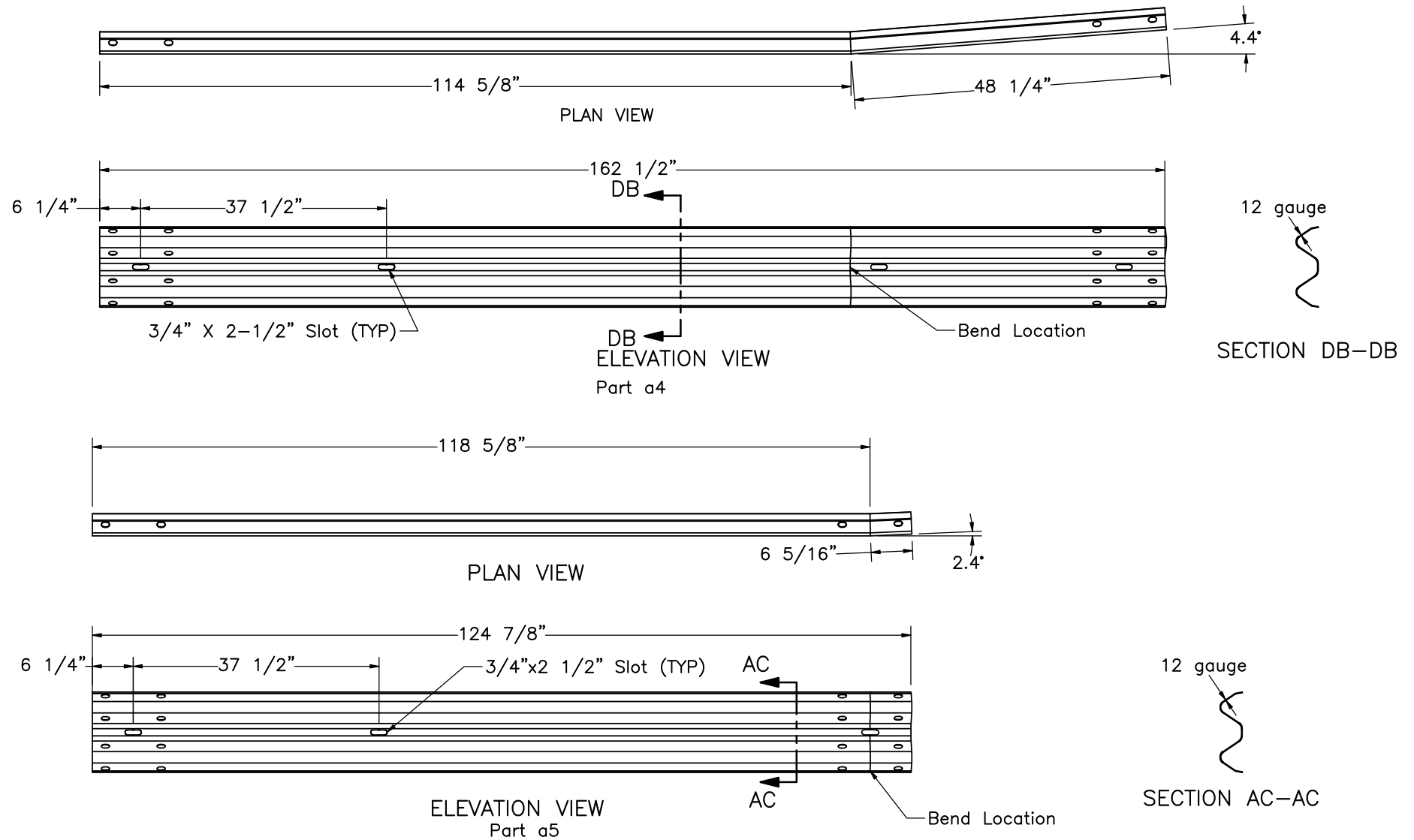
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SHEET:
24 of 32

DATE:
8/25/2025

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JJQ/MM/SR
W/TJC

REV. BY:
KAL/CSS/J
CH/AML



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Guardrail Section Details

DWG. NAME.
HBIB-2_R15

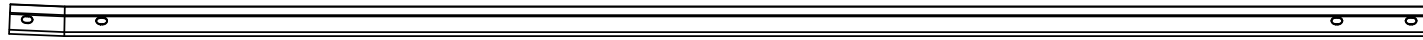
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SHEET:
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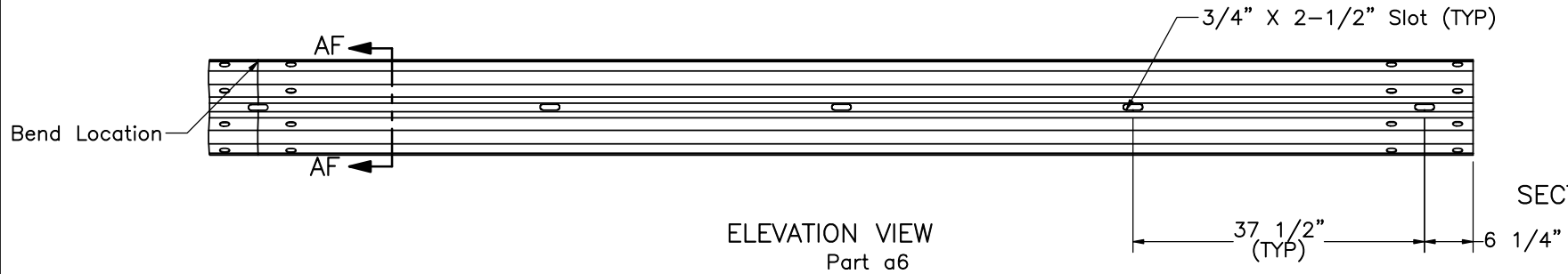
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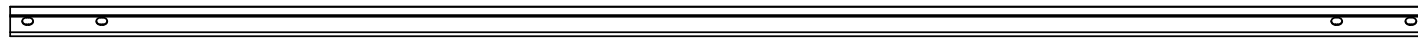
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KAL/CSS/J
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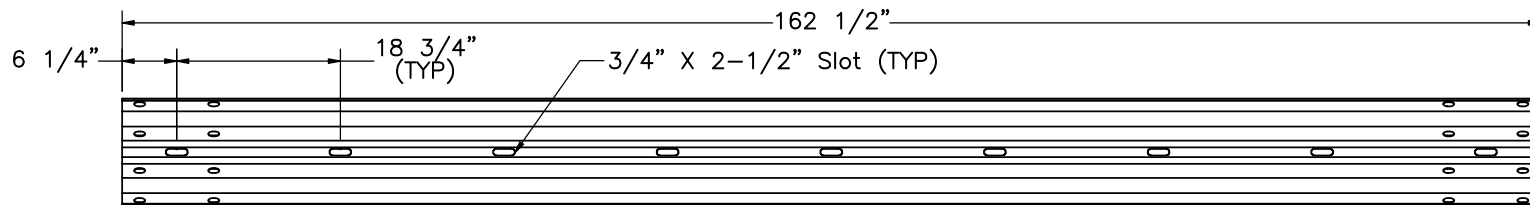
PLAN VIEW



ELEVATION VIEW
Part a6



PLAN VIEW



ELEVATION VIEW
Part a7

PROFILE VIEW



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Guardrail Section Details

DWG. NAME.
HBIB-2_R15

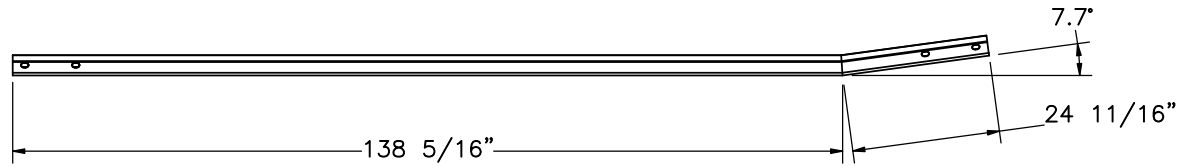
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26 of 32

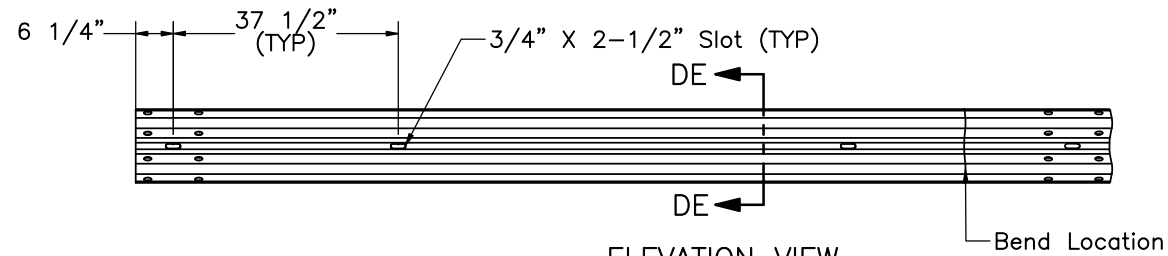
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8/25/2025

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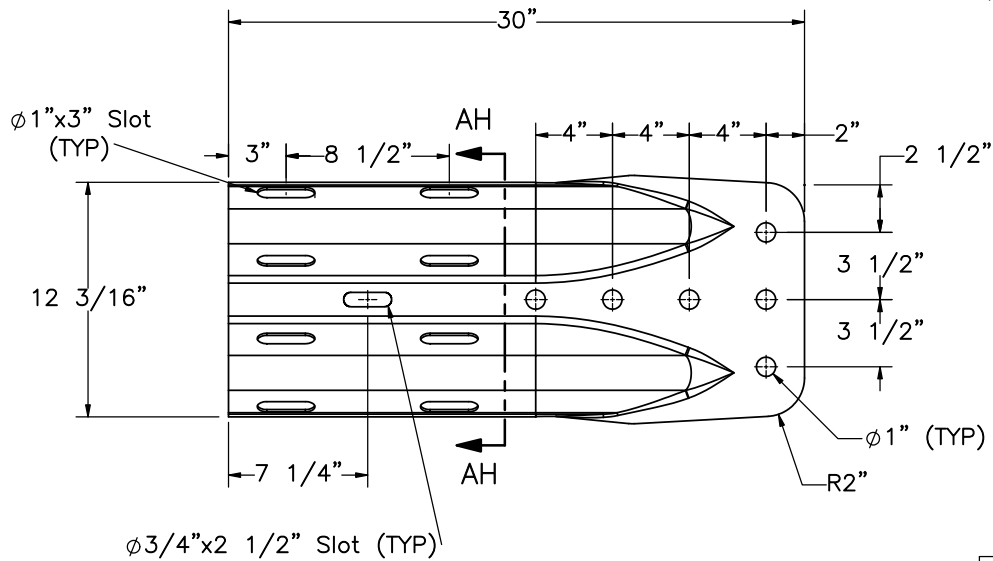
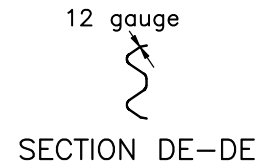


PLAN VIEW



ELEVATION VIEW

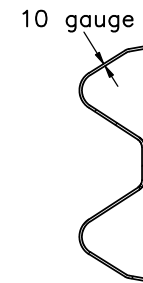
Part a9



ELEVATION VIEW

SCALE 1:10

Part a8



SECTION AH-AH



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Terminal Connector Details

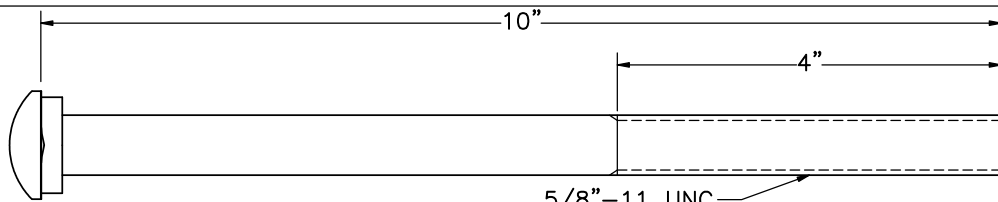
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HBIB-2_R15

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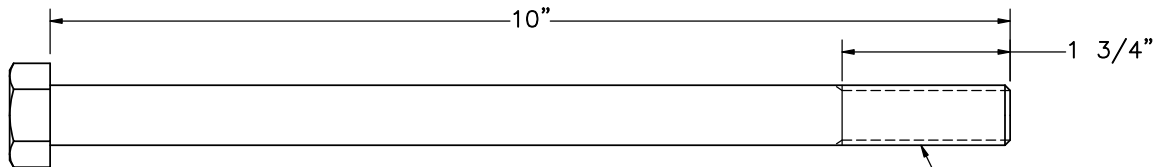
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DATE:
8/25/2025

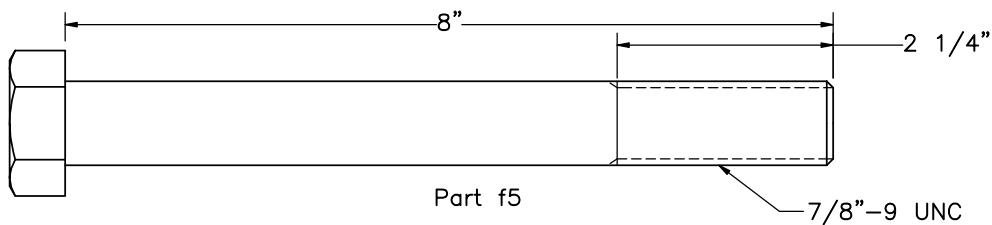
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JJQ/MM/SR
W/TJC
REV. BY:
KAL/CSS/J
CH/AML



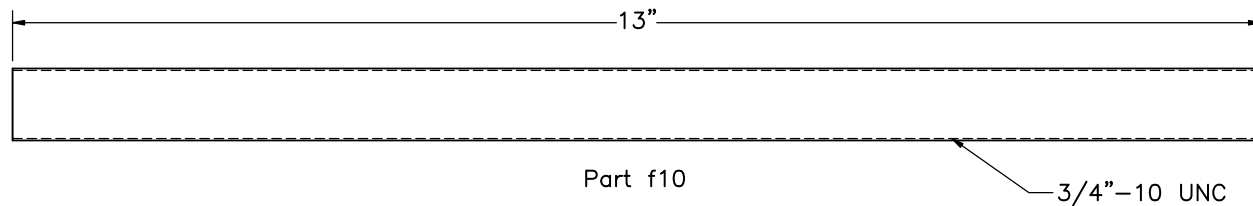
Part f1



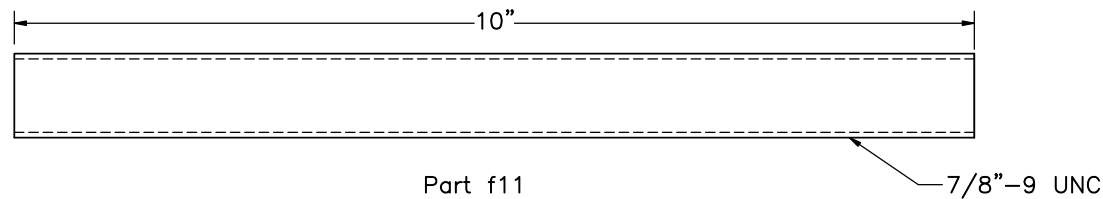
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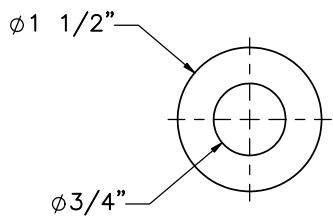
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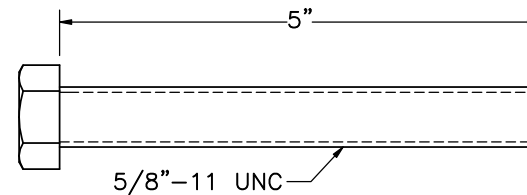
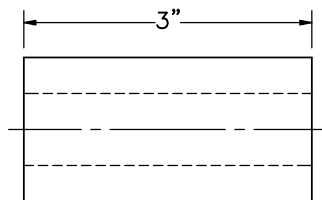
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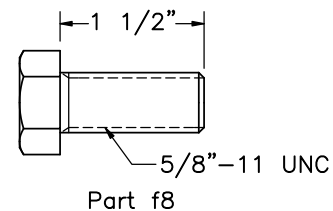
Part f11



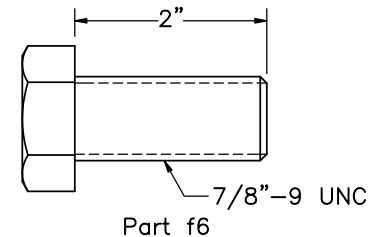
Part f9



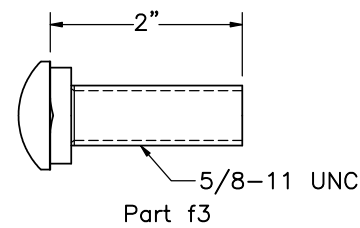
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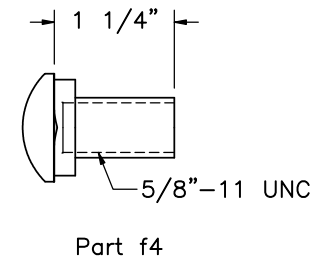
Part f8



Part f6



Part f3



Part f4



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Hardware

DWG. NAME.
HBIB-2_R15

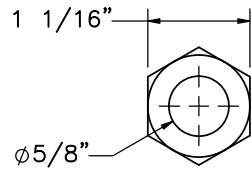
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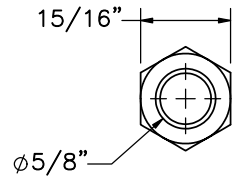
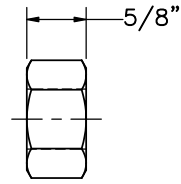
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W/TJC

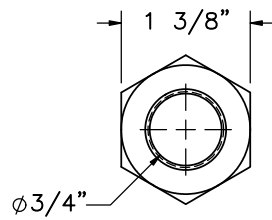
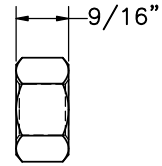
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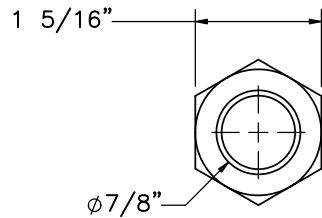
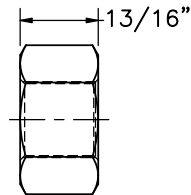
Part h1



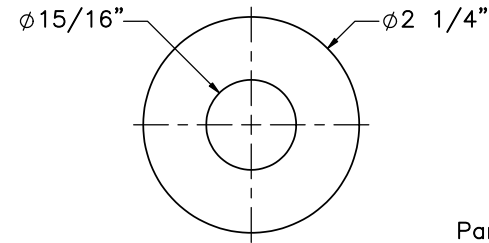
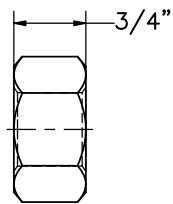
Part h2



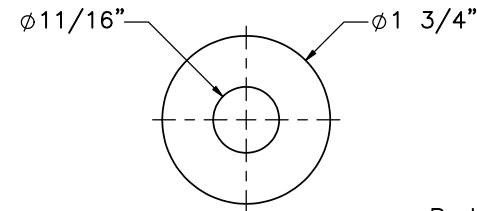
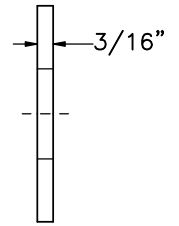
Part h3



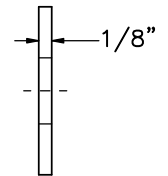
Part h4



Part g1



Part g2



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
Test No. HBIB-2

Hardware

DWG. NAME.
HBIB-2_R15

SCALE: 1:2
UNITS: in.

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DATE:
8/25/2025

DRAWN BY:
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Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
a1	20	12'-6" 12-gauge W-Beam MGS Section	AASHTO M180	ASTM A123 or A653	RWM04a
a2	1	12'-6" 12-gauge W-Beam MGS End Section	AASHTO M180	ASTM A123 or A653	RWM14a
a3	1	6'-3" 12-gauge W-Beam Section	AASHTO M180	ASTM A123 or A653	RWM01b
a4	1	12'-6" 12-gauge Bent W-Beam [4.4 deg]	AASHTO M180	ASTM A123 or A653	—
a5	2	9'-4 1/2" 12-gauge Bent W-Beam [2.4 deg]	AASHTO M180	ASTM A123 or A653	—
a6	2	12'-6" 12-gauge Bent W-Beam [2.4 deg]	AASHTO M180	ASTM A123 or A653	—
a7	4	12'-6" 12-gauge W-Beam Section - 1/4 Post Spacing	AASHTO M180	ASTM A123 or A653	RWM04a
a8	2	W-Beam Terminal Connector	AASHTO M180	ASTM A123 or A653	RWE02b
a9	1	12'-6" 12-gauge Bent W-Beam [7.7 deg]	AASHTO M180	ASTM A123 or A653	—
b1	1	3'x3'x3' Concrete Block Anchor	Min. f'c = 4,000 psi	—	—
c1	2	BCT Timber Post - MGS Height	SYP Grd No. 1 or better (No knots +/- 18" from ground on tension face)	—	PDF01
c2	2	72" Long Foundation Tube	ASTM A500 Gr. B	ASTM A123	PTE06
c3	1	Ground Strut Assembly	ASTM A36	ASTM A123	PFP02
c4	1	BCT Anchor Cable Assembly with Heavy Hex Nuts and Washers	Fitting-ASTM A576 Gr. 1035 Stud-ASTM F568 Class C	Fitting-ASTM A153 Cable, Nut, Washer & Stud-ASTM A153 or B695	FCA01
c5	1	Ground Anchor Bracket Assembly	ASTM A36	ASTM A123	FPA01
c6	1	8"x8"x5/8" Anchor Bearing Plate	ASTM A36	ASTM A123	FPB01
c7	1	2 3/8" O.D. 6" Long BCT Post Sleeve	ASTM A53 Gr. B Schedule 40	ASTM A123	FMM02



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Test No. HBIB-2

Bill of Materials

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Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
d1	27	W6x8.5 or W6x9, 84" Long Steel Post	ASTM A992 Gr. 50	ASTM A123	PWE06
d2	11	W6x8.5 or W6x9, 72" Long Steel Post	ASTM A992 Gr. 50	ASTM A123	PWE06
d3	3	W6x15, 120" Long Steel Post	ASTM A992 Gr. 50	ASTM A123	—
d4	38	14 3/16"x8"x5 1/8" Composite Recycled Blockout	Mondo Polymer GB14SH2 or Equivalent	—	—
d5	27	13 5/8" [346] Long, 8"x6"x1/4" [203x152x6] Steel Blockout	ASTM A500 Gr. B	ASTM A123	—
d6	2	16D Double Head Nail	—	—	—
e1	3	170" Unbent Length #4 Rebar	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	—
e2	4	30" Long #4 Rebar	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	—
f1	67	5/8" Dia. UNC, 10" Long Guardrail Bolt	ASTM A307 Gr. A	ASTM A153 or B695 Class 55 or F2329	FBB03
f2	1	5/8" Dia. UNC, 5" Long Hex Head Bolt	ASTM A449 Gr. 5 or equivalent	ASTM A153 or B695 Class 55 or F2329	FBX16a
f3	1	5/8" Dia. UNC, 2" Long Hex Head Bolt	ASTM A307 Gr. A or equivalent	ASTM A153 or B695 Class 55 or F2329	FBB01
f4	240	5/8" Dia. UNC, 1 1/4" Long Guardrail Bolt	ASTM A307 Gr. A	ASTM A153 or B695 Class 55 or F2329	FBB01
f5	2	7/8" Dia. UNC, 8" Long Hex Head Bolt	ASTM A307 Gr. A or equivalent	ASTM A153 or B695 Class 55 or F2329	FBX22a
f6	2	7/8" Dia. UNC, 2" Long Hex Head Bolt	ASTM A307 Gr. A or equivalent	ASTM A153 or B695 Class 55 or F2329	FBX22a
f7	2	5/8" Dia. UNC, 10" Long Hex Head Bolt	ASTM A307 Gr. A or equivalent	ASTM A153 or B695 Class 55 or F2329	FBX16a
f8	8	5/8" Dia. UNC, 1 1/2" Long Hex Head Bolt	ASTM A307 Gr. A or equivalent	ASTM A153 or B695 Class 55 or F2329	FBX16a
f9	1	3/4" Dia, Unthreaded Spacer Sleeve	ASTM A53 Gr. B	ASTM A123	FMM03-04
f10	6	3/4" Dia. UNC, 13" Long Fully Threaded Rod	ASTM A193 Gr. B7	ASTM A153 or B695 Class 55 or F2329	—
f11	6	7/8" Dia. UNC, 10" Long Fully Threaded Rod	ASTM A307 Gr. A or equivalent	ASTM A153 or B695 Class 55 or F2329	—



Midwest Roadside
Safety Facility

Hawaii Buried in Backslope
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Bill of Materials

DWG. NAME.
HBIB-2_R15

SCALE: None
UNITS: in.

SHEET:
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DRAWN BY:
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KAL/CSS/J
CH/AML

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
g1	4	7/8" Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	FWC20a
g2	22	5/8" Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	FWC16a
h1	309	5/8" Dia. UNC Heavy Hex Nut	ASTM A563A or equivalent	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FNX16b
h2	10	5/8" Dia. UNC Hex Nut	ASTM A563A	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FNX16a
h3	6	3/4" Dia. UNC Heavy Hex Nut	ASTM A563DH or equivalent	ASMT A153 or B695 Class 55 or F2329	FNX20b
h4	8	7/8" Dia. UNC Hex Nut	ASTM A563A or equivalent	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	—
i1	4	3/4" Dia. Wire Strut, 13 3/8" Long Unbent	Min. Tensile Strength = 100,000 psi	AASHTO M111	
i2	4	3/8" Dia. Wire Strut, 16 3/8" Long Unbent	Min. Tensile Strength = 100,000 psi	AASHTO M111	—
i3	2	3/8" Dia. Wire Strut, 18" Long Unbent	Min. Tensile Strength = 100,000 psi	AASHTO M111	—
i4	8	7/8 Dia. Threaded Ferrule	—	—	—
j1	—	Epoxy Adhesive	Min. Bond Strength = 1,450 psi	—	—
k1	—	Soil	—	—	—



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Hawaii Buried in Backslope
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Bill of Materials

DWG. NAME.
HBIB-2_R15

SCALE: 1:768
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DRAWN BY:
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W/TJC

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KAL/CSS/J
CH/AML

REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
0	7/28/2023	–	Original drawing created based off of HBIB-1	–	JJO
1	8/15/2023	–	Drawing edits.	–	SRW
2	8/22/2023	–	Final edits. Added 7/8–9 threaded rod Part f11	–	JJO/SRW
3	8/24/2023	–	Updated Notes, added rail call numbers.	–	JJO/SRW
4	9/1/2023	2	Added 62 mph.	KAL/CSS	JJO
		5	Added 3" dimension, added note 2.		
		9	Updated ballons, removed slope line.		
		12	Removed extra holes from posts, added field drill note.		
		14	Updated Blockouts.		
		15	Added hole depth and rod depth dimension.		
		31	Updated part no f11 quantities.		
5	9/12/2023	32	Updated part no h3 quantities.	KAL	JJO
		1	Moved section C–C to show post no. 29.		
		4	Added 2–1/2" Slope Break Point dimension.		
6	9/13/2023	6	Updated Post location chart to show upstream and downstream post corner dimensions.	KAL, JCH	JJO
		1	Updated notes.		
		3	Added Slope break point note.		
		4	Added Slope break point note.		
		5	Removed note 1		
		14	Updated Mondo Block details.		
7	9/25/2023	BOM	Updated BOM to correct hardware	KAL, JCH	JJO
		BOM	Updated BOM hardware to correct 5/8 nut		
8	10/10/2023	1	Updated Plan View drawing annotations and impact point dimensions.	CSS	MM
		Updated note 2.			
		2	Updated Plan View impact point dimensions		
		6	Added Top of the Back Side Centerline Post to Ditch column in post locations table		
		10	Added note 3–6		
		BOM	Updated part a3, a7, and a8 Material Specification		
		9	Updated detail K assembly. Added part f6 and updated drawing annotations.		

9	10/24/2023	15	Updated elevation view annotations	JCH	MM
		BOM2	Updated part f6 quantity		
10	10/27/2023	15	Updated elevation view annotations	JJO	MM
11	10/27/2023	1	Added note 6 and 7. Updated elevation view annotations	JJO	MM
12	8/21/2024	27	Updated end shoe to show correct profile	JJO	JJO
13	3/7/2025	BOM	Updated part b1, d5, f2, f3, f9, f10, f11, h2, h3, and h4 description and material specifications.	AML	TJC
14	5/15/2025	27	10 gauge was 12 gauge	KAL	JJO
		30	W-Beam Terminal Connector hardware guide RWE02b was RWE02a		
15	8/25/2025	2	Added angle dimensions between rail and ground line.	BP	JCS