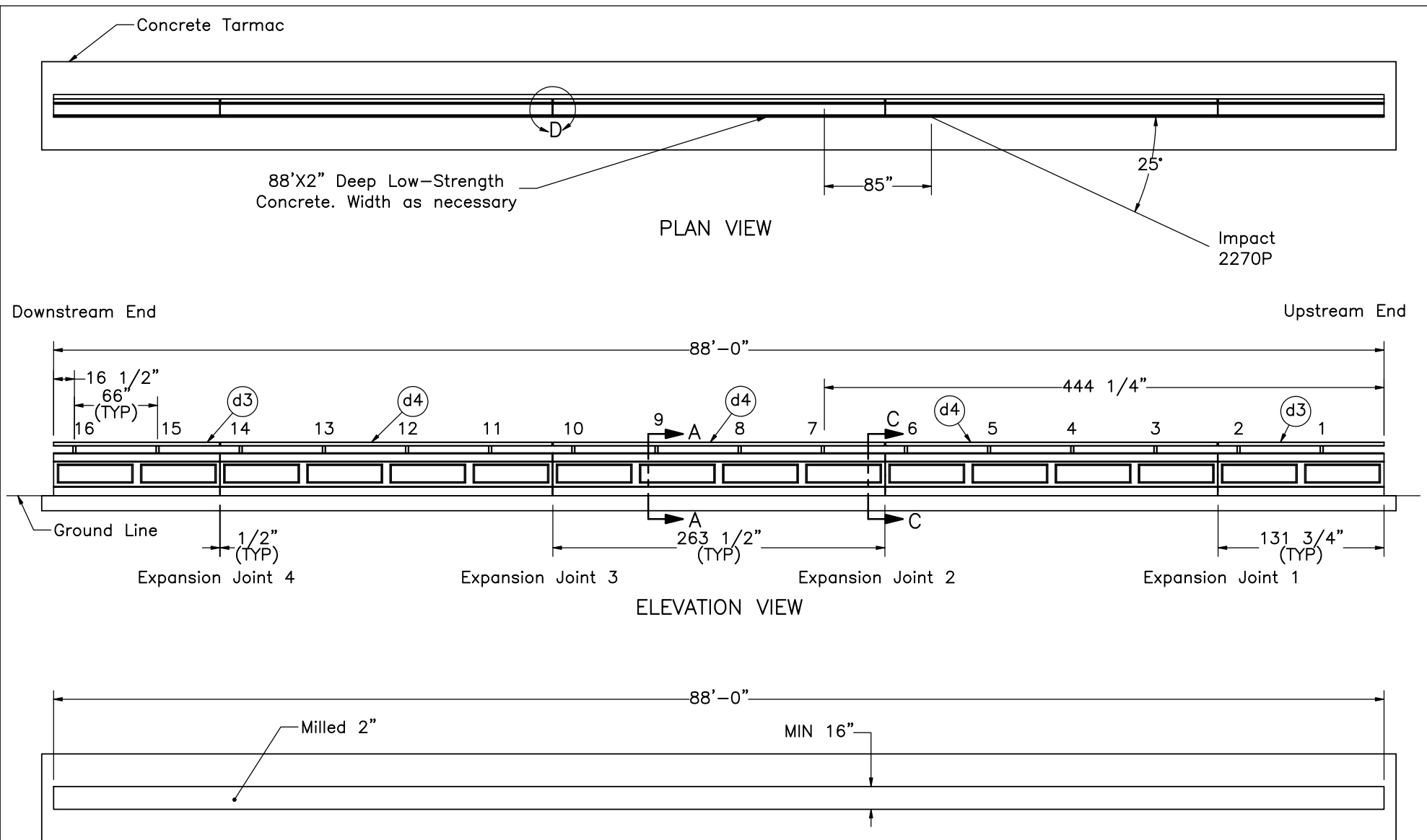




- Notes: (1) Test no. HP34-1 shall be performed according to test designation no. 3-11 of MASH 2016 criteria.
- (2) The impact location for test no. HP34-1 is located 85" upstream from the upstream face of post no. 7.
- (3) Mill existing tarmac surface down 2" in order to accomodate 2" thick concrete pad on front side of barrier.



Hawaii 34" Aesthetic Concrete Bridge Rail Test No. HP34-1

System Layout

DWG. NAME.
HP34_R14

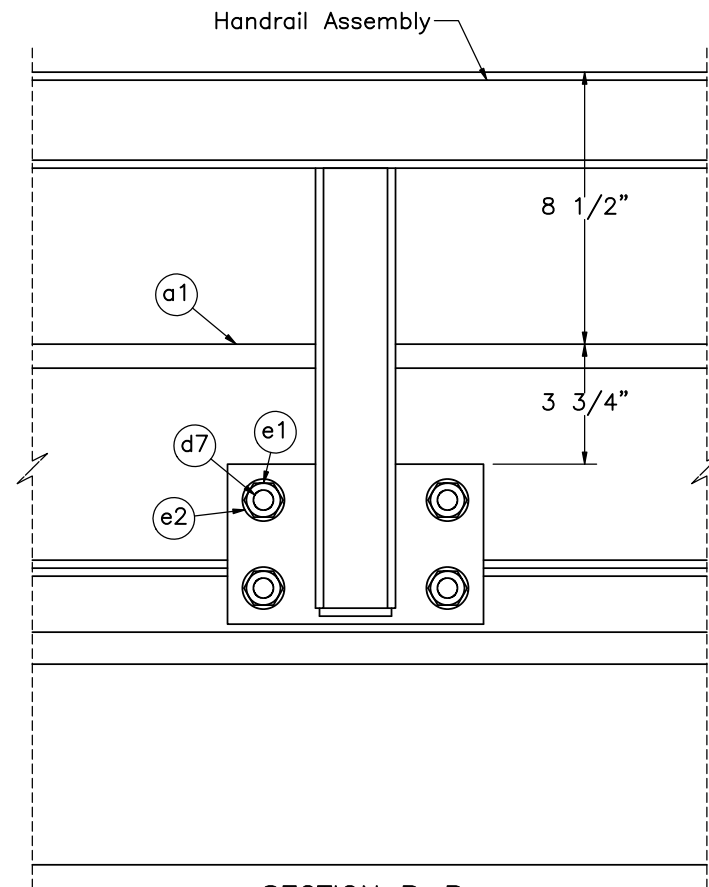
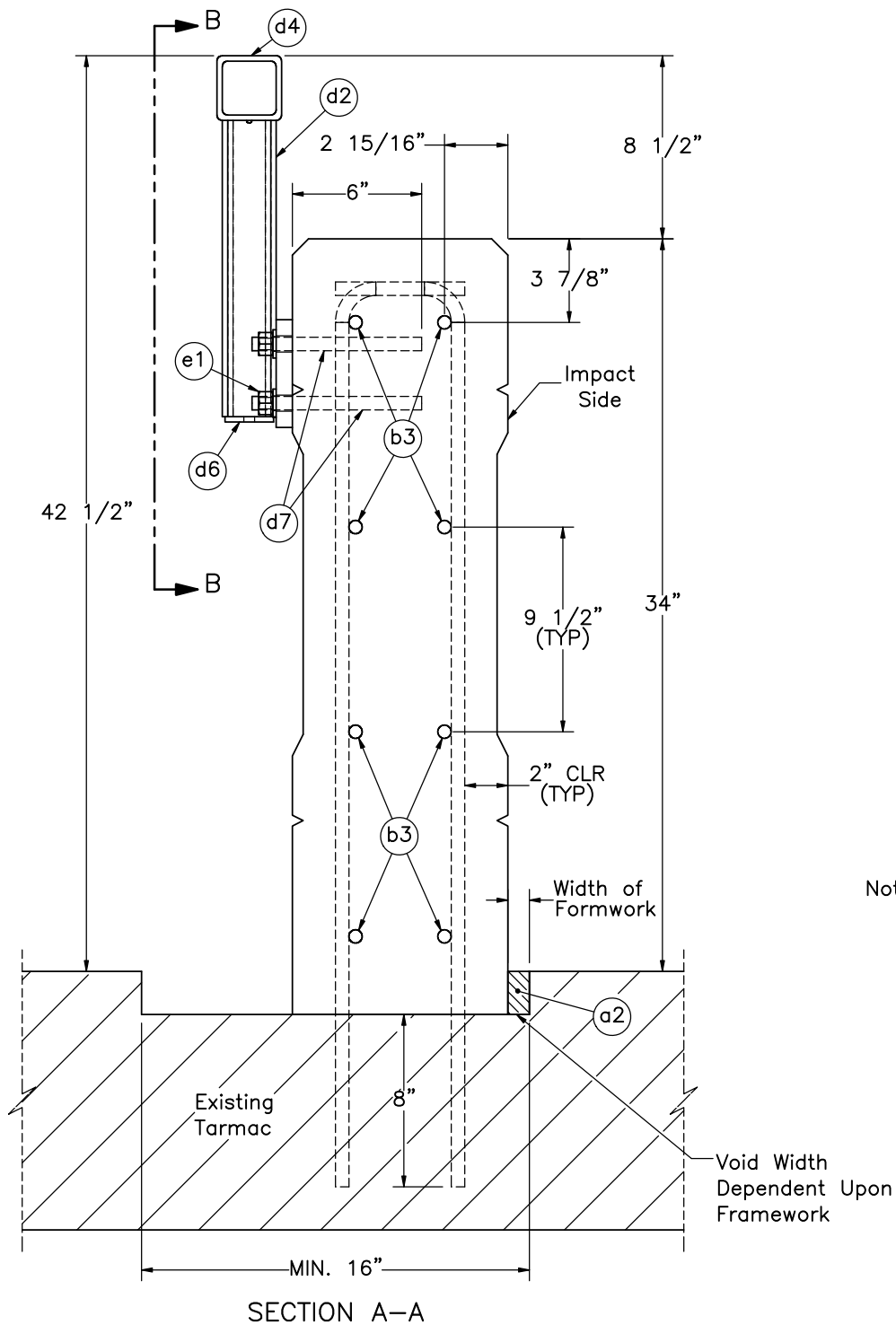
SCALE: 1:110
UNITS: in.

SHEET:
1 of 15

DATE:
3/28/2022

DRAWN BY:
LJP/SBW/G
HR

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



SECTION B-B
SCALE 1 : 6

- Notes: (1) Drill $3/4"$ ϕ holes for threaded rods (Part d7). Secure with epoxy adhesive (Part c4).
- (2) Mill existing tarmac down to a depth of 2" and a minimum width of 16" to allow for recess of bridge rail on tarmac and installation of concrete formwork. After removal of formwork, fill void on impact side only, using low-strength concrete.
- (3) Reinforcement bar no. b1 is to be anchored into the existing tarmac with Hilti HIT RE500 V3 (Part c4).



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Handrail Details

DWG. NAME.
HP34_R14

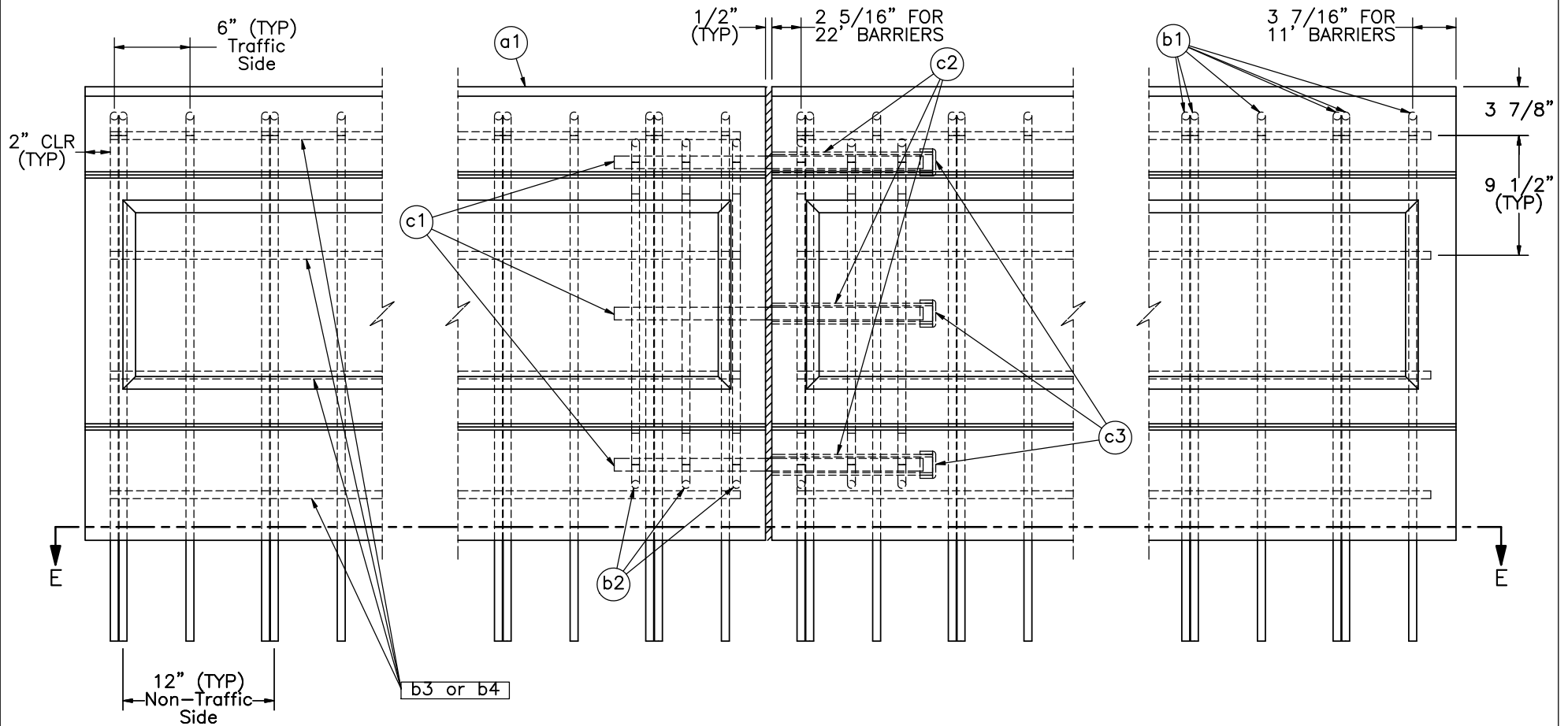
SCALE: 1:8
UNITS: in.

SHEET:
2 of 15

DATE:
3/28/2022

DRAWN BY:
LJP/SBW/G
HR

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



ELEVATION VIEW
(Handrail Hidden from View)

- Notes:
- (1) Handrail not shown.
 - (2) 1/2" Expansion joints to be bonded together by premolded joint filler (Part c5) and joint sealer (Part c6) according to specifications.
 - (3) PVC tubes (Parts c2 and c3) are to be cast into the upstream side of expansion joints for testing purposes.



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Parapet Reinforcement Detail

DWG. NAME.
HP34_R14

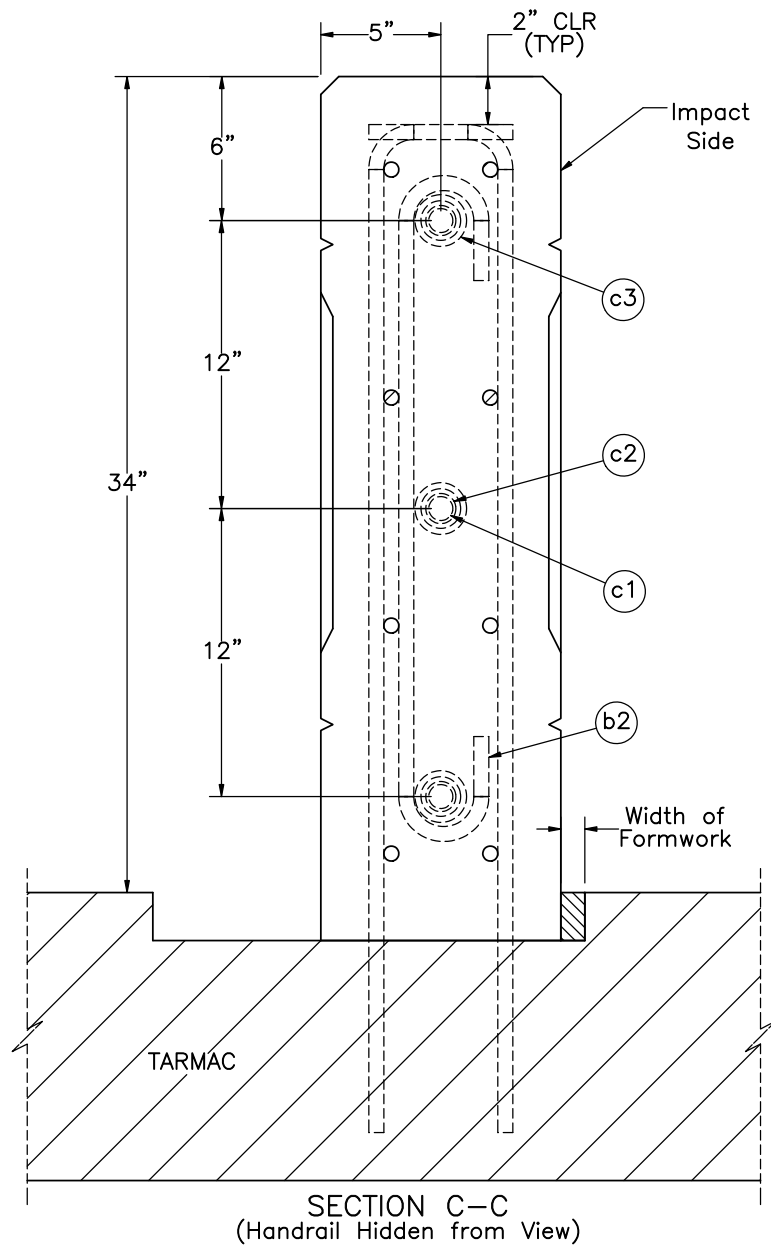
SCALE: 1:12
UNITS: in.

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

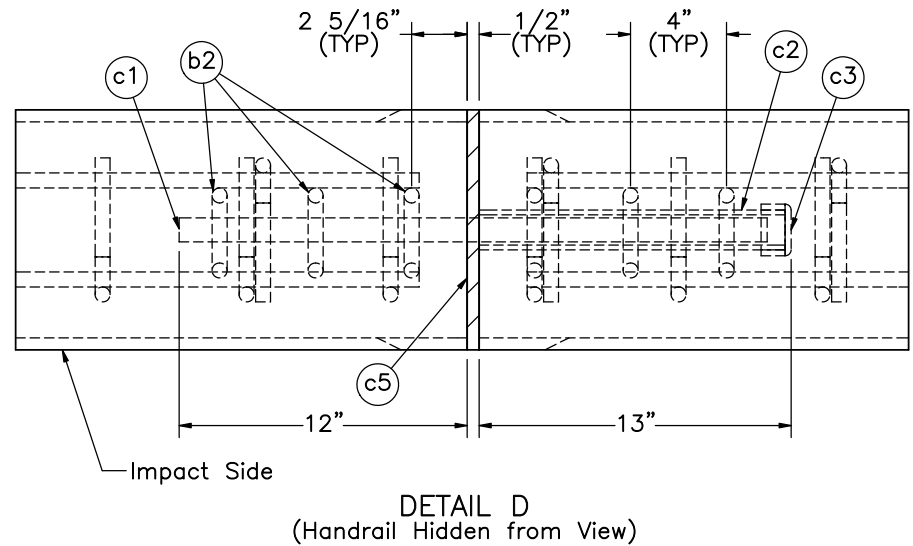
SHEET:
3 of 15

DATE:
3/28/2022

DRAWN BY:
LJP/SBW/G
HR



- Notes: (1) Smooth dowels (Part c1) are cast in place on one side of the expansion joint, and inserted into plastic sleeves (Part c2), which are cast into the barrier on the other side of the expansion joint.
- (2) 1/2" expansion joints to be bonded together by premolded jointfiller (part c5) and joint sealant (part c6) according to specifications.
- (3) PVC tubes (Part c2 & c3) are to be cast into the upstream side of the expansion joints for testing purposes.



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Expansion Joint Detail

DWG. NAME:
HP34_R14

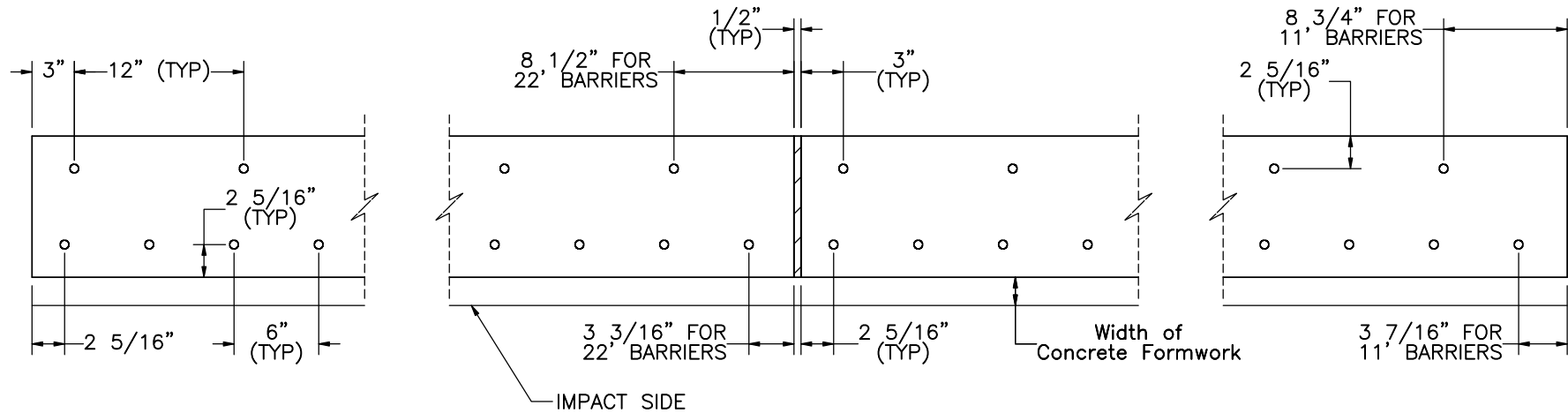
SCALE: 1:8
UNITS: in.

SHEET:
4 of 15

DATE:
3/28/2022

DRAWN BY:
LJP/SBW/G
HR

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



Midwest Roadside
Safety Facility

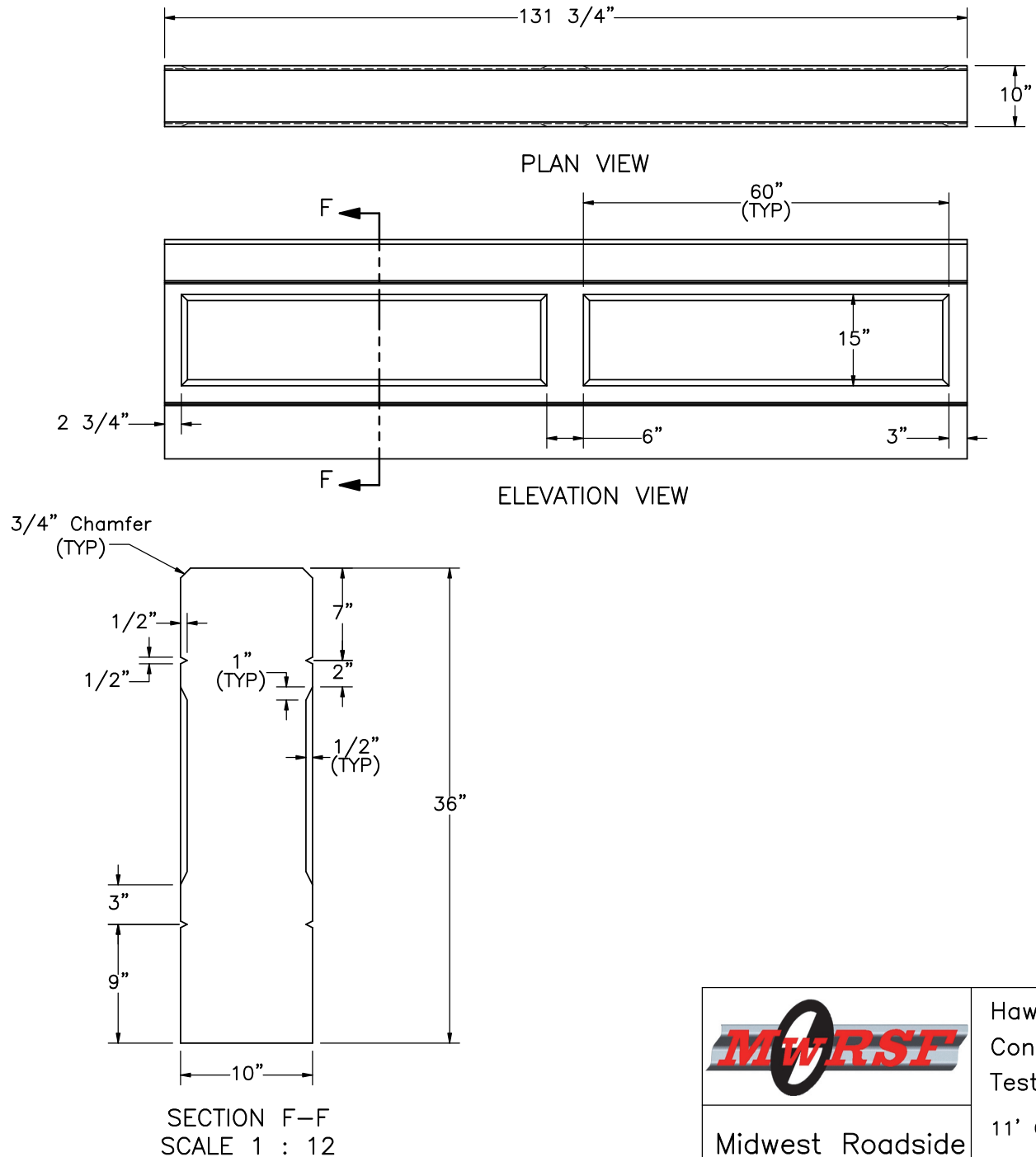
Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Rebar Positions

DWG. NAME.
HP34_R14

SCALE: 1:12
UNITS: in.

SHEET:
5 of 15
DATE:
3/28/2022
DRAWN BY:
LJP/SBW/G
HR
REV. BY:
KAL/CSS/J
CH/RN



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

11' Concrete Parapet Details

DWG. NAME.
HP34_R14

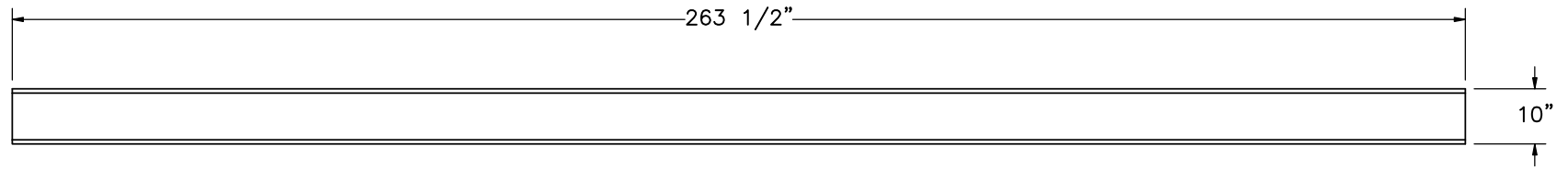
SCALE: 1:26
UNITS: in.

SHEET:
6 of 15

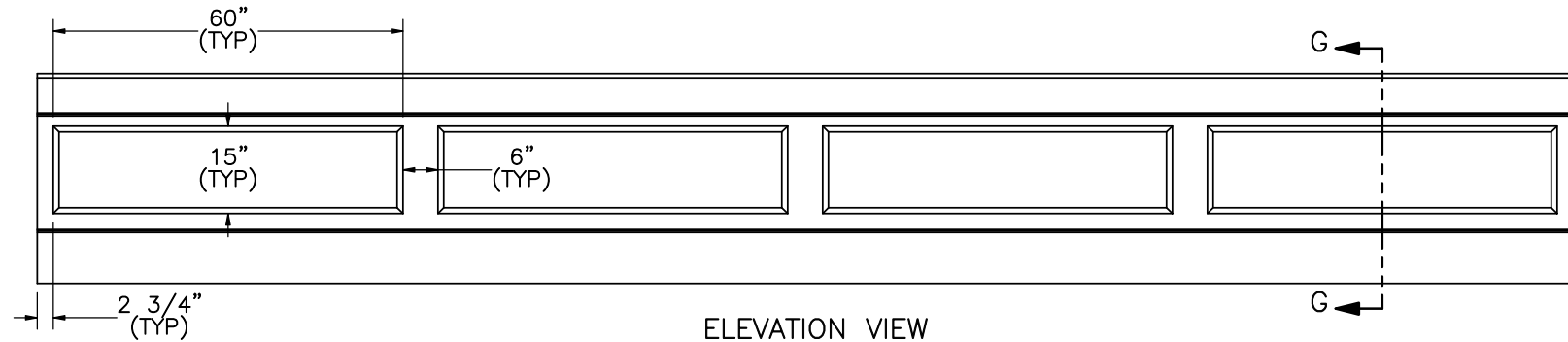
DATE:
3/28/2022

DRAWN BY:
LJP/SBW/G
HR

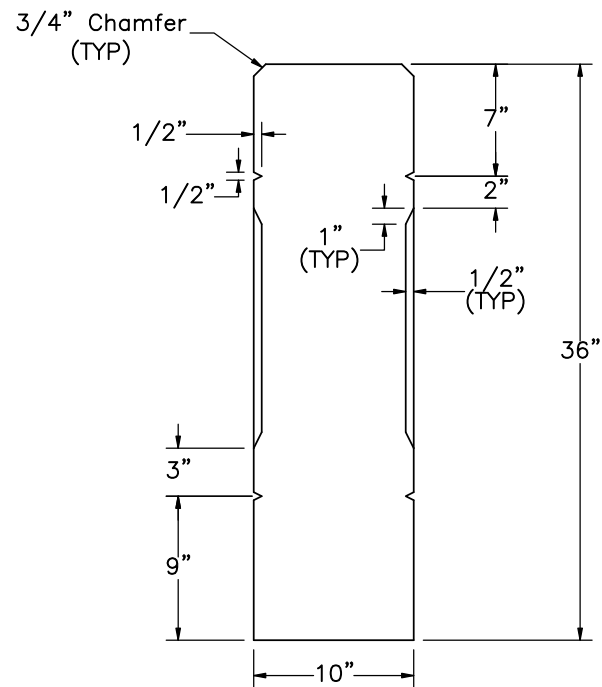
REV. BY:
KAL/CSS/J
CH/RN



PLAN VIEW



ELEVATION VIEW



SECTION G-G
SCALE 1:12



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

22' Concrete Parapet Details

DWG. NAME.
HP34_R14

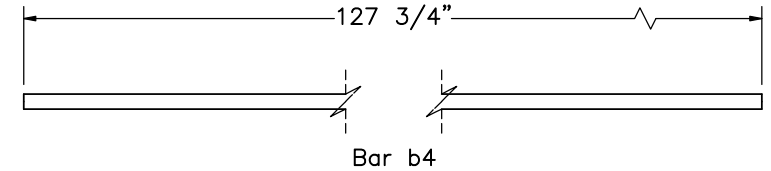
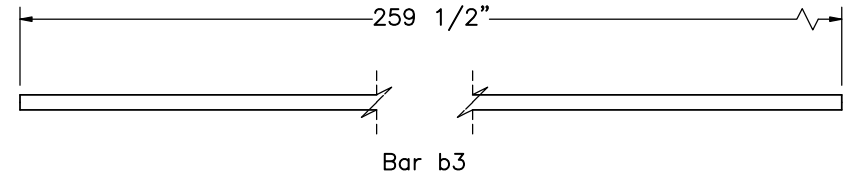
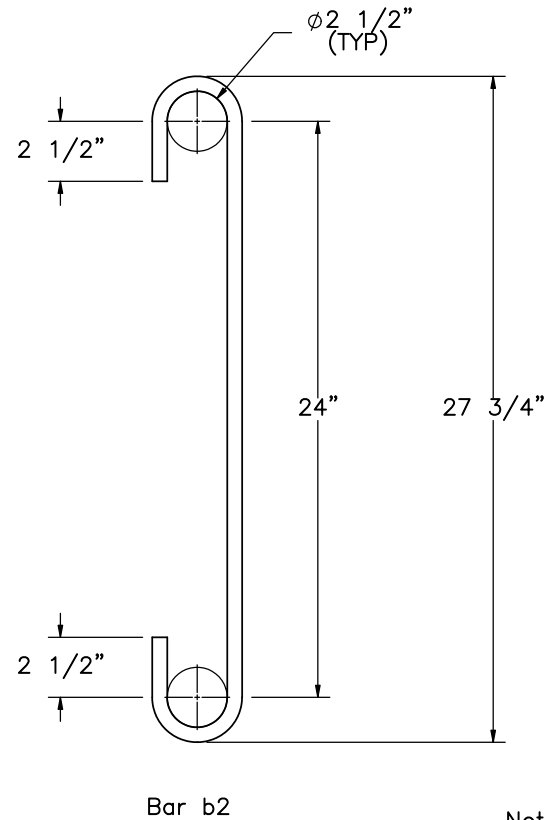
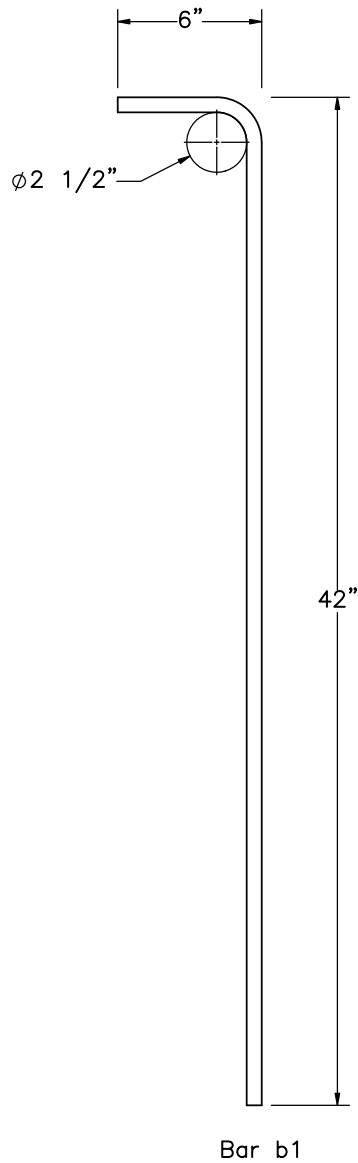
SCALE: 1:32
UNITS: in.

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

SHEET:
7 of 15

DATE:
3/28/2022

DRAWN BY:
LJP/SBW/G
HR



- Notes: (1) Reinforced Steel: Deformed and plain carbon steel bars for concrete reinforcement shall meet the requirements of AASHTO M31M/M31-07 Grade 60 (ASTM A615-15a Grade 60).
- (2) Steel reinforcing shall be supported, bent and placed as per AASHTO LRFD Bridge Design Specifications, 7th Edition, 2014 including all interim revisions.

Bill of Bars				
Part No.	Bar No.	Qty.	Unbent Length	Material Specification
b1	#5	264	46 3/4"	ASTM A615 Gr. 60
b2	#5	24	38 7/8"	ASTM A615 Gr. 60
b3	#5	24	259 1/2"	ASTM A615 Gr. 60
b4	#5	16	127 3/4"	ASTM A615 Gr. 60



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Rebar Details

DWG. NAME.
HP34_R14

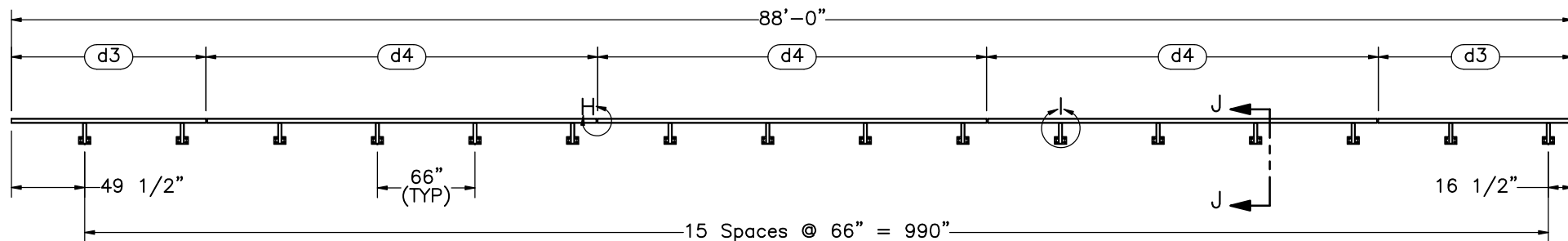
SCALE: 1:8
UNITS: in.

SHEET:
8 of 15

DATE:
3/28/2022

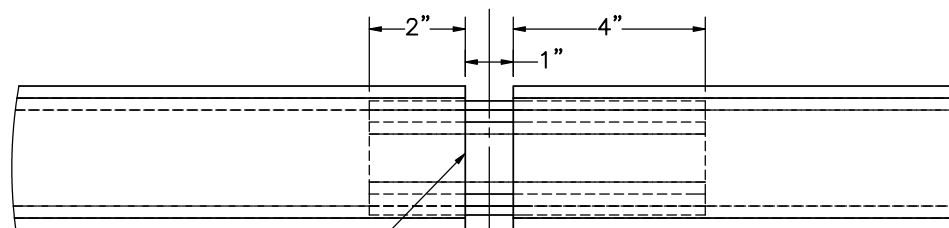
DRAWN BY:
LJP/SBW/G
HR

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

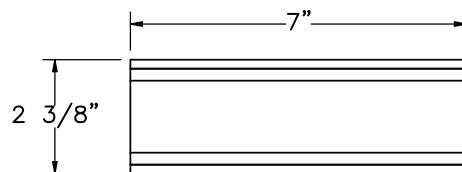


BACKSIDE VIEW

Handrail Expansion Joint

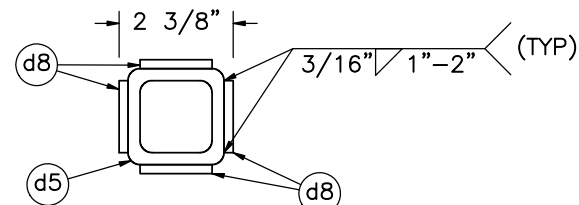


DETAIL H
SCALE 1 : 4
(TYPICAL SPLICE)



ELEVATION VIEW

Splice Assembly
SCALE 1:4



PROFILE VIEW

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	1	Handrail Assembly	—	ASTM A123
d1	16	8"x5"x3/4" Steel Plate	ASTM A36	—
d2	16	HSS 2 1/2"x2 1/2"x1/4", 13 3/4" Long	ASTM A500 Gr. B	—
d3	2	HSS 3"x3"x1/4", 131 1/2" Long	ASTM A500 Gr. B	—
d4	3	HSS 3"x3"x1/4", 263" Long	ASTM A500 Gr. B	—
d5	4	HSS 2"x2"x1/4", 7" Long	ASTM A500 Gr. B	—
d6	16	2 1/4"x2 1/4"x1/4" Steel Plate	ASTM A36	—
d8	16	7"x1 1/2"x3/16" Shim	ASTM A36	—

- Notes: (1) Handrail tubes (parts d3 and d4) shall be welded directly to shims (parts d8) before galvanization.
(2) Handrail assemblies shall be galvanized according to ASTM A123 after all welding is complete.



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Handrail Assembly

DWG. NAME.
HP34_R14

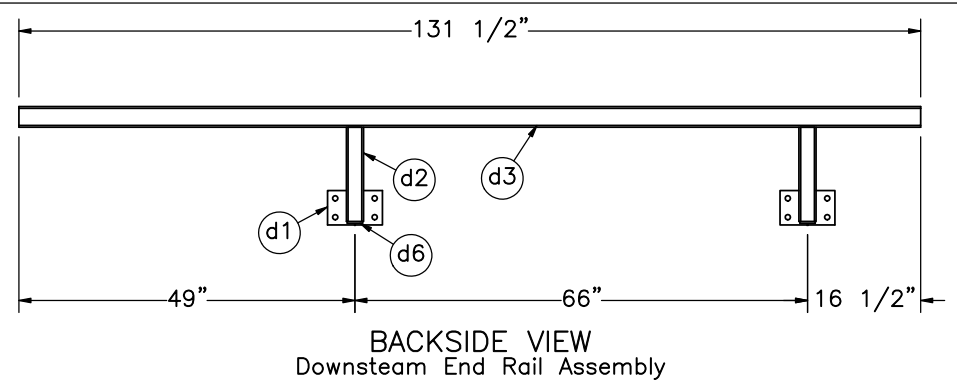
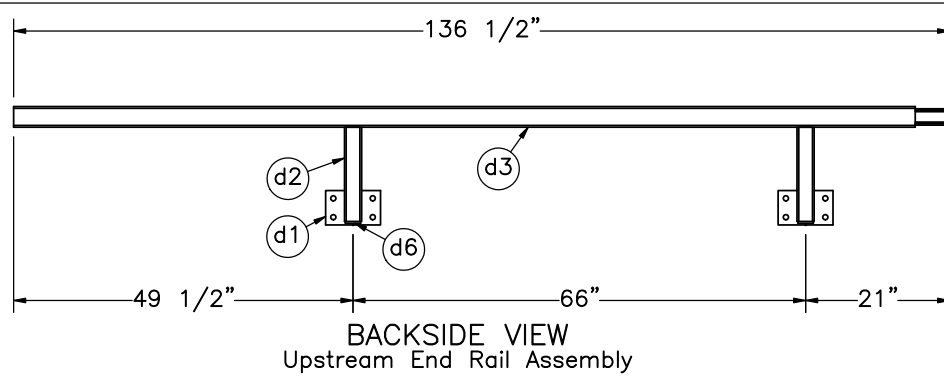
SCALE: 1:106
UNITS: in.

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

SHEET:
9 of 15

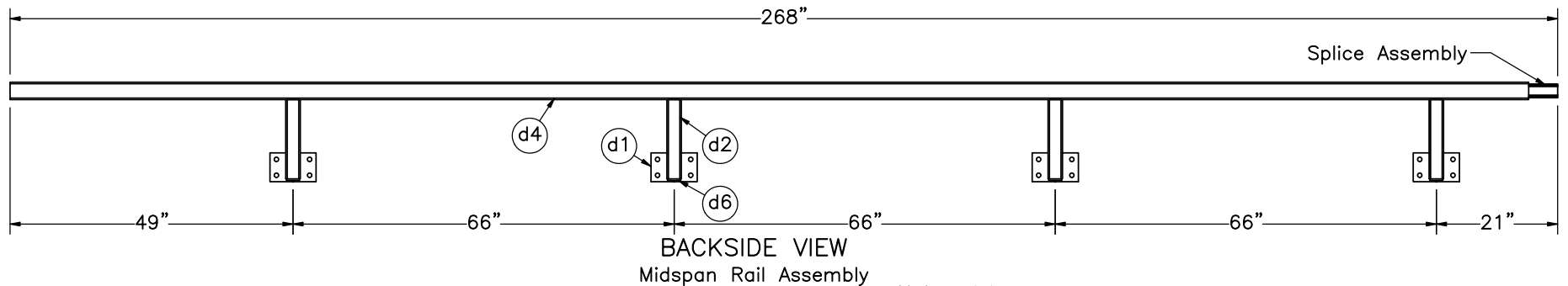
DATE:
3/28/2022

DRAWN BY:
LJP/SBW/G
HR



Item No.	QTY.	Description	Material Specification	Treatment Specification
—	1	Upstream End Rail Assembly	—	ASTM A123
d1	2	8"x5"x3/4" Steel Plate	ASTM A36	—
d2	2	HSS 2 1/2"x2 1/2"x1/4", 13 3/4" Long	ASTM A500 Gr. B	—
d3	1	HSS 3"x3"x1/4", 131 1/2" Long	ASTM A500 Gr. B	—
d5	1	HSS 2"x2"x1/4", 7" Long	ASTM A500 Gr. B	—
d6	2	2 1/4"x2 1/4"x1/4" Steel Plate	ASTM A36	—
d8	4	7"x1 1/2"x3/16" Shim	ASTM A36	—

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	1	Downstream End Rail Assembly	—	ASTM A123
d1	2	8"x5"x3/4" Steel Plate	ASTM A36	—
d2	2	HSS 2 1/2"x2 1/2"x1/4", 13 3/4" Long	ASTM A500 Gr. B	—
d3	1	HSS 3"x3"x1/4", 131 1/2" Long	ASTM A500 Gr. B	—
d6	2	2 1/4"x2 1/4"x1/4" Steel Plate	ASTM A36	—



- Notes: (1) Handrail assemblies shall be galvanized according to ASTM A123 after all welding is complete.
 (2) These sub-assemblies make up the handrail assembly on page 9.

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	3	Midspan Rail Assembly	—	ASTM A123
d1	4	8"x5"x3/4" Steel Plate	ASTM A36	—
d2	4	HSS 2 1/2"x2 1/2"x1/4", 13 3/4" Long	ASTM A500 Gr. B	—
d4	1	HSS 3"x3"x1/4", 263" Long	ASTM A500 Gr. B	—
d5	1	HSS 2"x2"x1/4", 7" Long	ASTM A500 Gr. B	—
d6	4	2 1/4"x2 1/4"x1/4" Steel Plate	ASTM A36	—
d8	4	7"x1 1/2"x3/16" Shim	ASTM A36	—



Midwest Roadside
Safety Facility

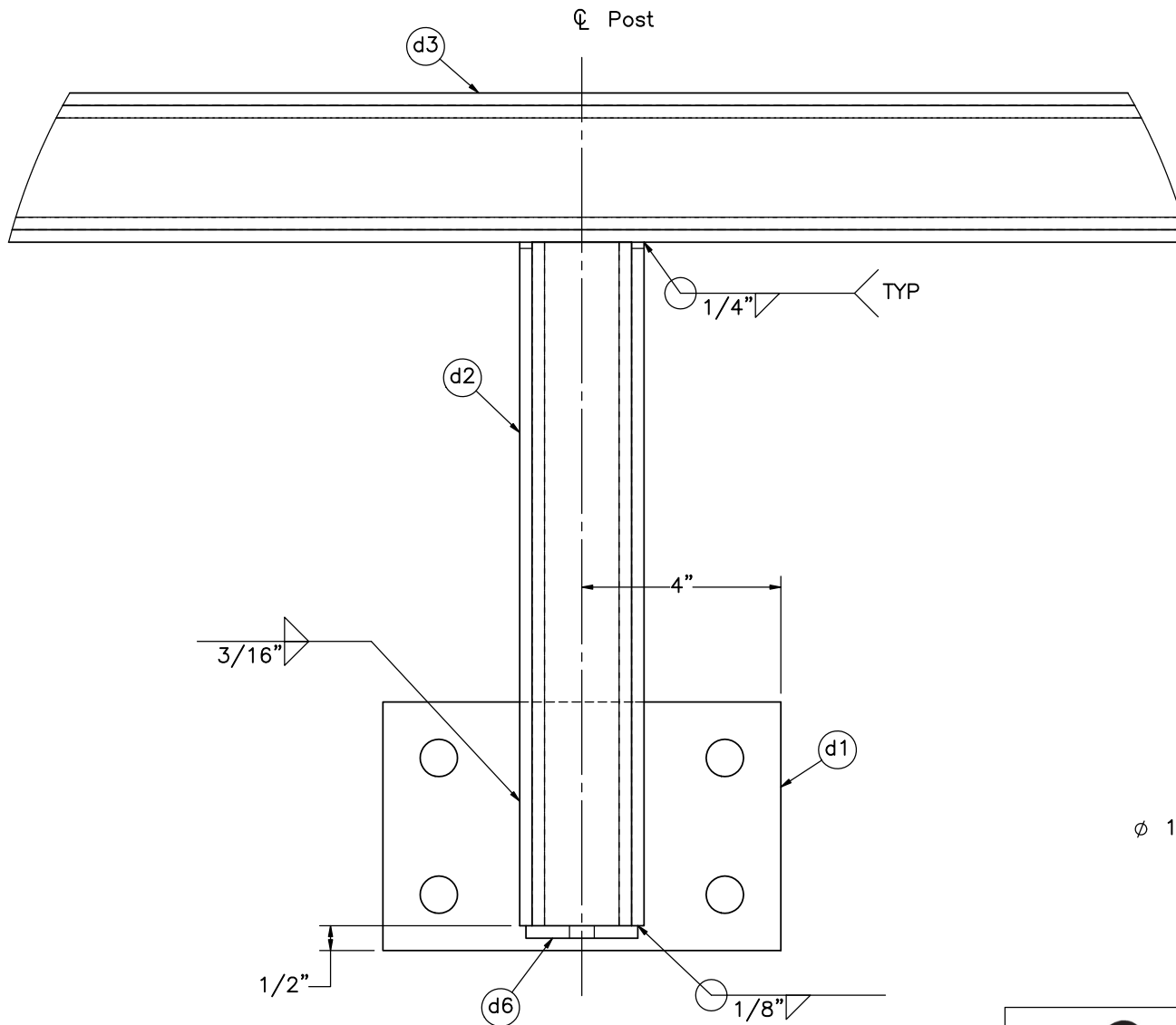
Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Handrail Assembly Details

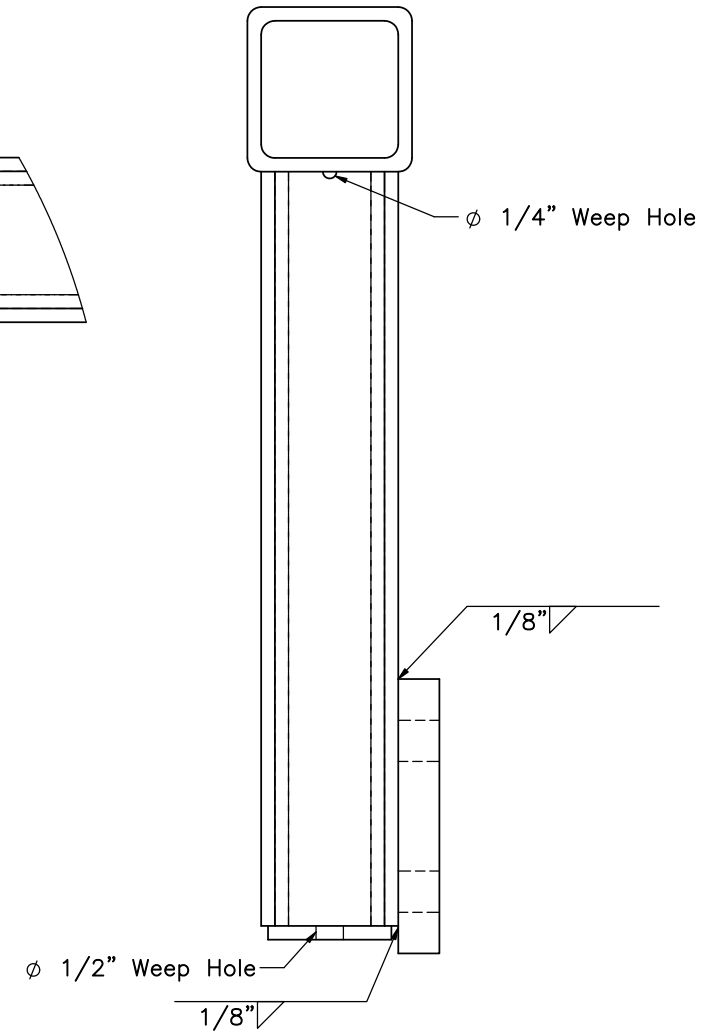
DWG. NAME.
HP34_R14

SCALE: 1:28
UNITS: in.

SHEET:
10 of 15
DATE:
3/28/2022
DRAWN BY:
LJP/SBW/G
HR
REV. BY:
KAL/CSS/J
CH/RN



DETAIL I



SECTION J-J



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Handrail Assembly Details

DWG. NAME.
HP34_R14

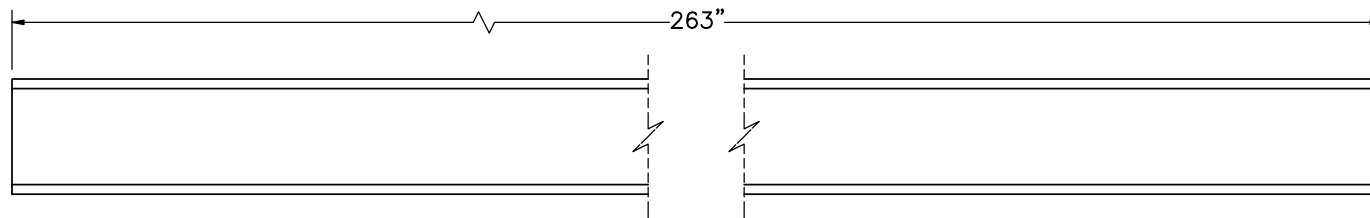
SCALE: 2:7
UNITS: in.

SHEET:
11 of 15

DATE:
3/28/2022

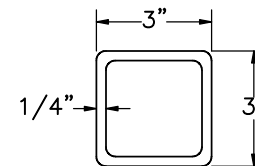
DRAWN BY:
LJP/SBW/G
HR

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

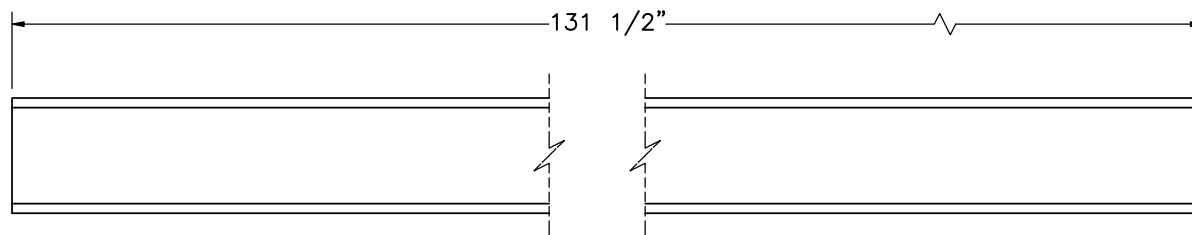


ELEVATION VIEW

Part d4

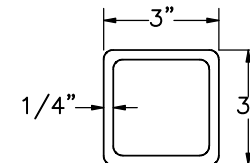


PROFILE VIEW

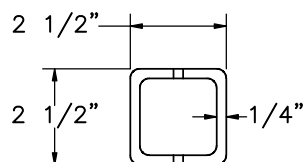


ELEVATION VIEW

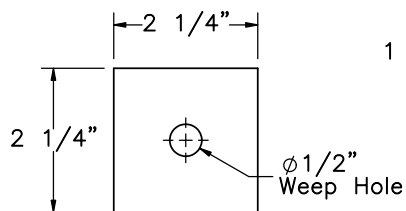
Part d3



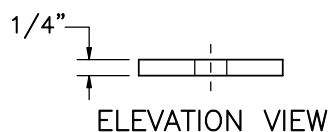
PROFILE VIEW



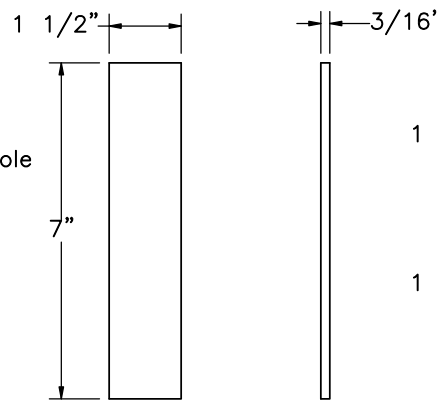
PLAN VIEW



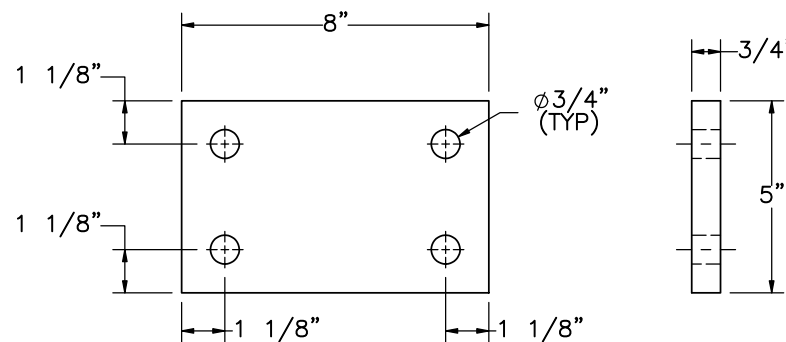
PLAN VIEW



ELEVATION VIEW
SCALE 1:3
Part d6



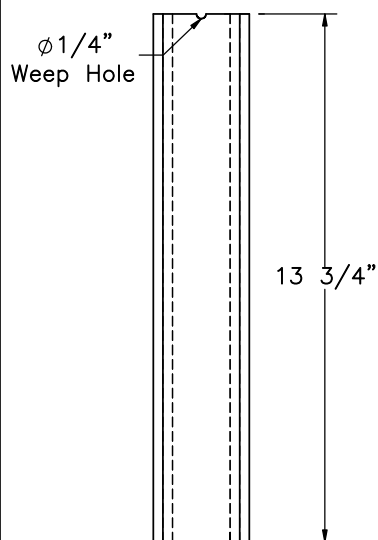
Part d8



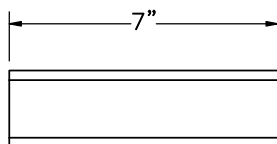
ELEVATION VIEW

PROFILE VIEW

Part d1

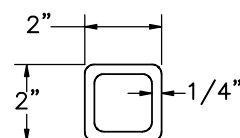


ELEVATION VIEW
Part d2



ELEVATION VIEW

Part d5



PROFILE VIEW



Midwest Roadside
Safety Facility

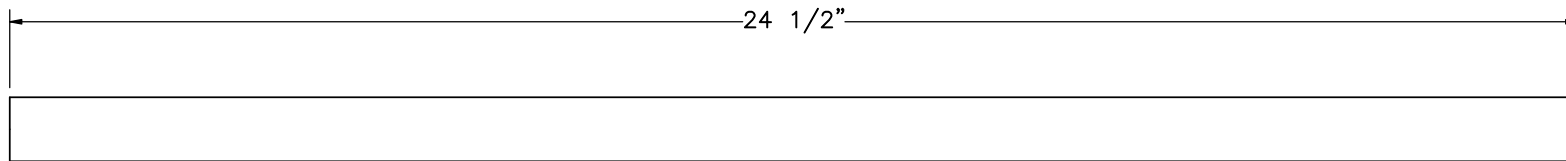
Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Handrail Components

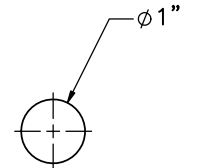
DWG. NAME.
HP34_R14

SCALE: 1:5
UNITS: in.

SHEET:
12 of 15
DATE:
3/28/2022
DRAWN BY:
LJP/SBW/G
HR
REV. BY:
KAL/CSS/J
CH/RN

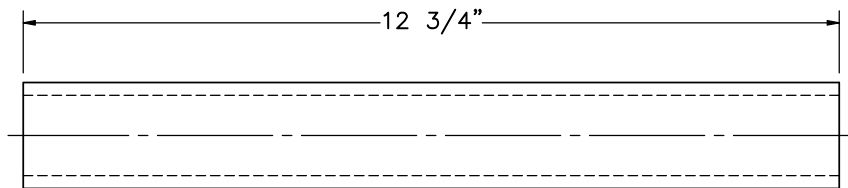


ELEVATION VIEW

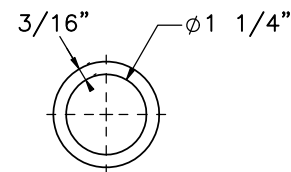


PROFILE VIEW

Part c1

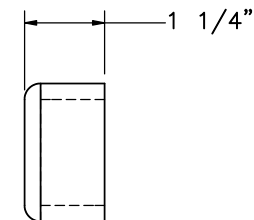


ELEVATION VIEW

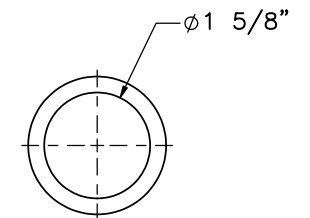


PROFILE VIEW

Part c2



ELEVATION VIEW



PROFILE VIEW

Part c3



Midwest Roadside
Safety Facility

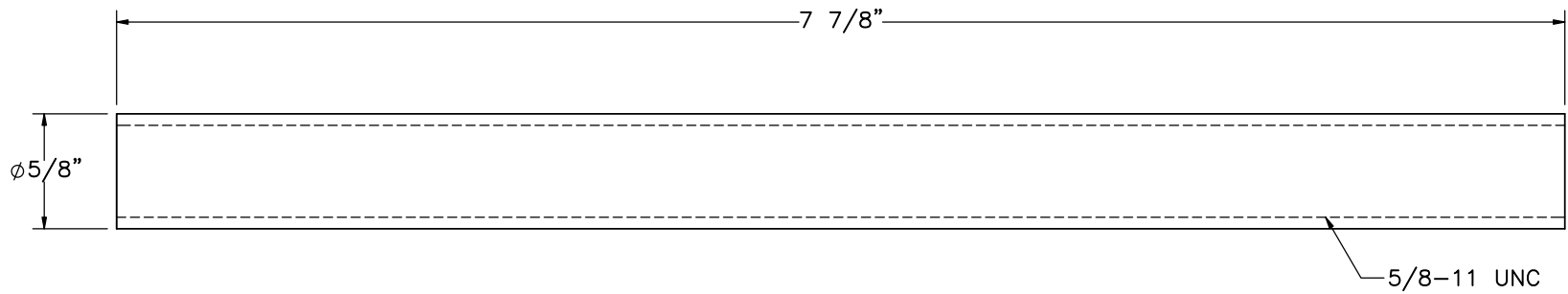
Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Expansion Joint Components

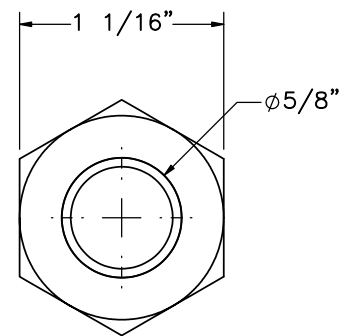
DWG. NAME.
HP34_R14

SCALE: 1:3
UNITS: in.

SHEET:
13 of 15
DATE:
3/28/2022
DRAWN BY:
LJP/SBW/G
HR
REV. BY:
KAL/CSS/J
CH/RN

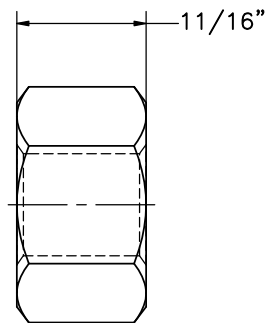


Part d7

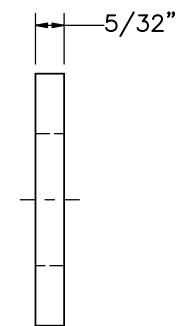


ELEVATION VIEW

Part e1

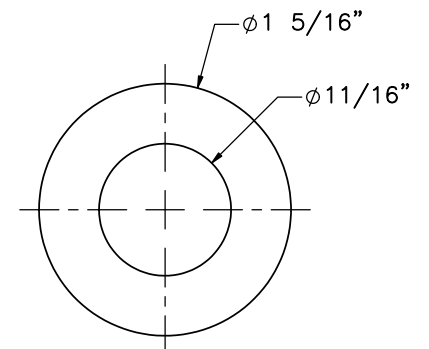


PROFILE VIEW



ELEVATION VIEW

Part e2



PROFILE VIEW



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34-1

Hardware

DWG. NAME.
HP34_R14

SCALE: 1:1
UNITS: in.

SHEET:
14 of 15

DATE:
3/28/2022

DRAWN BY:
LJP/SBW/G
HR

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

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
a1	—	Concrete*	Min. f'c = 4,000 psi	—	—
a2	—	Low-Strength Concrete Overlay	Concrete NE Mix 9019 CITY	—	—
b1	264	#5 Rebar, 46 3/4" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	—
b2	24	#5 Rebar, 38 7/8" Total Unbent Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	—
b3	24	#5 Rebar, 259 1/2" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	—
b4	16	#5 Rebar, 127 3/4" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	—
c1	12	#8 Smooth Rebar, 24 1/2" Total Length	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	—
c2	12	1 1/4" Dia. PVC Pipe	Schedule 80 PVC Gr. 12454	—	—
c3	12	1 1/4" Dia. PVC End Cap	Schedule 80 PVC Gr. 12454	—	—
c4	—	Epoxy Adhesive	Hilti HIT RE-500 V3	—	—
c5	—	Expansion Joint Filler	AASHTO M33, M153, or M213	—	—
c6	—	Expansion Joint Sealant	AASHTO M173, M282, M301, ASTM D3581, or ASTM D5893	—	—
d1	16	8"x5"x3/4" Steel Plate	ASTM A36	—	—
d2	16	HSS 2 1/2"x2 1/2"x1/4", 13 3/4" Long	ASTM A500 Gr. B	—	—
d3	2	HSS 3"x3"x1/4", 131 1/2" Long	ASTM A500 Gr. B	—	—
d4	3	HSS 3"x3"x1/4", 263" Long	ASTM A500 Gr. B	—	—
d5	4	HSS 2"x2"x1/4", 7" Long	ASTM A500 Gr. B	—	—
d6	16	2 1/4"x2 1/4"x1/4" Steel Plate	ASTM A36	—	—
d7	64	5/8"—11 UNC, 7 7/8" Long Threaded Rod	ASTM F1554—15 Gr. 105	ASTM F2329	—
d8	16	7"x1 1/2"x3/16" Shim	ASTM A36	—	—
e1	64	5/8"—11 UNC Heavy Hex Nut	ASTM A563—15 Grade DH	ASTM F2329	FNX16b
e2	64	5/8" Dia. Hardened Washer	ASTM F436	ASTM F2329	FWC16b

*NE Mix 47B1S/1PF4000HW was used for testing purposes.



Midwest Roadside
Safety Facility

Hawaii 34" Aesthetic
Concrete Bridge Rail
Test No. HP34—1

Bill of Materials

DWG. NAME.
HP34_R14

SCALE: None
UNITS: in.

SHEET:
15 of 15
DATE:
3/28/2022
DRAWN BY:
LJP/SBW/G
HR
REV. BY:
KAL/CSS/J
CH/RN

REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
0	9/23/2020	—	Drawing created from H34BR system. Handrail was added.	—	LJP
1	9/28/2020	—	Reordered sheets. Relabeled detail views to be in correct order.	KAL	LJP
		1	Added post numbers.		
		8	Added post numbers.		
		BOM	Removed note about not epoxy coating rebar.		
2	10/16/2020	3	Changed the vertical spacing of longitudinal bars from 10" to 9.5" Added note 4.	KAL/CSS	CJN
		7	Changed the expansion joint bar from 24" to 24 1/2"		
		BOM	Desc: c1 Qty: b2		
3	10/26/2020	All	Switched rail to be on non-impact side. Added sheet to detail handrail segments, added additional post.	CSS	SBW
		1	Added impact location, added additional post and adjusted spacing between posts. Updated test note to reflect test criteria and test impact location.		
		2	Changed detail be into a partial section to make for ease of drawing. Flipped posts to other side.		
		8	Added additional post and changed post spacings.		
		9	Added handrail assemblies		
		BOM	Changed part quantities for parts d1, d2, d6, d7, e1, and e2.		
4	11/4/2020	3	Removed note 4.	CSS	LJP
		4	Changed style of parapet details to be consistent with the one shown on sheet 5.		
		7	Removed expansion joint rebar. Added to note.		
		8	Added note that this is a backside view.		
5	11/13/2020	All	Shifted handrail posts 16.5" upstream. Added page to detail rail and concrete assemblies.	CSS	SBW
		1	Shifted posts.		
		7	Added page to detail position of posts and anchors on parapet.		

6	2/17/2021	7	Corrected upstream/downstream labels.	CSS/JCH	LJP
		9	Added views of new splice assembly with shims. Added notes 1 and 2.		
		10	Added galvanization specifications. Added note 1.		
		11	Edited dimensions of splice tube. Added views of new shim.		
7	3/10/2021	9	Added shims to handrail assembly BOM. Fixed stitch weld note. Added "before galvanization" to note 1. Added section J.	CSS	LJP
		10	New sheet showing handrail welds and weep holes.		
		12	Added weep holes to parts d2 and d6.		
8	5/21/2021	1	Corrected upstream/downstream labels.	KAL	GHR
		3,4,5	Added Width Dimension to concrete barrier.		
9	9/13/2021	All	Flipped system.	KAL	SBW
		1	Added Section Labels to Plan View.		
		2	Removed hatching, added notation.		
		3	Removed hatching, added notation.		
		6	Flipped drawing, added upstream-downstream notation.		
		7	Flipped drawing, added upstream-downstream notation.		
		8	Added page to detail rebar locations in concrete.		
		9	Flipped drawing, added upstream-downstream notation.		
		10	Flipped drawing, added upstream-downstream notation.		
		12	Flipped drawing, added upstream-downstream notation.		
10	9/14/2021	1	Mirrored impact point and upstream/downstream labels to match flipped system.	CSS	GHR
		7	Corrected upstream/downstream labels.		
		10	Corrected upstream/downstream labels.		
		12	Corrected upstream/downstream assemblies and BOM names.		
		16	Added Centerlines and view labels to parts e1 and e2.		
		1	Corrected Downstream/Upstream labels on Plan view. Shifted Dimensioning to correctly show upstream face of post no. 7.		
		4	Added Upstream/Downstream labels.		
		5	Added Upstream/Downstream labels.		

11	10/15/2021	6	Flipped upstream/downstream labels on all views. Edited handrails to be properly flipped.	CSS	SBW
		10	Flipped location of splice assembly to proper side.		
		12	Flipped location of splice assembly to proper side. Added upstream/downstream labels.		
		BOM	Edited discription and material spec of part a1. Added note about testing mix of concrete.		
12	11/3/2021	All	Reordered sheets. Relabeled detail views to be in correct order. Removed sheet detailing parapet reinforcement details. Removed sheet detailing backside view of parapet and rail assemblies.	JCH/RN	GHR/SBW
		1	Added detailing to elevation view. Moved detail to plan view. Removed detailing from plan view.		
		2	Added detailing to section view A. Edited note 1 and added notes 2 and 3.		
		3	Changed views to look like page 3 of H34BR.		
		4	Changed detail D to look like detail F of H34BR. Removed downstream upstream notes. Added note 2, moved previous note 2 to note 3.		
		5	Changed drawing views to be one unified section of page 3's elevation view.		
		6	Removed downstream and upstream labels from elevation view.		
		7	Removed downstream and upstream labels from elevation view.		
		9	Added dimensioning to Backside view. Added notation to detail H.		
		10	Removed upstream downstream notation from views. Added note 2. Changed sheet label.		
13	3/21/2022	All	Changed orientation of rail to match HP34S rail.	JCH/CSS	SBW
		1	Changed rail and dims concerning rail accordingly.		
		9	Edited sheet to match sheet 11 of HP34S, detail H and backside view affected.		
		11	Edited all views to reflect changes in rail layout.		
		BOM	Edited qty for part e2.		
14	3/28/2022	9	Edited rail dims to be similar to dims on page 11 of HP34S	CSS	SBW