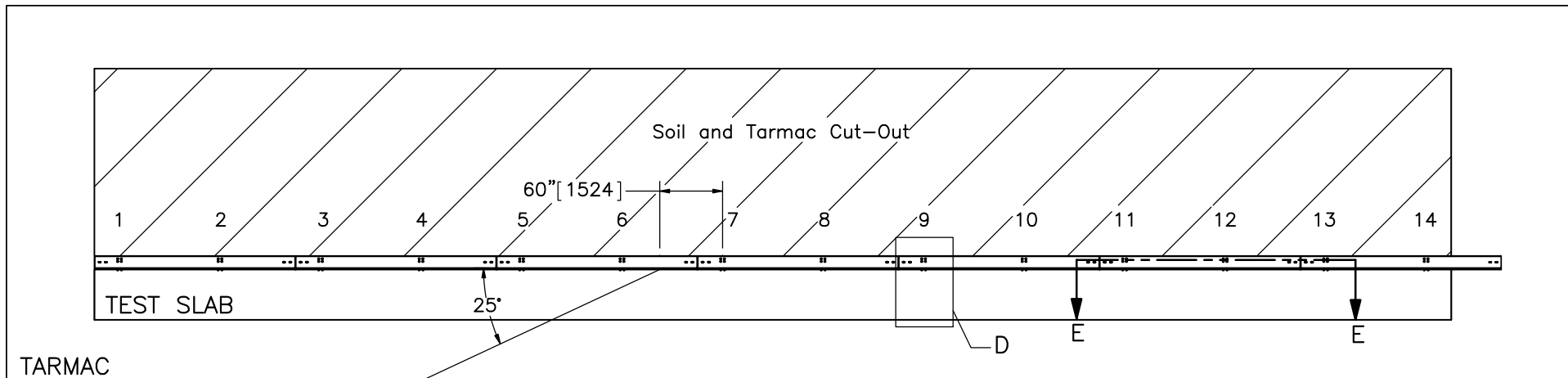
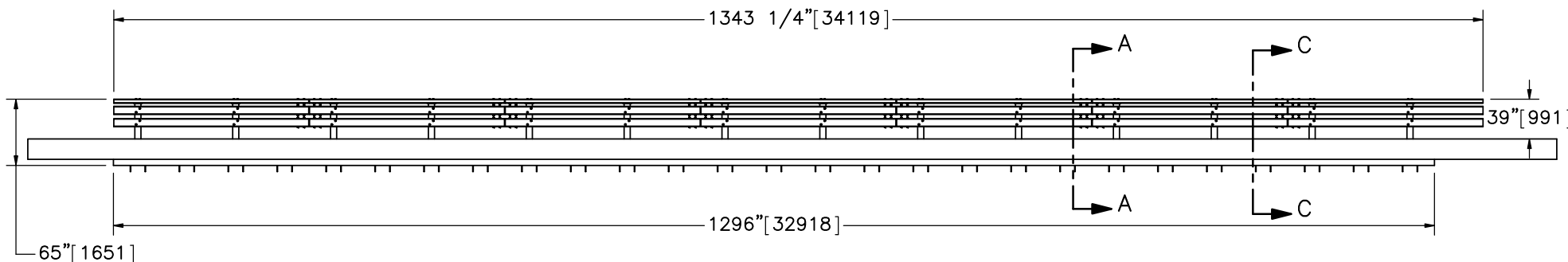




PLAN VIEW



ELEVATION VIEW

- Notes: (1) Test shall be performed according to test designation no. 4-10 using MASH 2016 criteria.
 (2) The impact location is 60" [1524] upstream from post no. 7.
 (3) Small car (1100C) crash test to simulate installation on a cast-in-place, reinforced concrete bridge deck with a roadway overlay.



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

System Layout

DWG. NAME.
STBR-3_R4

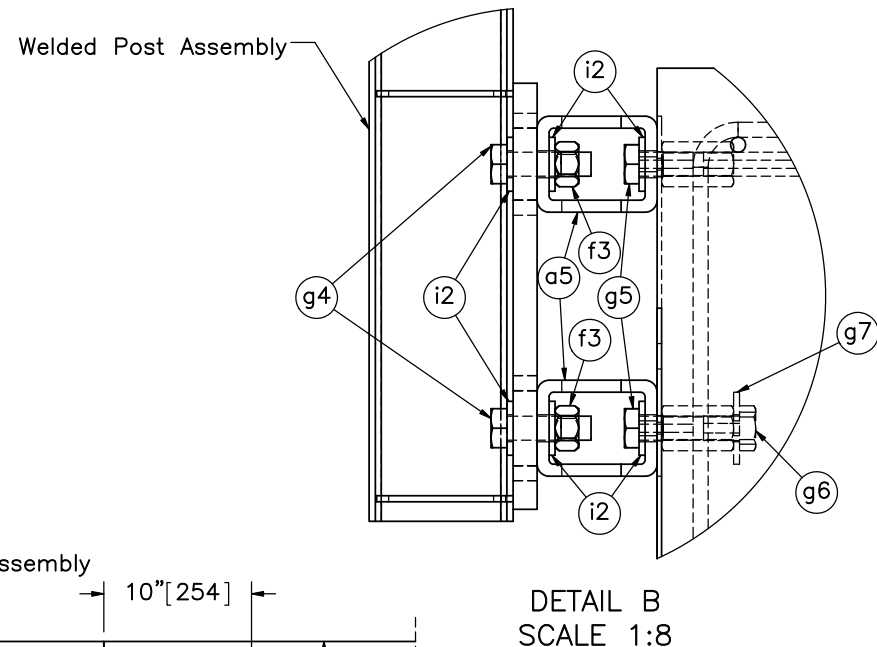
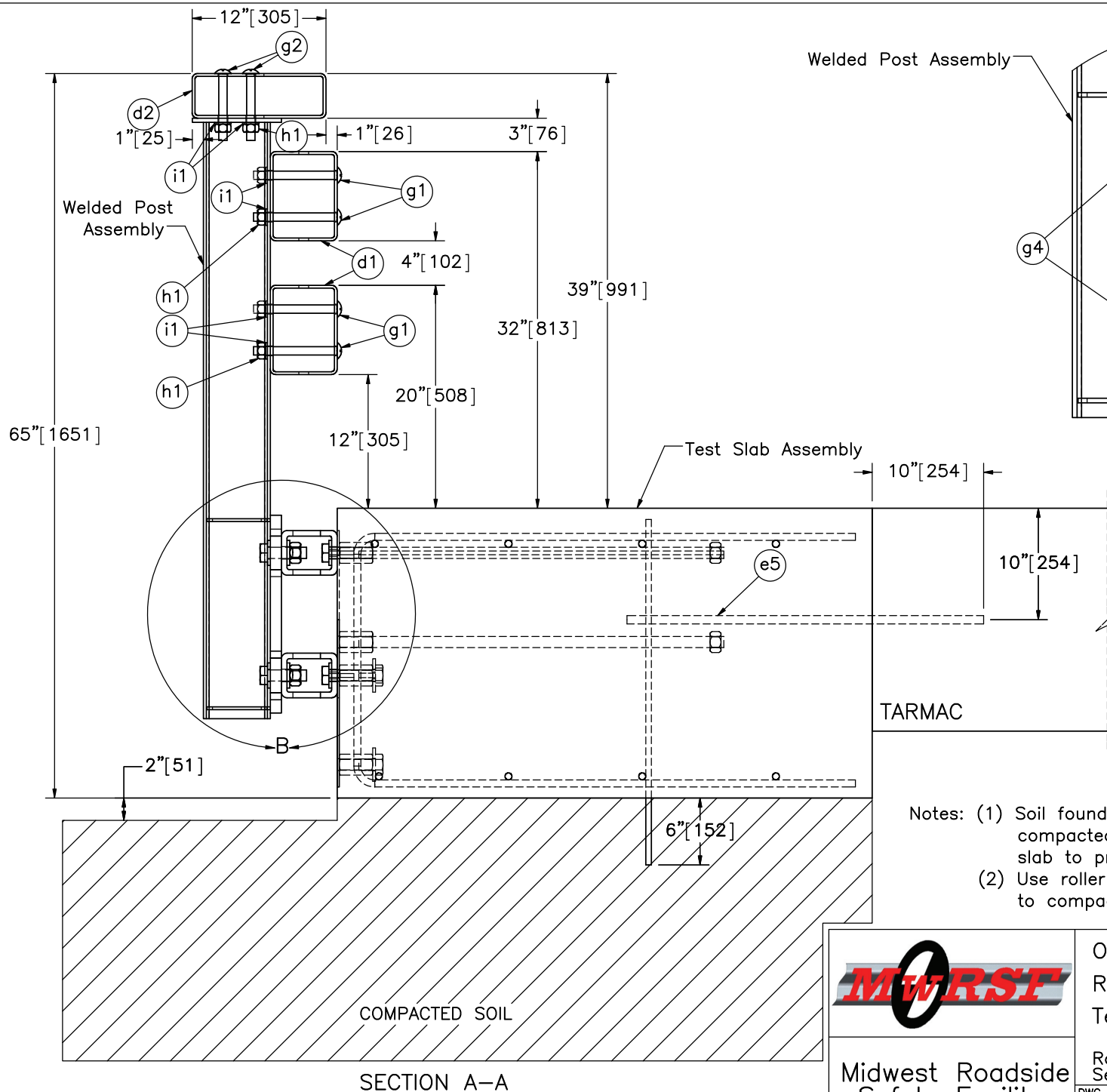
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UNITS: in.[mm]

SHEET:
1 of 22

DATE:
1/11/2019

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REV. BY:
JP/JCH/JEK



- Notes: (1) Soil foundation shall be heavily compacted prior to placing reinforced concrete slab to prevent settlement, rotation, etc.
(2) Use roller or large vibratory equipment to compact soil.



Midwest Roadside
Safety Facility

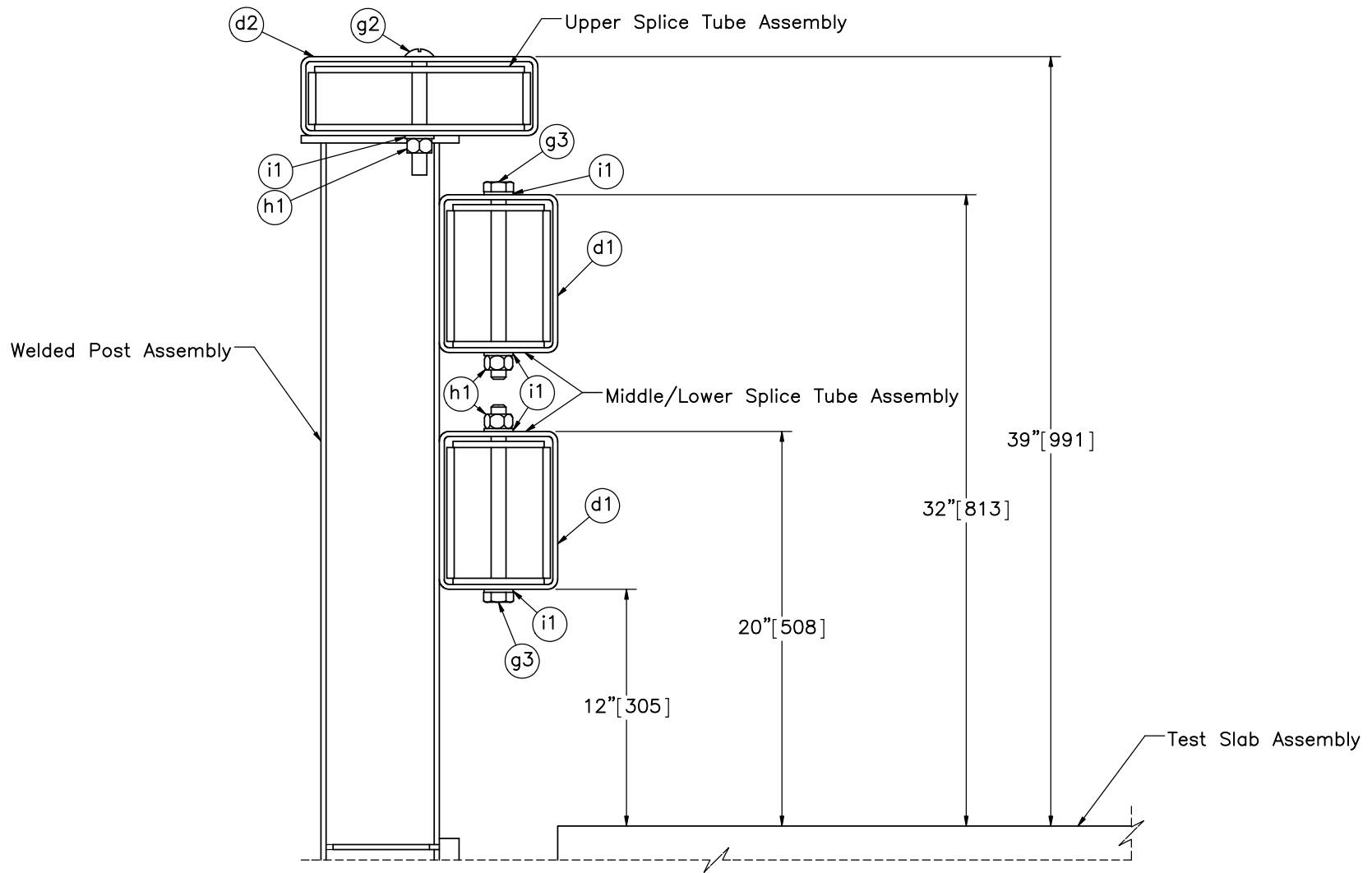
OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Rail and Post Attachment
Section Detail

DWG. NAME.
STBR-3_R4

SCALE: 1:13
UNITS: in.[mm]

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2 of 22
DATE:
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REV. BY:
OP/JCH/JEK



SECTION C-C



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Splice Section Detail

DWG. NAME.
STBR-3_R4

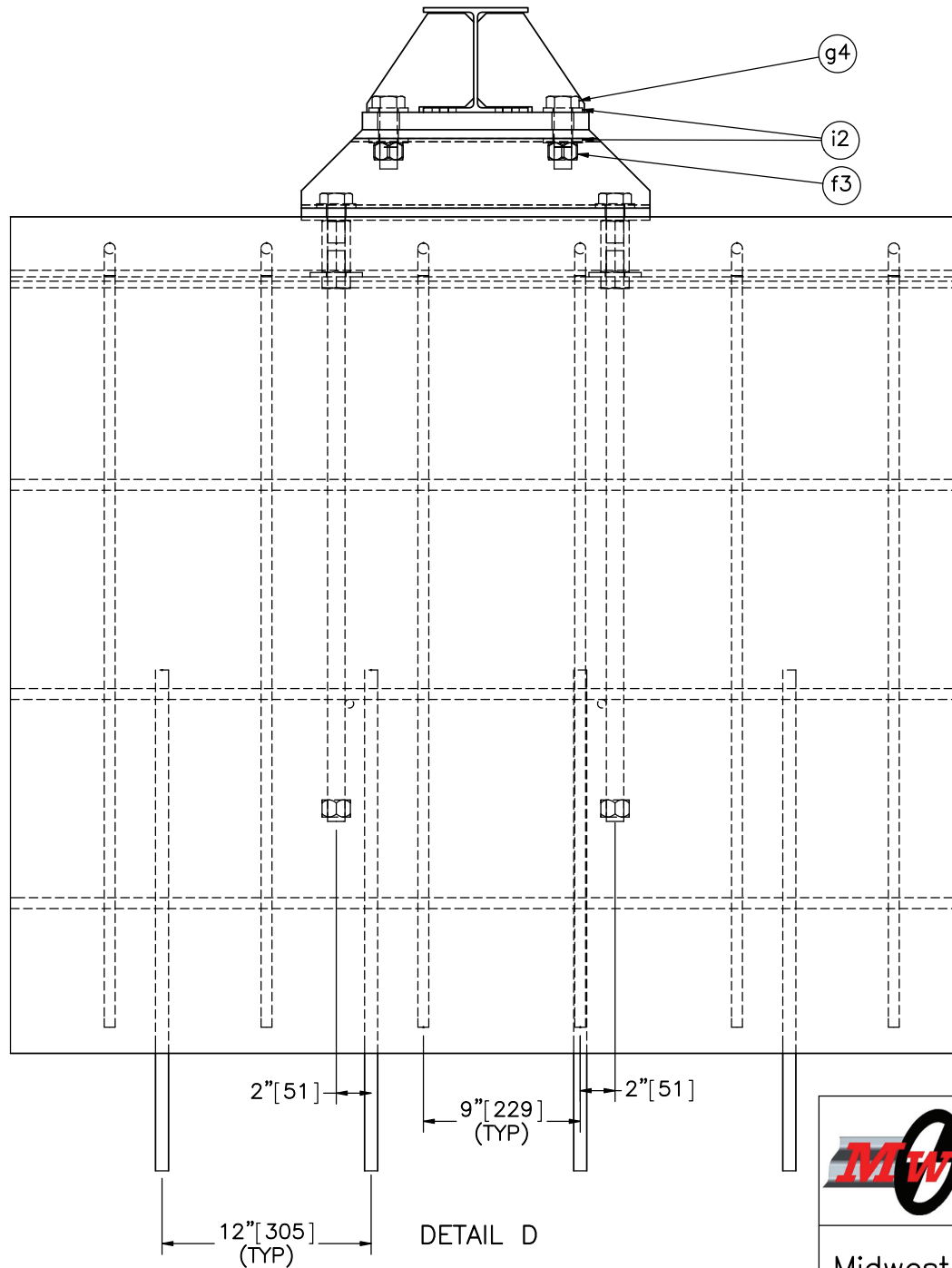
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REV. BY:
OP/JCH/JE
K



Note: (1) Rail components and hardware hidden for clarity.



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Internal Reinforcement Detail

DWG. NAME.
STBR-3_R4

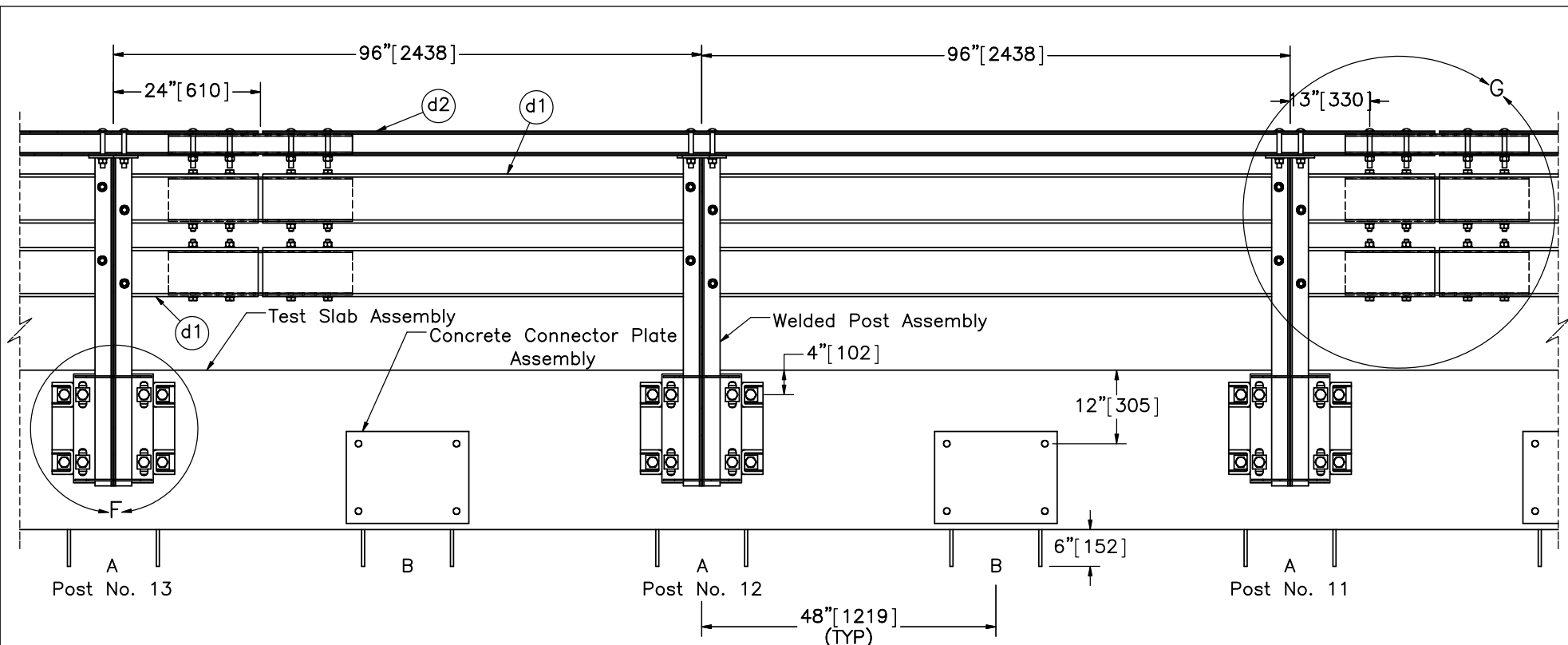
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4 of 22

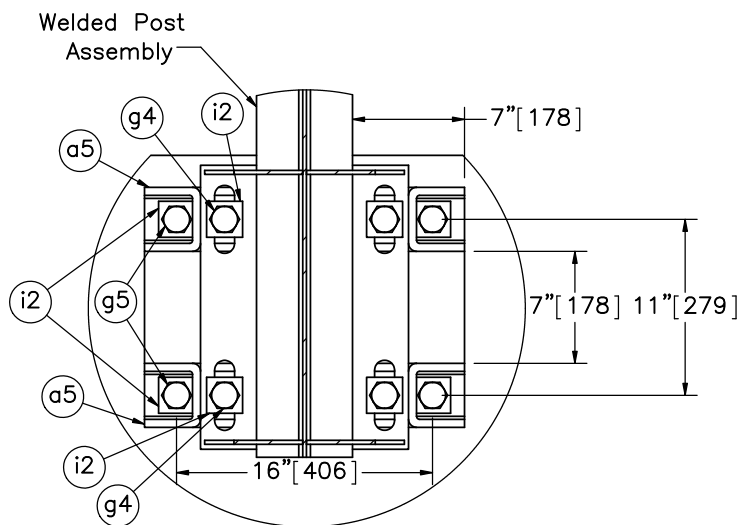
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1/11/2019

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REV. BY:
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SECTION E-E
BACKSIDE VIEW



DETAIL F
SCALE 1:12

- Notes: (1) Location A used for 1100C small car tests.
(2) Location B used for 2270P pickup truck and 10000S tests.



Midwest Roadside
Safety Facility

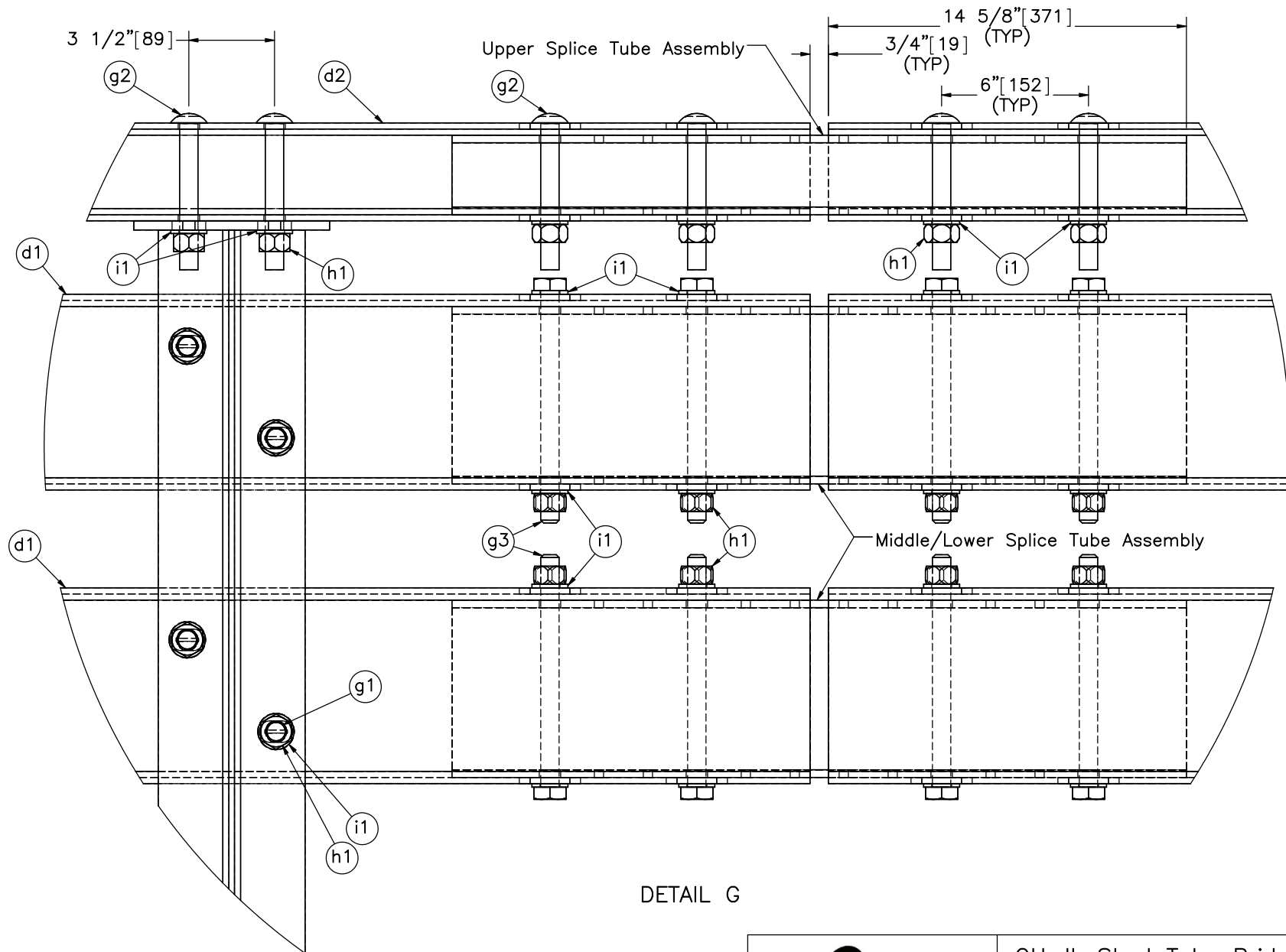
OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Backside Section View

DWG. NAME.
STBR-3_R4

SCALE: 1:25
UNITS: in./mm

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REV. BY:
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DETAIL G



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Splice Tube Details

DWG. NAME.
STBR-3_R4

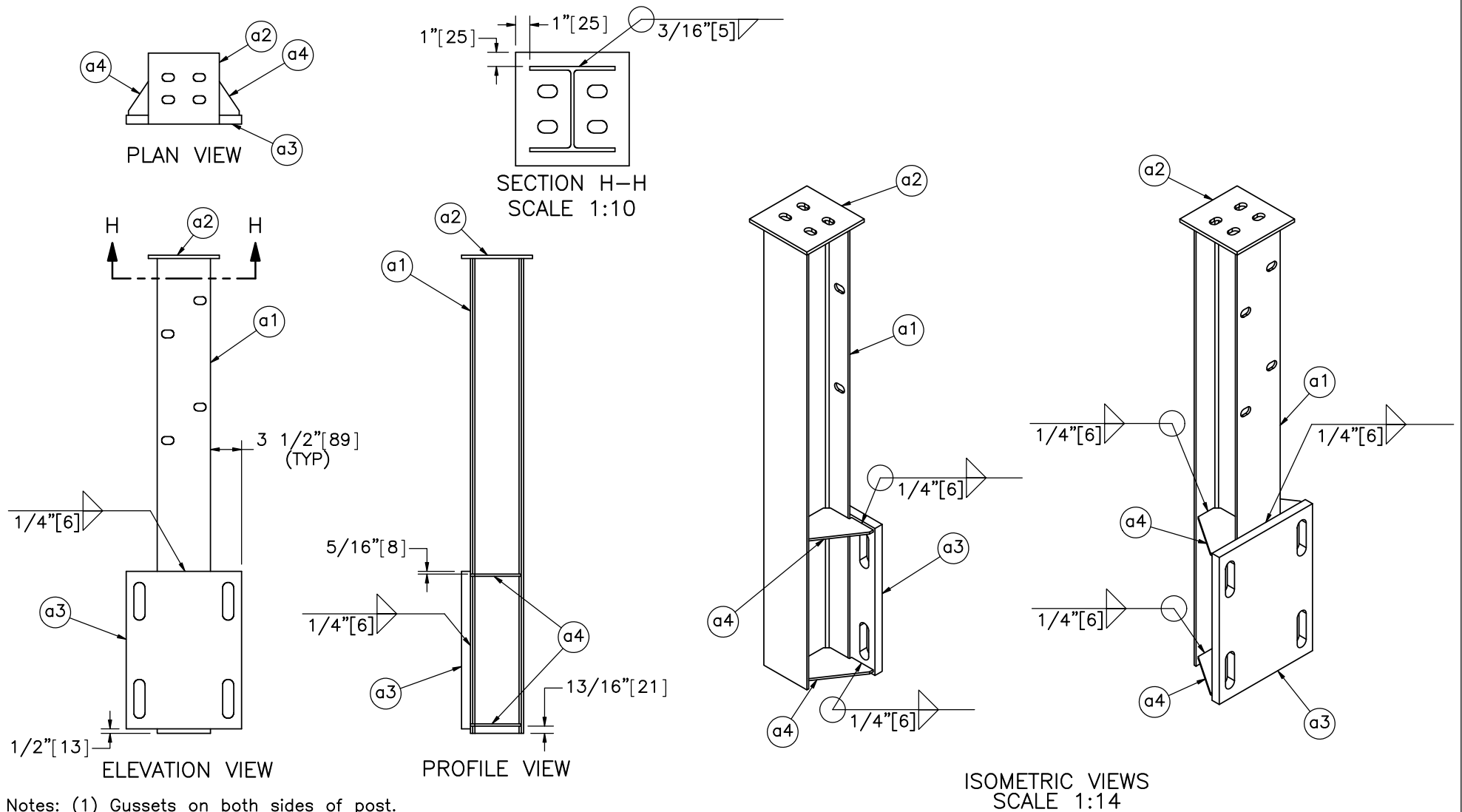
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DATE:
1/11/2019

DRAWN BY:
JEK/AJS

REV. BY:
OP/JCH/JE
K



- Notes: (1) Gussets on both sides of post.
 (2) To prevent welds to end at edges of gussets, leave 5/16" [8] of base material beyond weld to edge of welded part.
 (3) Leave coped corners of gussets open for drainage. Do not fill with welds.

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	14	Welded Post Assembly	—	ASTM A123
a1	1	W6x15 [W152x22], 53 1/2" [1,359] Long Post	ASTM A992	See Assembly
a2	1	8"x8"x3/8" [203x203x10] Plate	ASTM A572 Gr. 50	See Assembly
a3	1	13"x17 3/4"x1" [330x451x25] Post Plate with Slots for 1" [25] Bolts	ASTM A572 Gr. 50	See Assembly
a4	4	6 1/8"x5 11/16"x1/4" [156x144x6] Gusset Plate	ASTM A572 Gr. 50	See Assembly



Midwest Roadside
Safety Facility

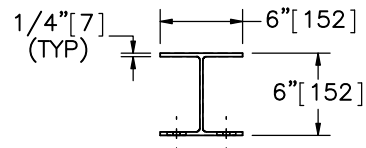
OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Welded Post Assembly Details

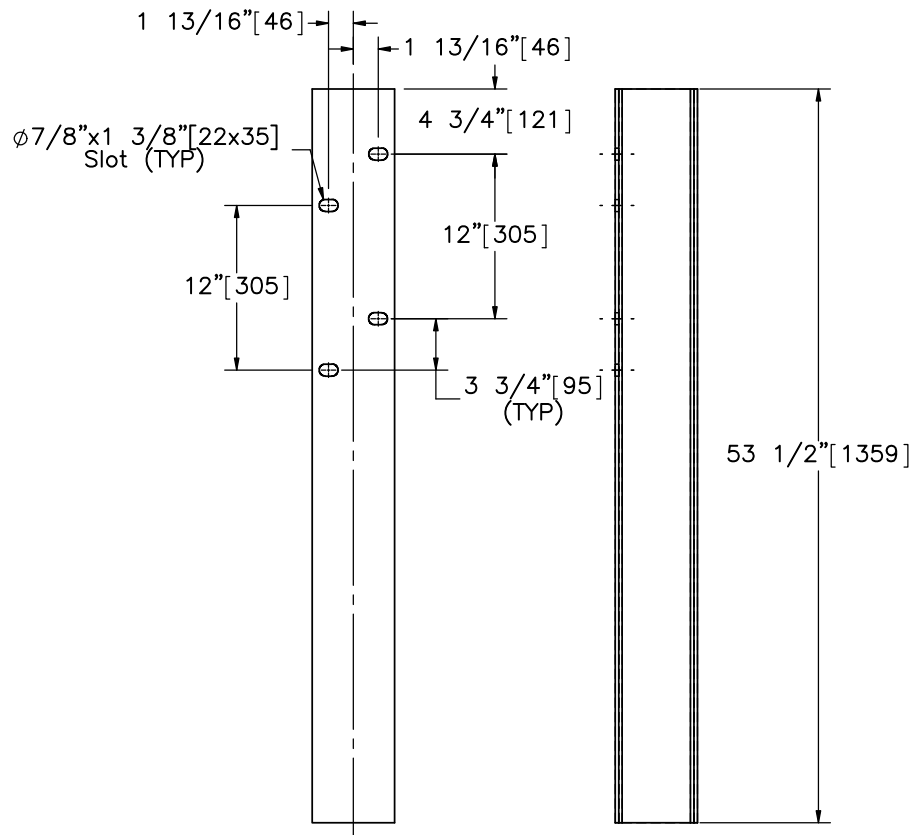
DWG. NAME.
STBR-3_R4

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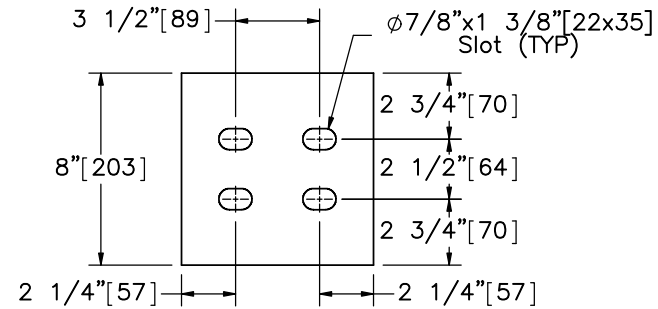
SHEET:
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DATE:
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DRAWN BY:
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REV. BY:
JP/JCH/JEK



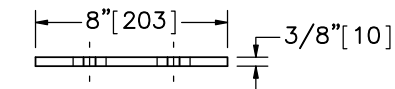
PLAN VIEW



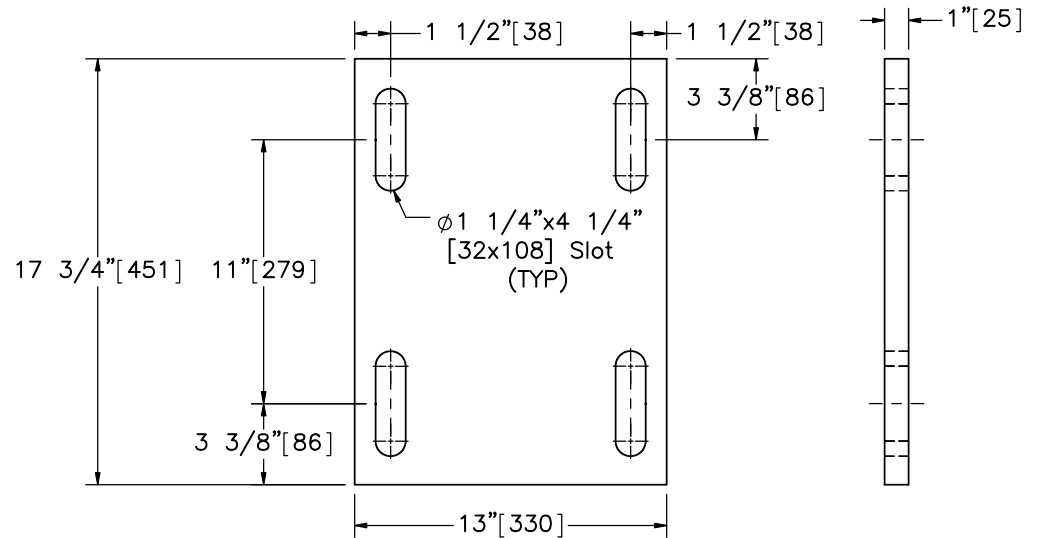
ELEVATION VIEW PROFILE VIEW
Part a1
SCALE 1:14



PLAN VIEW



ELEVATION VIEW
Part a2



ELEVATION VIEW

PROFILE VIEW

Part a3



Midwest Roadside
Safety Facility

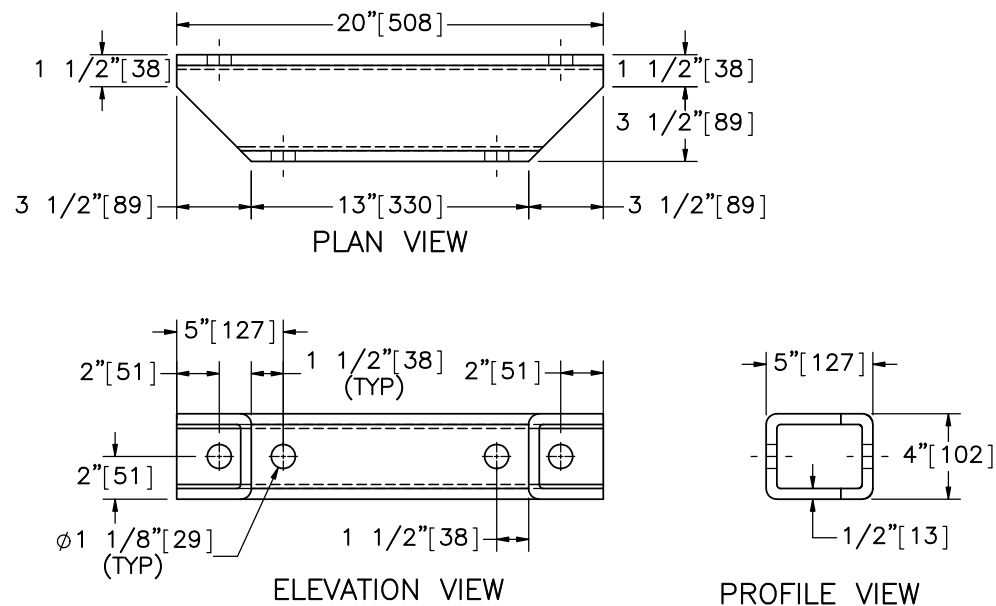
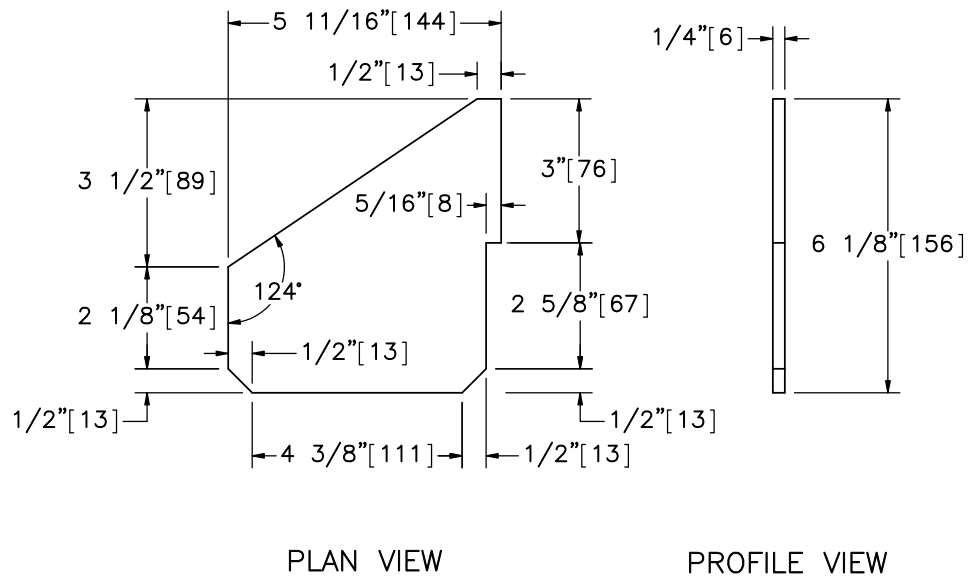
OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Post Components

DWG. NAME.
STBR-3_R4

SCALE: 1:8
UNITS: in./mm

SHEET:
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Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Post Components

DWG. NAME.
STBR-3_R4

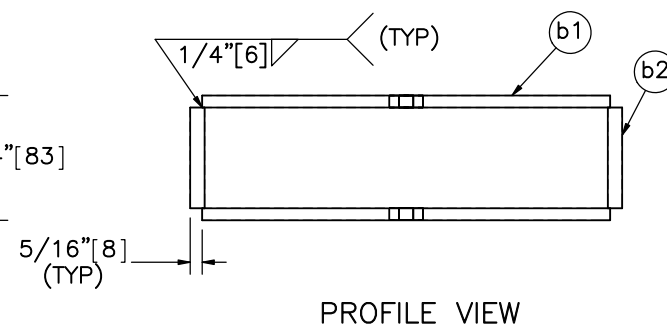
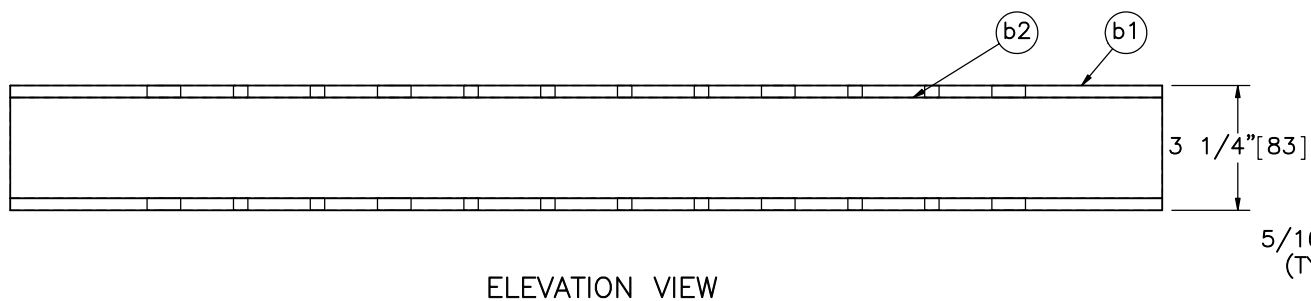
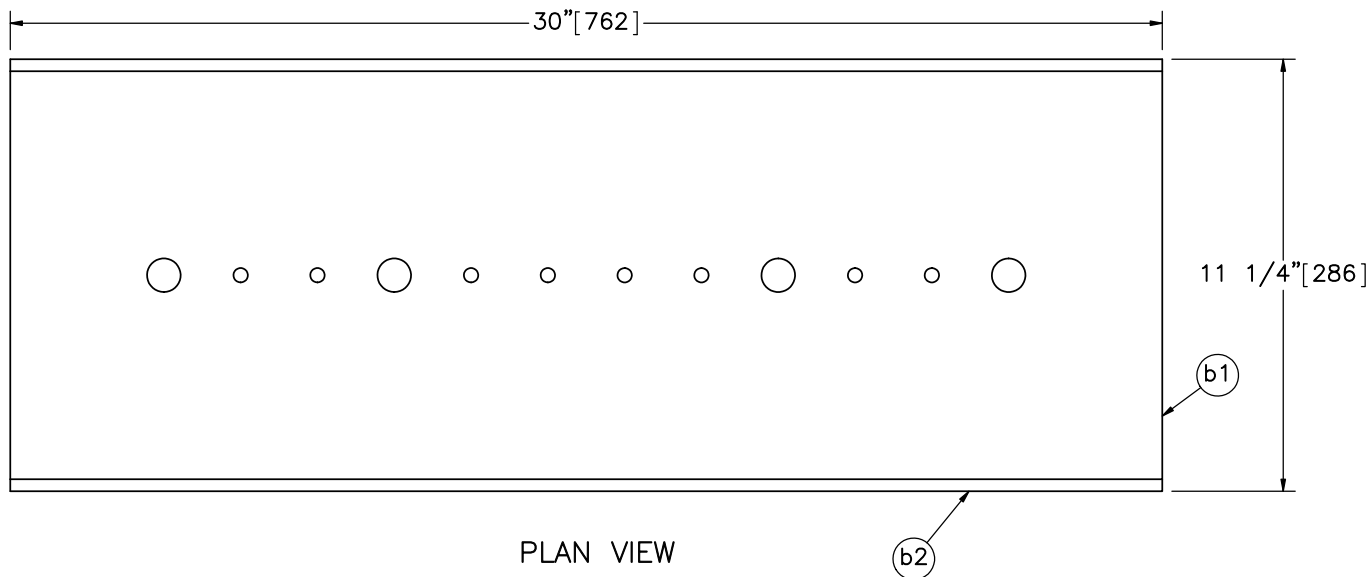
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Note: (1) To help hold the shape of the splice assembly through the welding and galvanizing processes, it is recommended to use gussets or shim blocks.

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	6	Upper Splice Tube Assembly — Option 1	—	ASTM A123
b1	2	30"x10 5/8"x5/16" [762x270x8] Plate	ASTM A572 Gr. 50	See Assembly
b2	2	30"x2 5/8"x3/8" [762x67x10] Plate	ASTM A572 Gr. 50	See Assembly

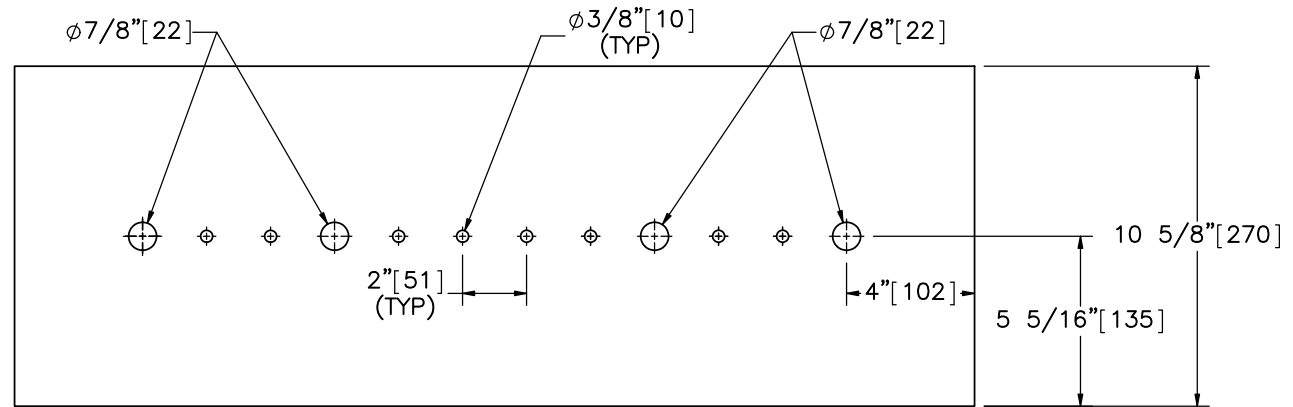


OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3
Upper Splice Tube Assembly

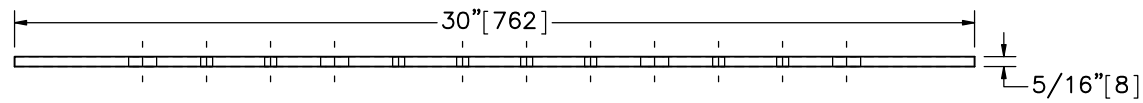
DWG. NAME.
STBR-3_R4

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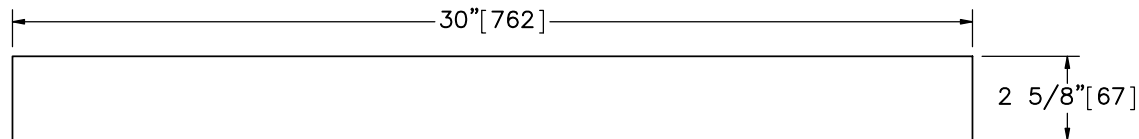
PLAN VIEW



ELEVATION VIEW
Part b1



PLAN VIEW



ELEVATION VIEW
Part b2



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Upper Splice Tube Components

DWG. NAME.
STBR-3_R4

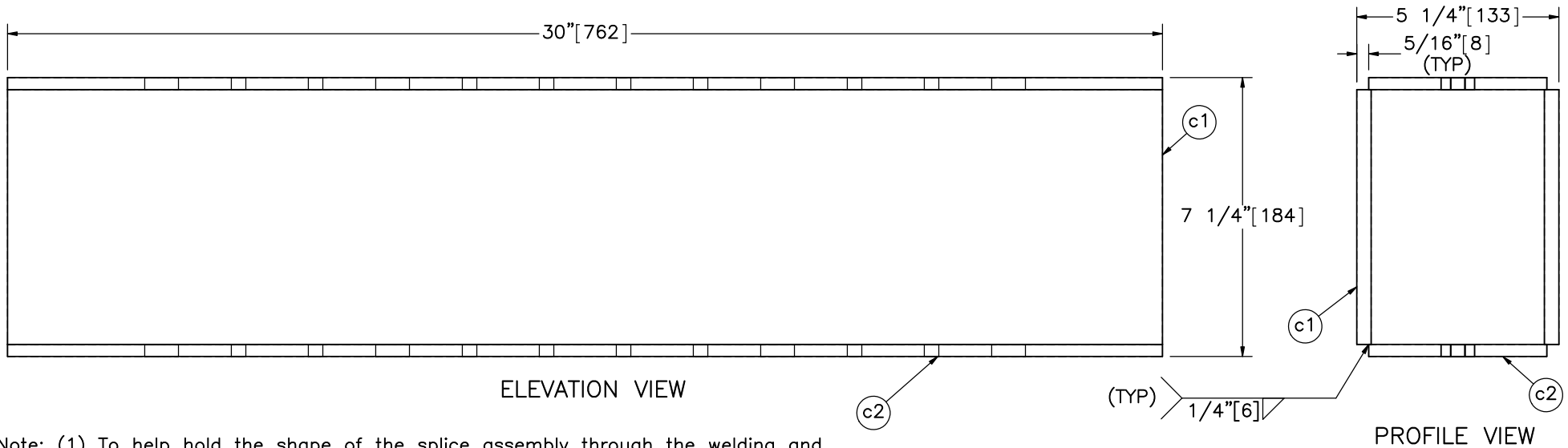
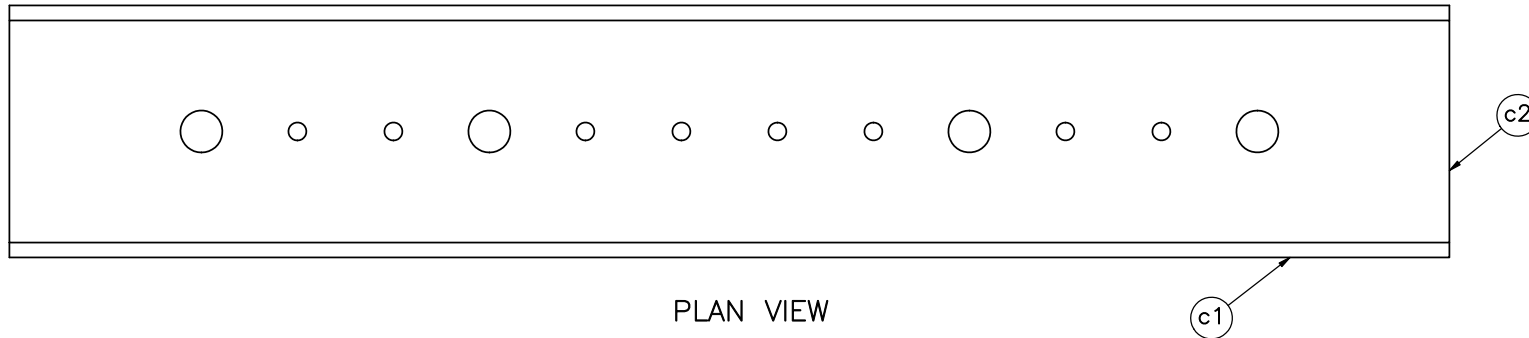
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DATE:
1/11/2019

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K



Note: (1) To help hold the shape of the splice assembly through the welding and galvanizing processes, it is recommended to use gussets or shim blocks.

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	12	Middle/Lower Splice Tube Assembly — Option 1	—	ASTM A123
c1	2	30"x6 5/8"x3/8" [762x168x10] Plate	ASTM A572 Gr. 50	See Assembly
c2	2	30"x4 5/8"x5/16" [762x117x8] Plate	ASTM A572 Gr. 50	See Assembly



OH—IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR—3

Middle/Lower Splice Tube
Assembly

DWG. NAME.
STBR—3_R4

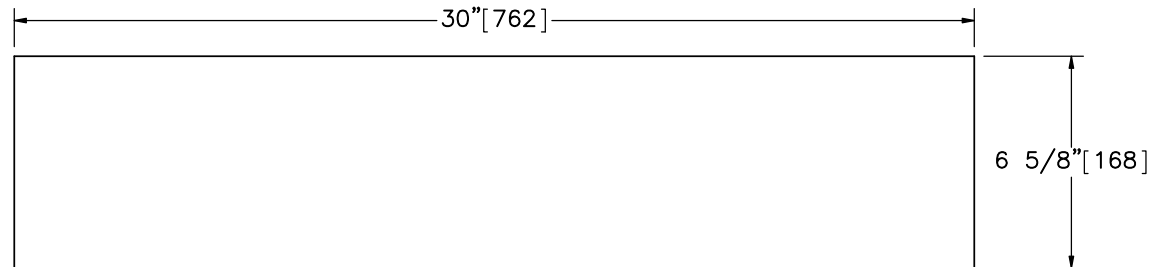
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SHEET:
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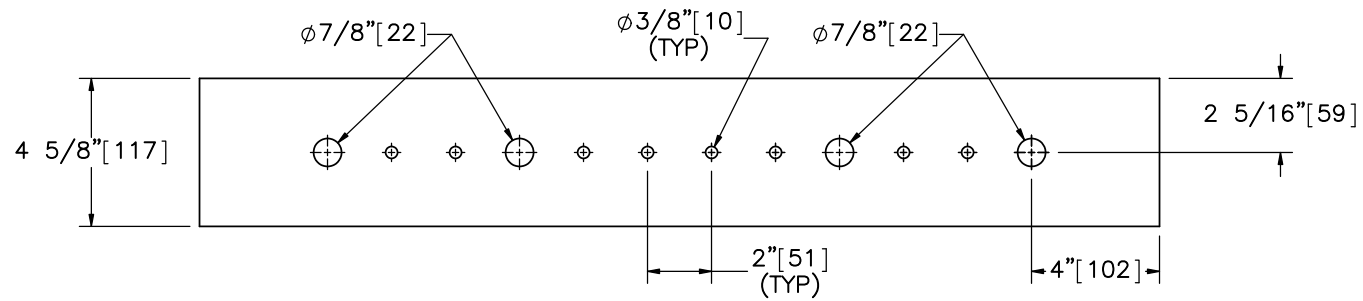
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1/11/2019

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JEK/AJS

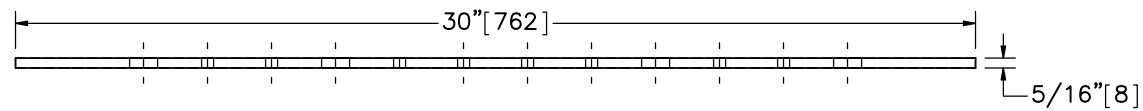
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ELEVATION VIEW
Part c1



PLAN VIEW



ELEVATION VIEW
Part c2



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Middle/Lower Splice Tube
Components

DWG. NAME:
STBR-3_R4

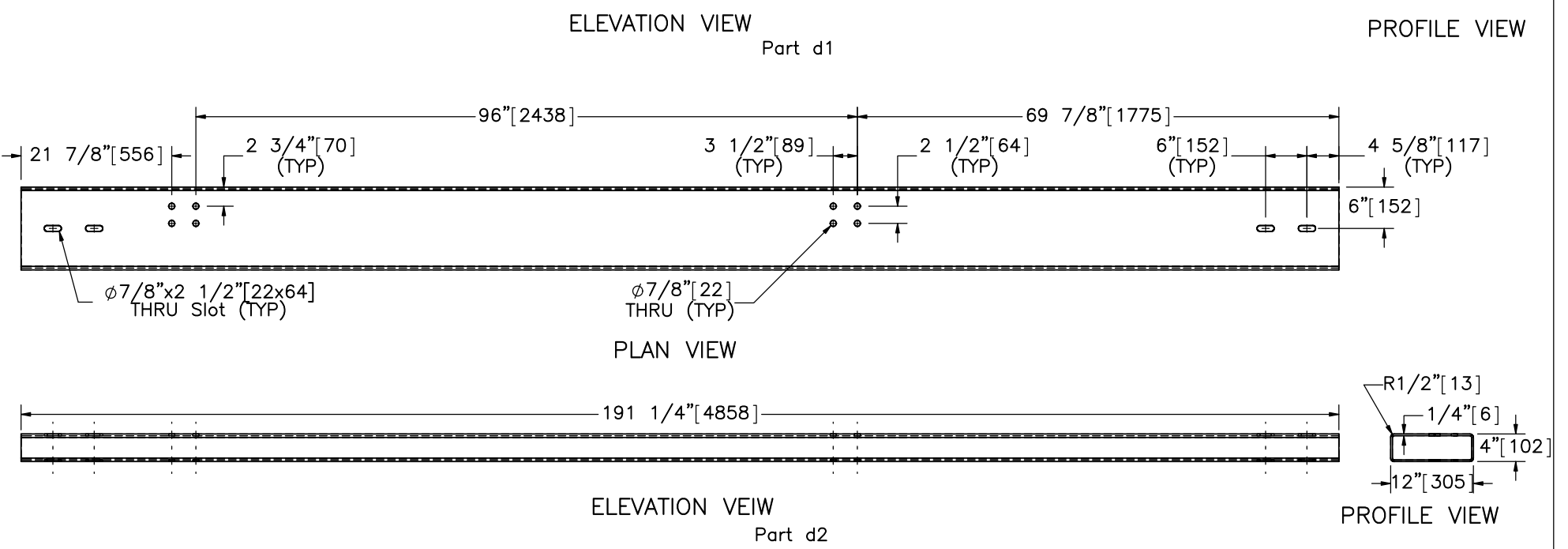
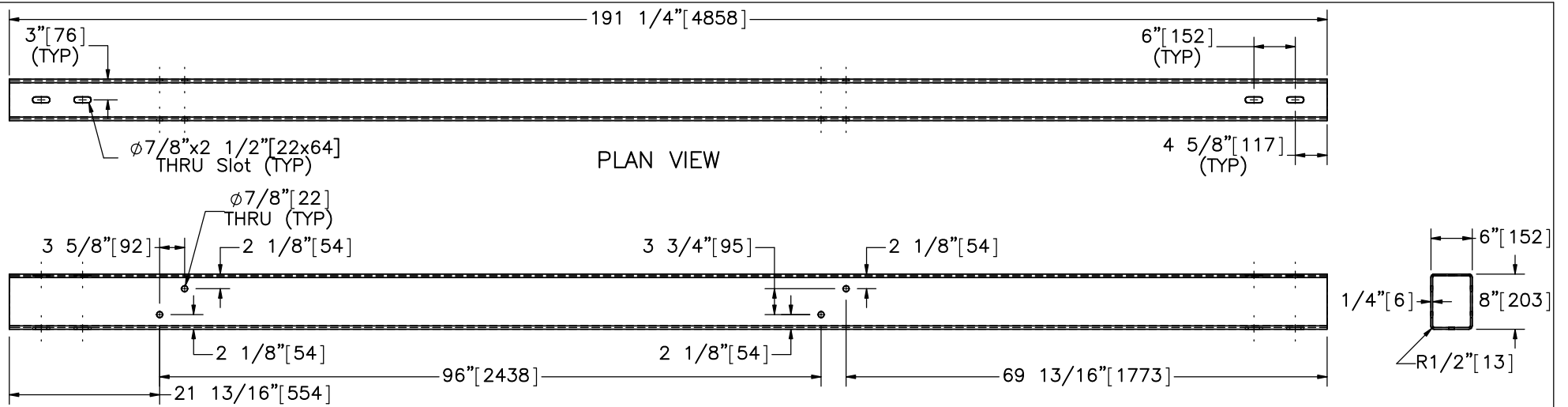
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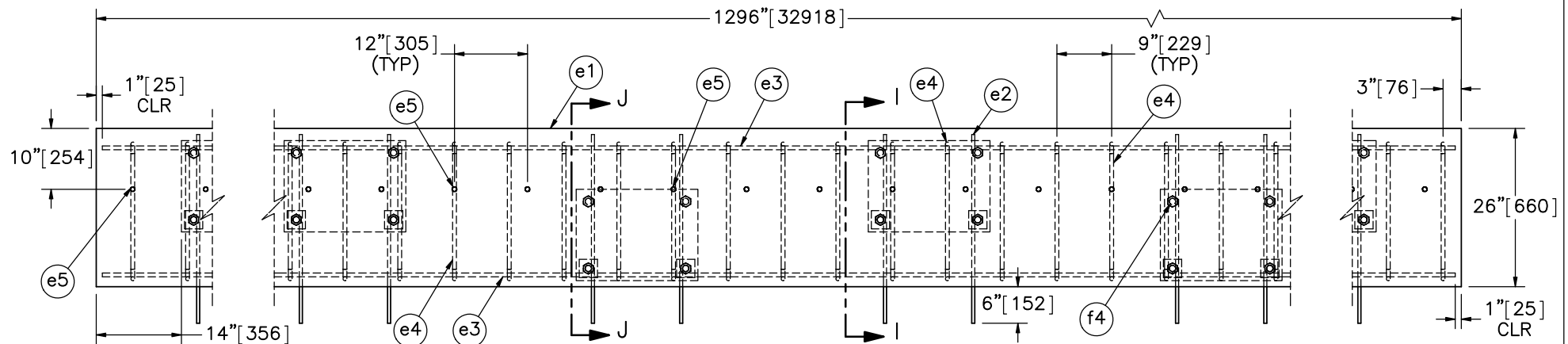
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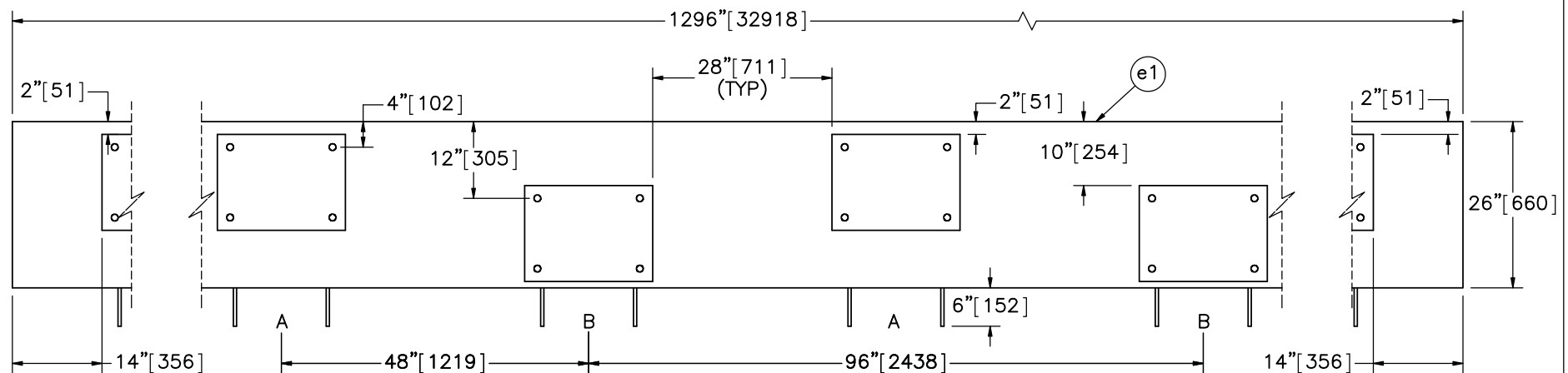
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	OH-IL Steel Tube Bridge		SHEET:
	Rail on Surrogate Slab		14 of 22
Midwest Roadside Safety Facility	Test No. STBR-3		DATE:
	Rail Components		1/11/2019
DWG. NAME:	SCALE: 1:22	REV. BY:	DRAWN BY:
STBR-3_R4	UNITS: in.[mm]	OP/JCH/JE	JEK/AJS



ELEVATION VIEW



BACKSIDE VIEW

- Notes: (1) Place vertical bar (part no. e2) driven 6" [152] into ground tangent to the threaded rods (part no. f4) at the attachment locations. For support of f4 rods during casting only.
 (2) Location A used for 1100C small car tests.
 (3) Location B used for 2270P pickup truck and 10000S SUT tests.
 (4) Internal reinforcement not shown on backside view.



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Test Slab Assembly Details

DWG. NAME.
STBR-3_R4

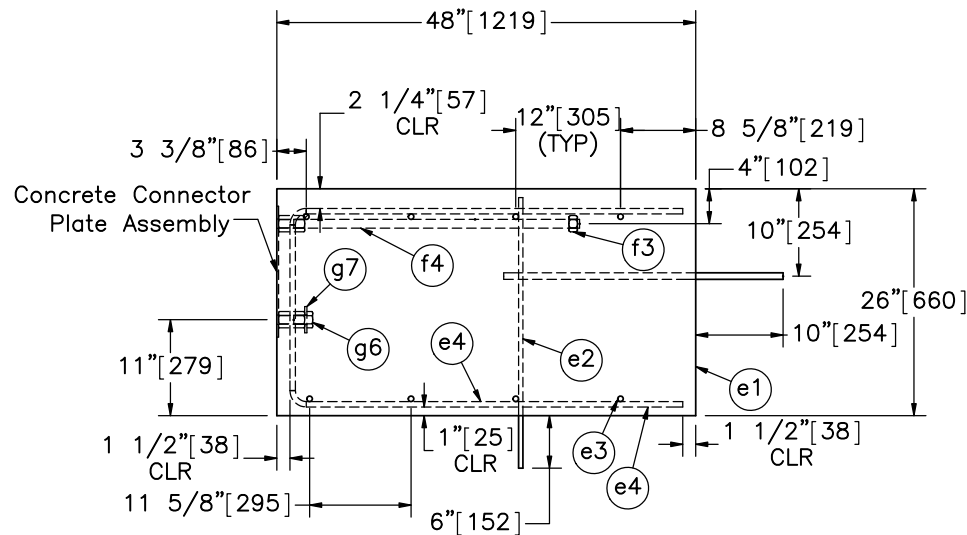
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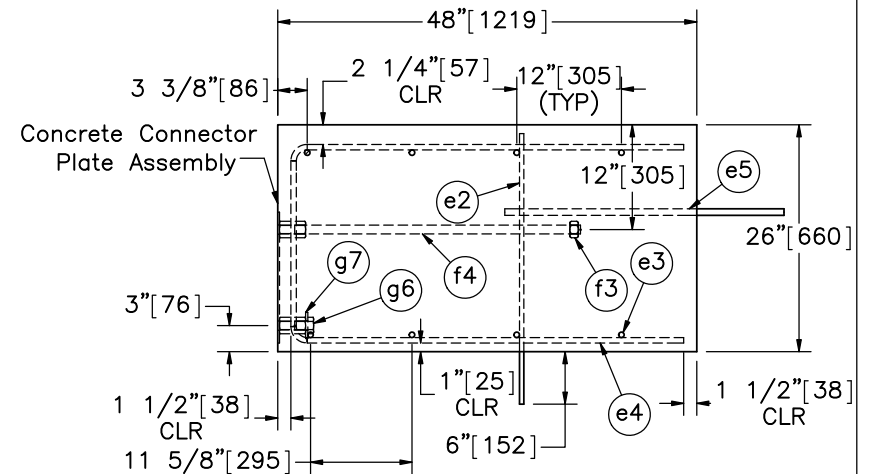
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1/11/2019

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SECTION I-I
LOCATION A ATTACHMENT



SECTION J-J
LOCATION B ATTACHMENT

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	1	Test Slab Assembly	—	—
e1	1	Concrete	Min. $f'_c = 4,000$ psi [27.6 MPa]	—
e2	54	#5 [16] Bar, 31" [787] Long	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)
e3	8	#5 [16] Bar, 1,294" [32,868] Long	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)
e4	144	#5 [16] Bar, 110 3/16" [2,799] Long Unbent	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)
e5	108	#6 [19] Bar, 32" [813] Long	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)
—	27	Concrete Connector Plate Assembly	—	ASTM A123
f3	54	1"—8 UNC [M24x3] Heavy Hex Nut	ASTM A563DH	ASTM A153 or B695 Class 55 or F2329
f4	54	1"—8 UNC [M24x3], 32 3/4" [832] Long Fully Threaded Anchor Rod	ASTM F1554 Gr. 105	ASTM A153 or B695 Class 55 or F2329
g6	54	1"—8 UNC [M24x3], 1 1/2" [38] Long Hex Head Bolt	ASTM A449	ASTM A153 or B695 Class 55 or F2329
g7	54	3"x3"x1/4" [76x76x6] Plate	ASTM A36	ASTM A123

- Notes: (1) Location A used for 1100C small car tests.
(2) Location B used for 2270P pickup truck and 10000 SUT tests.
(3) Place vertical bar (part no. e2) driven 6" [152] into ground tangent to the threaded rods (part no. f4) at the attachment locations. For support during casting.
(4) Part f4 is threaded 1 1/4" [32] into part f2 (coupling nut) on Concrete Connector Plate Assembly.



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Test Slab Assembly Details

DWG. NAME.
STBR-3_R4

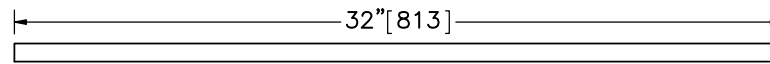
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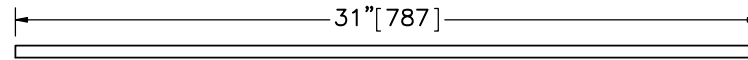
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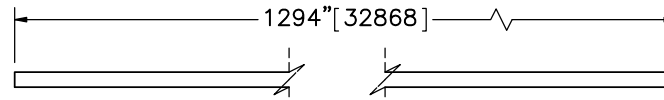
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JP/JCH/JE



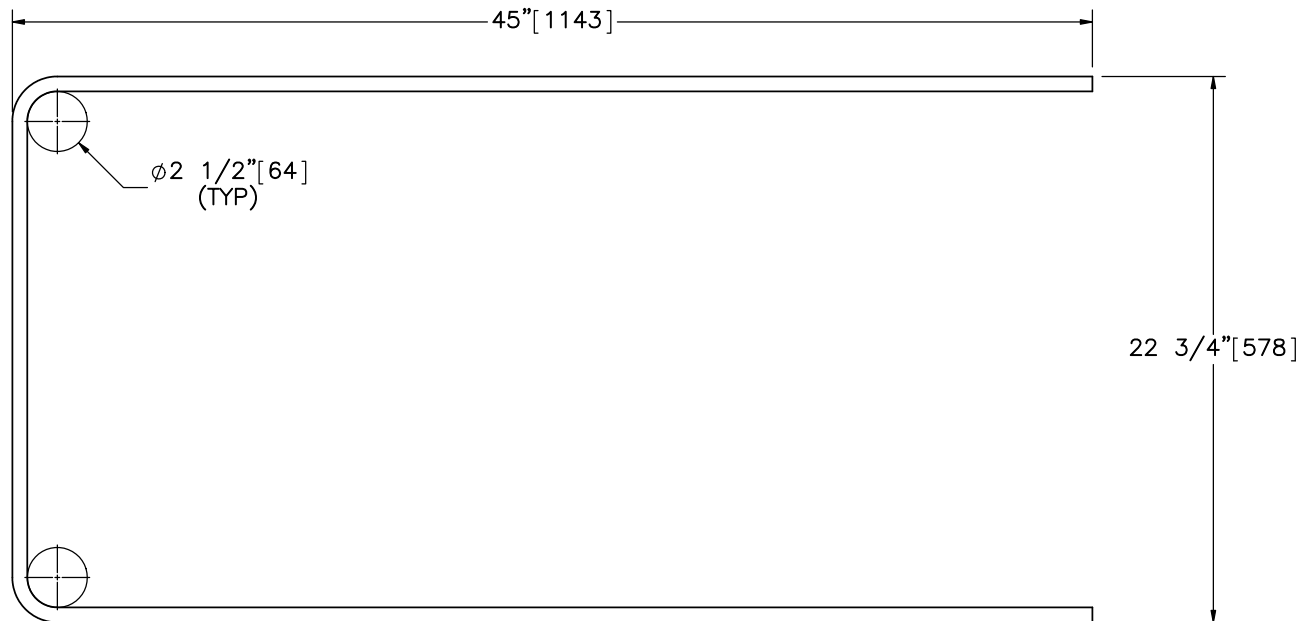
Part e5



Part e2



Part e3



Part e4

General Table

Bill of Bars

Bar	QTY.	Size	Total Unbent Length	Material Specification	Treatment Specification
e2	54	#5	31" [787]	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)
e3	8	#5	1294" [32868]	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)
e4	144	#5	110 3/16" [2799]	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)
e5	108	#6	32" [813]	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)

Note: (1) Minimum lap length for a #5 bar is 18" [457].



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Reinforcement Details

DWG. NAME.
STBR-3_R4

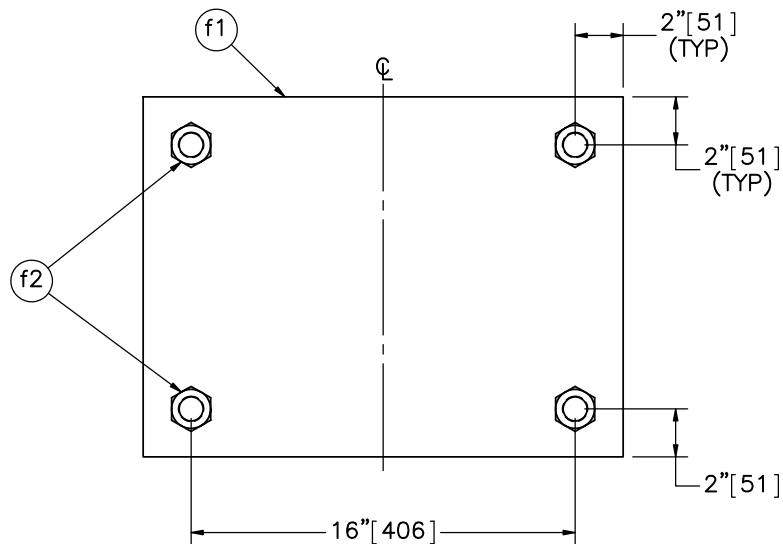
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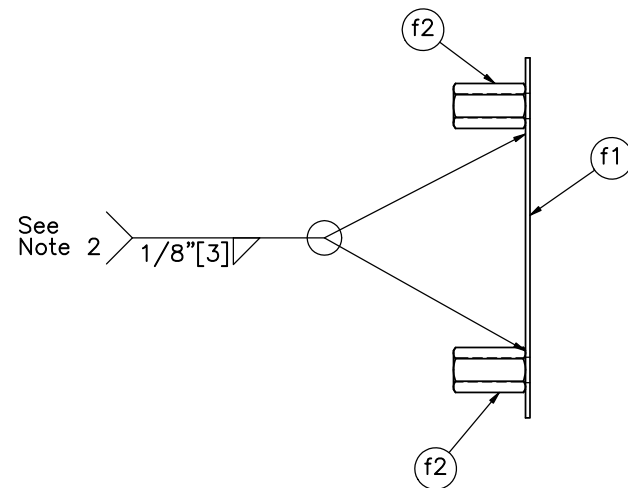
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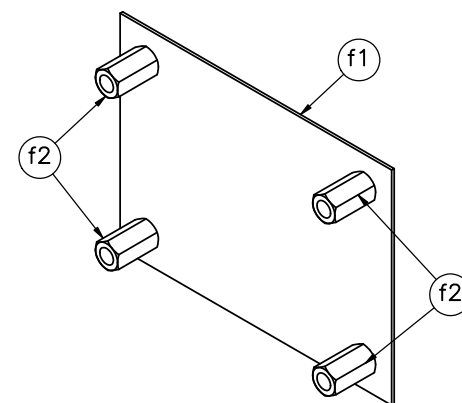
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K



ELEVATION VIEW



PROFILE VIEW



ISOMETRIC VIEW

- Notes: (1) Connector plate assembly is symmetric along the centerline.
 (2) During casting, the nuts may be held in place by extending bolts through the formwork into the nuts, or by tack welding nuts to inside face of the plate. The welds are not structurally important.

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
—	27	Concrete Connector Plate Assembly	—	ASTM A123	—
f1	1	20"x15"x3/16" [508x381x5] Steel Plate	ASTM A572 Gr. 50	See Assembly	—
f2	4	1"—8 UNC [M24x3] Heavy Hex Coupling Nut	ASTM A563DH	See Assembly	—



Midwest Roadside
Safety Facility

OH—IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR—3

Concrete Connector Plate
Assembly Details

DWG. NAME.
STBR—3_R4

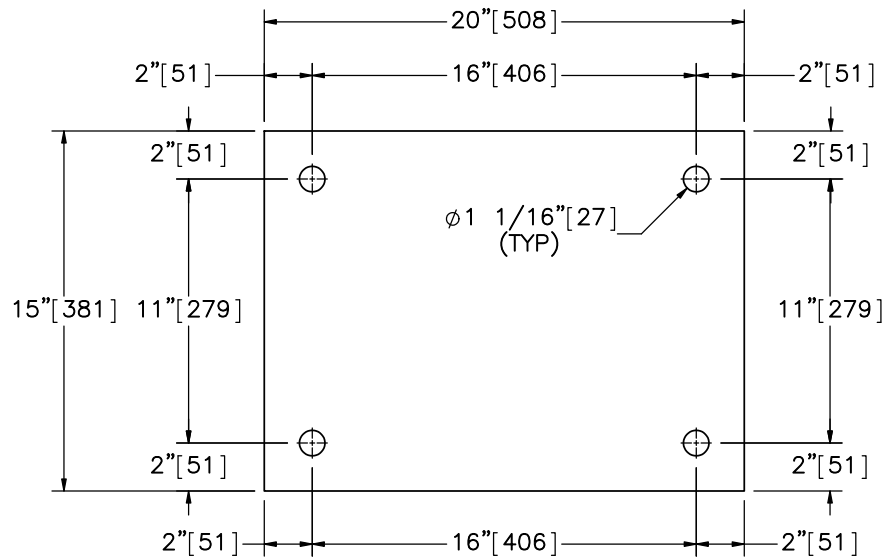
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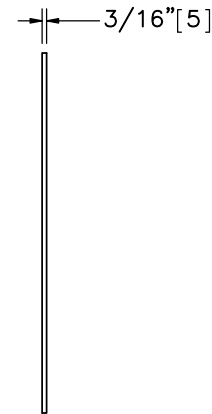
DRAWN BY:
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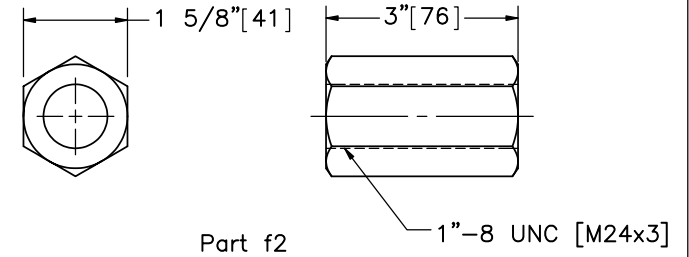


ELEVATION VIEW

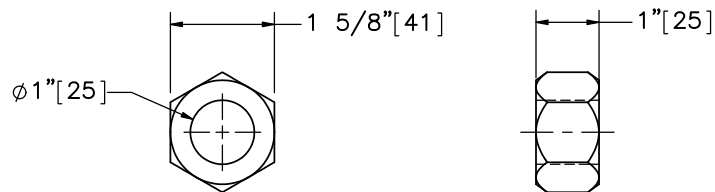
Part f1
SCALE 1:8



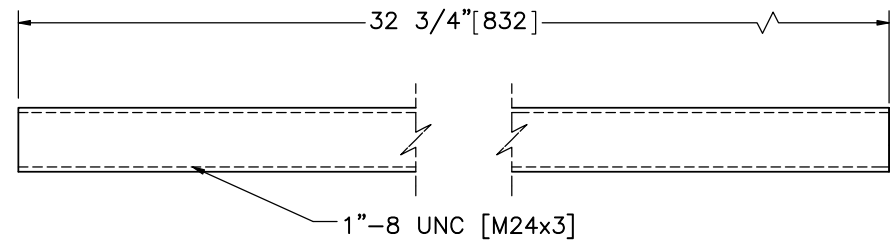
PROFILE VIEW



Part f2



Part f3



Part f4



Midwest Roadside
Safety Facility

OH-IL Steel Tube Bridge
Rail on Surrogate Slab
Test No. STBR-3

Test Slab Components

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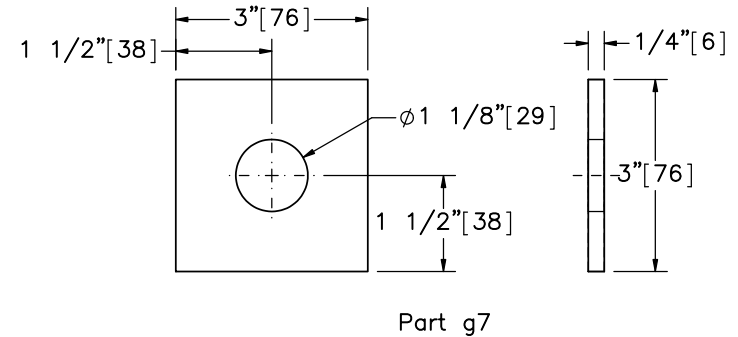
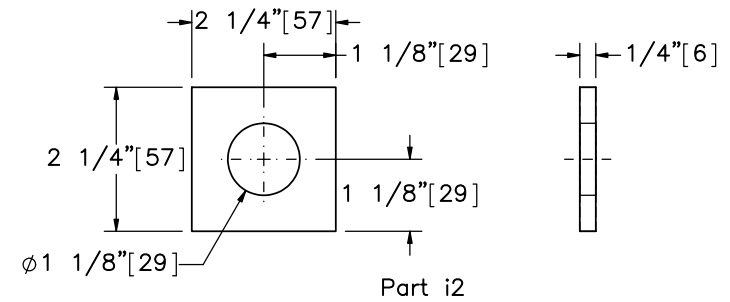
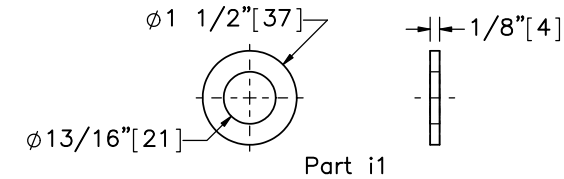
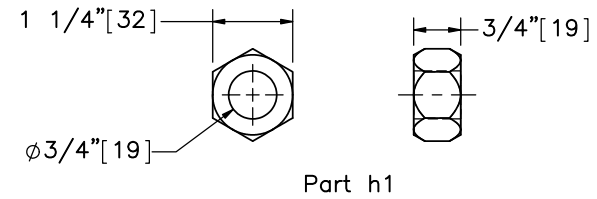
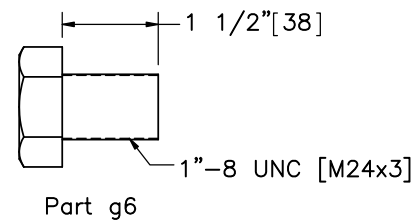
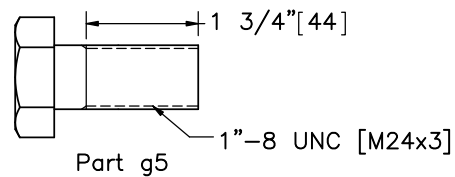
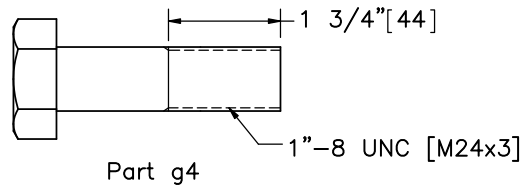
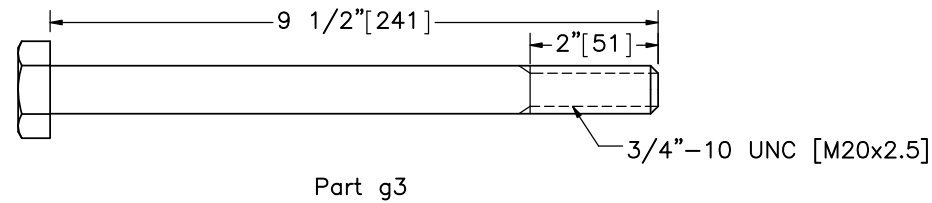
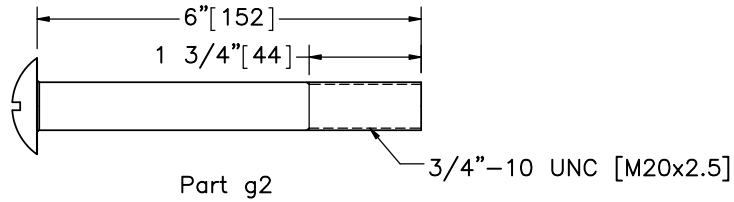
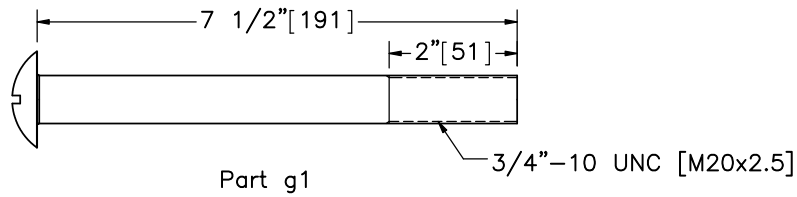
SCALE: 1:3
UNITS: in.[mm]

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Notes: (1) Round head bolts may have a flat head key in center region or key shapes in the heads.



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OH-IL Steel Tube Bridge
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Hardware

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Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
a1	14	W6x15 [W152x22], 53 1/2" [1,359] Long Post	ASTM A992	See Assembly	—
a2	14	8"x8"x3/8" [203x203x10] Plate	ASTM A572 Gr. 50	See Assembly	—
a3	14	13"x17 3/4"x1" [330x451x25] Post Plate with Slots for 1" [25] Bolts	ASTM A572 Gr. 50	See Assembly	—
a4	56	6 1/8"x5 11/16"x1/4" [156x144x6] Gusset Plate	ASTM A572 Gr. 50	See Assembly	—
a5	28	HSS 5"x4"x1/2" [127x102x13], 20" [508] Long with 1 1/8" [29] Holes	ASTM A500 Gr. C	ASTM A123	—
b1	12	30"x10 5/8"x5/16" [762x270x8] Plate	ASTM A572 Gr. 50	See Assembly	—
b2	12	30"x2 5/8"x3/8" [762x67x10] Plate	ASTM A572 Gr. 50	See Assembly	—
c1	24	30"x6 5/8"x3/8" [762x168x10] Plate	ASTM A572 Gr. 50	See Assembly	—
c2	24	30"x4 5/8"x5/16" [762x117x8] Plate	ASTM A572 Gr. 50	See Assembly	—
d1	14	HSS 8"x6"x1/4" [203x152x6], 191 1/4" [4,858] Long	ASTM A500 Gr. C	ASTM A123	—
d2	7	HSS 12"x4"x1/4" [305x102x6], 191 1/4" [4,858] Long	ASTM A500 Gr. C	ASTM A123	—
e1	1	Concrete	Min. f'c = 4,000 psi [27.6 MPa]	—	—
e2	54	#5 [16] Bar, 31" [787] Long	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)	—
e3	8	#5 [16] Bar, 1,294" [32,868] Long	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)	—
e4	144	#5 [16] Bar, 110 3/16" [2,799] Long Unbent	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)	—
e5	108	#6 [19] Bar, 32" [813] Long	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or ASTM A934)	—
f1	27	20"x15"x3/16" [508x381x5] Steel Plate	ASTM A572 Gr. 50	See Assembly	—
f2	108	1"—8 UNC [M24x3] Heavy Hex Coupling Nut	ASTM A563DH	See Assembly	—
f3	110	1"—8 UNC [M24x3] Heavy Hex Nut	ASTM A563DH	ASTM A153 or B695 Class 55 or F2329	FNX24b
f4	54	1"—8 UNC [M24x3], 32 3/4" [832] Long Fully Threaded Anchor Rod	ASTM F1554 Gr. 105	ASTM A153 or B695 Class 55 or F2329	FRR24b



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Rail on Surrogate Slab
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Bill of Materials

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Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
g1	56	3/4"-10 UNC [M20x2.5], 7 1/2" [191] Long Round Head Bolt	ASTM A449	ASTM A153 or B695 Class 55 or F2329	FBX20b
g2	80	3/4"-10 UNC [M20x2.5], 6" [152] Long Round Head Bolt	ASTM A449	ASTM A153 or B695 Class 55 or F2329	FBX20b
g3	48	3/4"-10 UNC [M20x2.5], 9 1/2" [241] Long Heavy Hex Head Bolt	ASTM F3125 Gr. A325 Type 1	ASTM A153 or B695 Class 55 or F2329	FBX20b
g4	56	1"-8 UNC [M24x3], 3 1/2" [89] Long Heavy Hex Head Bolt	ASTM F3125 Gr. A325 Type 1	ASTM A153 or B695 Class 55 or F1136 Gr. 3 or F2329 or F2833 Gr. 1	FBX24b
g5	56	1"-8 UNC [M24x3], 2 1/4" [57] Long Heavy Hex Head Bolt	ASTM F3125 Gr. A325 Type 1	ASTM A153 or B695 Class 55 or F1136 Gr. 3 or F2329 or F2833 Gr. 1	FBX24b
g6	54	1"-8 UNC [M24x3], 1 1/2" [38] Long Hex Head Bolt	ASTM A449	ASTM A153 or B695 Class 55 or F2329	FBX24b
g7	54	3"x3"x1/4" [76x76x6] Plate	ASTM A36	ASTM A123	—
h1	184	3/4 -10 UNC [M20x2.5] Heavy Hex Nut	ASTM A563DH	ASTM A153 or B695 Class 55 or F2329	FNX20b
i1	232	3/4" [19] Dia. Hardened Flat Washer	ASTM F436	ASTM A153 or B695 Class 55 or F1136 Gr. 3 or F2329	FWC20b
i2	168	2 1/4"x2 1/4"x1/4" [57x57x6] Square Washer	ASTM A36	ASTM A123	—



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REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
0	10/18/2018	–	Drawing created from STBR-1_R14.	–	JEK
1	11/12/2018	8	Part a1, a2 edit.	OP/JCH	JEK
		14	Part d1, d2 edit.		
		17	Bar size edit (e2).		
		BOM	Description: e2. Treatment: e2-5.		
2	12/3/2018	17	Note added.	JCH	AJS
3	1/7/2019	10	Note add.	OP	JEK
		12	Note add.		
4	1/11/2019	10	Note edit	JEK	AJS
		12	Note edit		