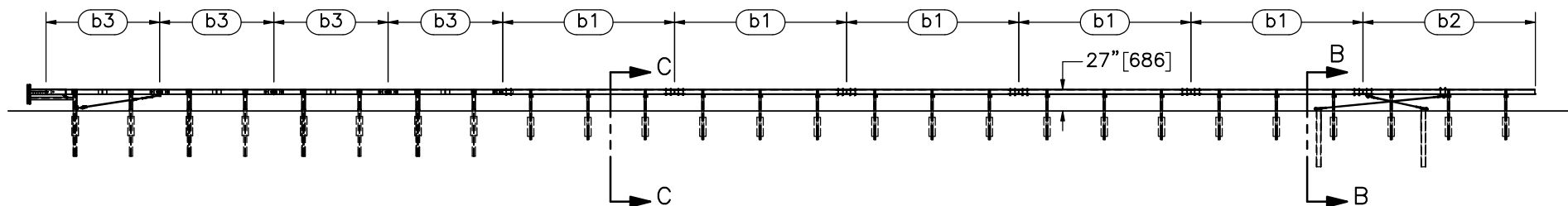
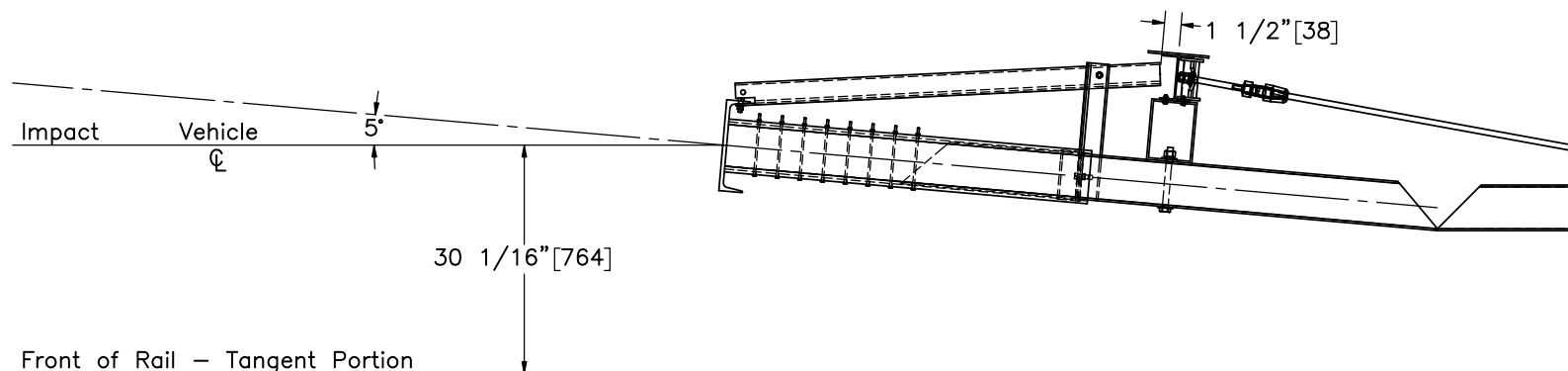


PLAN VIEW



ELEVATION VIEW



DETAIL A
SCALE 1:25

- Notes: (1) Test shall be performed according to test designation no. 3-31 of MASH criteria.
 (2) The impact location is the centerline of the vehicle impacting at 0° to the tangent system at the centerline of the rail at impact face.
 (3) Critical region is between post nos. 1 and 12.
 (4) Anchor posts are placed in $\phi 3'$ [914] holes, then backfilled and tamped with soil.



Midwest Roadside
Safety Facility

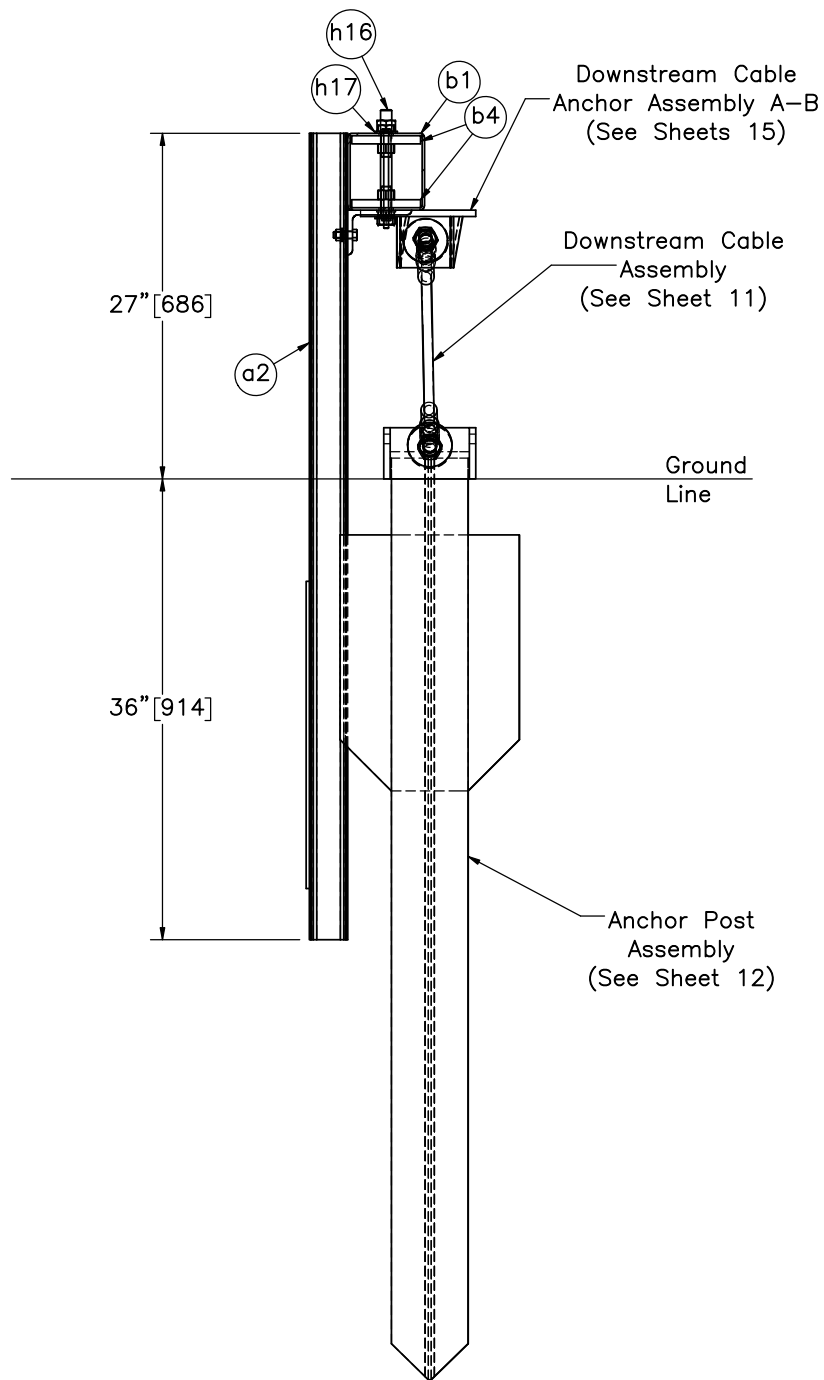
NY "Zig Zag" Box Beam
End Terminal

System Layout

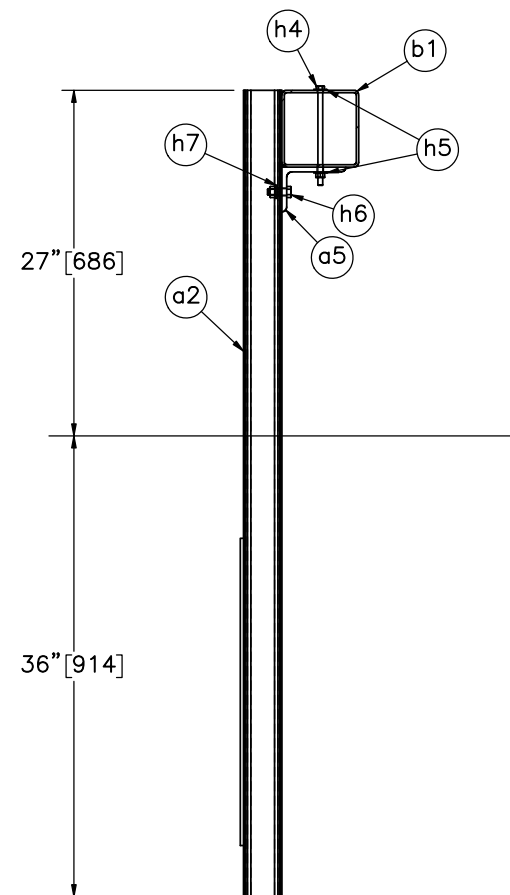
DWG. NAME.
NYBoxRail_R15

SCALE: 1:200
UNITS: in.[mm]

SHEET:
1 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



SECTION B-B

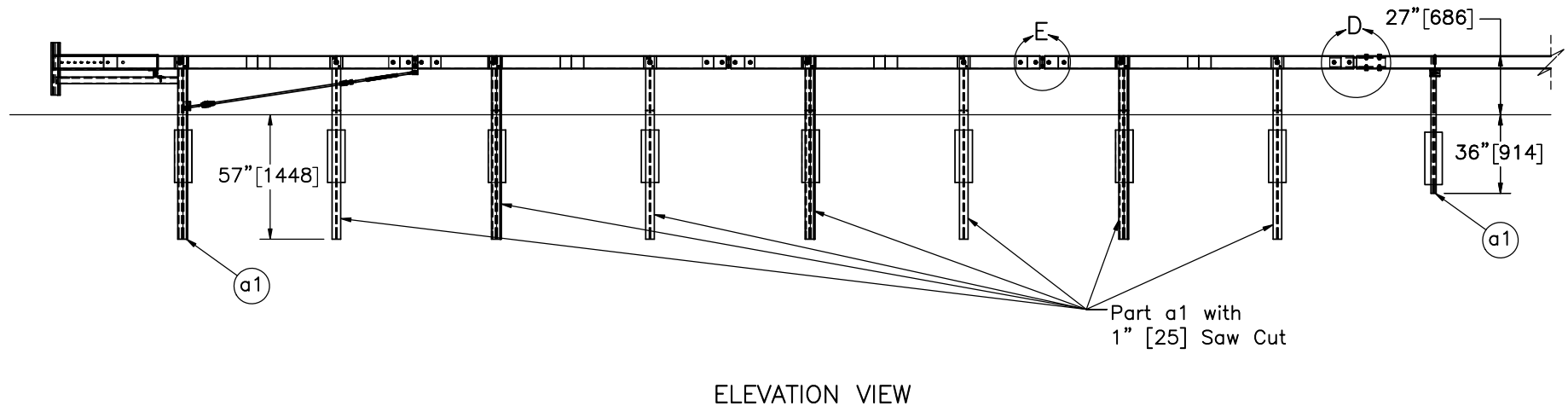
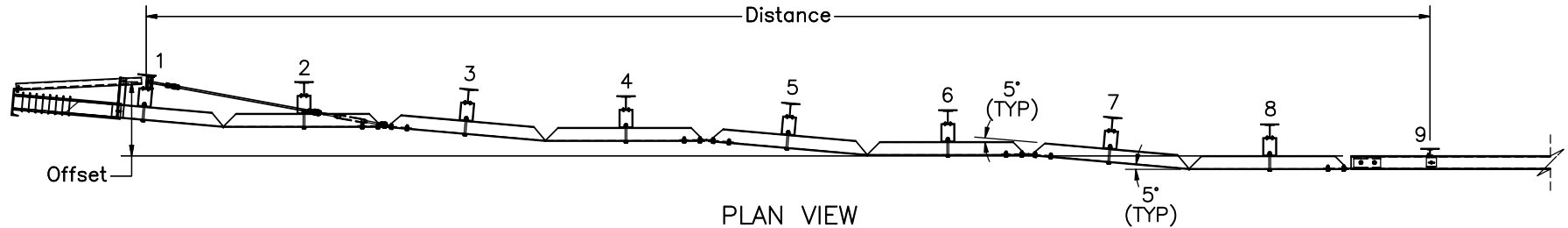


SECTION C-C

	NY "Zig Zag" Box Beam End Terminal		SHEET: 2 of 30
	Post Sections		DATE: 10/24/2019
Midwest Roadside Safety Facility	DWG. NAME: NYBoxRail_R15		DRAWN BY: JEK/GRL/ JRD
	SCALE: 1:15 UNITS: in.[mm]		REV. BY: TJD/KAL/ JCH/ELU

Post No.	Distance	Offset
1	47'-9 1/8"	2'-8 7/8"
2	41'-10 11/16"	2'-5 3/4"
3	35'-9 3/8"	2'-2 9/16"
4	29'-11"	1'-11 1/2"
5	23'-9 11/16"	1'-8 5/16"
6	17'-11 1/4"	1'-5 1/4"
7	11'-10"	1'-2"
8	5'-11 9/16"	10 15/16"

- (1) Origin is the middle of the roadside flange of post no. 9.
- (2) Distance is measured along the tangent to the run of rail at post no. 9.
- (3) Offset is measured from the above tangent to the center of post nos. 1-8.
- (4) Post nos. 1, 3, 5, and 7 to be rotated 5° in plan.



NY "Zig Zag" Box Beam
End Terminal

End Assembly

DWG. NAME.
NYBoxRail_R15

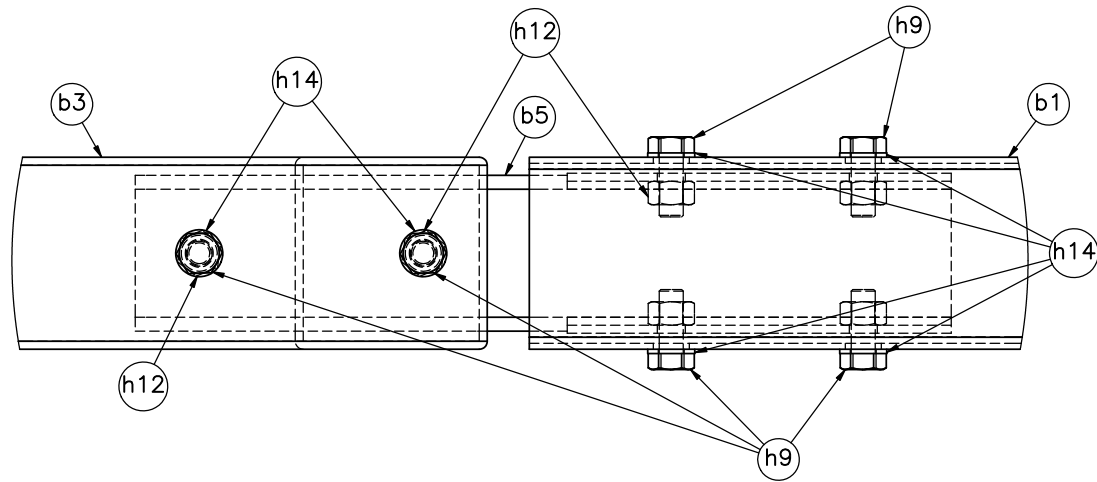
SCALE: 1:75
UNITS: in.[mm]

SHEET:
3 of 30

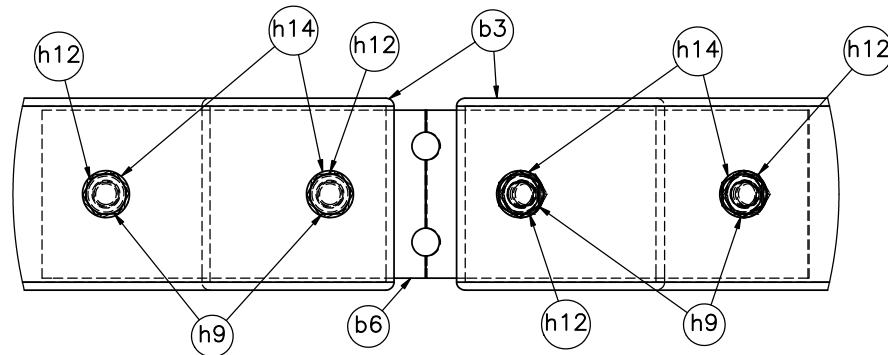
DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

REV. BY:
TJD/KAL/
JCH/ELU



DETAIL D



DETAIL E



Midwest Roadside
Safety Facility

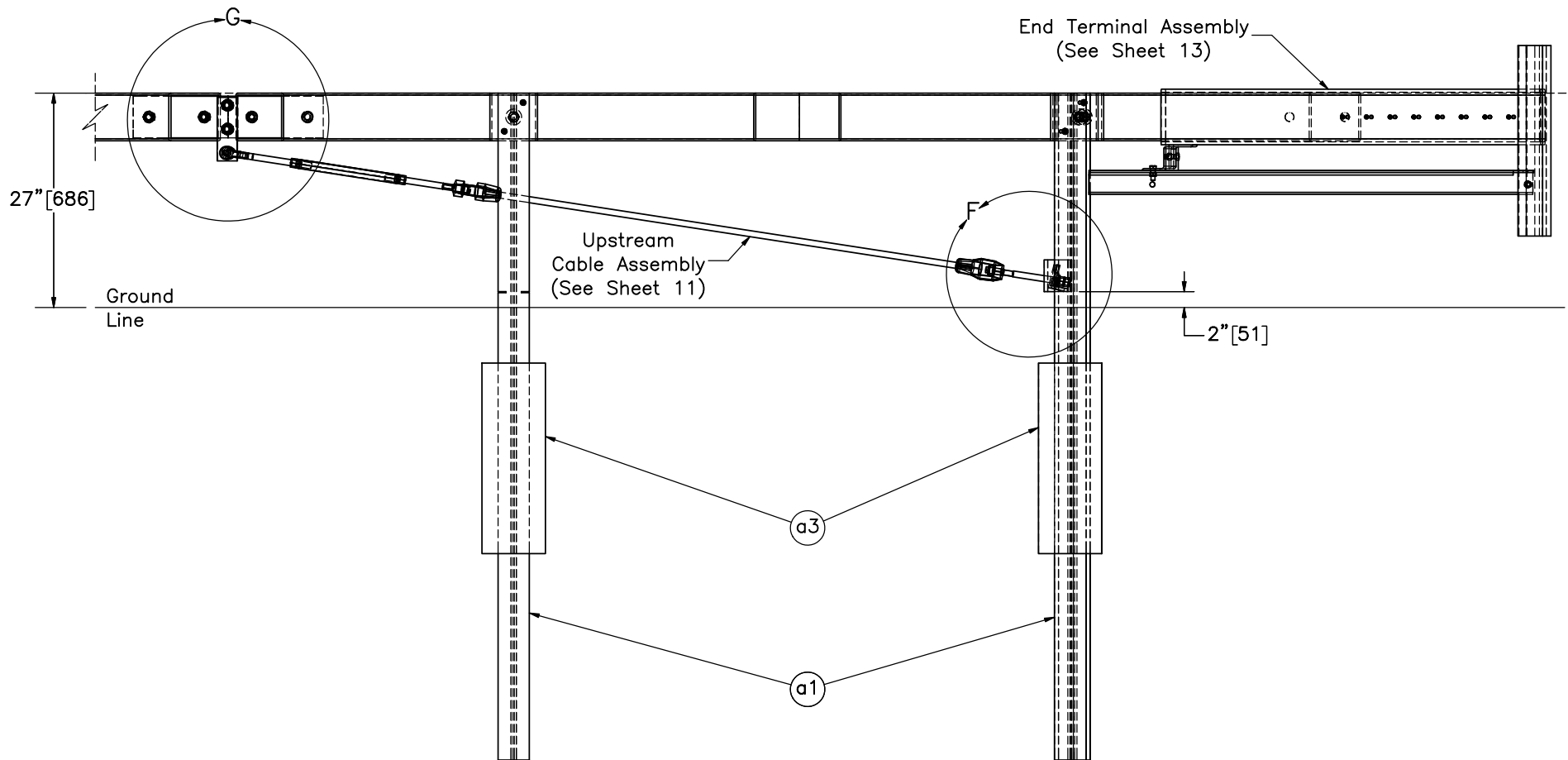
NY "Zig Zag" Box Beam
End Terminal

Splice Details

DWG. NAME.
NYBoxRail_R15

SCALE: 1:6
UNITS: in./mm

SHEET:
4 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



Upstream End Terminal
(BACK SIDE VIEW)



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Upstream End Details

DWG. NAME.
NYBoxRail_R15

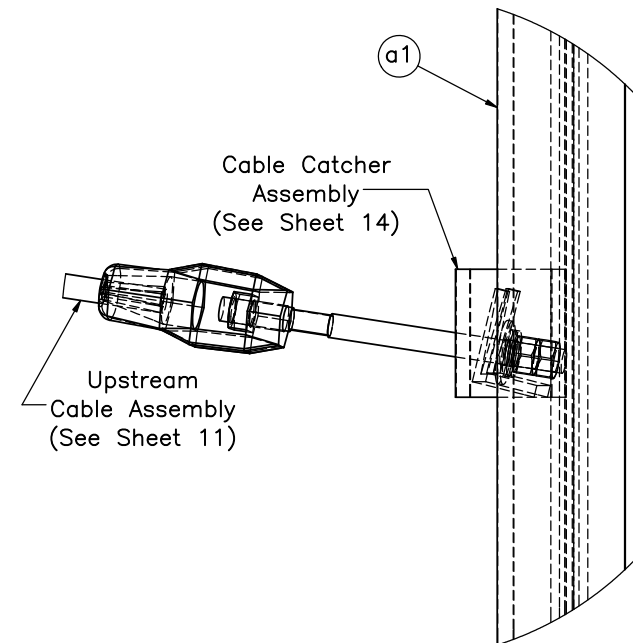
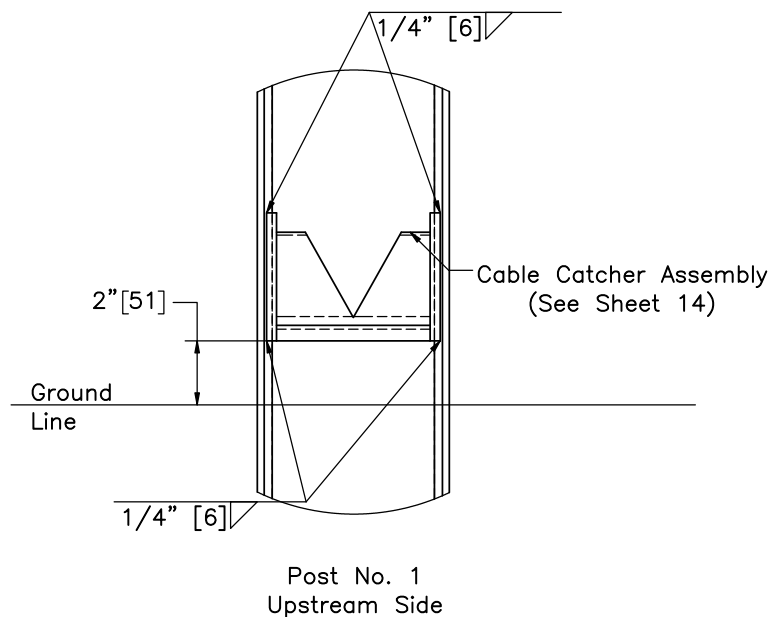
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UNITS: in.[mm]

SHEET:
5 of 30

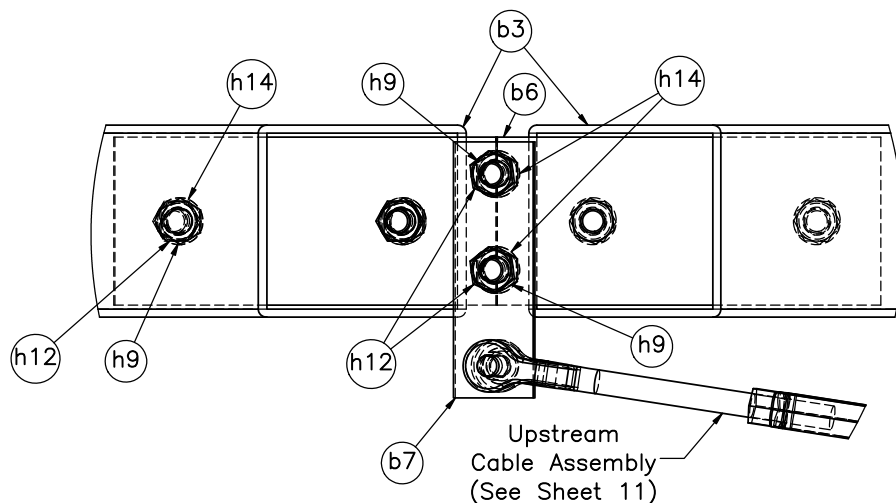
DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

REV. BY:
TJD/KAL/
JCH/ELU



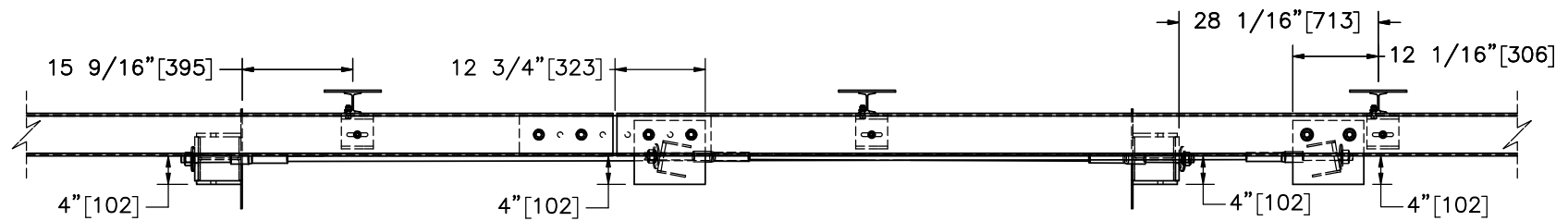
DETAIL F



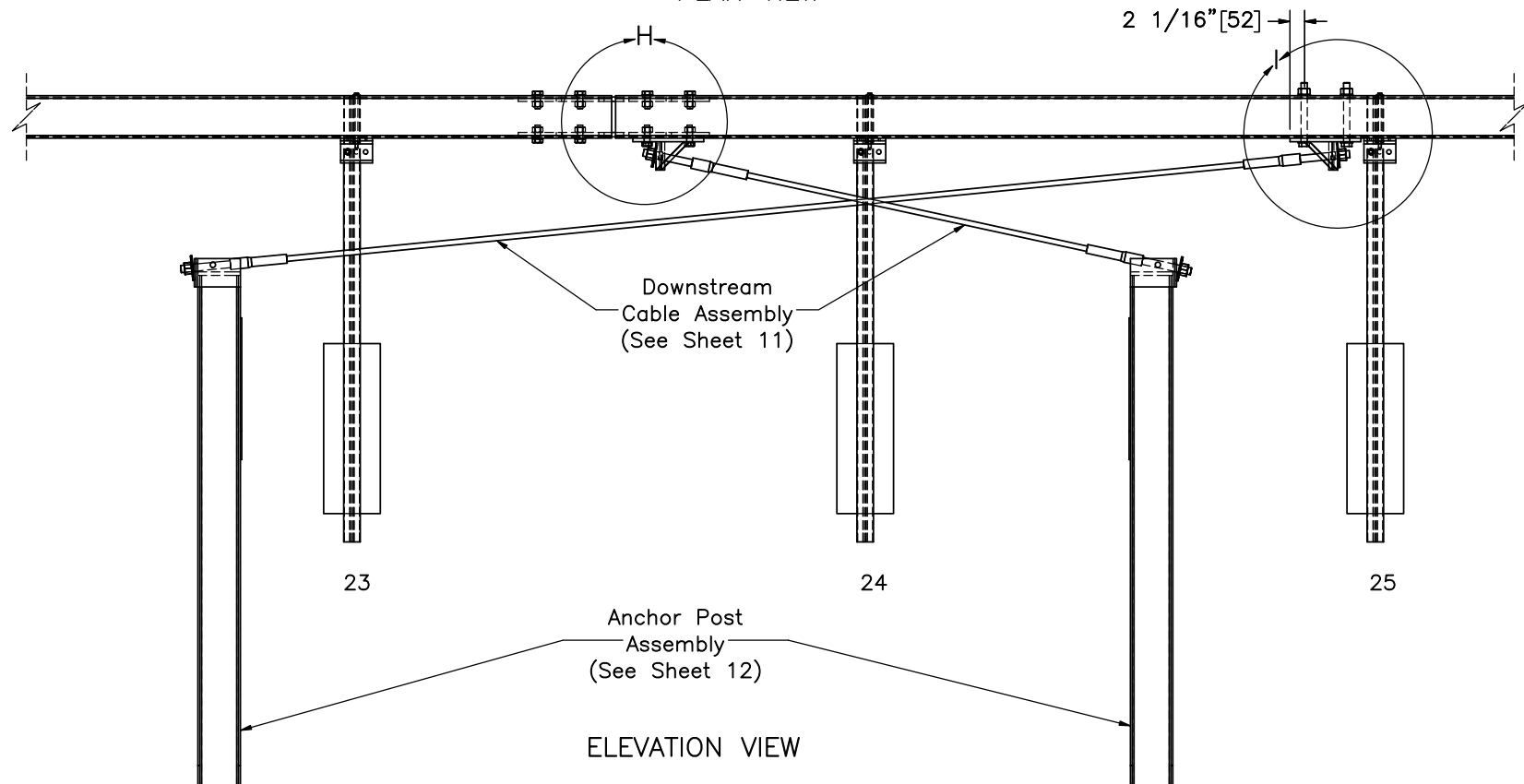
DETAIL G

Note: Keel plate (part b7) is attached on the backside of the furthest upstream splice plate (part b6).

	NY "Zig Zag" Box Beam End Terminal		SHEET: 6 of 30
	Upstream Anchor Cable Mounting		DATE: 10/24/2019
Midwest Roadside Safety Facility	DWG. NAME: NYBoxRail_R15		DRAWN BY: JEK/GRL/ JRD
	SCALE: 1:6 UNITS: in.[mm]		REV. BY: TJD/KAL/ JCH/ELU



PLAN VIEW



ELEVATION VIEW

Note: (1) Talked with Dave Charroin about anchors. He said they were not installed differently.



Midwest Roadside
Safety Facility

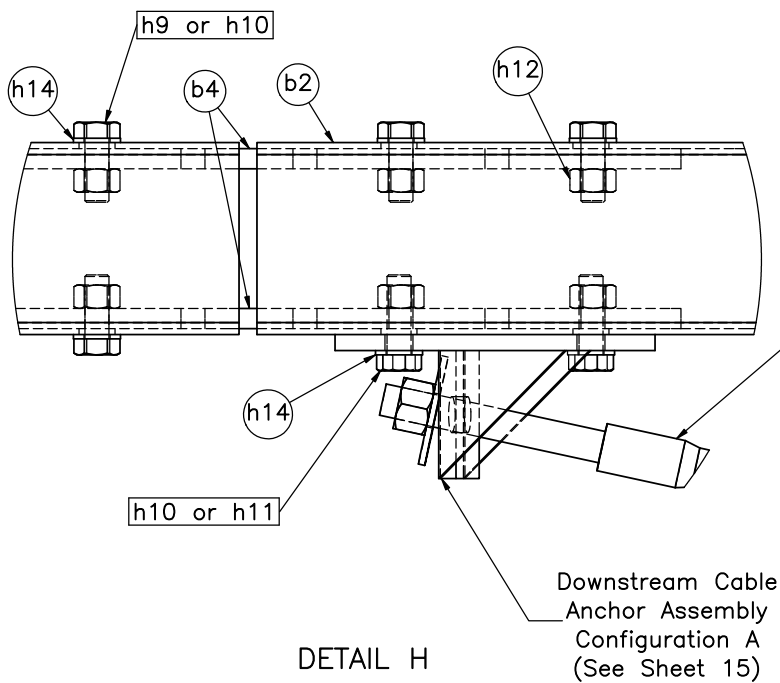
NY "Zig Zag" Box Beam
End Terminal

Downstream Anchor Details

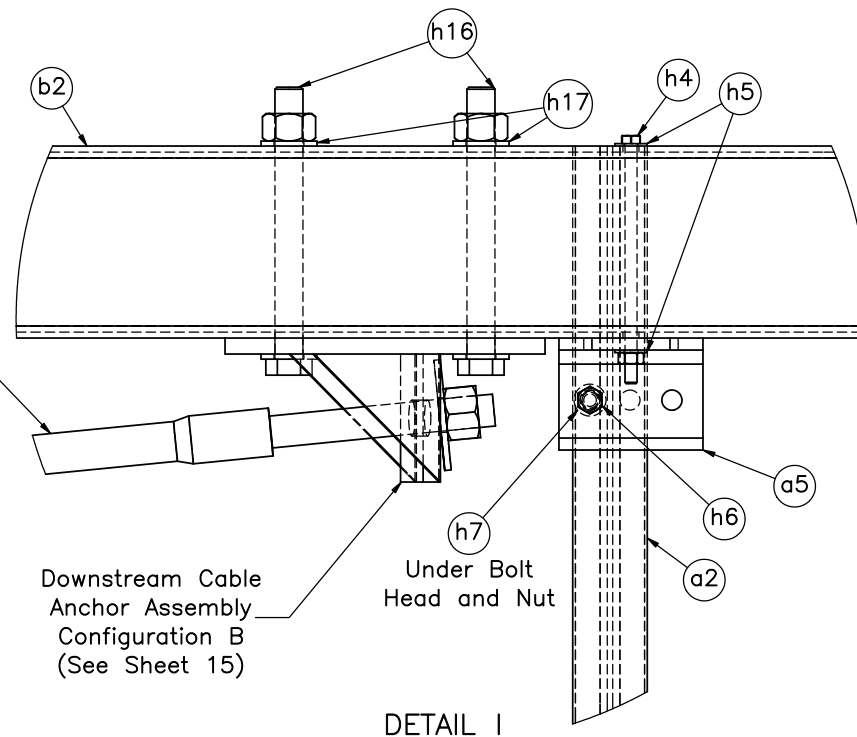
DWG. NAME.
NYBoxRail_R15

SCALE: 1:25
UNITS: in./mm

SHEET:
7 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



Downstream Cable Assembly
(See Sheet 11)



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Downstream Anchor Mounting
Details

DWG. NAME.
NYBoxRail_R15

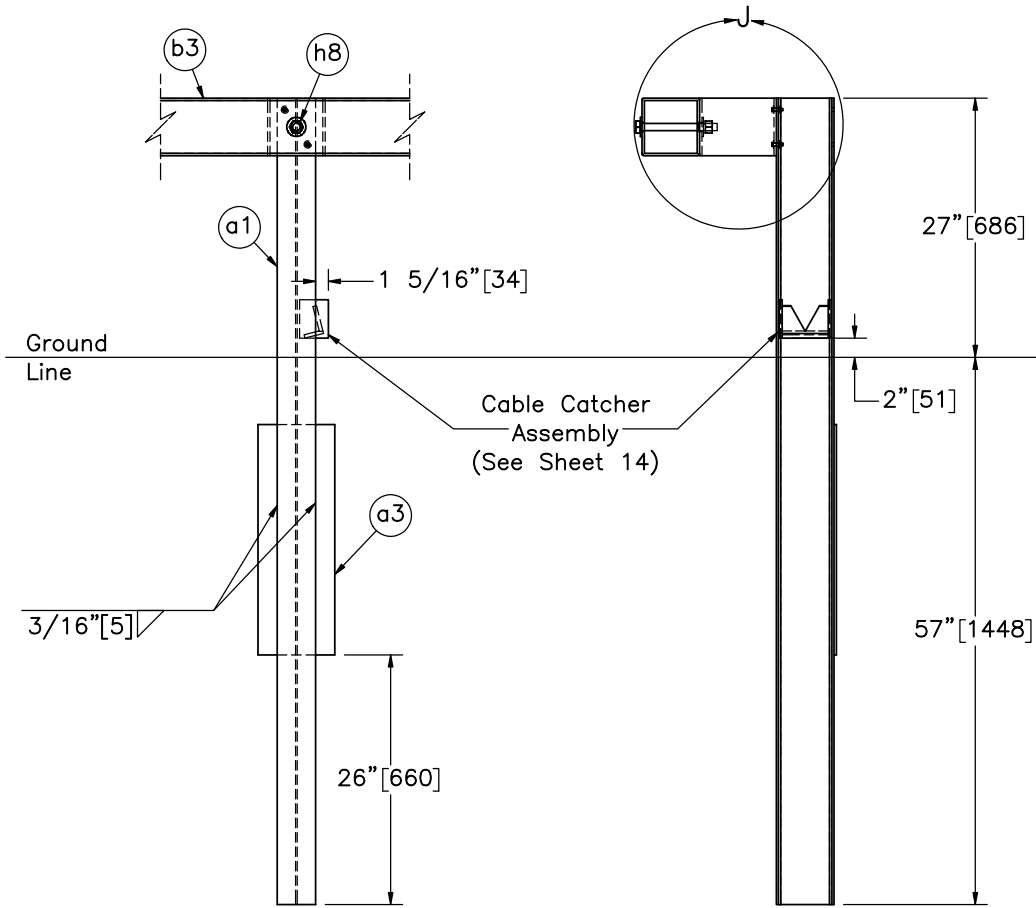
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SHEET:
8 of 30

DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

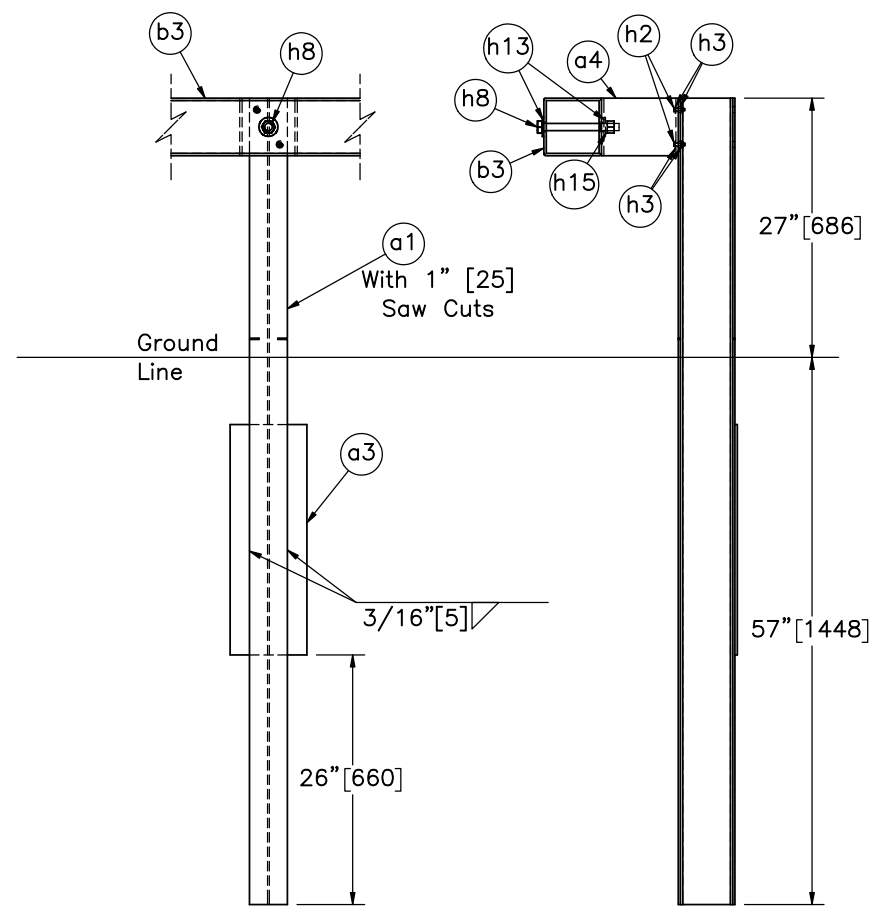
REV. BY:
TJD/KAL/
JCH/ELU



ELEVATION VIEW

PROFILE VIEW

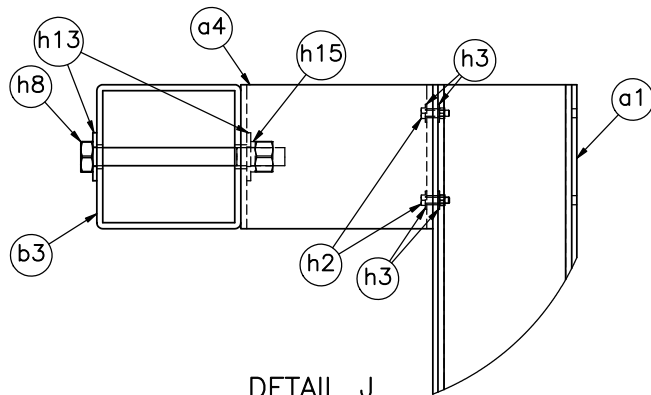
Post No. 1 Assembly



ELEVATION VIEW

PROFILE VIEW

Post Nos. 2-8 Assembly



DETAIL J
SCALE 1:8



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Post Assembly Details

DWG. NAME.
NYBoxRail_R15

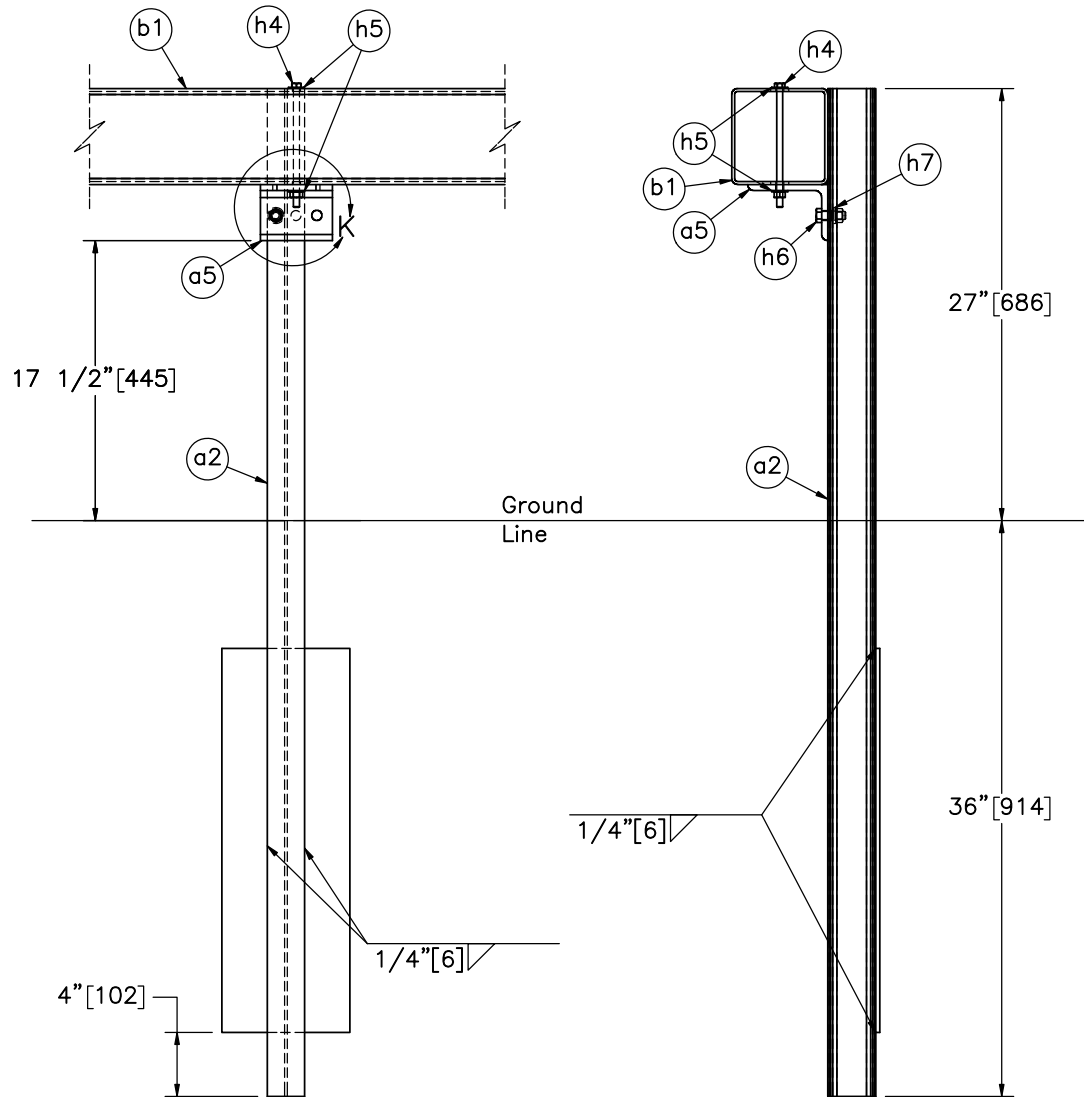
SCALE: 1:20
UNITS: in./mm

SHEET:
9 of 30

DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

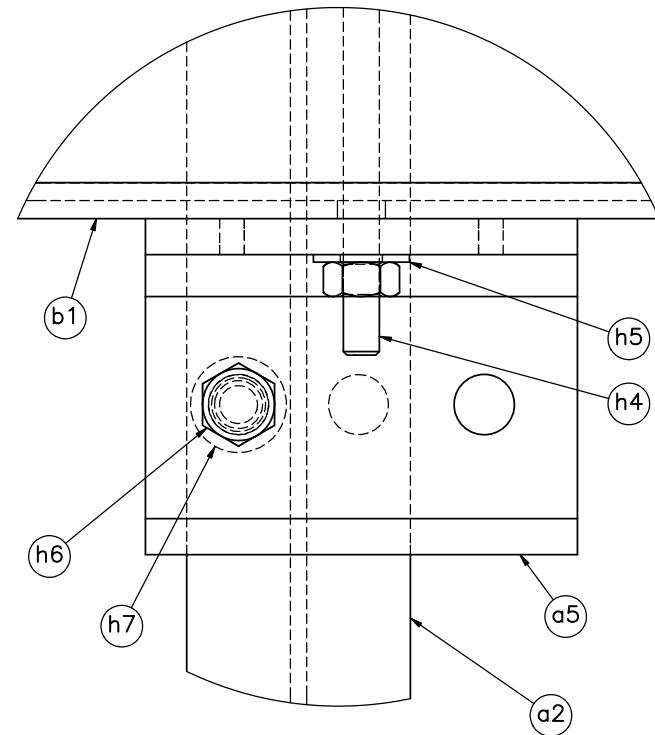
REV. BY:
TJD/KAL/
JCH/ELU



ELEVATION VIEW

PROFILE VIEW

Post Nos. 9-26 Assembly



DETAIL K
SCALE 1:2



Midwest Roadside
Safety Facility

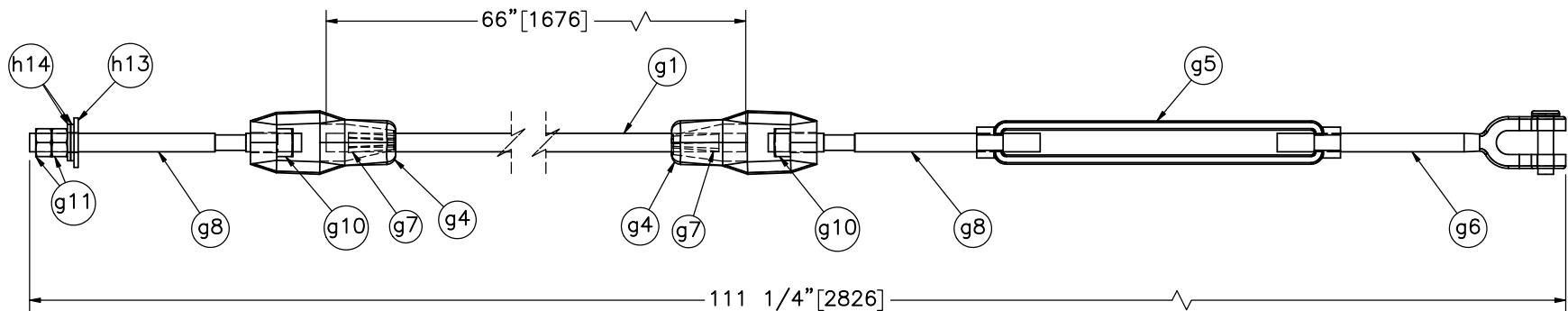
NY "Zig Zag" Box Beam
End Terminal

Post Assembly Details

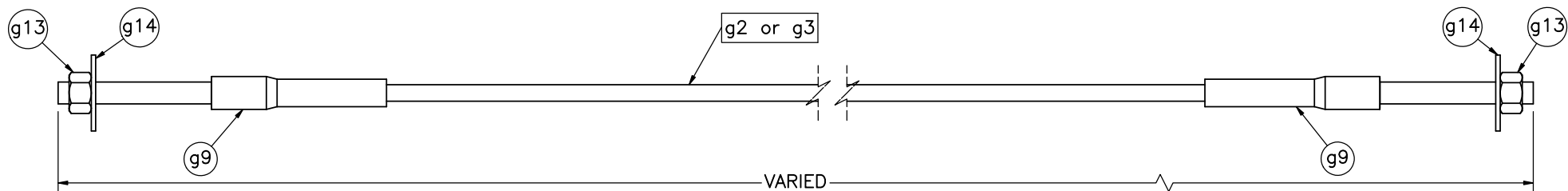
DWG. NAME.
NYBoxRail_R15

SCALE: 1:12
UNITS: in.[mm]

SHEET:
10 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



Upstream Anchor Cable Assembly



Downstream Cable Assemblies

Note: Total lengths of the two cable assemblies on the downstream end are 77 1/16" [1,957] and 166 11/16" [4234].



Midwest Roadside
Safety Facility

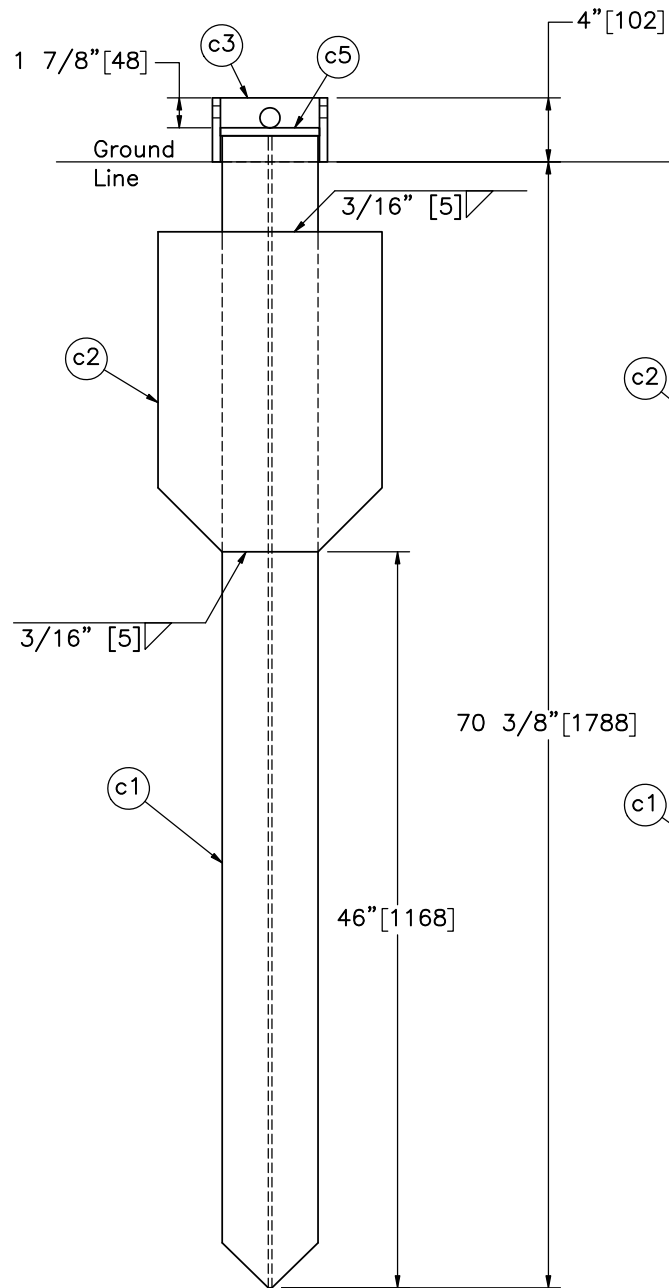
NY "Zig Zag" Box Beam
End Terminal

Anchor Cable Details

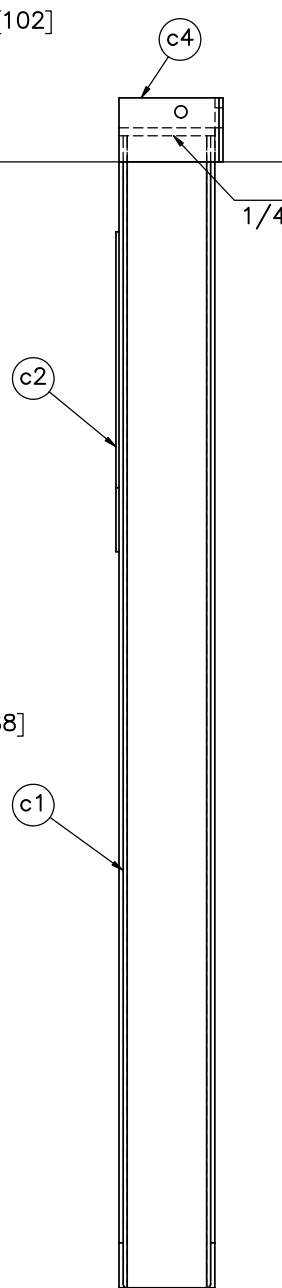
DWG. NAME:
NYBoxRail_R15

SCALE: 1:7
UNITS: in.[mm]

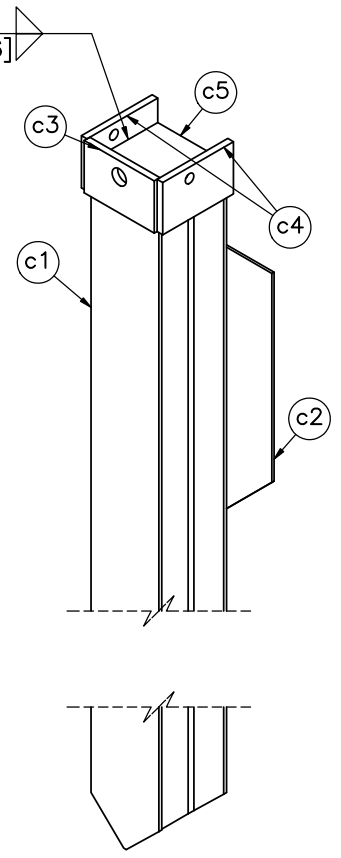
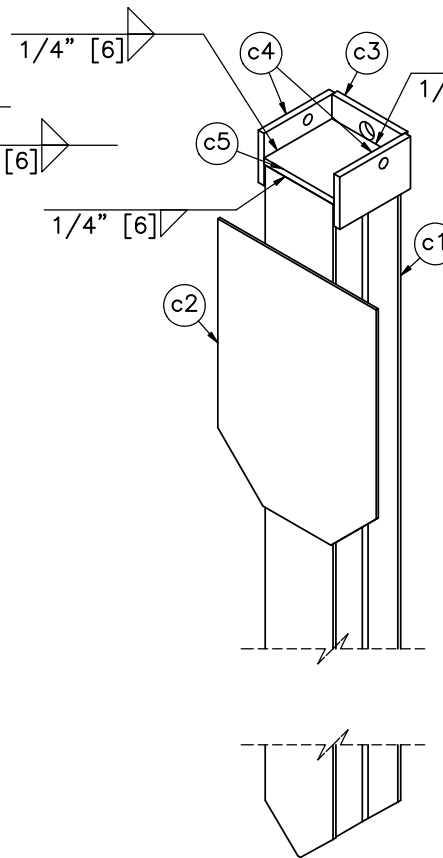
SHEET:
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DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



ELEVATION VIEW



PROFILE VIEW



ISOMETRIC VIEWS



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Anchor Post Assembly

DWG. NAME.
NYBoxRail_R15

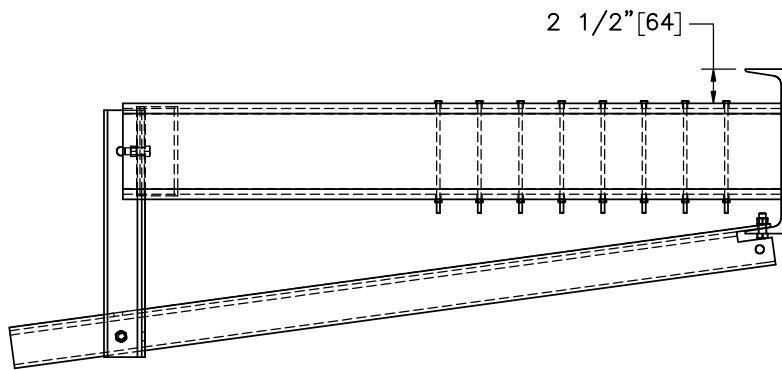
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SHEET:
12 of 30

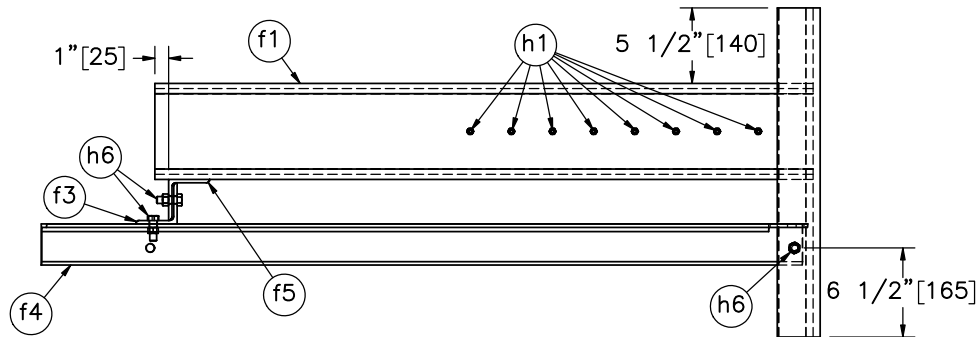
DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

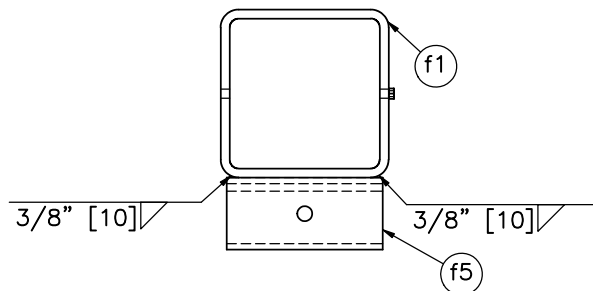
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TJD/KAL/
JCH/ELU



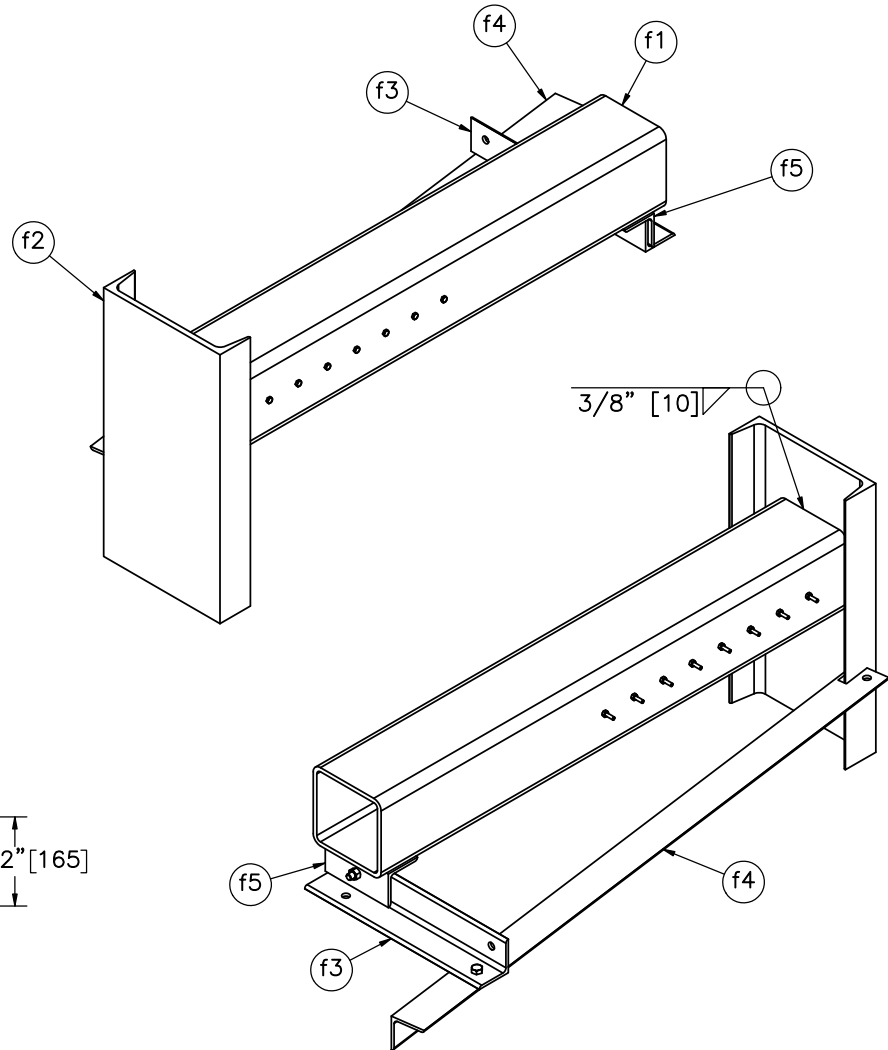
PLAN VIEW



ELEVATION VIEW
BACK SIDE



PROFILE VIEW
SCALE 1:8



ISOMETRIC VIEWS



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Upstream End Terminal
Assembly

DWG. NAME:
NYBoxRail_R15

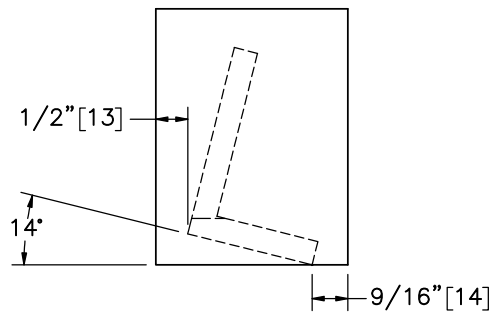
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UNITS: in.[mm]

SHEET:
13 of 30

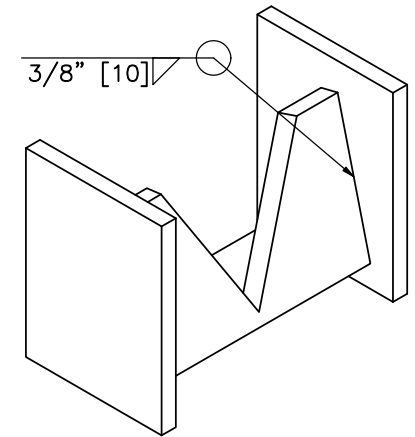
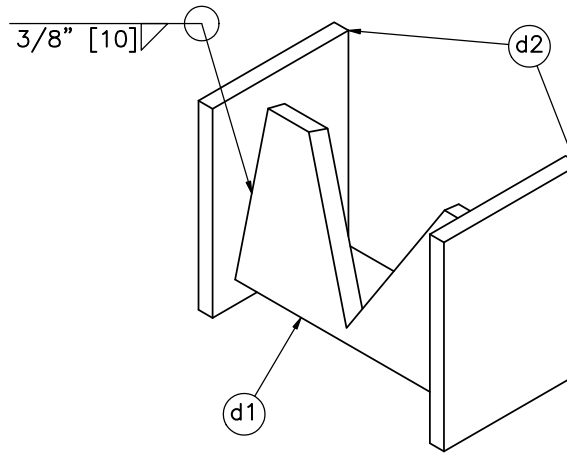
DATE:
10/24/2019

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JEK/GRL/
JRD

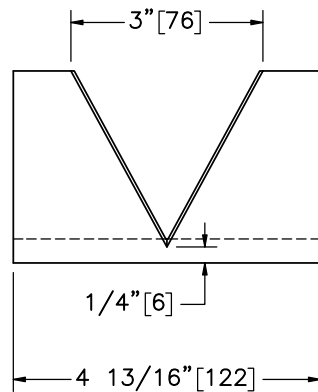
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TJD/KAL/
JCH/ELU



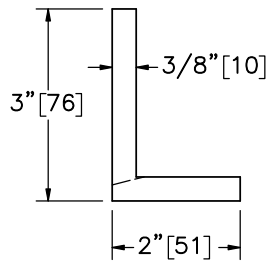
ELEVATION VIEW
Cable Catcher Assembly



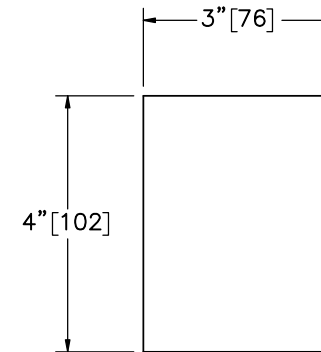
ISOMETRIC VIEWS



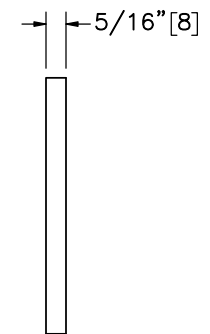
ELEVATION VIEW



PROFILE VIEW



ELEVATION VIEW



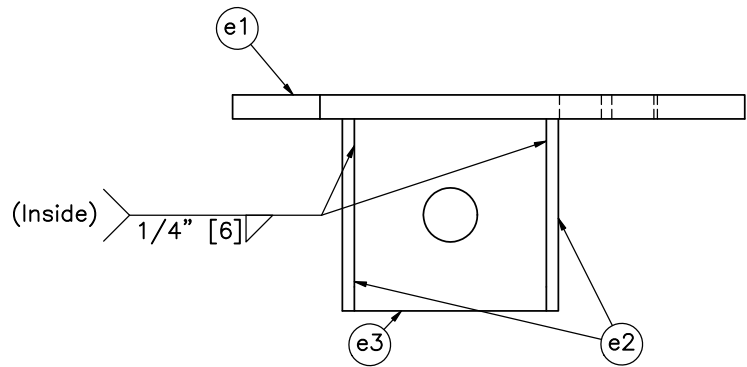
PROFILE VIEW

Part d2

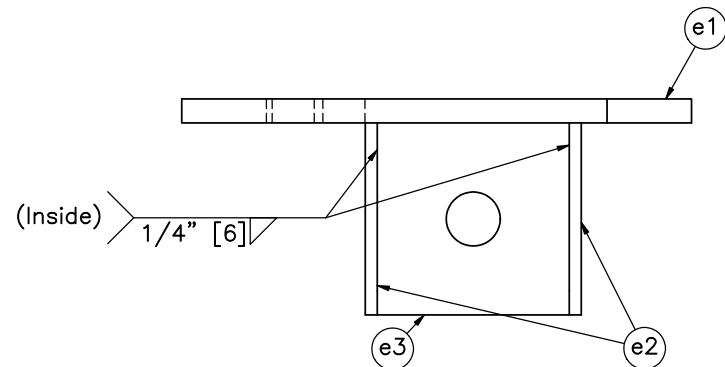
Part d1

Note: The Cable Catcher Assembly is welded to the downstream side of post no. 1.

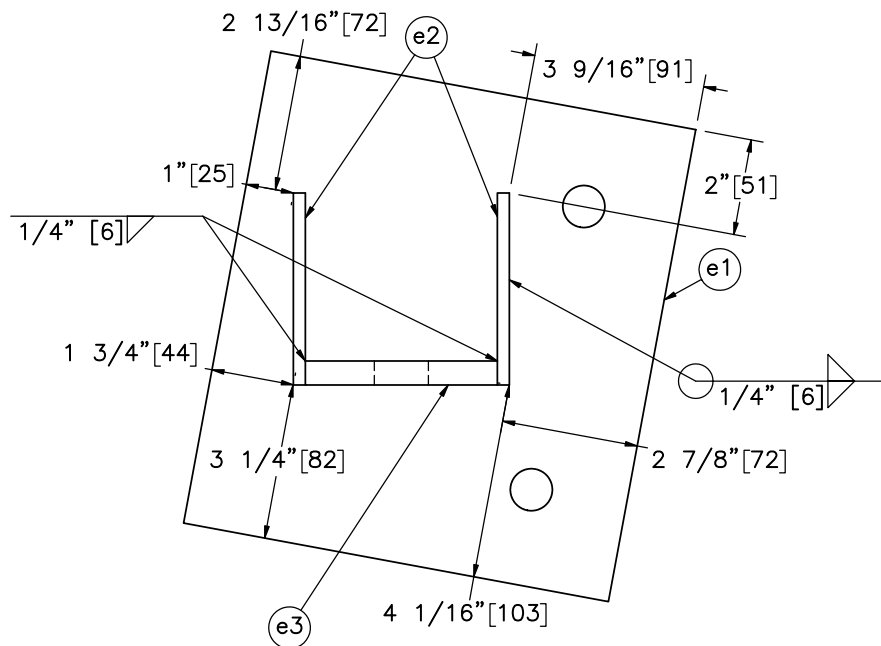
	NY "Zig Zag" Box Beam End Terminal		SHEET: 14 of 30
	Cable Catcher Assembly Details		DATE: 10/24/2019
Midwest Roadside Safety Facility	DWG. NAME: NYBoxRail_R15		DRAWN BY: JEK/GRL/ JRD
	SCALE: 1:3 UNITS: in.[mm]		REV. BY: TJD/KAL/ JCH/ELU



ELEVATION VIEW

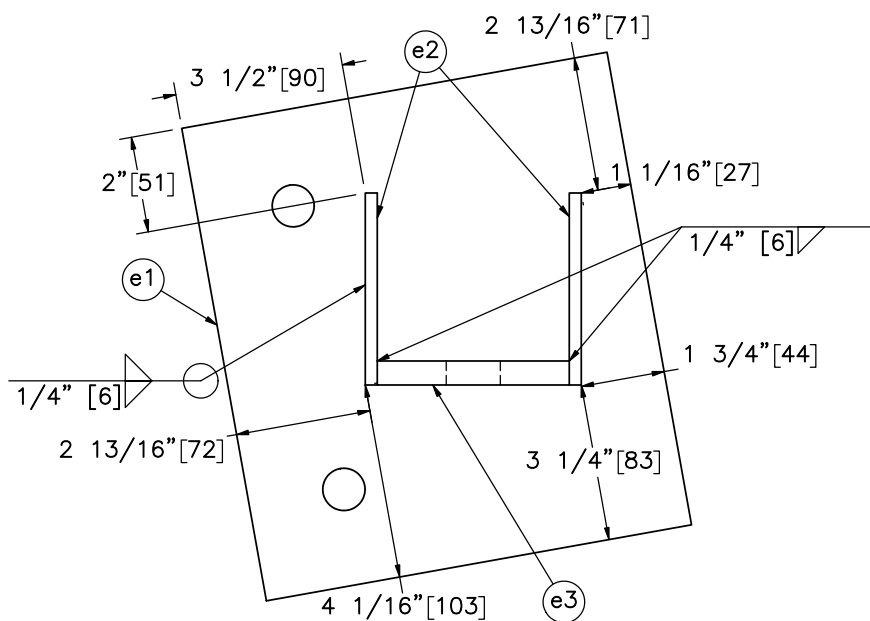


ELEVATION VIEW



UNDERSIDE VIEW

Downstream Cable Anchor Assembly
Configuration A



UNDERSIDE VIEW

Downstream Cable Anchor Assembly
Configuration B



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Downstream Cable Anchor
Assembly Details

DWG. NAME.
NYBoxRail_R15

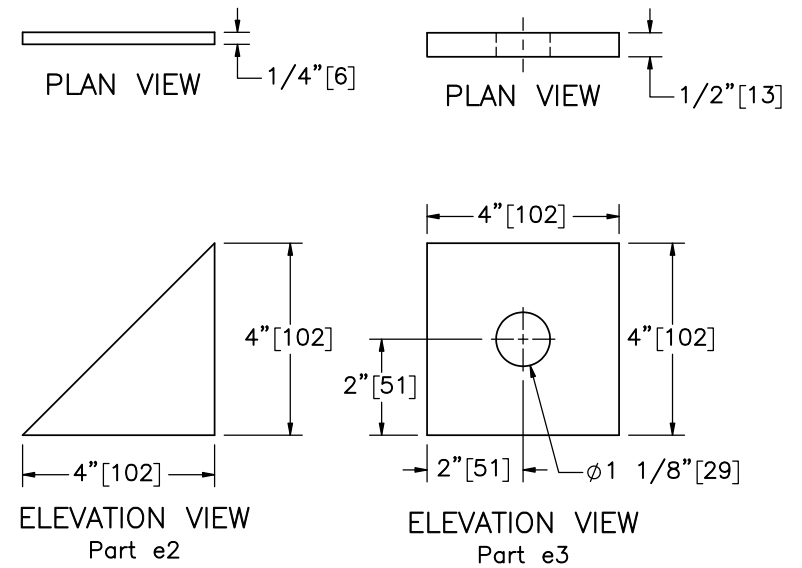
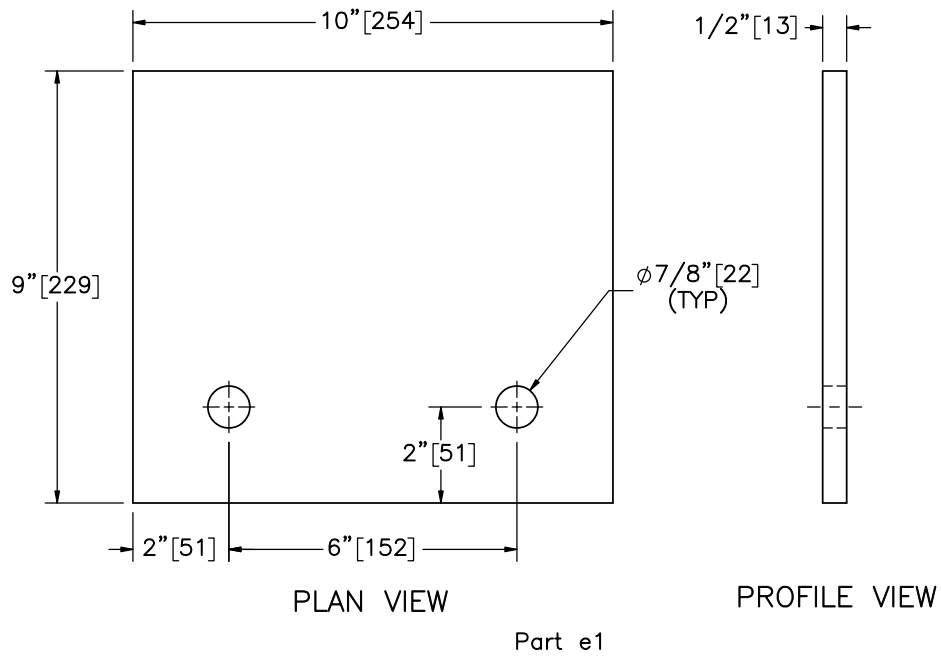
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UNITS: in.[mm]

SHEET:
15 of 30

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10/24/2019

DRAWN BY:
JEK/GRL/
JRD

REV. BY:
TJD/KAL/
JCH/ELU



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Downstream Cable Anchor
Assembly Details

DWG. NAME.
NYBoxRail_R15

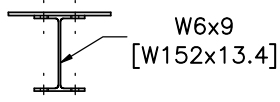
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SHEET:
16 of 30

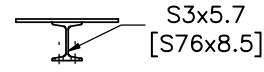
DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

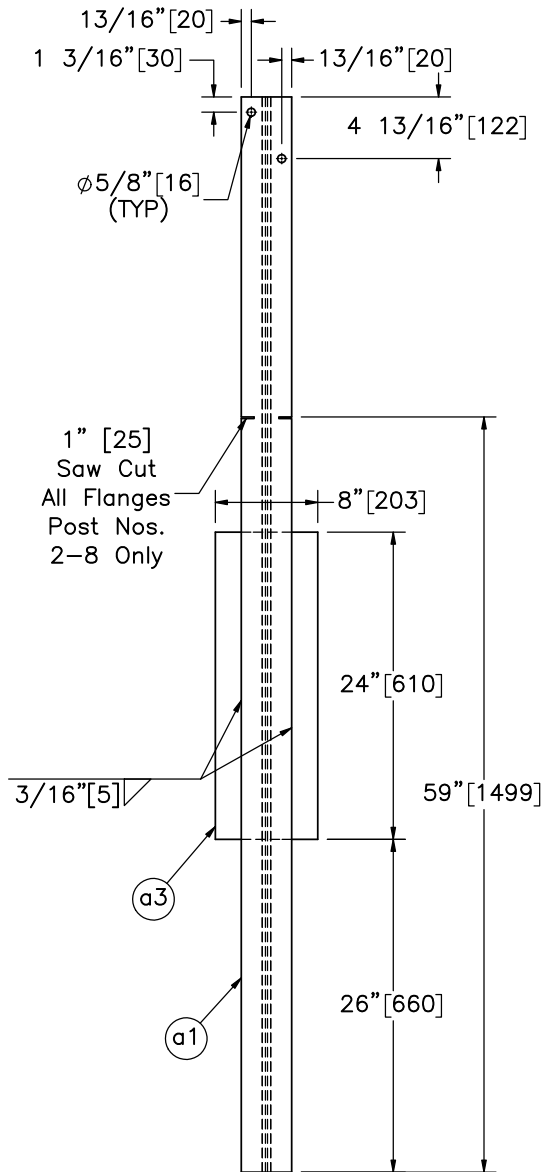
REV. BY:
TJD/KAL/
JCH/ELU



PLAN VIEW

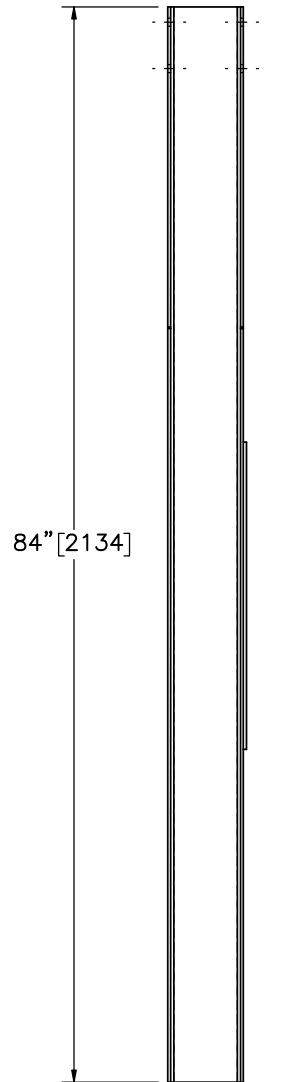


PLAN VIEW

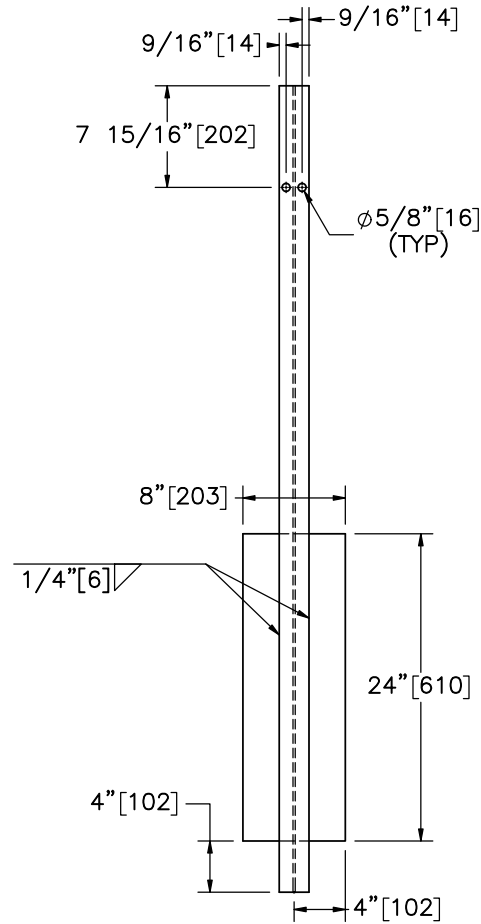


ELEVATION VIEW

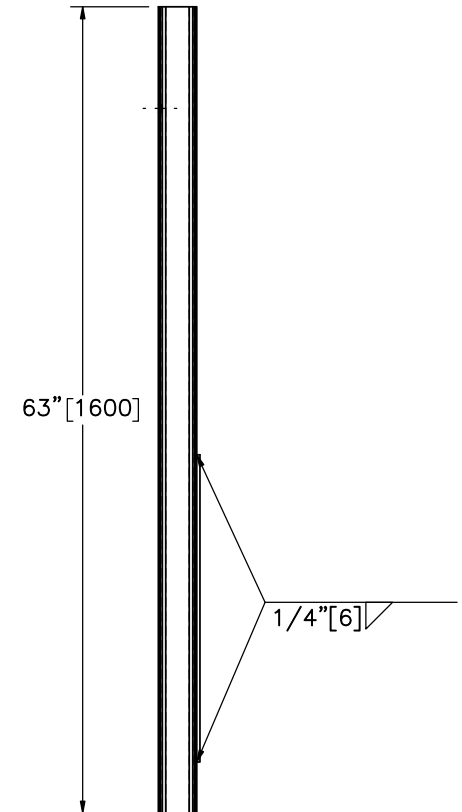
Post Nos. 1-8



PROFILE VIEW



ELEVATION VIEW



PROFILE VIEW

Part a2



Midwest Roadside
Safety Facility

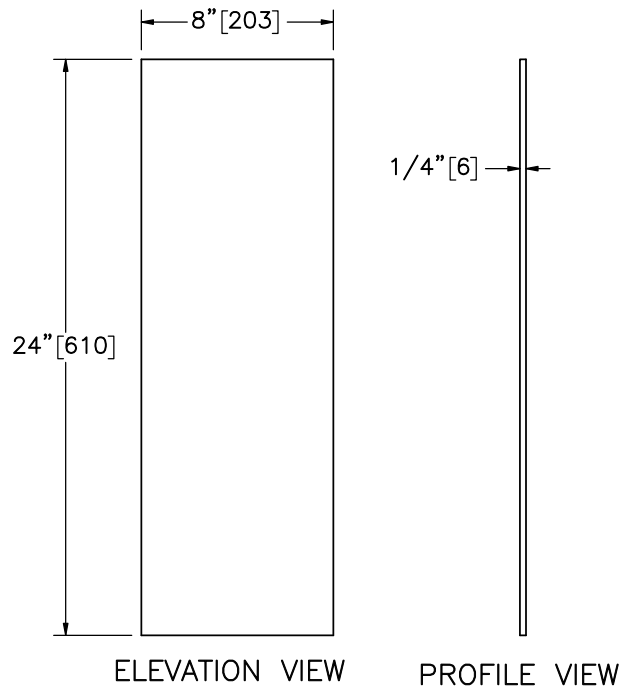
NY "Zig Zag" Box Beam
End Terminal

Post Details

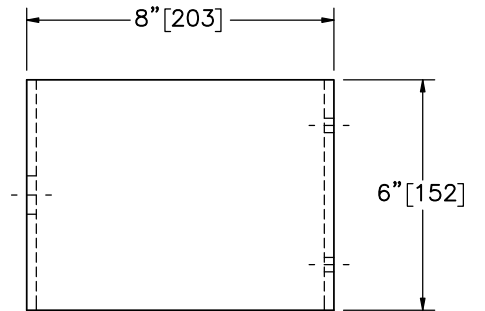
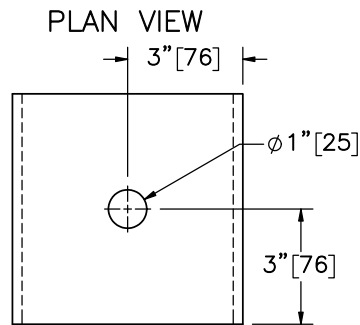
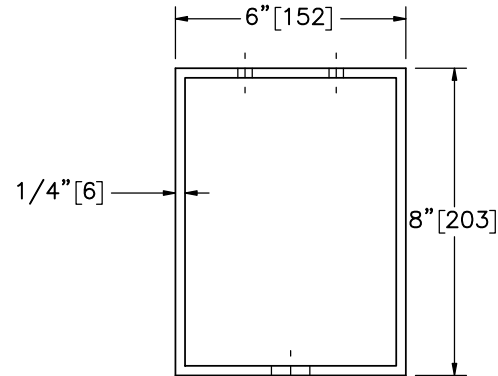
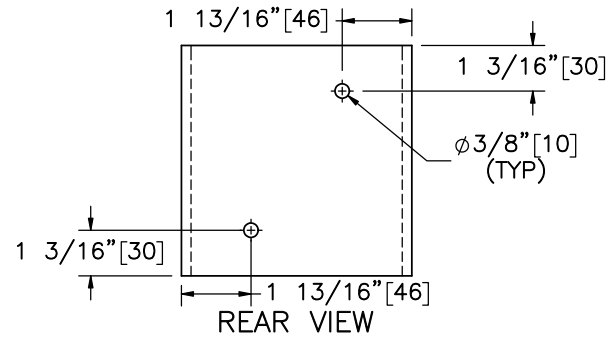
DWG. NAME.
NYBoxRail_R15

SCALE: 1:15
UNITS: in.[mm]

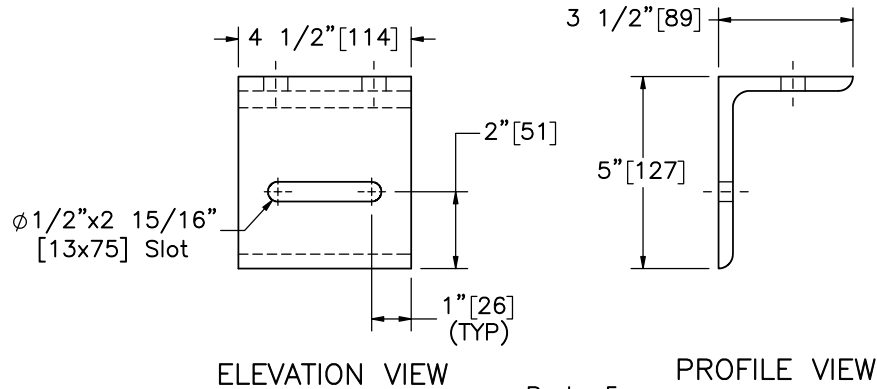
SHEET:
17 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



Part a3
SCALE 1:8



Part a4



Part a5



Midwest Roadside
Safety Facility

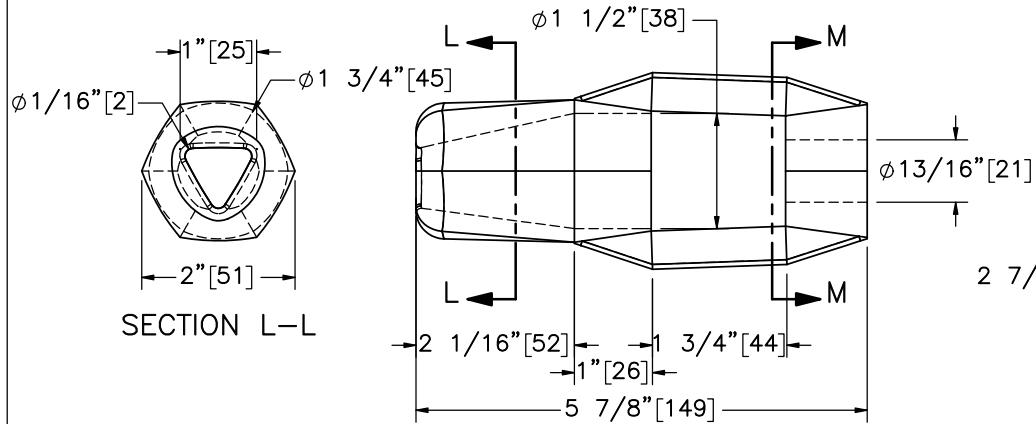
NY "Zig Zag" Box Beam
End Terminal

Post Component Details

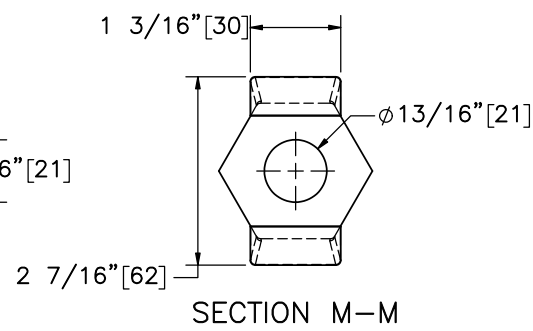
DWG. NAME.
NYBoxRail_R15

SCALE: 1:5
UNITS: in.[mm]

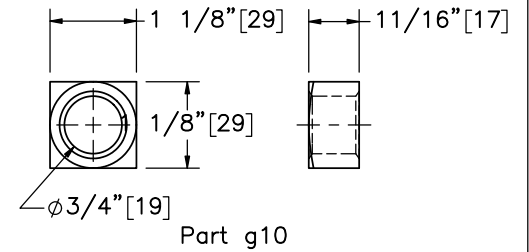
SHEET:
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DATE:
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JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



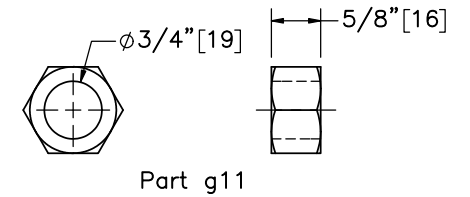
ELEVATION VIEW
Part g4



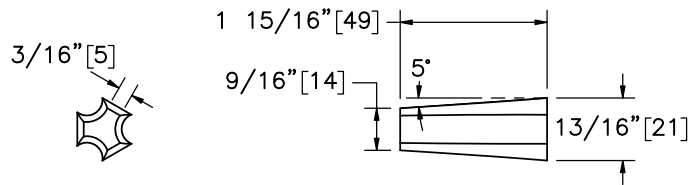
SECTION M-M



Part g10

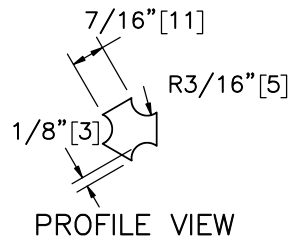


Part g11

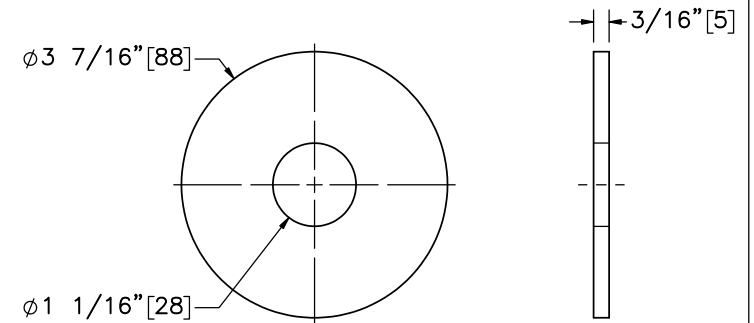


REAR VIEW

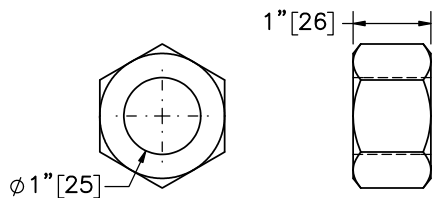
ELEVATION VIEW
Part g7



PROFILE VIEW



Part g14



Part g13



Midwest Roadside
Safety Facility

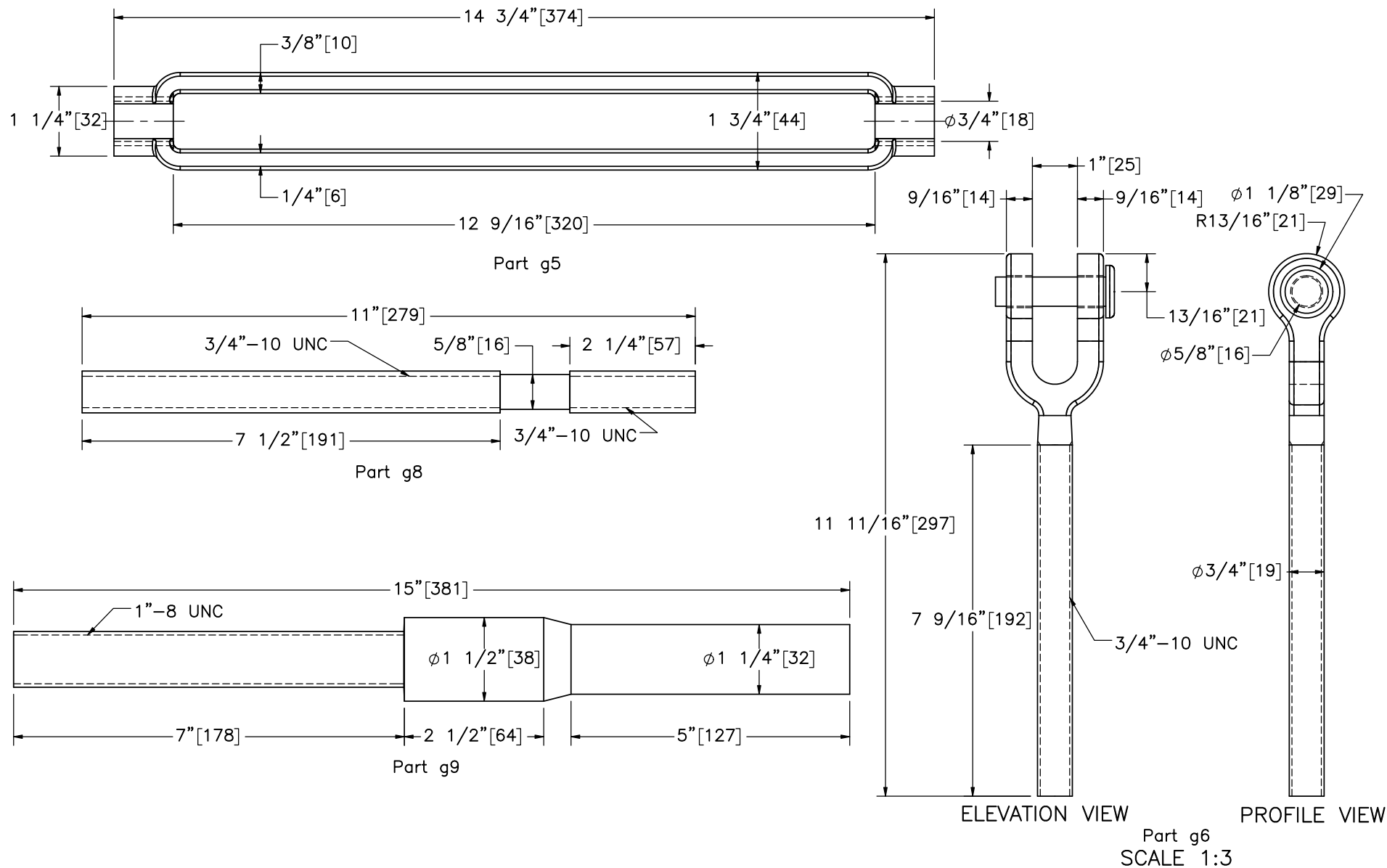
NY "Zig Zag" Box Beam
End Terminal

Cable Anchor Component
Details

DWG. NAME:
NYBoxRail_R15

SCALE: 2:5
UNITS: in.[mm]

SHEET:
19 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



Note: (1) Flattened portion of part g8 not necessary.



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Cable Anchor Component
Details

DWG. NAME:
NYBoxRail_R15

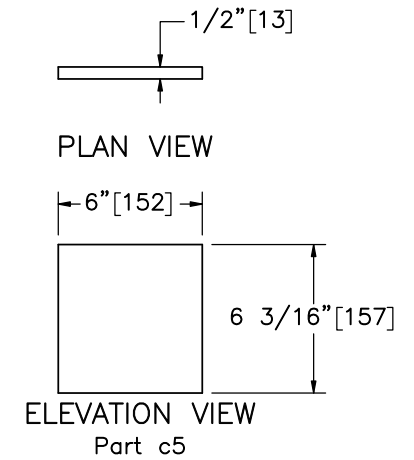
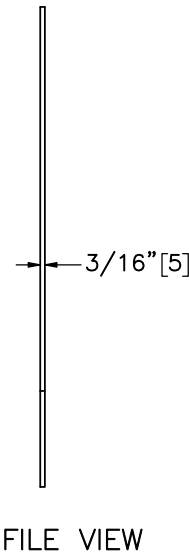
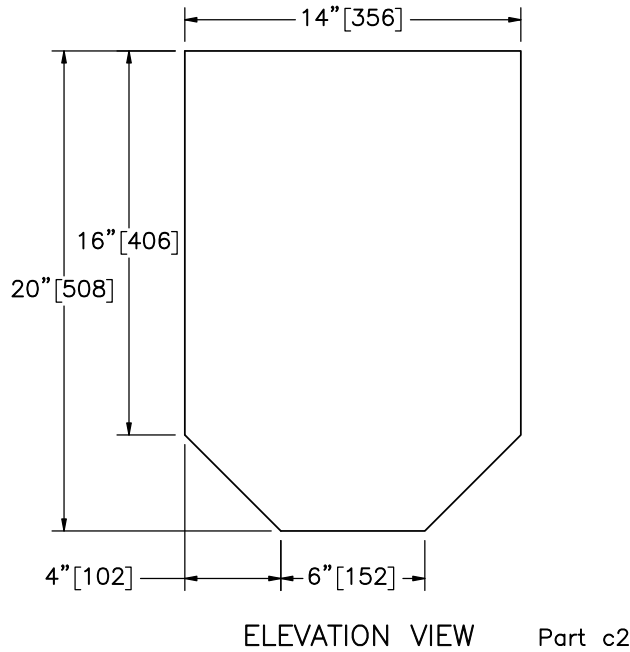
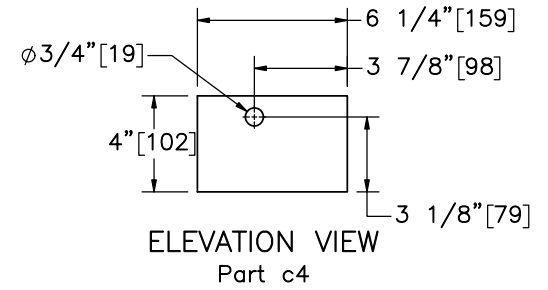
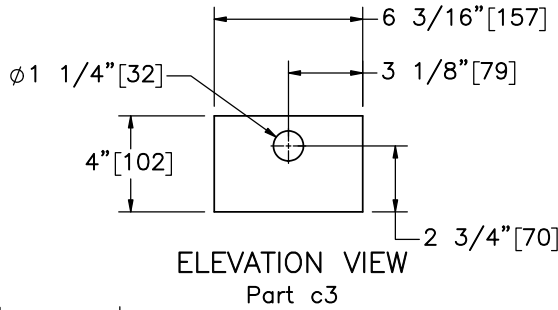
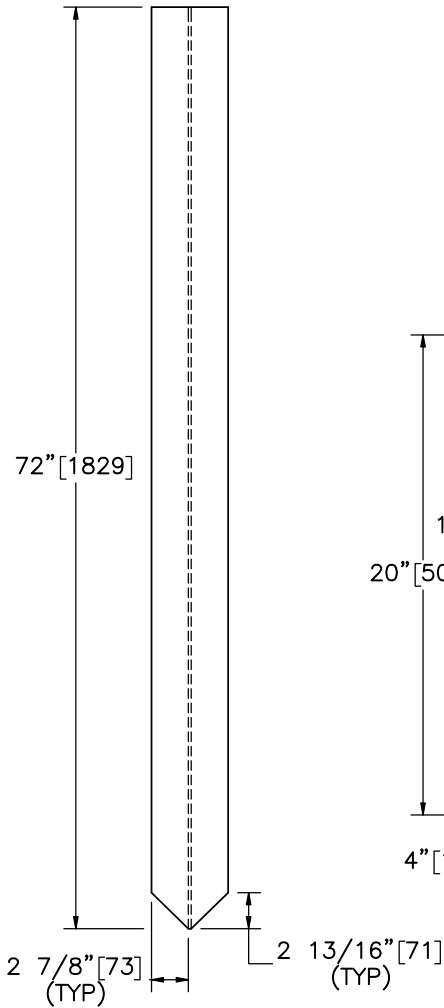
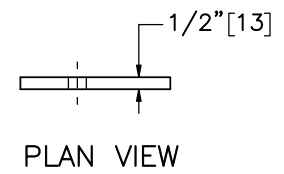
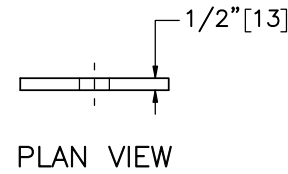
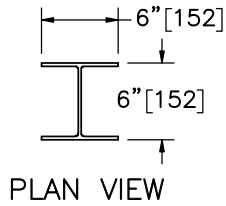
SCALE: 2:5
UNITS: in.[mm]

SHEET:
20 of 30

DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

REV. BY:
TJD/KAL/
JCH/ELU



Part c1
SCALE 1:15



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Anchor Post Component Details

DWG. NAME.
NYBoxRail_R15

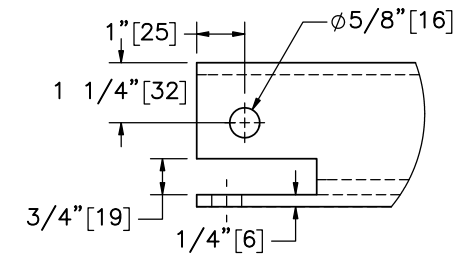
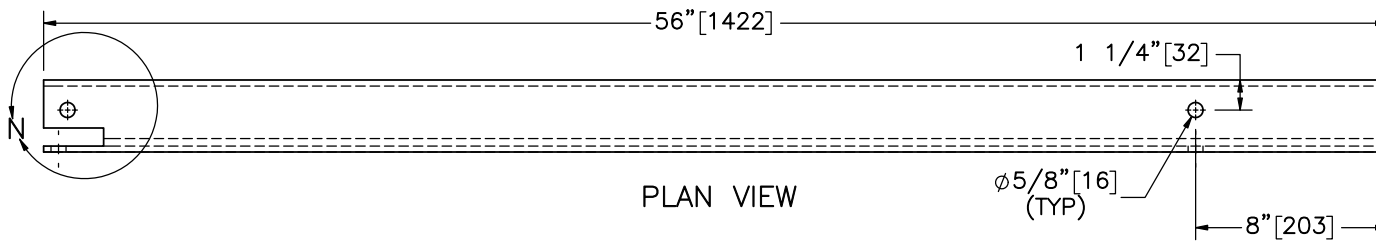
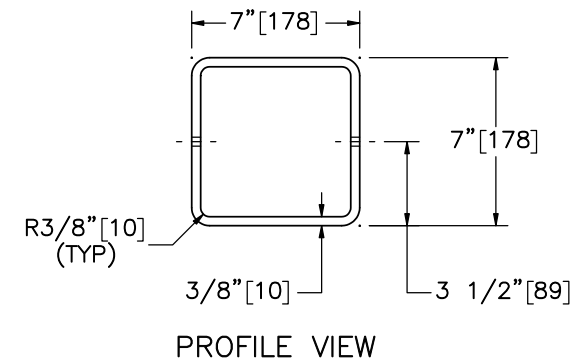
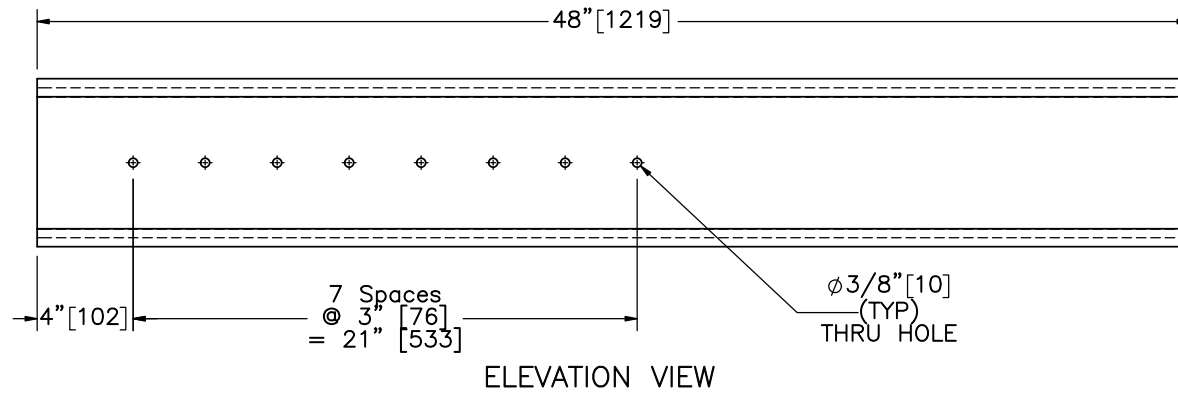
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REV. BY:
TJD/KAL/
JCH/ELU

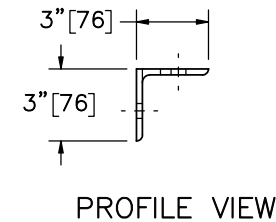
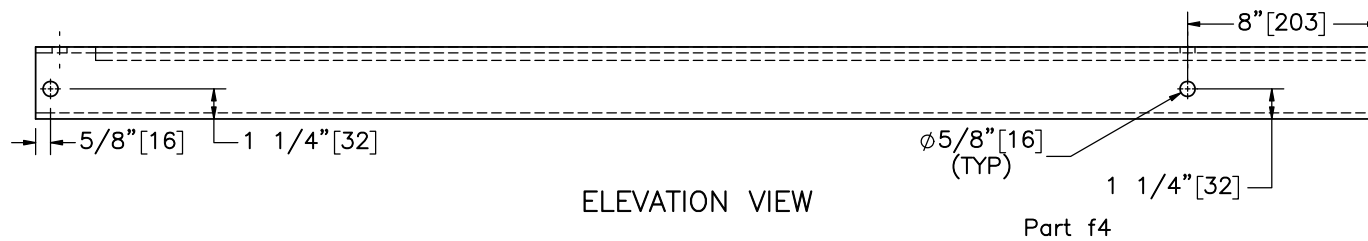
SHEET:
21 of 30

DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD



DETAIL N
SCALE 1 : 4



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Upstream End Terminal
Component Details

DWG. NAME.
NYBoxRail_R15

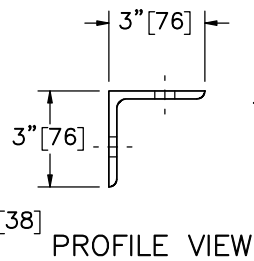
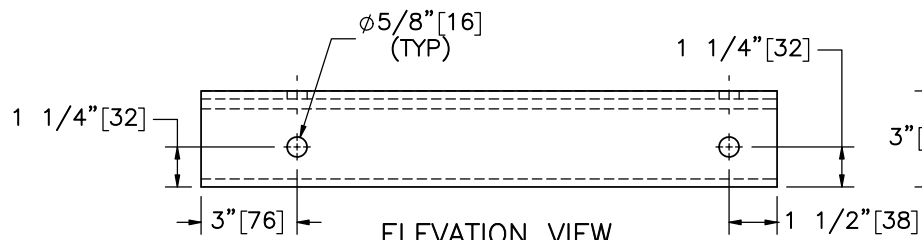
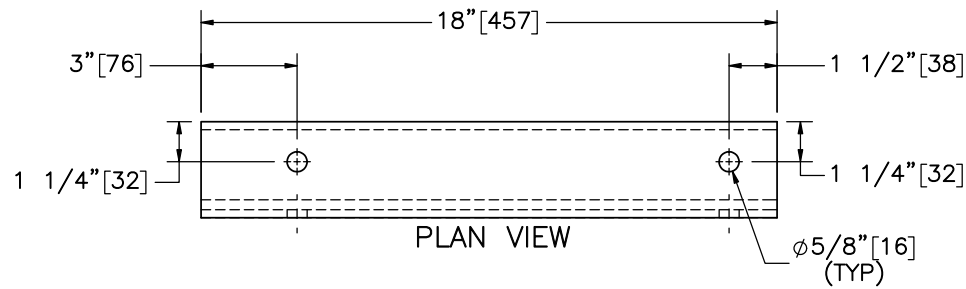
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UNITS: in.[mm]

SHEET:
22 of 30

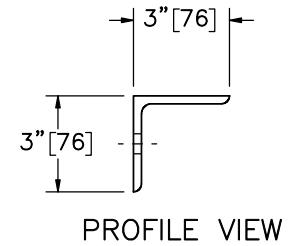
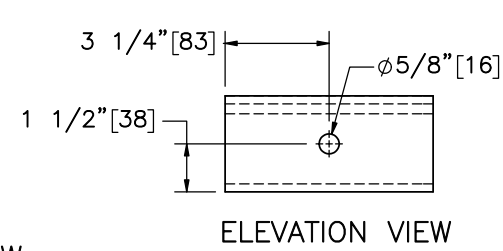
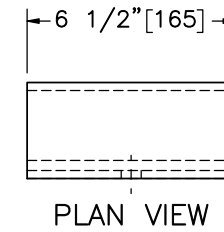
DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

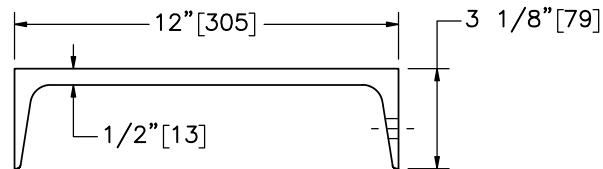
REV. BY:
TJD/KAL/
JCH/ELU



Part f3

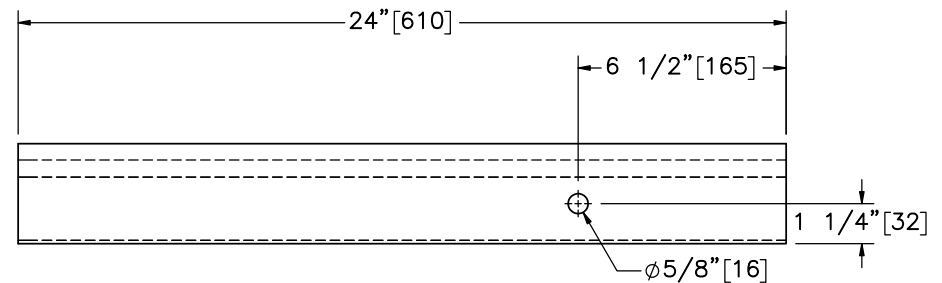


Part f5



PLAN VIEW

Part f2



PROFILE VIEW



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Upstream End Terminal
Component Details

DWG. NAME:
NYBoxRail_R15

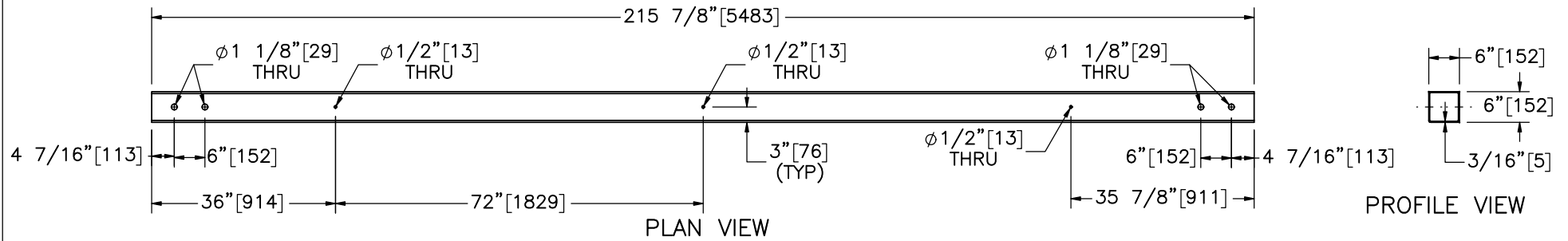
SCALE: 1:6
UNITS: in.[mm]

REV. BY:
TJD/KAL/
JCH/ELU

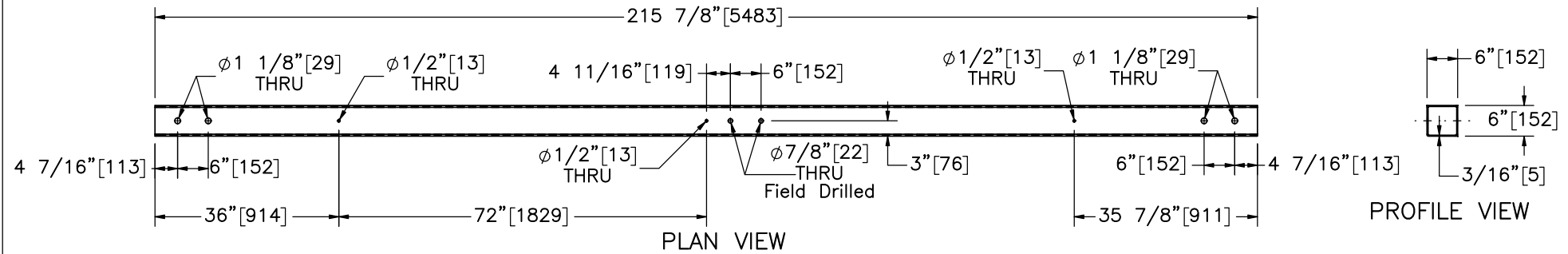
SHEET:
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DATE:
10/24/2019

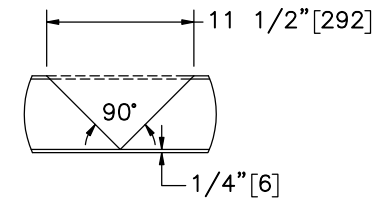
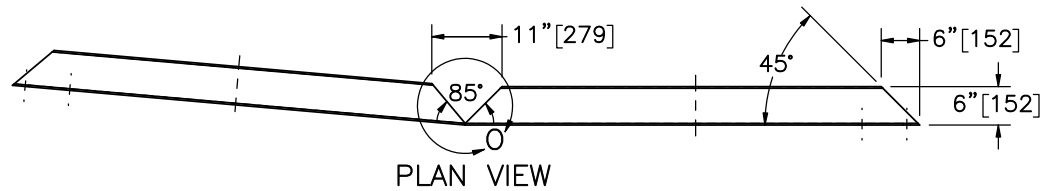
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JEK/GRL/
JRD



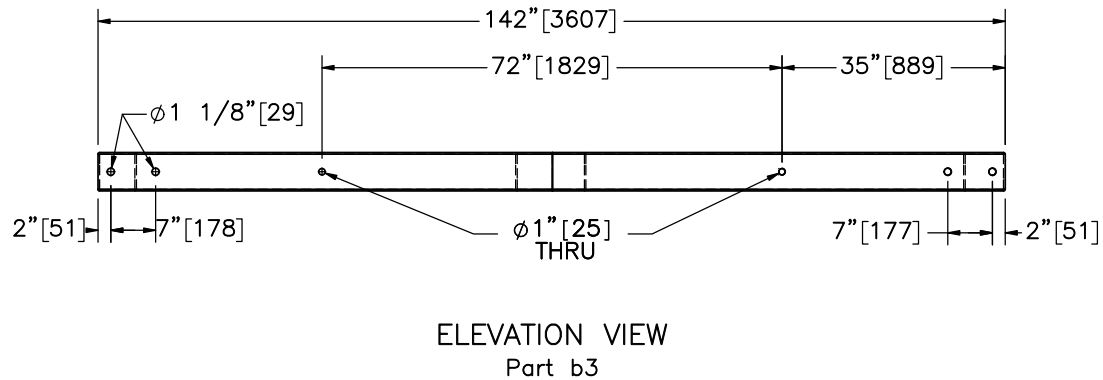
Part b1



Part b2



SCALE 1:15
PRIOR TO BEND



Midwest Roadside
Safety Facility

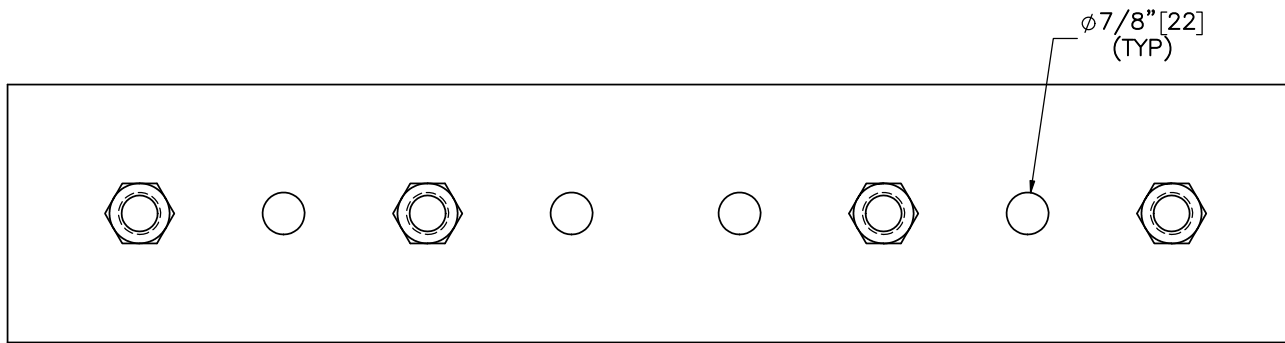
NY "Zig Zag" Box Beam
End Terminal

Rail Components

DWG. NAME.
NYBoxRail_R15

SCALE: 1:30
UNITS: in.[mm]

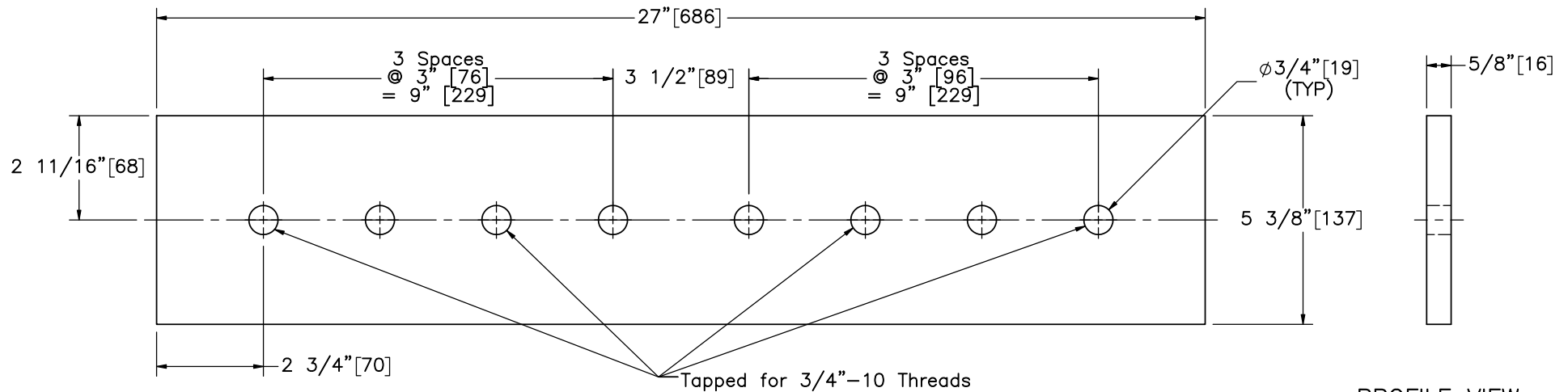
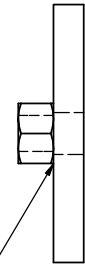
SHEET:
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DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



Assembled Splice Plate and Nuts
Parts b4 and h10

ELEVATION VIEW

Tack weld all nuts
to splice plates
prior to assembly. PROFILE VIEW



ELEVATION VIEW

PROFILE VIEW

Alternative Splice Plate
With Tapped Holes

Note: Splice plate with tapped holes may be used instead of splice plate with tack welded nuts.



Midwest Roadside
Safety Facility

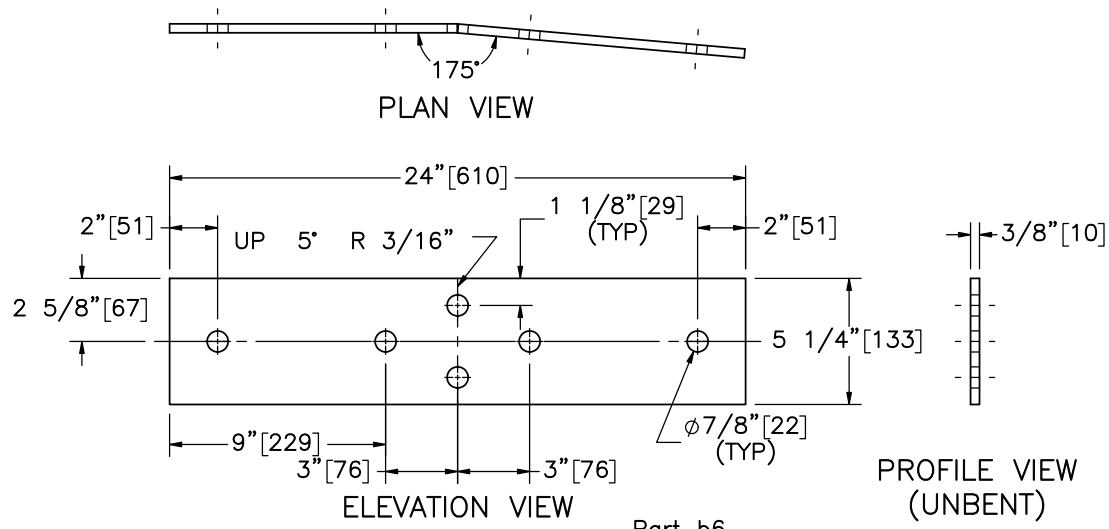
NY "Zig Zag" Box Beam
End Terminal

Splice Plate Details

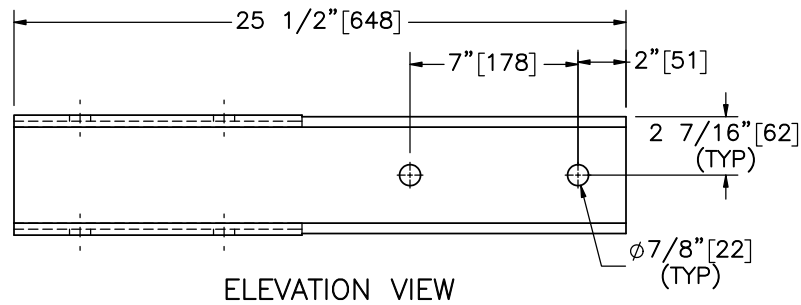
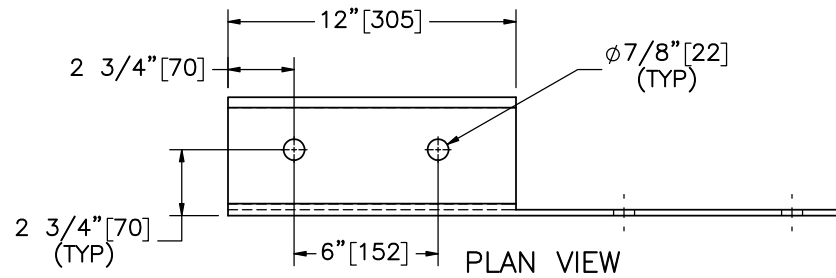
DWG. NAME.
NYBoxRail_R15

SCALE: 1:4
UNITS: in.[mm]

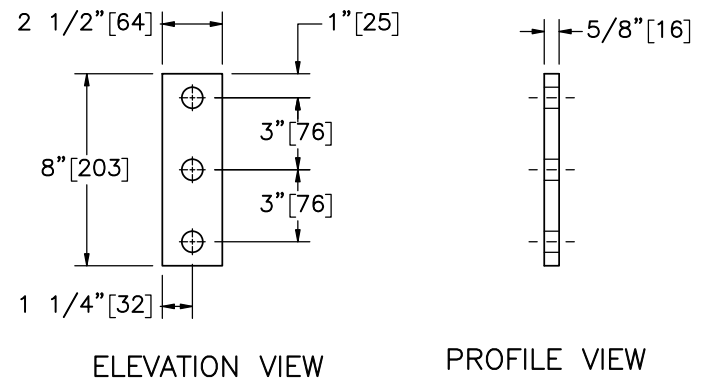
SHEET:
25 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU



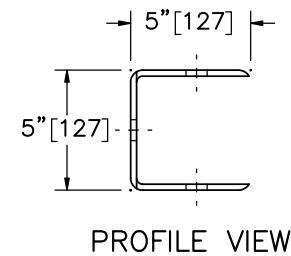
Part b6



Part b5

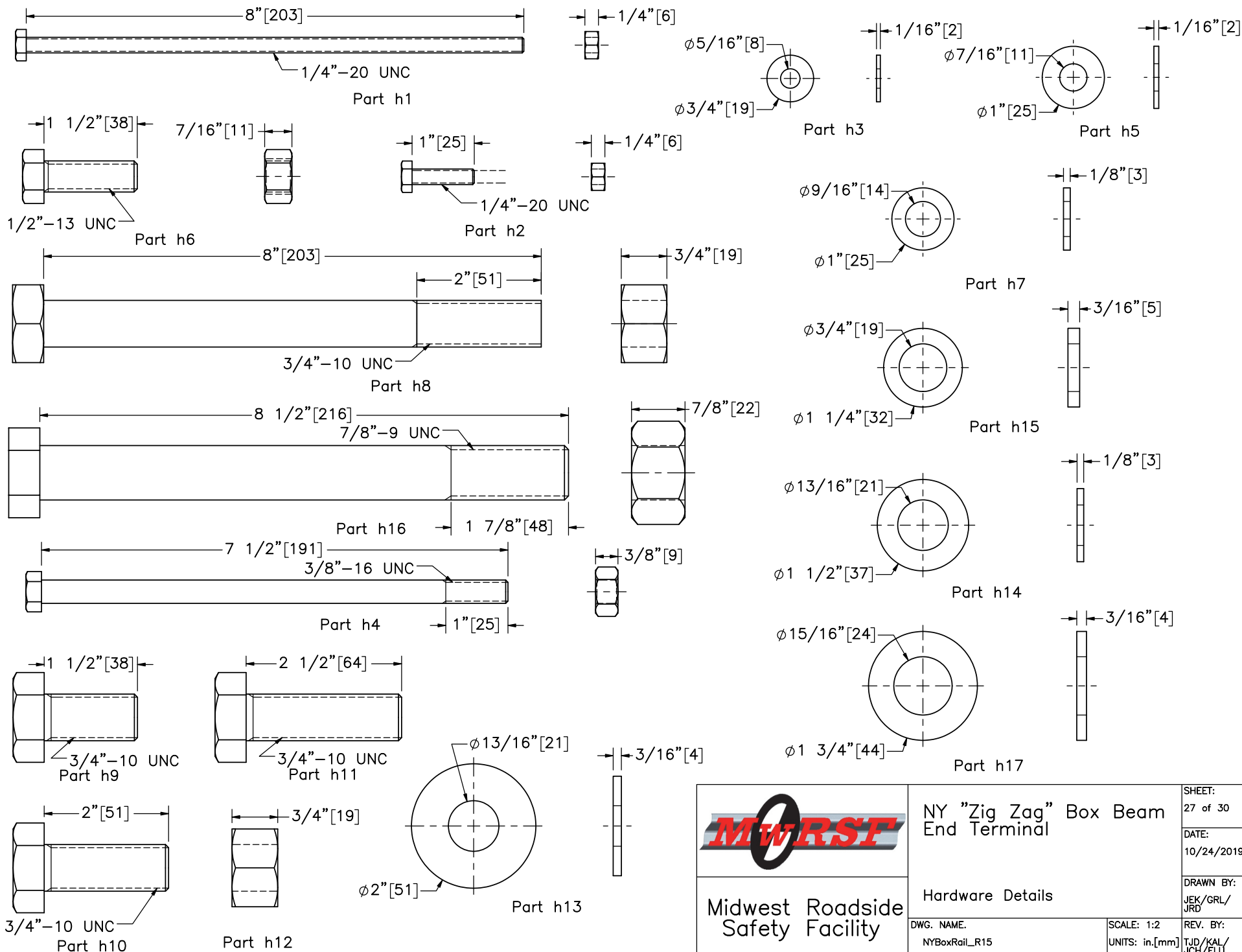


Part b7



	NY "Zig Zag" Box Beam End Terminal		SHEET: 26 of 30
	Splice and Connection Plate Details		DATE: 10/24/2019
DWG. NAME: NYBoxRail_R15		SCALE: 1:8 UNITS: in.[mm]	DRAWN BY: JEK/GRL/JRD REV. BY: TJD/KAL/JCH/ELU

Midwest Roadside Safety Facility



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Hardware Details

DWG. NAME.
NYBoxRail_R15

SCALE: 1:2
UNITS: in.[mm]

SHEET:
27 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU

Item No.	QTY.	Description	Material Spec	Galv Spec	Hardware Guide
a1	8	W6x8.5 [W152x12.6] or W6x9 [W152x13.4], 84" [2,134] Long Post	ASTM A992 Min. 50 ksi Steel	ASTM A123 (AASHTO M111)	PWE07
a2	18	S3x5.7 [S75x8.5], 63" [1,600] Long Post	ASTM A36	ASTM A123 (AASHTO M111)	PSE08
a3	8	24"x8"x1/4" [610x203x6] Soil Plate	ASTM A36	ASTM A123 (AASHTO M111)	PLS01
a4	8	8"x6"x1/4" [203x152x6], 6" [152] Long Blockout	ASTM A500 Gr. B	ASTM A123 (AASHTO M111)	—
a5	18	5"x3 1/2"x3/8" [127x89x10], 4 1/2" [114] Long L-Bracket	ASTM A36	ASTM A123 (AASHTO M111)	—
b1	5	TS6"x6"x3/16" [152x152x5], 215 7/8" [5,483] Long Box Beam	ASTM A500 Gr. B	ASTM A123 (AASHTO M111)	—
b2	1	TS6"x6"x3/16" [152x152x5], 215 7/8" [5,483] Long Box Beam	ASTM A500 Gr. B	ASTM A123 (AASHTO M111)	—
b3	4	TS6"x6"x1/4" [152x152x6], 142" [3,607] Long Box Beam, Bent	ASTM A500 Gr. B	ASTM A123 (AASHTO M111)	—
b4	10	27"x5 3/8"x5/8" [686x137x16] Splice Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
b5	1	TS5"x5"x1/4" [127x127x6], 25 1/2" [648] Long Box Beam, Cut	ASTM A500 Gr. B	ASTM A123 (AASHTO M111)	—
b6	3	24"x5 1/4"x3/8" [610x133x10] Plate, Bent	ASTM A36	ASTM A123 (AASHTO M111)	—
b7	1	8"x2 1/2"x5/8" [203x64x16] Keel Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
c1	2	W6x15 [W152x22.3], 72" [1,829] Long Post	ASTM A992 or ASTM A572-50	ASTM A123 (AASHTO M111)	—
c2	2	20"x14"x3/16" [508x356x5] Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
c3	2	6 3/16"x4"x1/2" [157x102x13] Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
c4	4	6 1/4"x4"x1/2" [159x102x13] Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
c5	2	6 3/16"x6"x1/2" [159x152x13] Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
d1	1	3"x2"x3/8" [76x51x10], 4.8" [122] Long L-Bracket	ASTM A36	ASTM A123 (AASHTO M111)	—
d2	2	3"x4"x5/16" [76x102x8] Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
e1	2	10"x9"x1/2" [254x229x13] Box Beam Cable Anchor Base Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
e2	4	4"x4"x1/4" [102x102x6] Box Beam Cable Anchor Gusset	ASTM A36	ASTM A123 (AASHTO M111)	—
e3	2	4"x4"x1/2" [102x102x13] Box Beam Cable Anchor Mounting Plate	ASTM A36	ASTM A123 (AASHTO M111)	—
f1	1	TS7"x7"x3/8" [178x178x10], 48" [1,219] Long Box Beam	ASTM A500 Gr. B	ASTM A123 (AASHTO M111)	—
f2	1	C12x30, 24" [610] Long C-Channel	ASTM A36	ASTM A123 (AASHTO M111)	—
f3	1	3"x3"x1/4" [76x76x6], 18" [457] Long L-Bracket	ASTM A36	ASTM A123 (AASHTO M111)	—
f4	1	3"x3"x1/4" [76x76x6], 56" [1,422] Long L-Bracket	ASTM A36	ASTM A123 (AASHTO M111)	—
f5	1	3"x3"x1/4" [76x76x6], 6 1/2" [165] Long L-Bracket	ASTM A36	ASTM A123 (AASHTO M111)	—



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Bill of Materials

DWG. NAME.
NYBoxRail_R15

SCALE: None
UNITS: in.[mm]

SHEET:
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DATE:
10/24/2019

DRAWN BY:
JEK/GRL/
JRD

REV. BY:
TJD/KAL/
JCH/ELU

Item No.	QTY.	Description	Material Spec	Galv Spec	Hardware Guide
g1	1	3/4" [19] Dia. 3x7, 66" [1,676] Long IWRC IPS Wire Rope	ASTM A741 Type 1 (AASHTO M30 Type 1)	Class A Coating	RCM01
g2	1	3/4" [19] Dia. 6x19, 56" [1,422] Long IWRC IPS Wire Rope	ASTM A741 Type 2 (AASHTO M30 Type 2)	Class A Coating	—
g3	1	3/4" [19] Dia. 6x19, 145 3/4" [3,702] Long IWRC IPS Wire Rope	ASTM A741 Type 2 (AASHTO M30 Type 2)	Class A Coating	—
g4	2	Cable End Fitting	ASTM A27 (AASHTO M103) Gr. 70-40 Class 1	ASTM A153 or B695 (AASHTO M232 or M298)	RCE03
g5	1	Crosby Threaded Turnbuckle	C1030/C1035 ASTM F1145	ASTM A153	—
g6	1	3/4" [19] Dia. UNJ, Crosby HG 4037 Jaw	ASTM F1145	As Supplied	—
g7	2	Cable Wedge	ASTM A47 Gr. 32510	—	FMM01
g8	2	3/4" [19] Dia. UNC, 11" [279] Long Threaded Rod	ASTM A307 Gr. A or SAE Gr. 2	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	RCE03
g9	4	BCT Anchor Cable End Swaged Fitting	Grade 5	Fitting — ASTM A153 (AASHTO M232), Stud — ASTM A153 or B695 (AASHTO M232 or M298)	—
g10	2	3/4" [19] Dia. UNC Square Nut	ASTM A563A	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FNS20
g11	2	3/4" [19] Dia. UNC Hex Nut	ASTM A563A	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FNX20a
g13	4	1" [25] Dia. UNC Heavy Hex Nut	ASTM A563DH	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FNX24b
g14	4	1" [25] Dia. Plain Round Washer	ASTM F844	ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	FWC24a
h1	8	1/4" [6] Dia. UNC, 8" [203] Long Fully Threaded Hex Head Shear Bolt and Nut	Bolt — ASTM A307 Gr. A or SAE Gr. 2 Nut — ASTM A563A	Both — ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	—
h2	16	1/4" [6] Dia. UNC, 1" [25] Long Fully Threaded Hex Head Bolt and Nut	Bolt — ASTM A307 Gr. A or SAE Gr. 2 Nut — ASTM A563A	Both — ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	FBX06a
h3	32	1/4" [6] Flat Washer	ASTM F844	ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	FWC06a
h4	18	3/8" [10] Dia. UNC, 7 1/2" [191] Long Hex Head Bolt and Nut	Bolt — ASTM A307 Gr. A or SAE Gr. 2 Nut — ASTM A563A	Both — ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	FBX10a
h5	36	3/8" [10] Dia. Plain Round Washer	ASTM F844	ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	FWC10a
h6	21	1/2" [13] Dia. UNC, 1 1/2" [38] Long Fully Threaded Hex Head Bolt and Nut	Bolt — ASTM A307 Gr. A or SAE Gr. 2 Nut — ASTM A563A	Both — ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FBX14b
h7	18	1/2" [13] Dia. Plain Narrow Round Washer	SAE Low Carbon Gr. 2	ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	—
				NY "Zig Zag" Box Beam End Terminal	
				Bill of Materials	
Midwest Roadside Safety Facility				DWG. NAME. NYBoxRail_R15	SCALE: None UNITS: in.[mm]
				REV. BY: TJD/KAL/ JCH/ELU	SHEET: 29 of 30 DATE: 10/24/2019 DRAWN BY: JEK/GRL/ JRD

Item No.	QTY.	Description	Material Spec	Galv Spec	Hardware Guide
h8	8	3/4" [19] Dia. UNC, 8" [203] Long Hex Head Bolt and Nut	Bolt – ASTM A307 Gr. A or SAE Gr. 2 Nut – ASTM A563A	Both – ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FBX20a
h9*	20	3/4" [19] Dia. UNC, 1 1/2" [38] Long Fully Threaded Heavy Hex Head Bolt	Bolt – ASTM F3125 Gr. A325 or ASTM A449 or SAE J429 Gr. 5 Nut – ASTM A563DH or ASTM A194 Gr. 2H	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	–
h10*	38	3/4" [19] Dia. UNC, 2" [51] Long Fully Threaded Heavy Hex Head Bolt	Bolt – ASTM F3125 Gr. A325 or ASTM A449 or SAE J429 Gr. 5 Nut – ASTM A563DH or ASTM A194 Gr. 2H	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FBX20b
h11*	2	3/4" [19] Dia. UNC, 2 1/2" [64] Long Fully Threaded Heavy Hex Head Bolt	Bolt – ASTM F3125 Gr. A325 or ASTM A449 or SAE J429 Gr. 5 Nut – ASTM A563DH or ASTM A194 Gr. 2H	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FBX20b
h12**	60	3/4" [19] Dia. UNC Heavy Hex Nut	ASTM A563DH	ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	FNX20b
h13	17	3/4" [19] Dia. Plain Round Washer	ASTM F844	ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	FWC20a
h14	62	3/4" [19] Dia. Hardened Flat Washer	ASTM F436	ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	FWC20b
h15	8	3/4" [19] Dia. Lock Washer	Steel	ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	–
h16	2	7/8" [22] Dia. UNC, 8 1/2" [216] Long Heavy Hex Head Bolt and Nut	Bolt – ASTM F3125 Gr. A325 or ASTM A449 or SAE J429 Gr. 5 Nut – ASTM A563DH or ASTM A194 Gr. 2H	Both – ASTM A153 (AASHTO M232) for Class C or ASTM B695 (AASHTO M298) for Class 50	–
h17	4	7/8" [22] Hardened Flat Washer	ASTM F436	ASTM A153 (AASHTO M232) for Class D or ASTM B695 (AASHTO M298) for Class 50	FWC22b

* If using the splice plates with tapped holes instead of tack welded nuts, h9 quantity required will be 58, and h10 quantity will be 2, and h11 will not be required.

** If using the splice plates with tapped holes instead of tack welded nuts, only 20 of part h12 will be required.

Washer	Washer Series	Inside Diameter			Outside Diameter			Thickness		
		Basic	Tolerance		Basic	Tolerance		Basic	Max.	Min.
			Plus	Minus		Plus	Minus			
3/4"	Regular (h14)	0.812"	0.03"	0.007"	1.469"	0.03"	0.007"	0.134"	0.16"	0.108"
	Wide (h13)	0.812"	0.03"	0.007"	2"	0.03"	0.007"	0.165"	0.192"	0.136"



Midwest Roadside
Safety Facility

NY "Zig Zag" Box Beam
End Terminal

Bill of Materials

DWG. NAME.
NYBoxRail_R15

SCALE: None
UNITS: in./mm

SHEET:
30 of 30
DATE:
10/24/2019
DRAWN BY:
JEK/GRL/
JRD
REV. BY:
TJD/KAL/
JCH/ELU

REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
0	9/6/2016	–	Originated from drawing NYBBT–9_R1. (Modeled upon, original drawing make due to age of original)	–	JEK
1	9/14/2016	–	Pages reordered. New pages. Parts/views moved between pages. Additional views/details. Part renumbering. View renaming. Specific sheet references added.	KAL/TJD	JEK
		1	Rail segments labeled. Notes added.		
		3	Post location chart added. Notes added.		
		27	Description & material edits. New parts/part numbering edits. HWG column move.		
		28	Description & material edits. New parts/part numbering edits. HWG column move.		
		29	Description & material edits. New parts/part numbering edits. HWG column move. Notes added. Washer table added. Quantity edits.		
2	9/15/2016	6	Note added.	TJD	JEK
		8	Bolt attaching plate in Detail H changed to a longer version. (New part).		
		9	Text shift.		
		12	Weld note moved. Dim add.		
		21	Dim shift.		
		25	Dim edits/additions.		
		26	New part (h11) added. Duplicate nut removed.		
		27	Description edit: a5, b1–3, e1–3, f1, f3.		
		28	Description edit: g2–3, g13, h4, h6. Galv edit: g4, g9.		
3	9/15/2016	–	Detail and Section Lettering.	KAL	JEK
		1	Impact detail added. Note edits.		
4	10/18/2016	–	Upstream anchor cable assembly placement edited such that a [visual] straight line exists between start and end.	KAL	JEK
5	12/20/2016	–	Parts b1, b2 change. Dimensions and description to correspond.	KAL	JEK
6	1/27/2017	12	Weld note additions.	JCH	JEK
		15	Weld note shift/change.		
		25	Part b6 bent view added. General shift.		

7	4/3/2017	–	Physical change: g4, g5, g6. New part: g7. Replaced: g7 by g8.	KAL	JEK
		1	Note 3 edit.		
		11	Part g15 added, labeled. Replaced: g7 by g8.		
		18	Part g4 update. Part g7 add. Part g5 moved to page 19.		
		19	Part g6 update. Part g5 added, updated. Note added. Part g7 removed.		
		27	Material edit: a1. Metric – English galv spec swap all parts.		
		28	Removed: g7. New: g7. Qty: g8. Description: g4, g5. Material: g4, g5, g6, h1. Galv: g4. Metric – English mtrl & galv spec swap all applicable parts.		
		29	Material edit: h9, h10, h11, h16. Metric – English galv spec swap all parts.		
8	4/4/2017	–	Part h7 washer replacement/update/correction.	KAL	JEK
		26	Part h7 changes.		
		28	Description: h7. Material: h7. Hwg: h7.		
		29	Table at bottom, part no changes.		
9	4/28/2017	–	System layout flipped. Most assymetric components and subassemblies flipped. Second downstream cable anchor configuration. New page (16). Dual unit display edit. General and dimension shift throughout.	JCH/KAL	JEK
		1	Rail center and tangent lines added. Dim add.		
		2	Label change. Some labels removed.		
		8	Cable Anchor Assembly labeling change (A and B). Detail H and I swap.		
		9	Weld note adds.		
		10	Post bolt location change. Weld note adds.		
		13	End terminal assembly flip.		
		14	Part d2 thickness change.		
		15	New configuration. Parts moved to page 16.		
		17	Soil plate added to post view. Part labeling. Dim adds. Weld add. View orientation correction.		
		18	Part a4 elevation view edit. Part a4 rear view add.		
		22	Part f4 change.		
		23	Part f2 change.		
		24	Plan view rotation part b3.		
		27	Part h2 change.		
		BOM	Description: b4, d2, h1, h2, h6, h9–h11. Material: g8, h2, h4, h6, h8. HWG: h16.		

10	5/2/2017	1	Dim add.	JCH/KAL	JEK
		11	Dim add.		
		15	Dims shown changed. Weld notes added. Gen shift.		
		BOM	Description: g1.		
11	6/19/2018	7	Note added. Dimension edited.	JEK/KAL	GRL
		BOM	Part g1 description edit.		
12	4/1/2019	14	Note edit.	KAL	JEK
		BOM	Mtrl: g5, g6. Trtmnt: g5.		
13	6/27/2019	1	Edited note 1.	ELU	JRD
		3	Edited note 2.		
14	8/9/2019	–	Changed 'HFT Anchor Assembly' to 'Anchor Post Assembly'.	KAL	JRD
		1	Edited Detail A scale note. Edited note 4.		
		2	Edited anchor post assembly annotation.		
		7	Edited anchor post assembly annotation.		
		9	Edited Detail J scale note. Moved cable catcher assembly annotation.		
		10	Edited Detail K scale note.		
		12	Changed sheet name to 'Anchor Post Assembly'.		
		21	Changed sheet name to 'Anchor Post Component Details'.		
		24	Edited Detail O scale note.		
15	10/24/2019	BOM	Corrected BOM typo of b1 being replaced by b2.	ELU	JEK