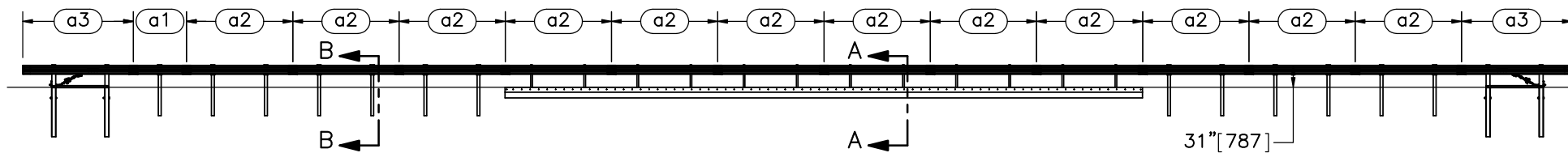



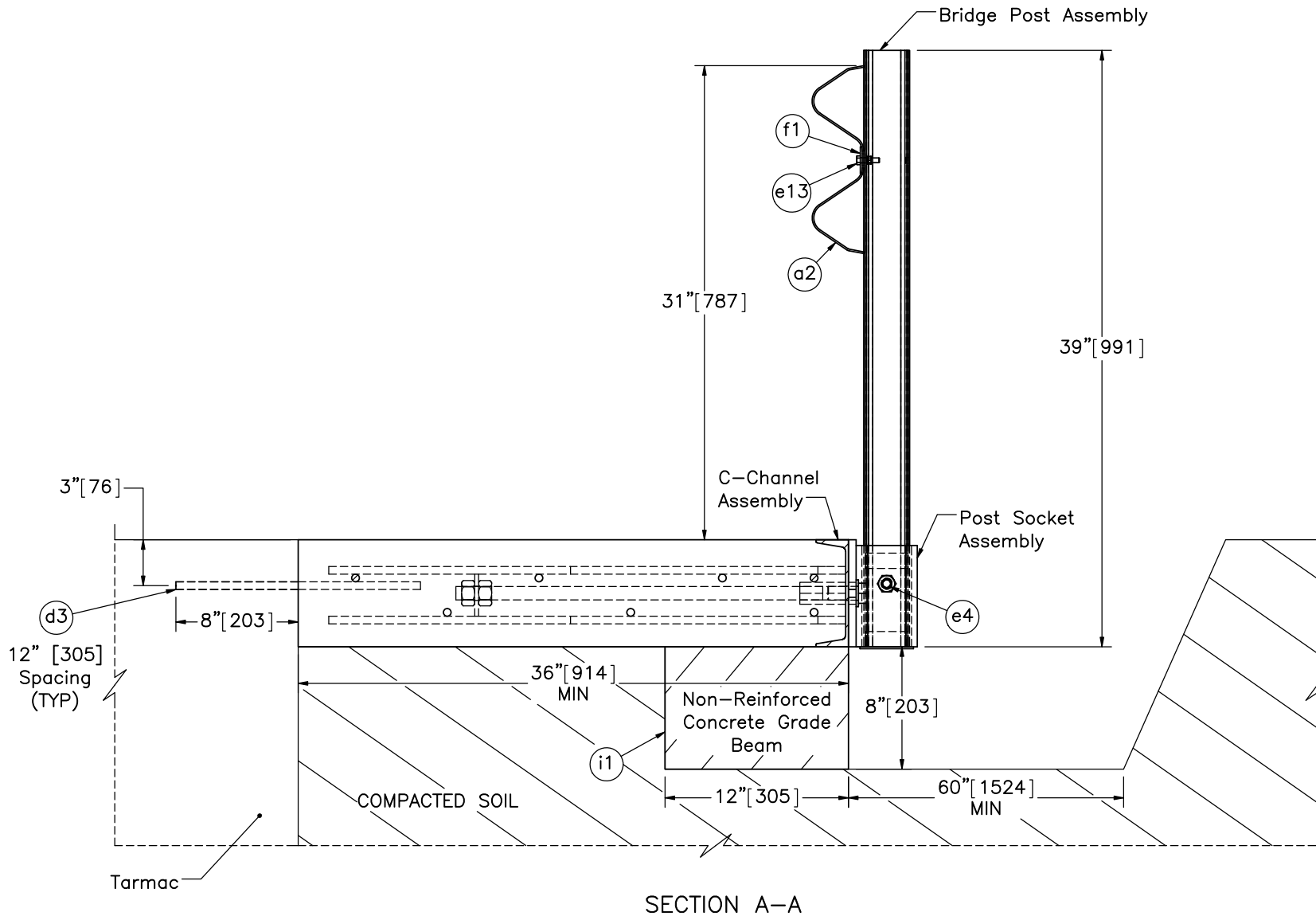
PLAN VIEW



ELEVATION VIEW

- Notes: (1) Test shall be performed according to test designation no. 2-11 using MASH 2016 criteria.  
 (2) The impact location is 123" [3,124] upstream from the center of splice between post nos. 14 and 15.  
 (3) BCT anchors are placed in  $\phi 3'$  [914] holes, then backfilled and tamped with soil.

 Midwest Roadside Safety Facility	TL-2 Bridge Rail Test No. N2BR-1		SHEET: 1 of 27
	System Layout		DATE: 2/9/2018
DWG. NAME: NDOR_TL2BR_R10	SCALE: 1:220 UNITS: in.[mm]	REV. BY: JK/SR/RB/ RF/KL/JH	DRAWN BY: MES/JEK



Notes: (1) Shim posts in deck region with shim plates (part c6) on front and back side, as necessary.  
 (2) Embed part no. d3 bars into tarmac with Powersfast 100+ AC gold epoxy.



Midwest Roadside Safety Facility

TL-2 Bridge Rail  
 Test No. N2BR-1

Bridge Deck Cross Section

DWG. NAME:  
 NDOR\_TL2BR\_R10

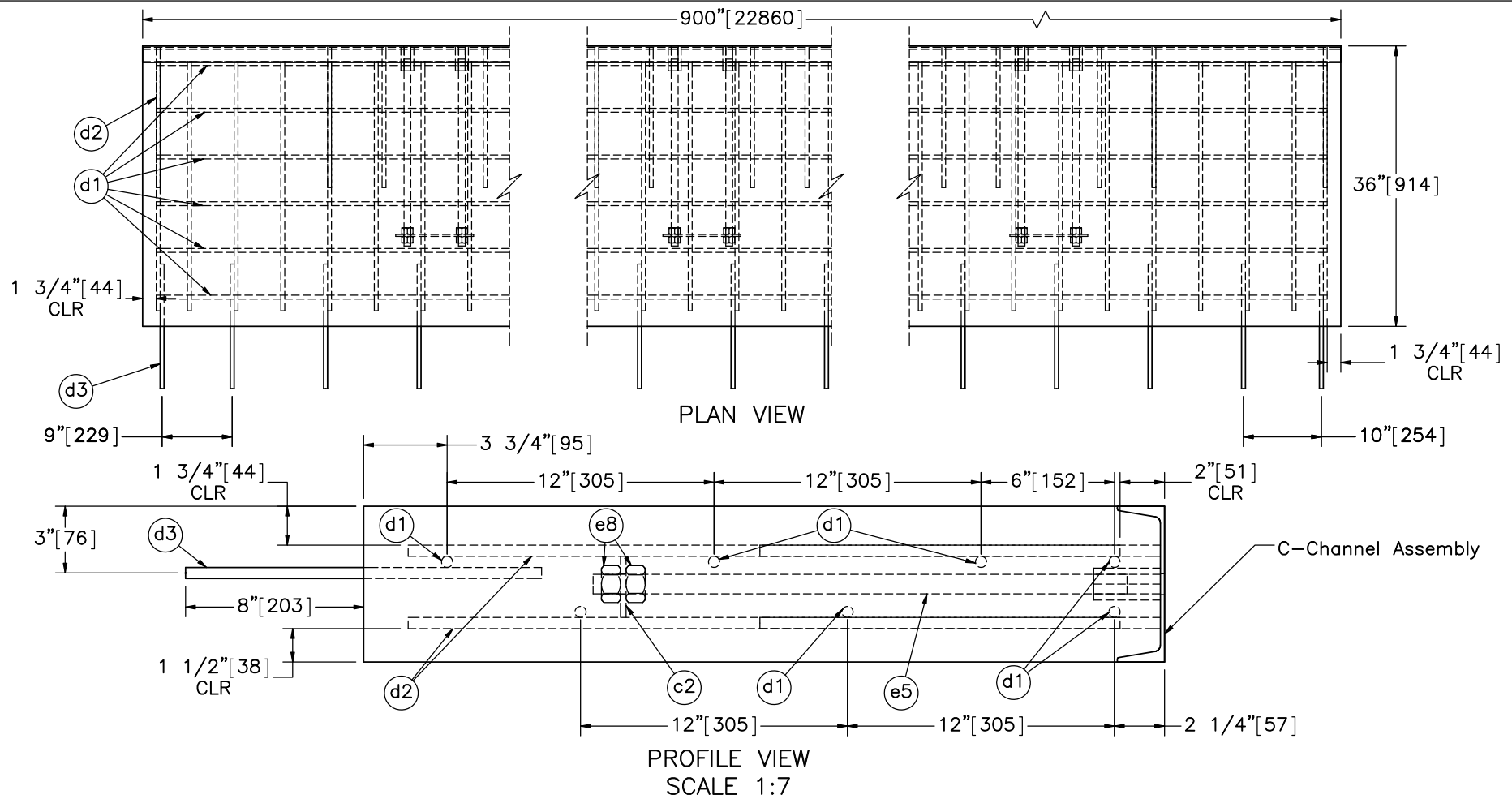
SCALE: 1:10  
 UNITS: in.[mm]

SHEET:  
 2 of 27

DATE:  
 2/9/2018

DRAWN BY:  
 MES/JEK

REV. BY:  
 JK/SR/RB/  
 RF/KL/JH



Item No.	QTY.	Description	Material Specification	Treatment Specification
-	1	Deck Assembly	-	-
-	4	C-Channel Assembly	-	ASTM A123
c2	12	10"x2 3/4"x1/4" [254x70x6] Plate Washer	ASTM A36	ASTM A123
d1	7	#4 [13] Bar, 896 1/2" [22,771] Long	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)
d2	302	#4 [13] Bar, 32" [813] Long	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)
d3	76	#4 [13] Bar, 16" [406] Long	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)
e5	24	7/8"-9 UNC [M22x2.5], 24" [610] Long Threaded Rod	ASTM A449 or Equivalent	ASTM A153 or B695 Class 55 or F2329
e8	48	7/8" [22] Dia. Heavy Hex Nut	ASTM A563DH or Equivalent	ASTM A153 or B695 Class 55 or F2329

- Notes: (1) C-Channel Assembly and reinforcement is hidden for clarity.  
 (2) Part e5 is threaded 1 1/4" [32] into part e7 (coupler nut).  
 (3) Part e7 held in place by external bolt during casting of deck.



Midwest Roadside Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Concrete Deck Assembly Details

DWG. NAME:  
NDOR\_TL2BR\_R10

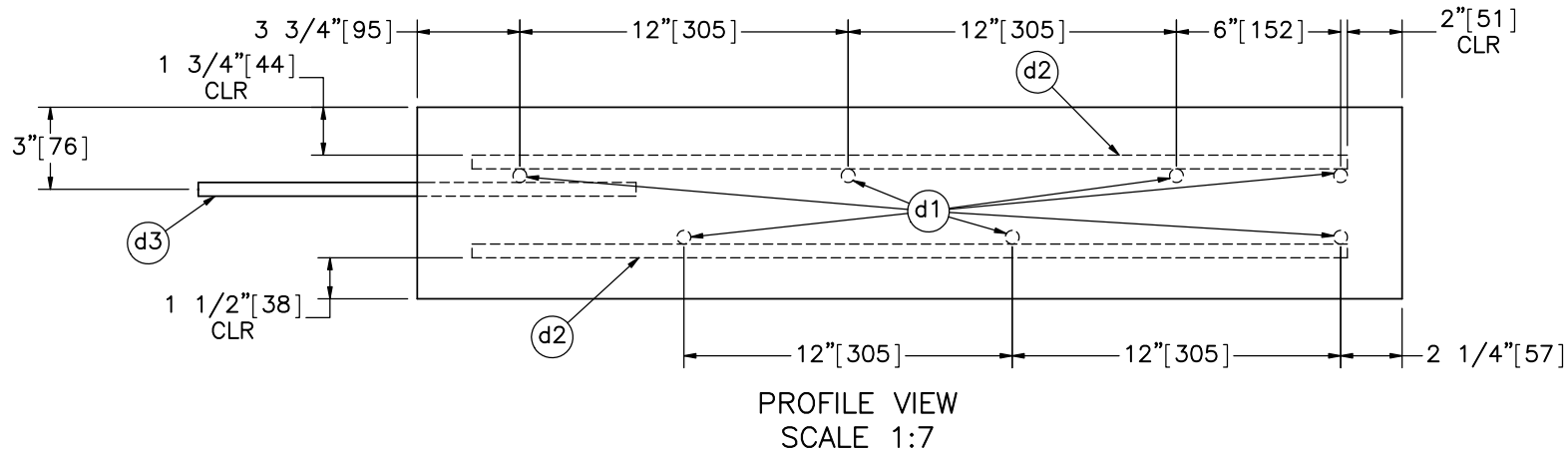
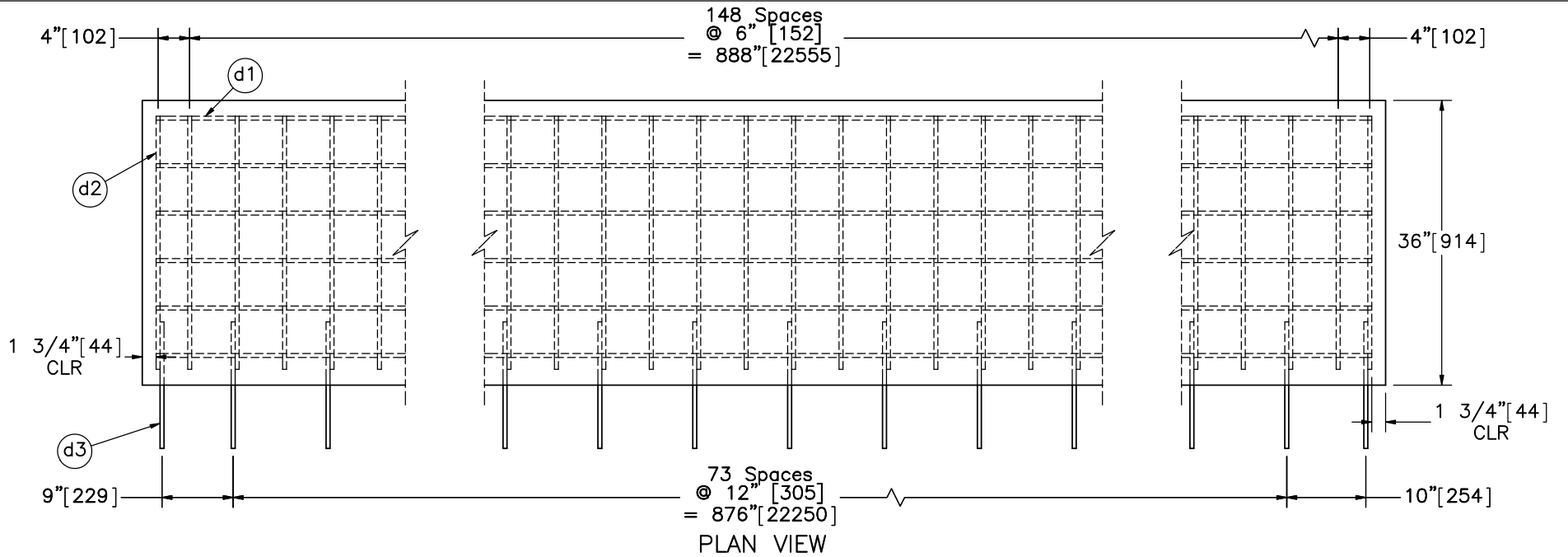
SCALE: 1:20  
UNITS: in./mm

SHEET:  
3 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH



Note: (1) C-Channel Assembly and hardware is hidden for clarity.



Midwest Roadside  
 Safety Facility

TL-2 Bridge Rail  
 Test No. N2BR-1

Concrete Deck Reinforcement  
 Details

DWG. NAME:  
 NDOR\_TL2BR\_R10

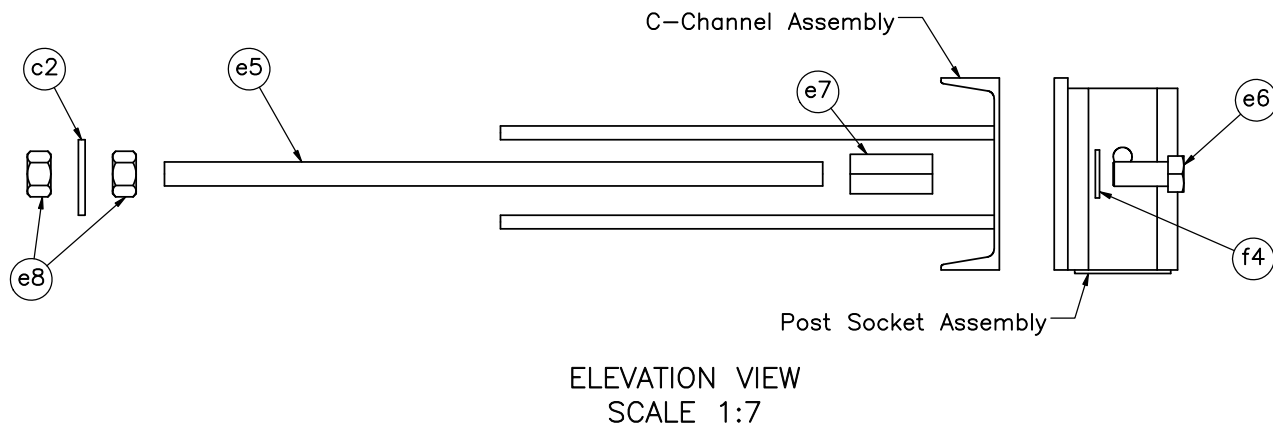
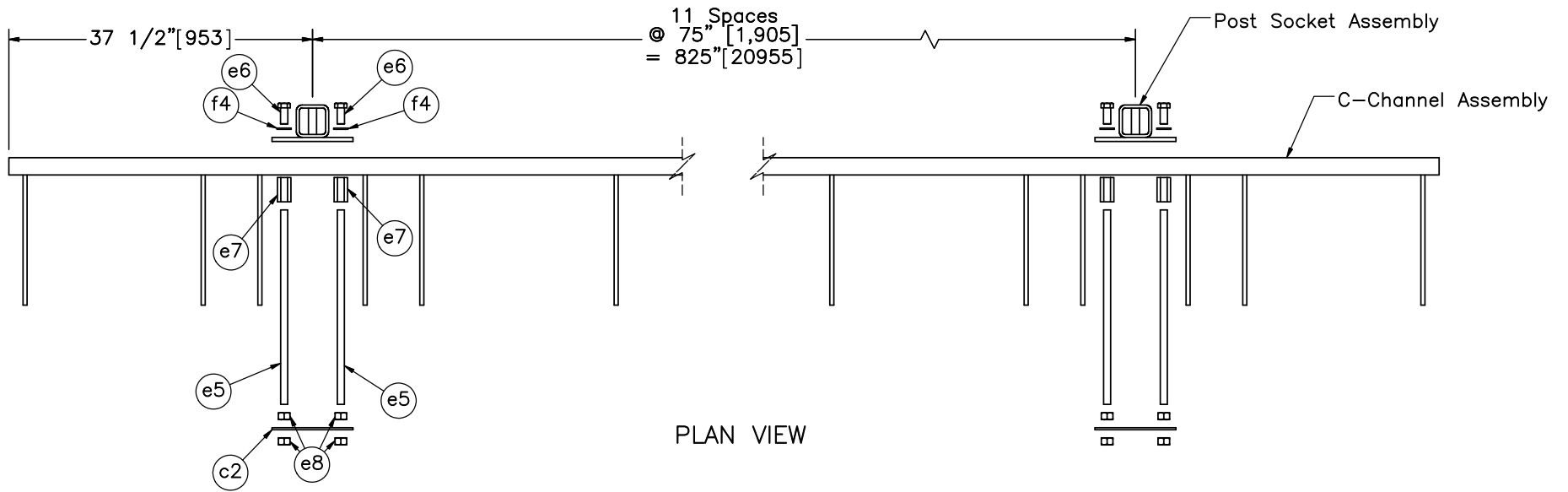
SCALE: 1:20  
 UNITS: in.[mm]

SHEET:  
 4 of 27

DATE:  
 2/9/2018

DRAWN BY:  
 MES/JEK

REV. BY:  
 JK/SR/RB/  
 RF/KL/JH



Note: (1) Part e5 is threaded 1 1/4" [32] into part e7 (coupler nut).



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

C-Channel and Post Socket  
Component Details

DWG. NAME:  
NDOR\_TL2BR\_R10

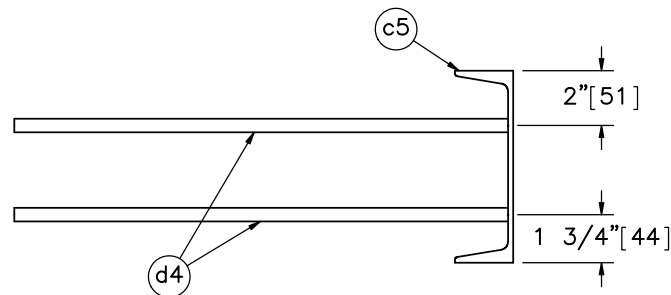
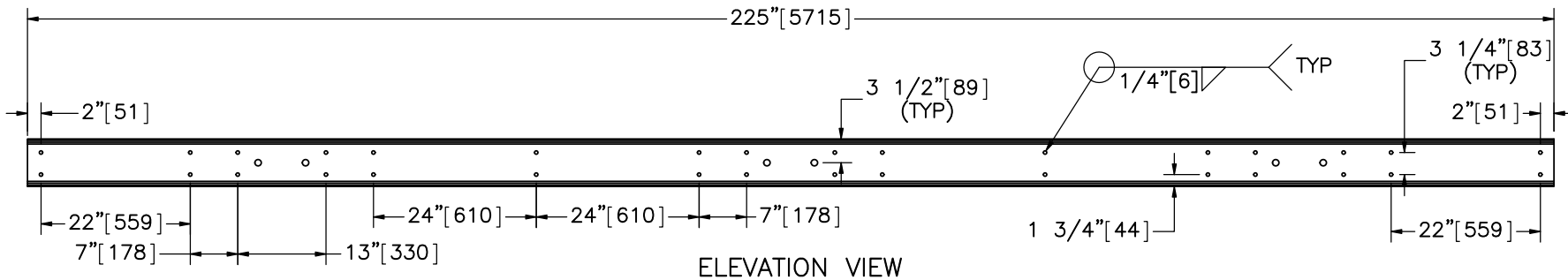
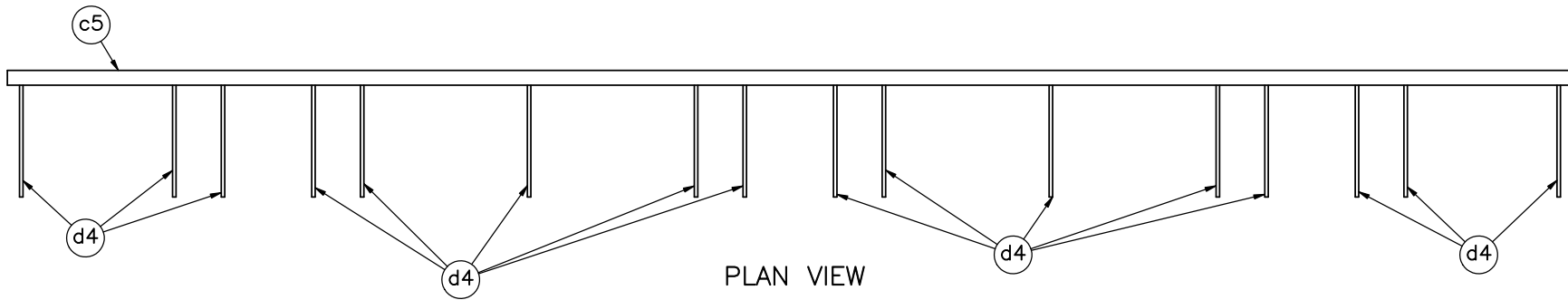
SCALE: 1:20  
UNITS: in.[mm]

SHEET:  
5 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH



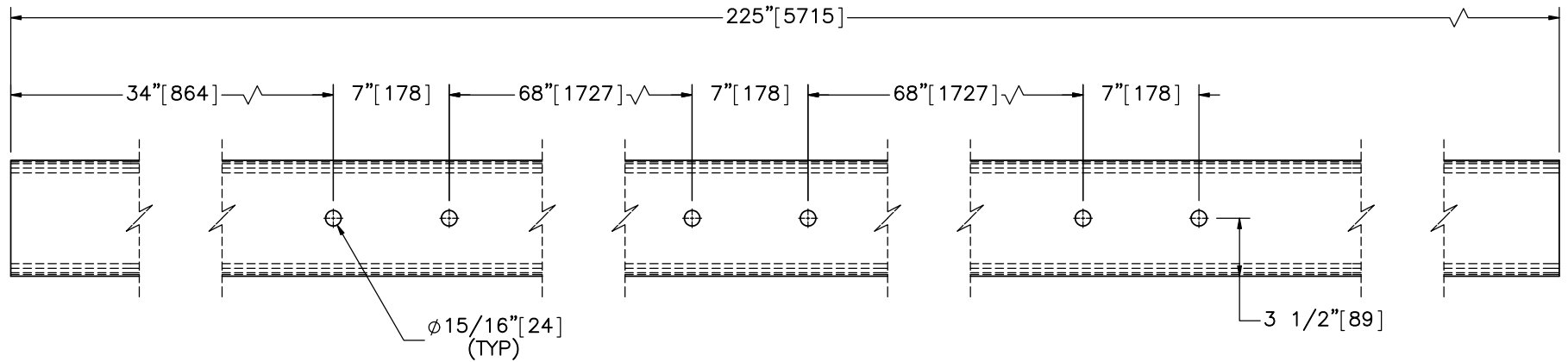
Note: (1) Adjacent C-Channel Assemblies will result in continuous 75" [1,905] post spacing.

Item No.	QTY.	Description	Material Specification	Treatment Specification
-	4	C-Channel Assembly	-	ASTM A123
c5	1	C7x9.8 [C178x14.3], 225" [5,715] Long C-Channel	ASTM A36	-
d4	32	#4 [13] Bar, 18" [457] Long	ASTM A706 Gr. 60	-

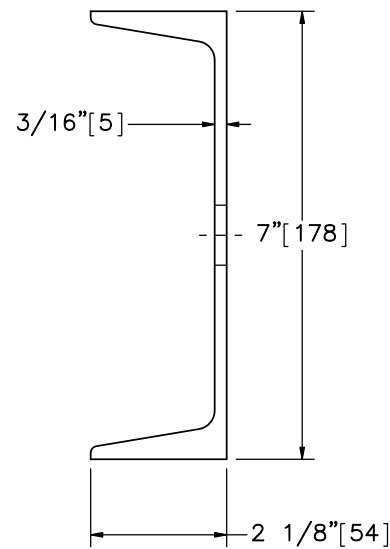


Midwest Roadside Safety Facility

TL-2 Bridge Rail Test No. N2BR-1	SHEET: 6 of 27
C-Channel Assembly Details	DATE: 2/9/2018
DWG. NAME: NDOR_TL2BR_R10	DRAWN BY: MES/JEK
SCALE: 1:25 UNITS: in.[mm]	REV. BY: JK/SR/RB/ RF/KL/JH



ELEVATION VIEW



PROFILE VIEW  
Part c5



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Deck C-Channel

DWG. NAME:  
NDOR\_TL2BR\_R10

SCALE: 1:10  
UNITS: in.[mm]

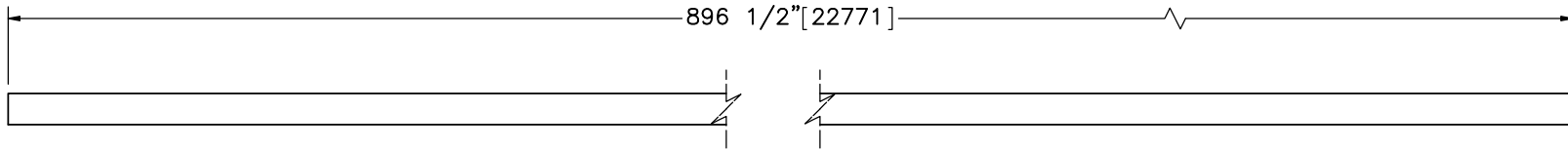
SHEET:  
7 of 27

DATE:  
2/9/2018

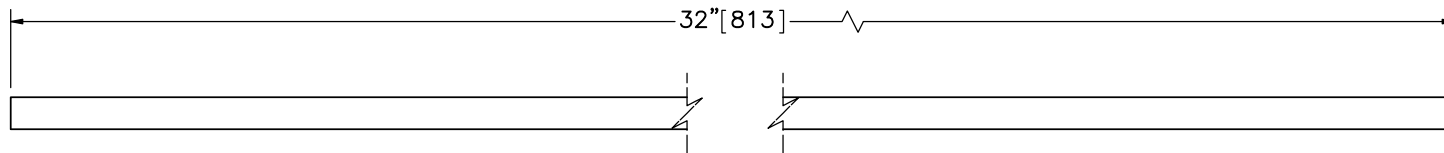
DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH

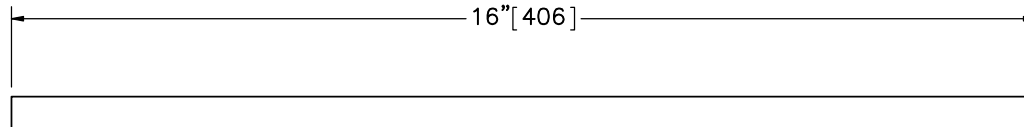
Bill of Bars				
Bar	QTY	Size	Total Unbent Length	Material
d1	7	#4 [13]	896 1/2" [22,771]	ASTM A615 Gr. 60
d2	302	#4 [13]	32" [813]	ASTM A615 Gr. 60
d3	76	#4 [13]	16" [406]	ASTM A615 Gr. 60
d4	128	#4 [13]	18" [457]	ASTM A706 Gr. 60



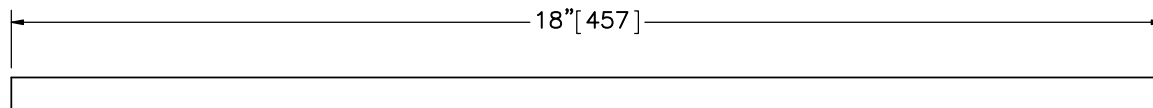
Part d1



Part d2



Part d3



Part d4



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Deck Reinforcement

DWG. NAME:  
NDOR\_TL2BR\_R10

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

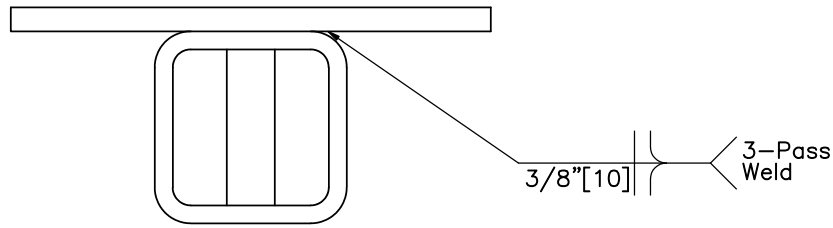
SHEET:  
8 of 27

DATE:  
2/9/2018

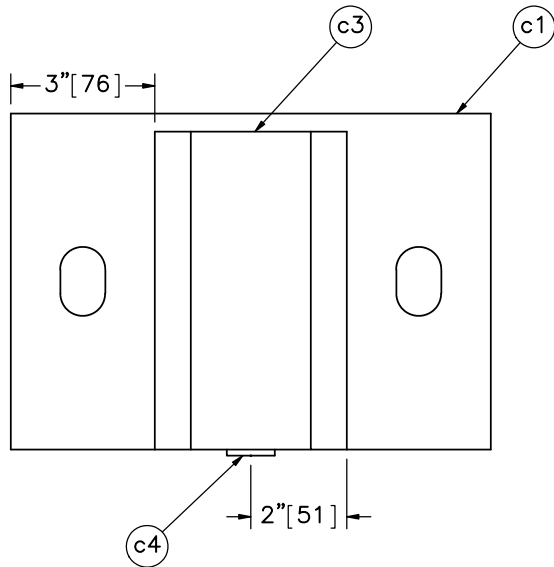
DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH

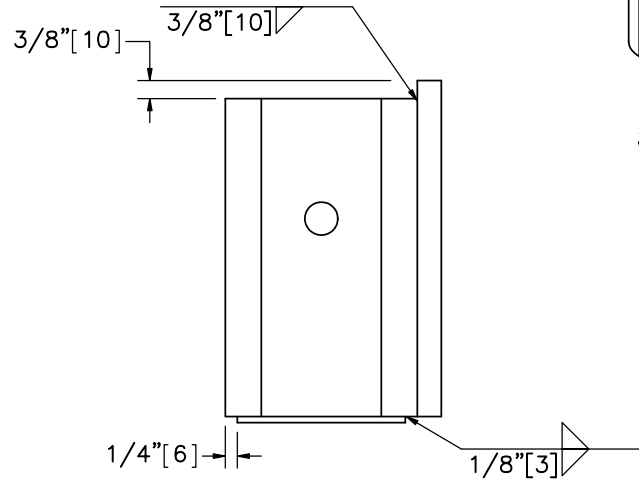




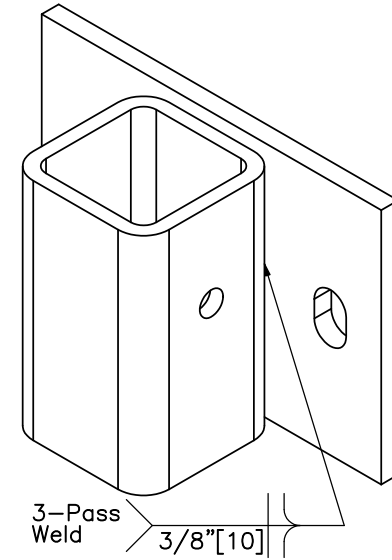
PLAN VIEW



ELEVATION VIEW



PROFILE VIEW



ISOMETRIC VIEW

Post Socket Assembly

Item No.	QTY.	Description	Material Specification	Treatment Specification
-	12	Post Socket Assembly	-	ASTM A123
c1	1	10"x7"x1/2" [254x178x13] Steel Plate	ASTM A572 Gr. 50	-
c3	1	HSS4"x4"x3/8" [102x102x10], 6 5/8" [168] Long Square Tube	ASTM A500 Gr. B	-
c4	1	3 1/2"x1"x1/8" [89x25x4]	ASTM A36	-



Midwest Roadside Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Post Socket Assembly

DWG. NAME:  
NDOR\_TL2BR\_R10

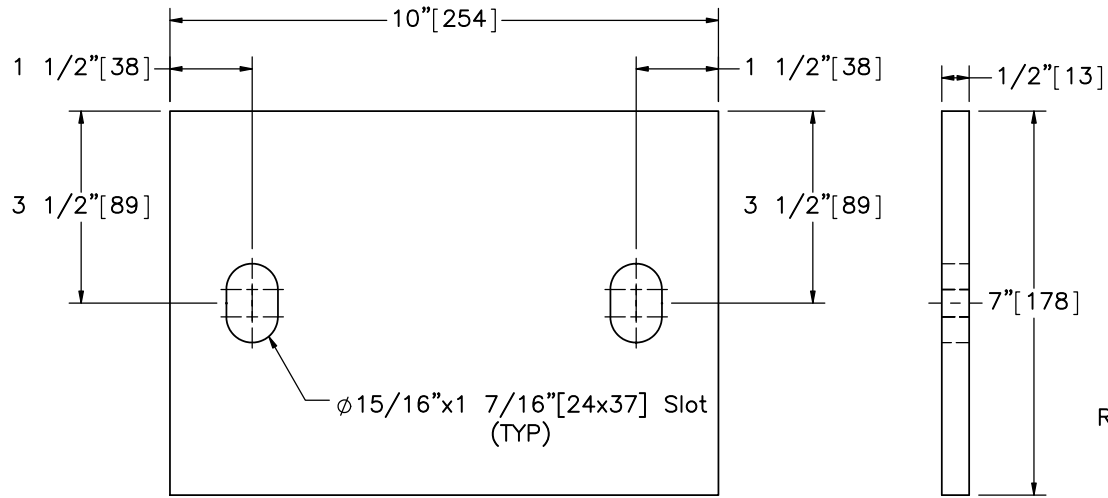
SCALE: 1:4  
UNITS: in.[mm]

SHEET:  
9 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

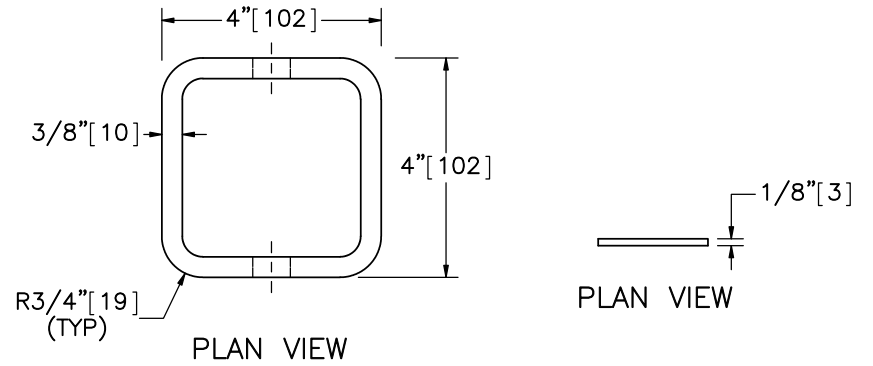
REV. BY:  
JK/SR/RB/  
RF/KL/JH



ELEVATION VIEW

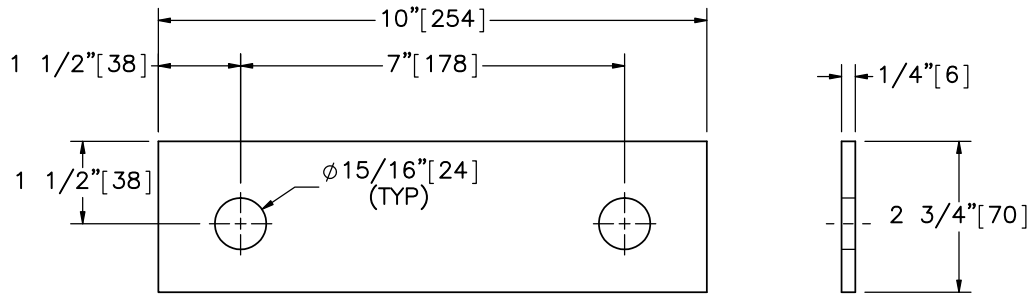
PROFILE VIEW

Part c1



PLAN VIEW

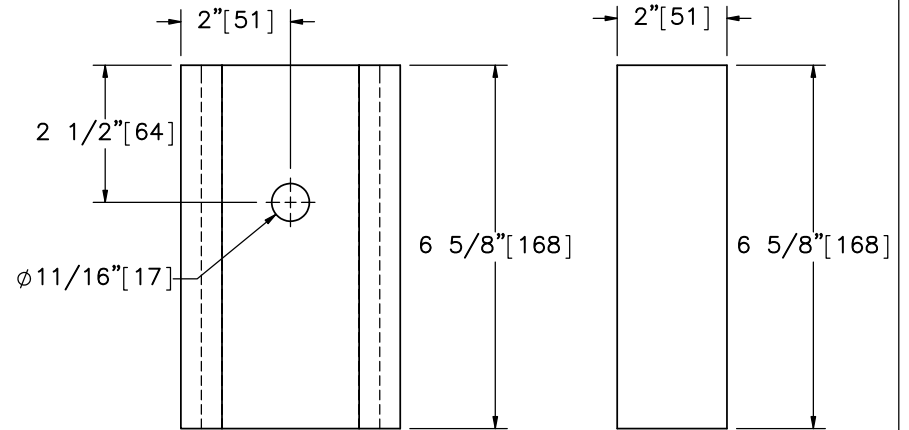
PLAN VIEW



ELEVATION VIEW

PROFILE VIEW

Part c2

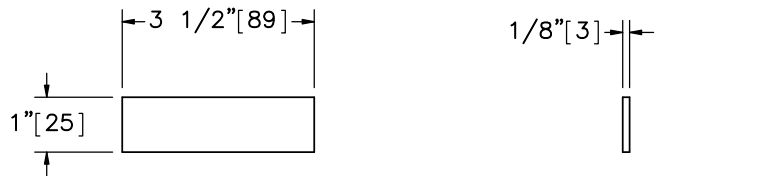


PROFILE VIEW

ELEVATION VIEW

Part c3

Part c6



PLAN VIEW

ELEVATION VIEW

Part c4



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Plate Washer and Post Socket  
Components

DWG. NAME:  
NDOR\_TL2BR\_R10

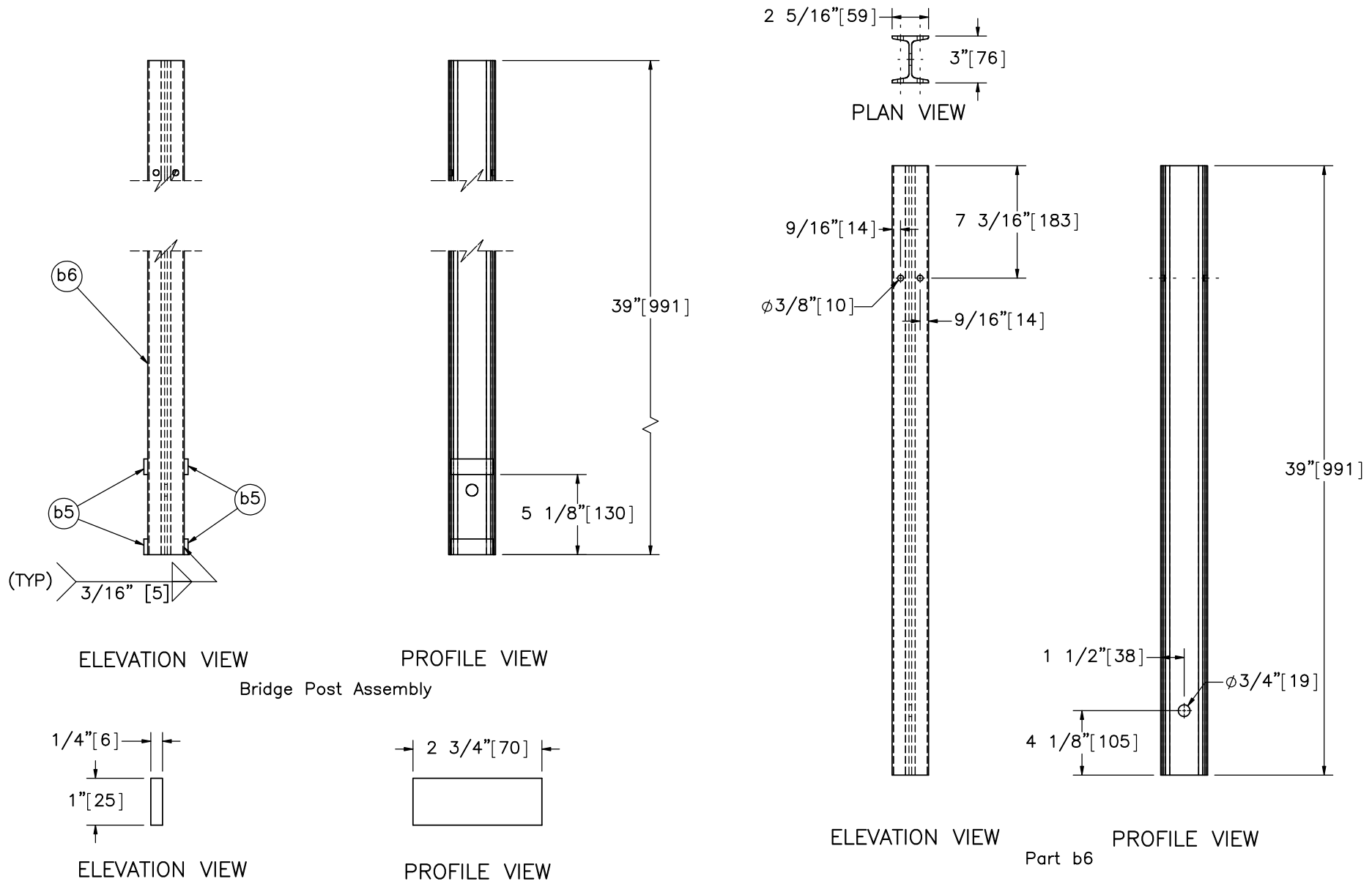
SCALE: 2:7  
UNITS: in.[mm]

SHEET:  
10 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH



Part b5  
SCALE 1:3

Item No.	QTY.	Description	Material Specification	Treatment Specification
-	12	Bridge Post Assembly	-	ASTM A123
b6	1	S3x5.7 [S76x8.5], 39" [991] Long Steel Post	ASTM A992 Gr. 50	-
b5	4	2 3/4"x1"x1/4" [70x25x6] Post Standoff	ASTM A36	-



Midwest Roadside Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Bridge Post Assembly and Components

DWG. NAME:  
NDOR\_TL2BR\_R10

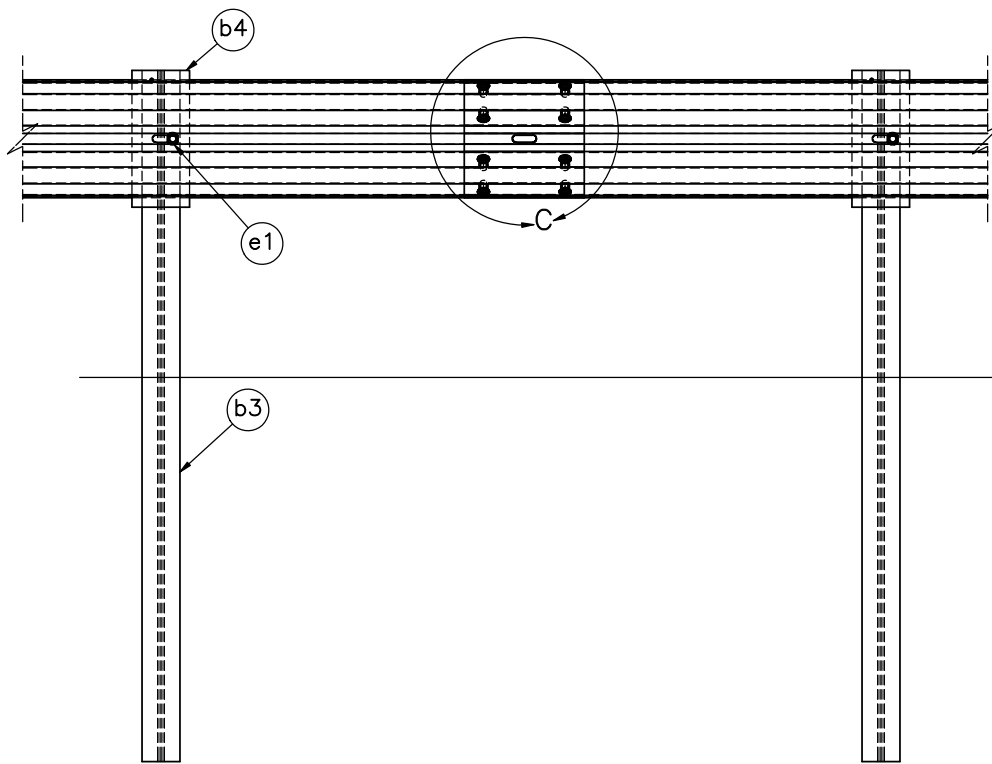
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UNITS: in.[mm]

SHEET:  
11 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

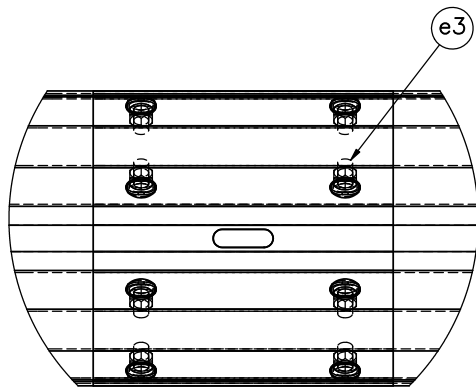
REV. BY:  
JK/SR/RB/RF/KL/JH



Post No. 7

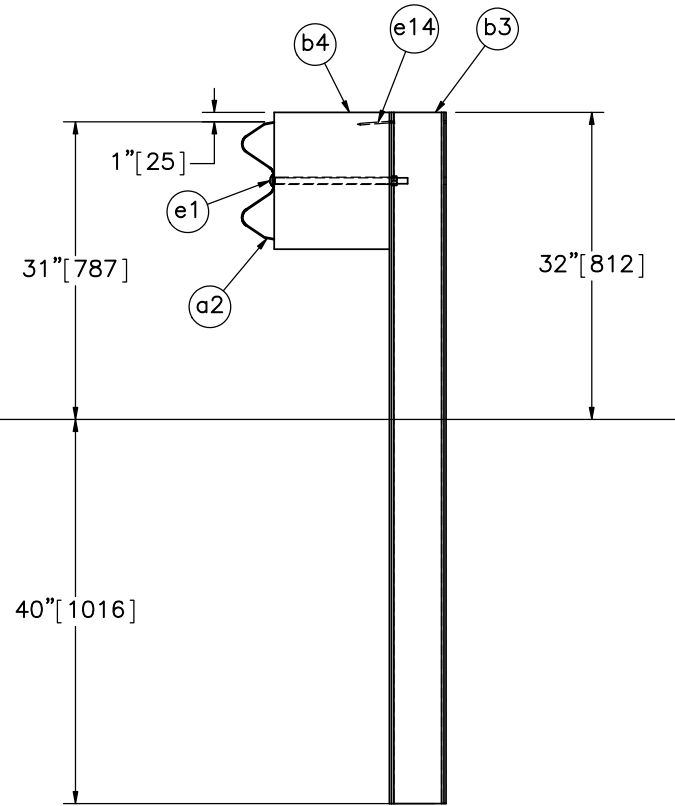
Post No. 6

SPLICE DETAIL  
FRONT SIDE



DETAIL C  
SCALE 1 : 8

Ground  
Line



SECTION B-B

Note: (1) Guardrail bolts (part e1) on the upstream side of the web.



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Splice and Post Detail

DWG. NAME:  
NDOR\_TL2BR\_R10

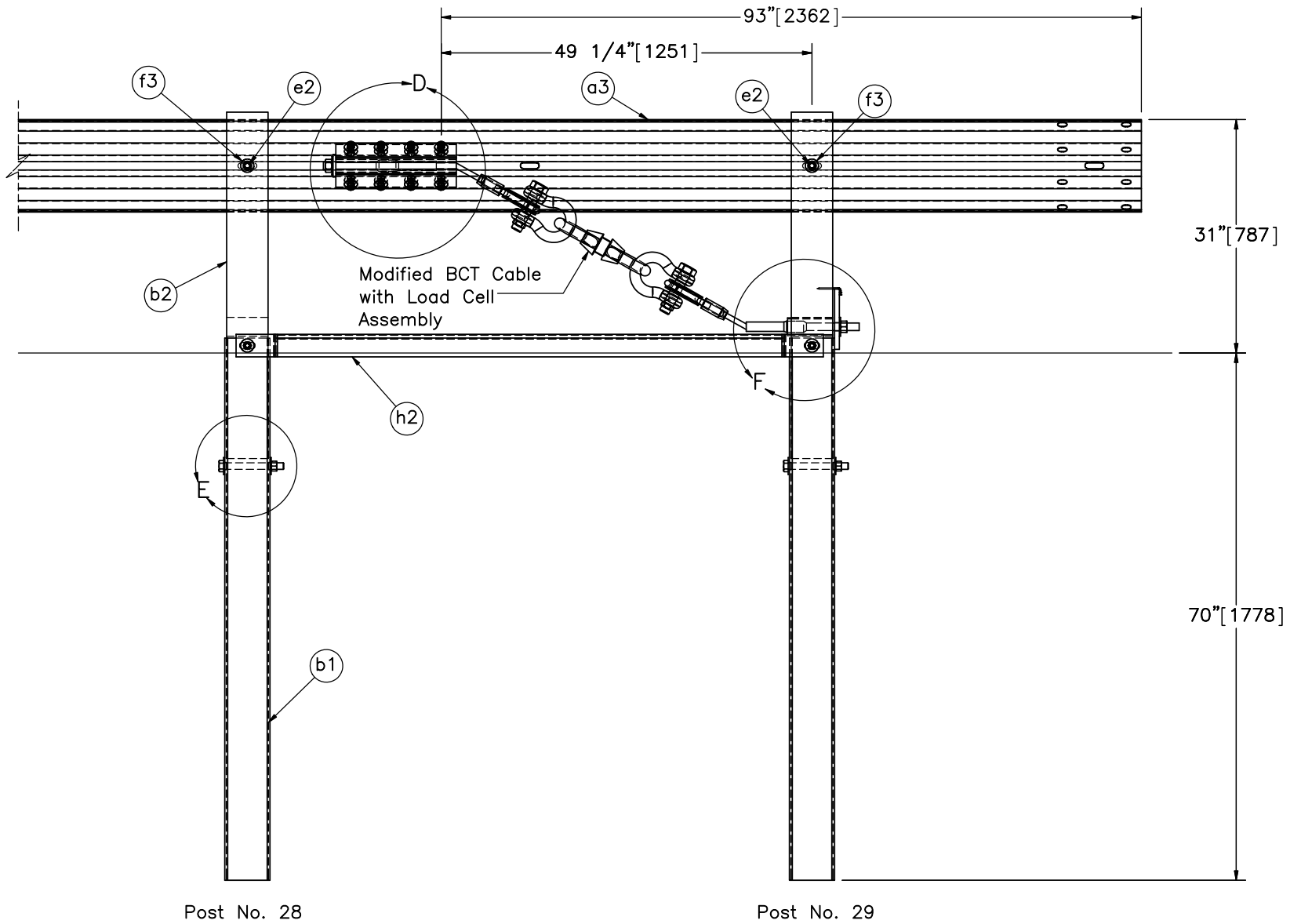
SCALE: 1:20  
UNITS: in.[mm]

SHEET:  
12 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH



Post No. 28

Post No. 29

END SECTION DETAIL  
BACKSIDE (TYP)



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

End Section Details

DWG. NAME:  
NDOR\_TL2BR\_R10

SCALE: 1:20  
UNITS: in.[mm]

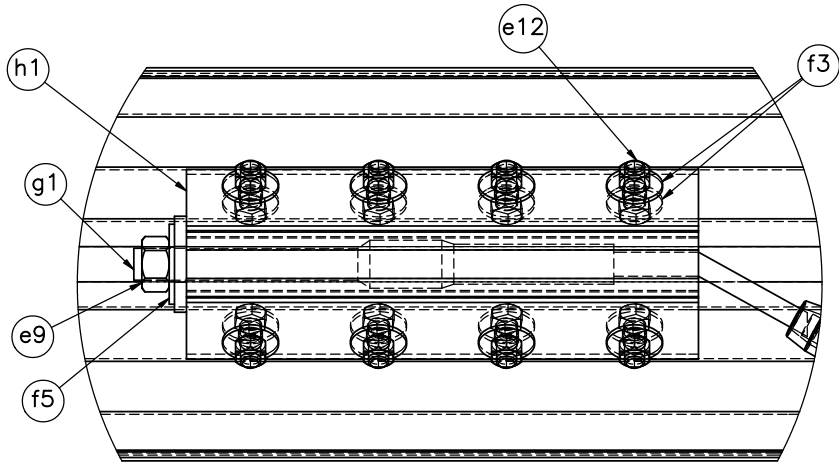
SHEET:  
13 of 27

DATE:  
2/9/2018

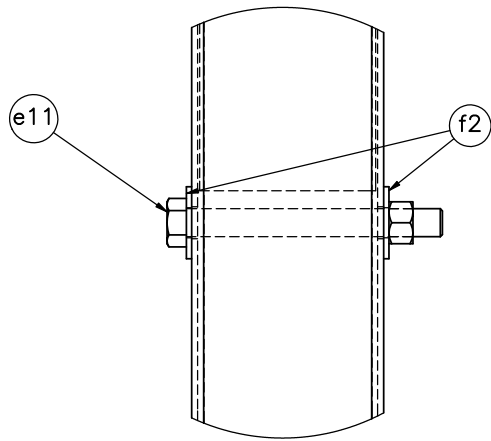
DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH

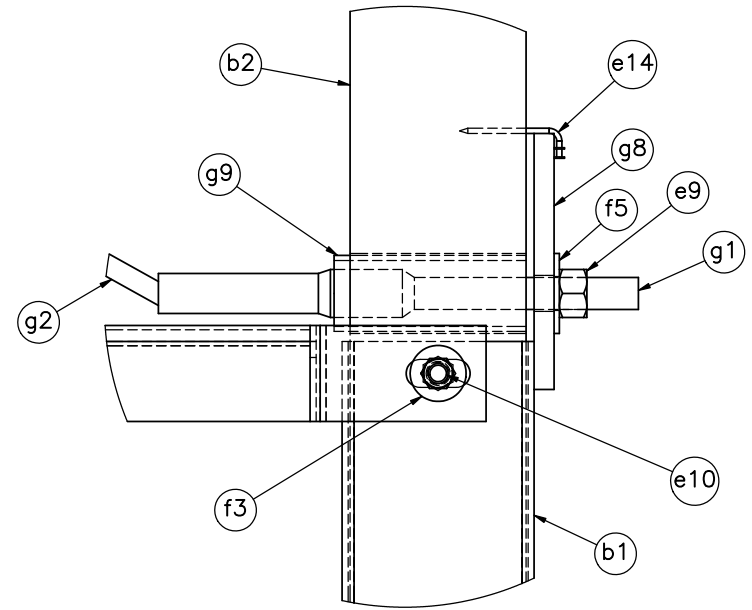
Note: (1) Upstream end section (post nos. 1 & 2) is mirrored.



DETAIL D




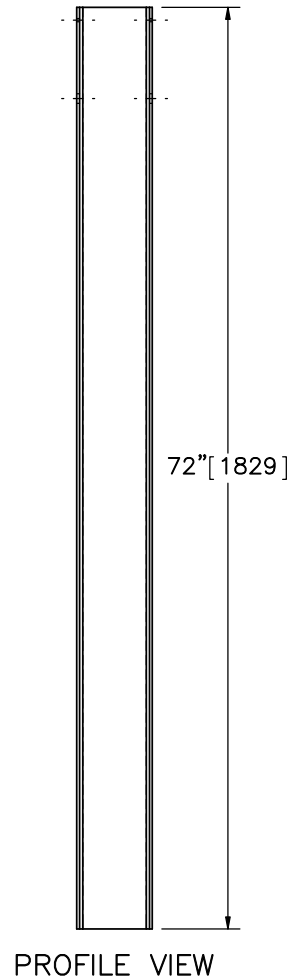
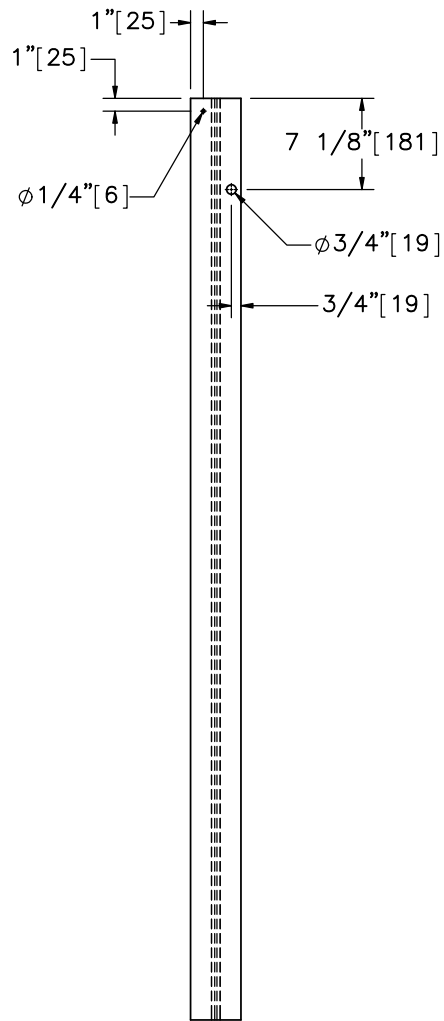
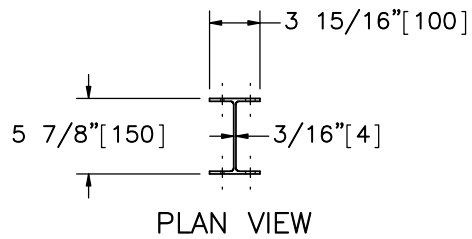
DETAIL E



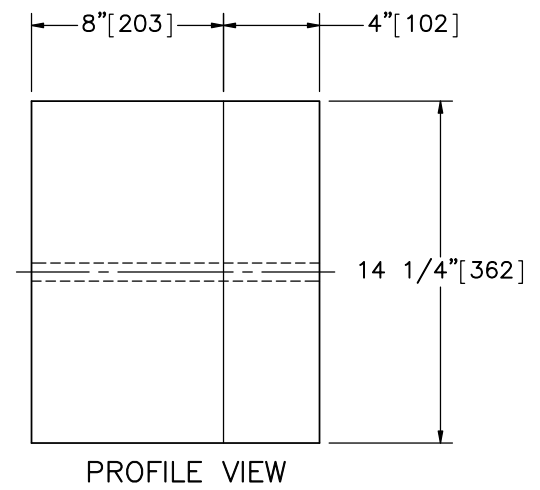
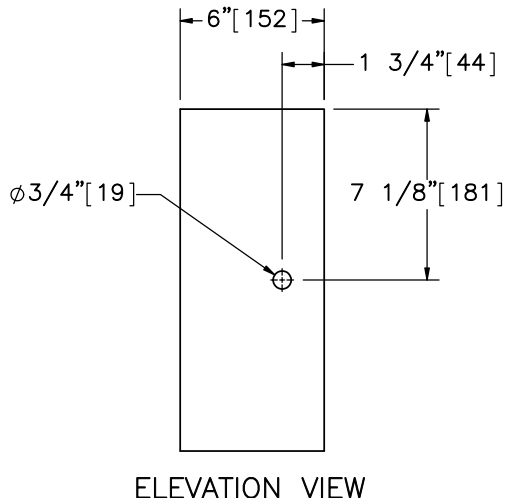
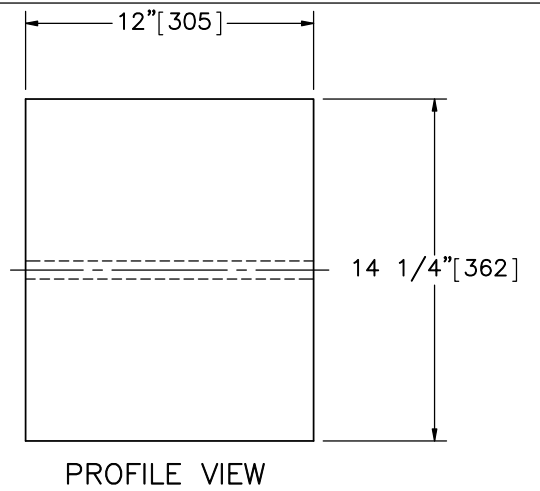
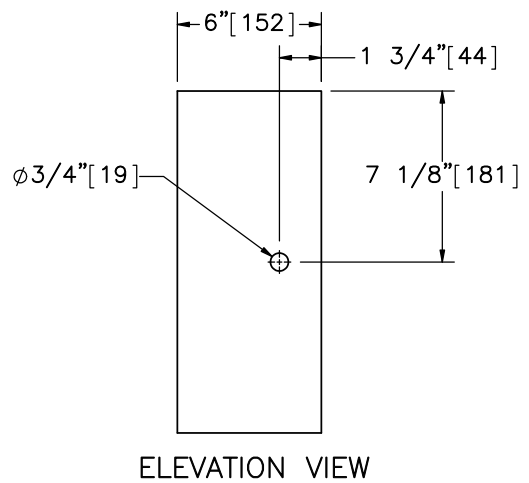
DETAIL F

Note: (1) Additional washer (part f3) on the opposite side under the head of bolt (part e9).

	TL-2 Bridge Rail Test No. N2BR-1	SHEET: 14 of 27
		DATE: 2/9/2018
Midwest Roadside Safety Facility	BCT Anchor Details	DRAWN BY: MES/JEK
	DWG. NAME: NDOR_TL2BR_R10	SCALE: 1:6 UNITS: in.[mm]
		REV. BY: JK/SR/RB/ RF/KL/JH



Part b3



Part b4  
SCALE 1:8

SCALE 1:8

Alternate Blockout Option -  
6"x4"x14 1/4" [152x102x362] Blockout  
with 6"x8"x14 1/4" [152x203x362] Blockout



Midwest Roadside  
Safety Facility

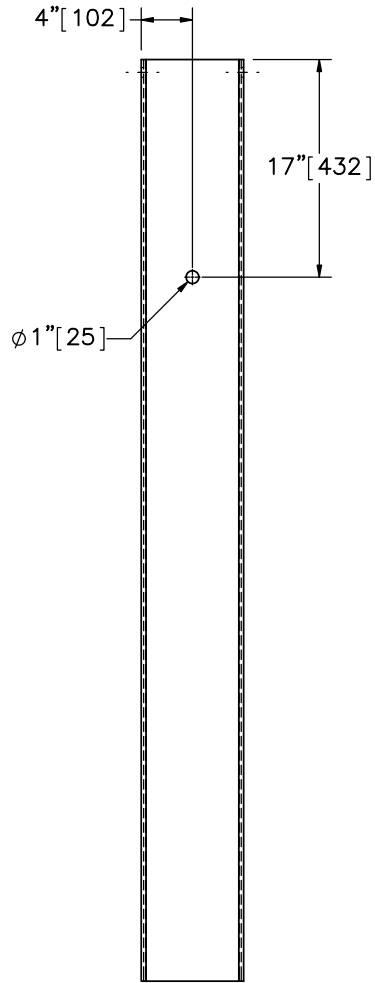
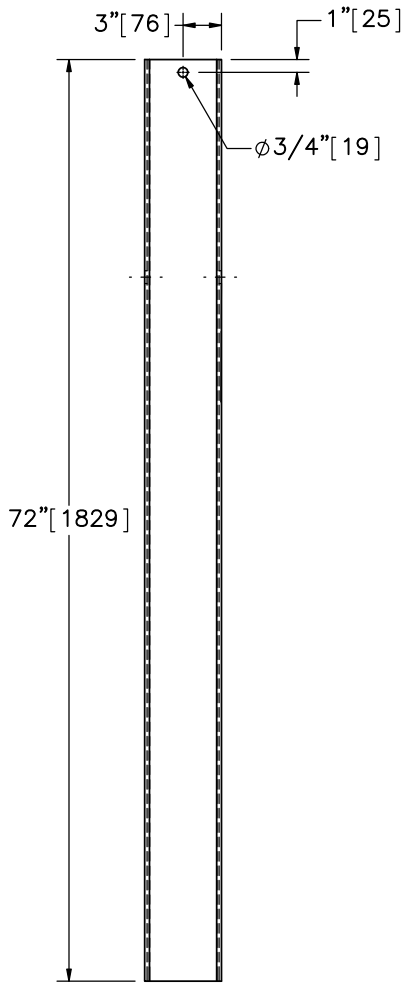
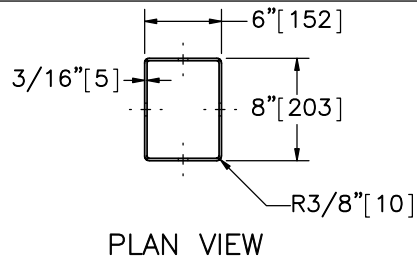
TL-2 Bridge Rail  
Test No. N2BR-1

Line Post Components

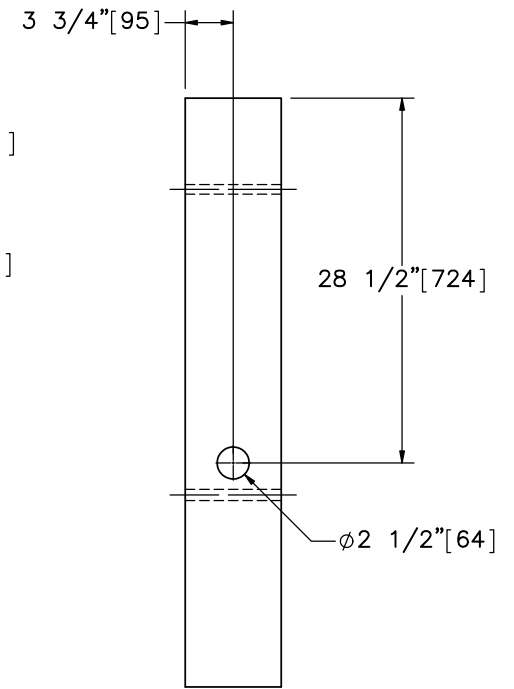
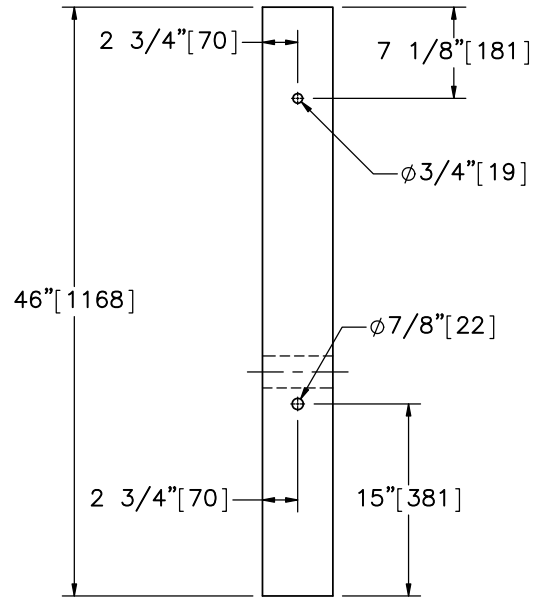
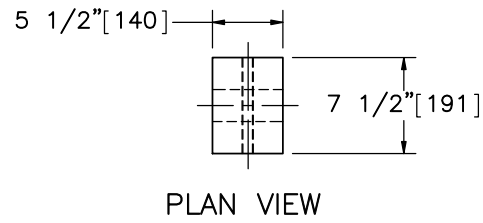
DWG. NAME:  
NDOR\_TL2BR\_R10

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

SHEET:  
15 of 27  
DATE:  
2/9/2018  
DRAWN BY:  
MES/JEK  
REV. BY:  
JK/SR/RB/  
RF/KL/JH



Part b1



Part b2



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Foundation Tube and BCT  
Timber Post Details

DWG. NAME:  
NDOR\_TL2BR\_R10

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

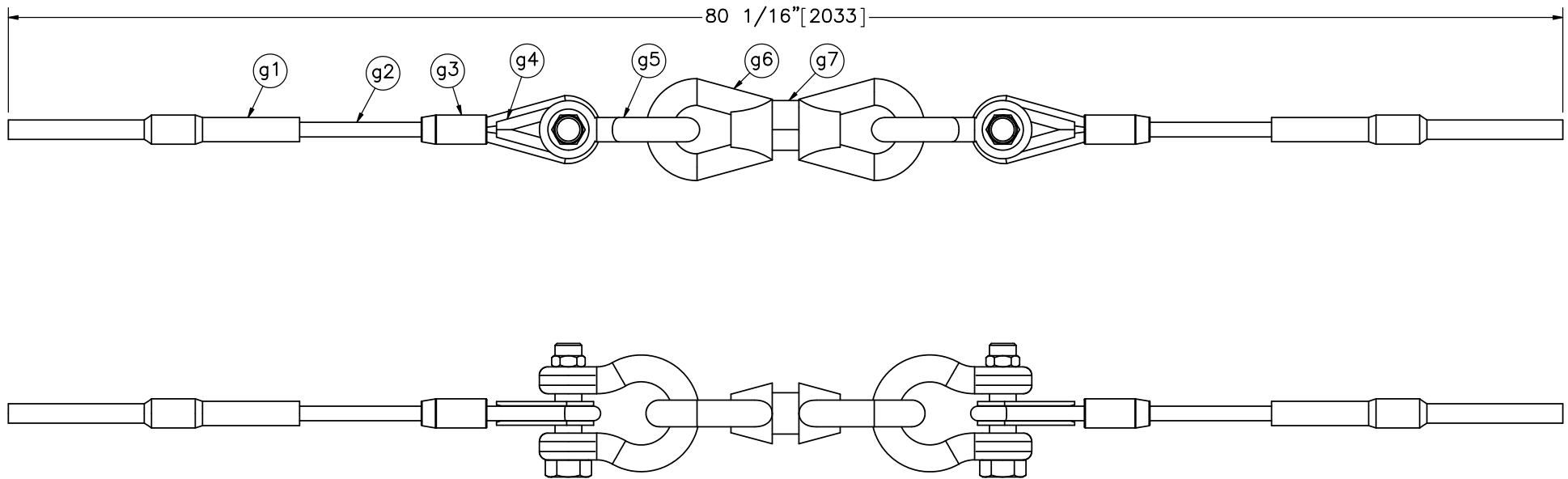
SHEET:  
16 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH





Item No.	QTY.	Description	Material Specification	Treatment Specification
-	2	Load Cell Assembly	-	-
g1	2	BCT Anchor Cable End Swaged Fiting	Fitting - ASTM A576 Gr. 1035 Stud - ASTM F568 Class C	Fitting - ASTM A153 Stud - ASTM A153 or B695
g2	2	3/4" 6x19, 24 1/2" [622] Long IWRC IPS Wire Rope	IPS	ASTM A741 Type II Class A
g4	2	Crosby Heavy Duty HT - 3/4" [19] Dia. Cable Thimble	Stock No. 1037773	As Supplied
g3	2	115-HT Mechanical Splice - 3/4" [19] Dia.	As Supplied	-
g5	2	Crosby G2130 or S2130 Bolt Type Shackle - 1 1/4" [32] Dia. with thin head bolt, nut, and cotter pin, Grade A, Class 3	Stock Nos. 1019597 and 1019604 - As Supplied	-
g6	2	Chicago Hardware Drop Forged Heavy Duty Eye Nut - Drilled and Tapped 1 1/2" [38] Dia. - UNC 6 [M36x4]	Stock No. 107 - As Supplied	-
g7	1	TLL-50K-PTB Load Cell	-	-

Note: (1) 6x25 IWRC IPS cables meet the minimum breaking strength of 42.7 kips [190 kN] and may be substituted for the 6x19 IWRC IPS cables.



Midwest Roadside Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

BCT Anchor Cable & Load Cell  
Detail

DWG. NAME.  
NDOR\_TL2BR\_R10

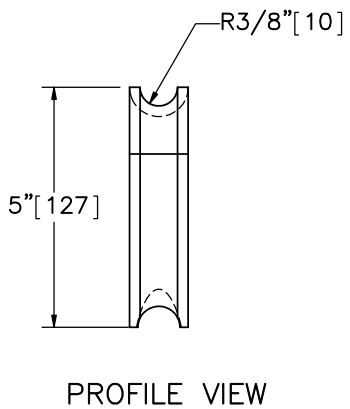
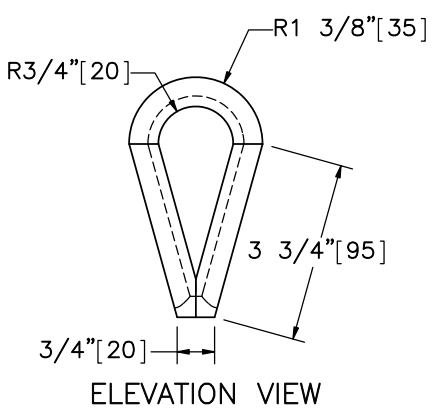
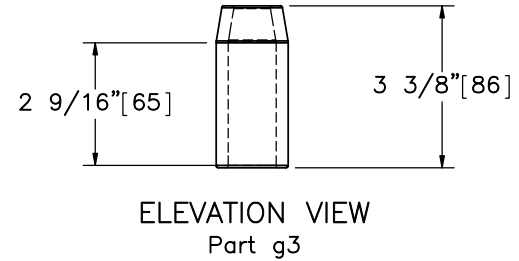
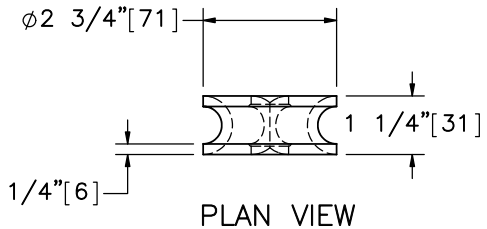
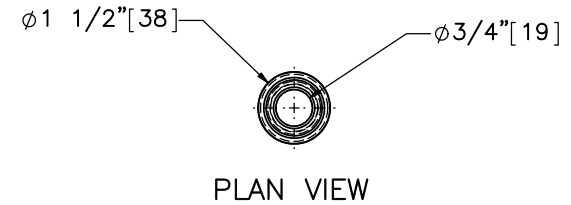
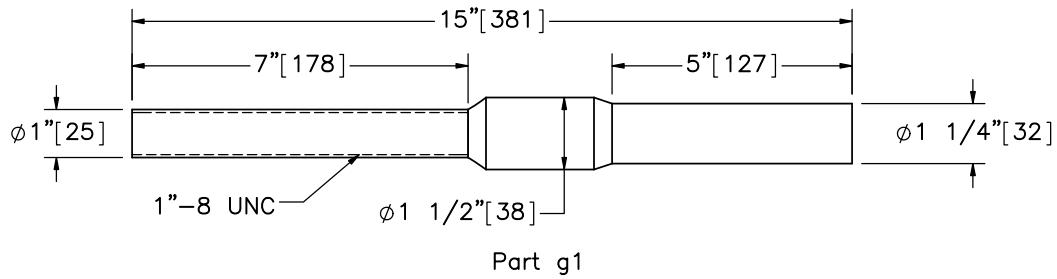
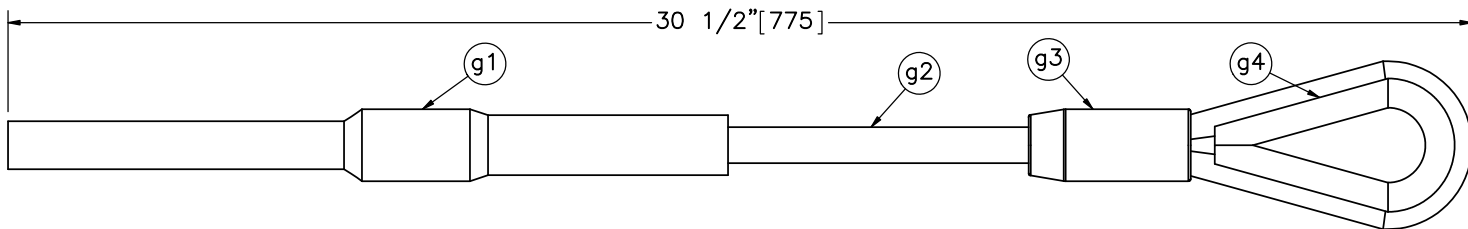
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UNITS: in.[mm]

SHEET:  
17 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH



Part g4



Midwest Roadside Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Modified BCT Anchor Cable

DWG. NAME:  
NDOR\_TL2BR\_R10

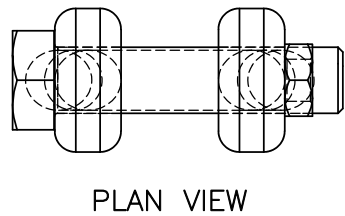
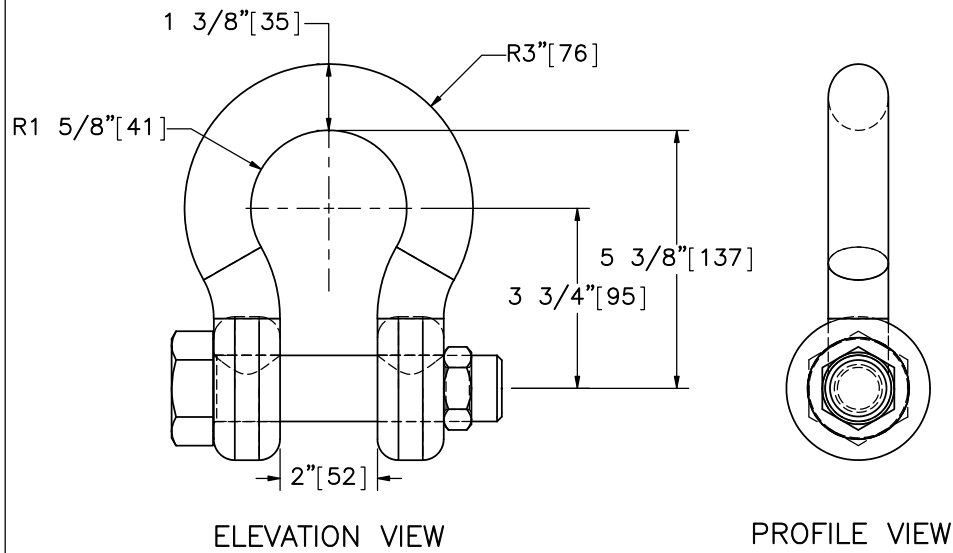
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SHEET:  
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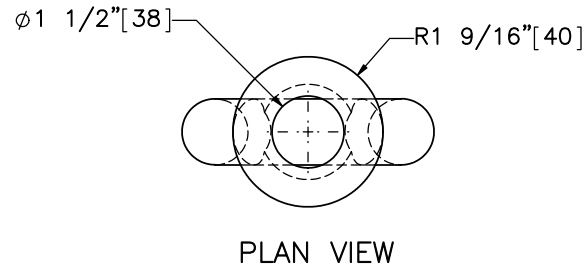
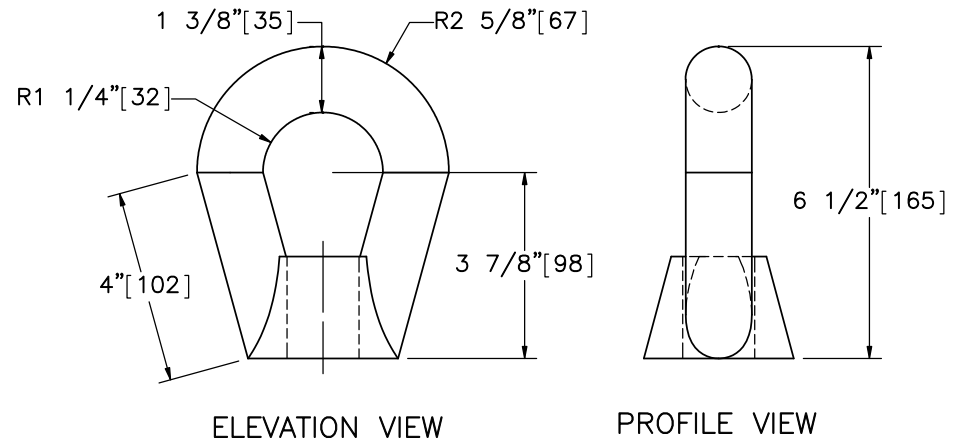
DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH



Part g5



Part g6



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Shackle and Eye Nut Detail

DWG. NAME:  
NDOR\_TL2BR\_R10

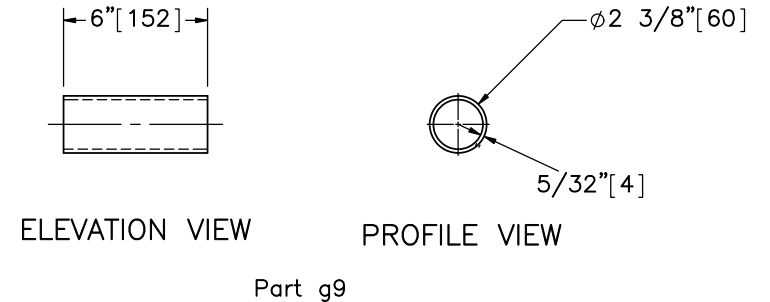
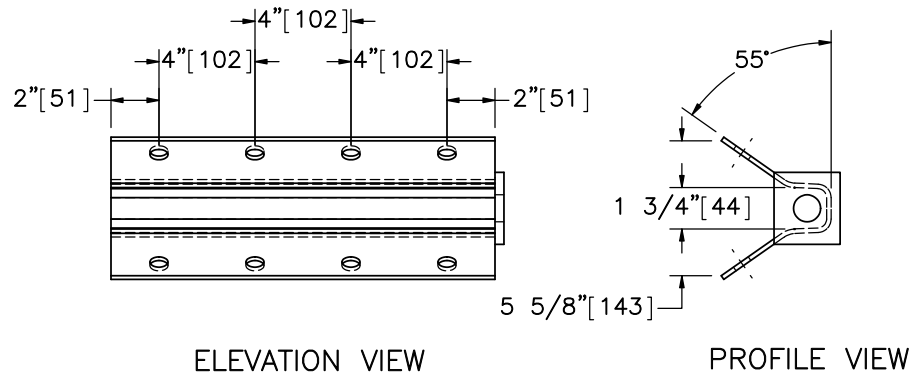
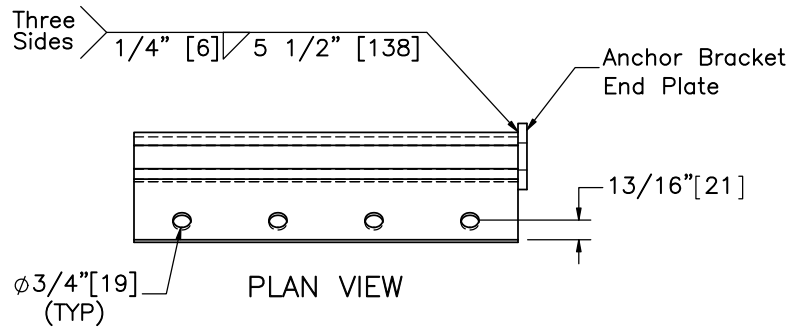
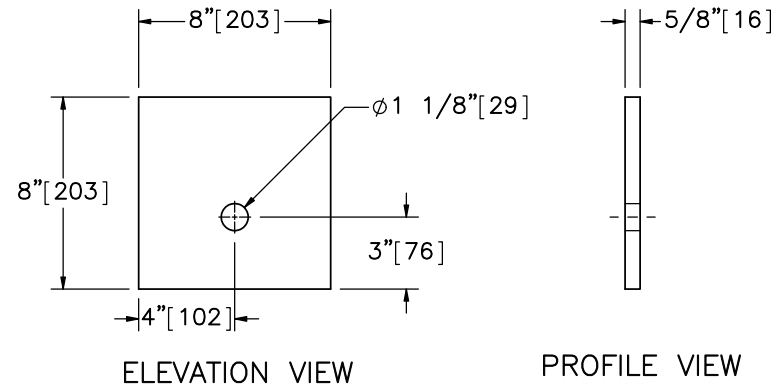
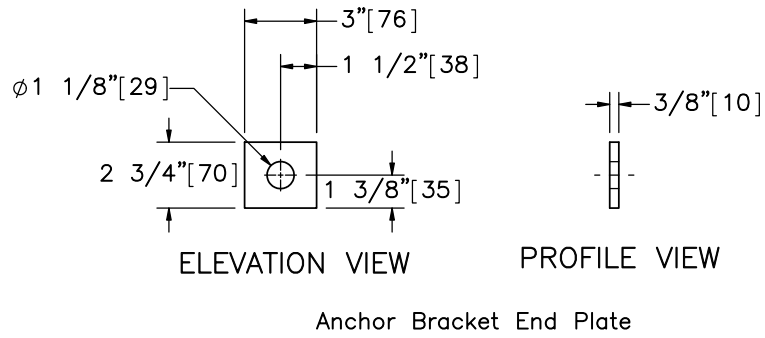
SCALE: 1:4  
UNITS: in.[mm]

SHEET:  
19 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

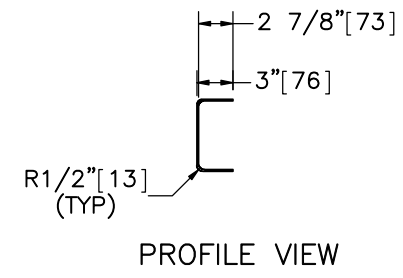
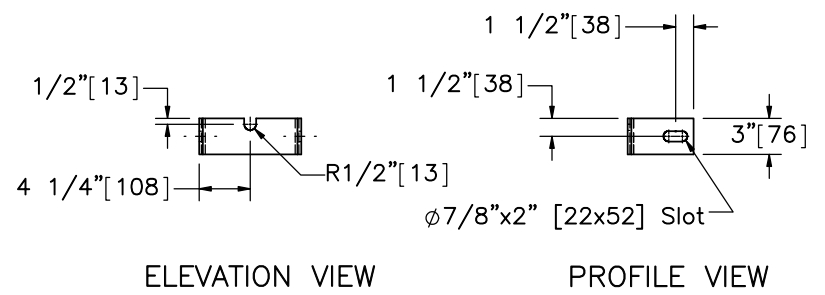
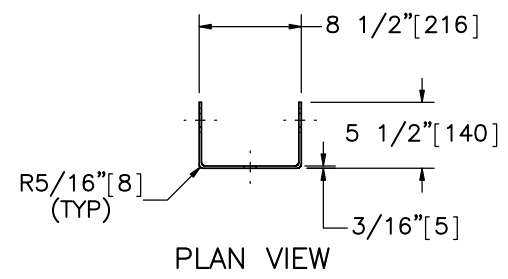
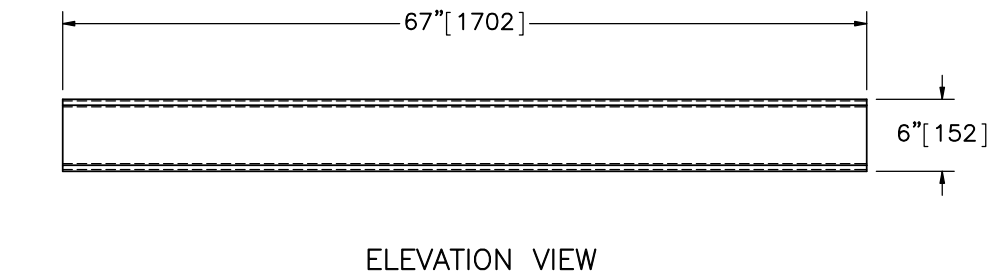
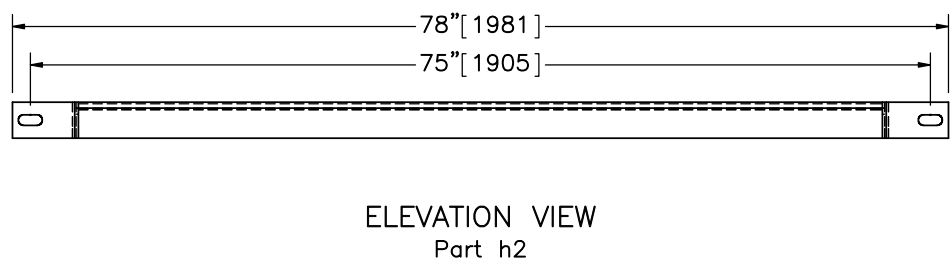
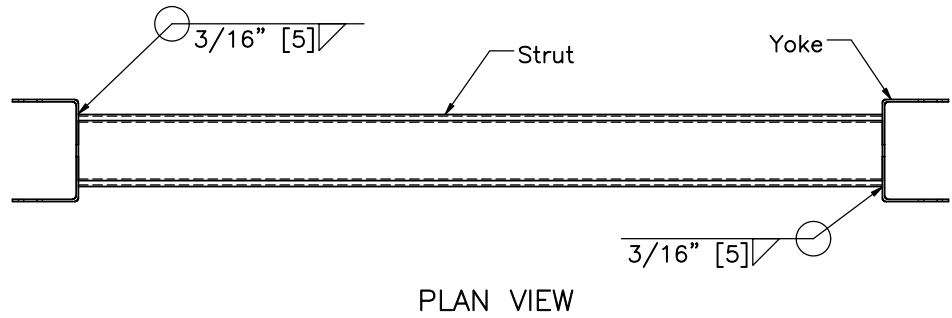
REV. BY:  
JK/SR/RB/  
RF/KL/JH



Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
h1	2	Anchor Bracket Assembly	ASTM A36	ASTM A123	FPA01
-	1	Anchor Bracket	ASTM A36	-	-
-	1	End Plate	ASTM A36	-	-


Midwest Roadside Safety Facility

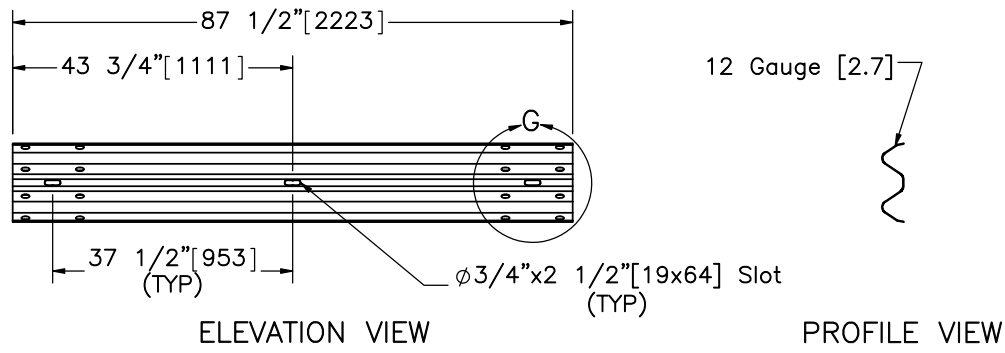
TL-2 Bridge Rail Test No. N2BR-1	SHEET: 20 of 27
	DATE: 2/9/2018
BCT Post Components & Anchor Bracket	DRAWN BY: MES/JEK
DWG. NAME: NDOR_TL2BR_R10	REV. BY: JK/SR/RB/ RF/KL/JH
	SCALE: 1:8 UNITS: in.[mm]



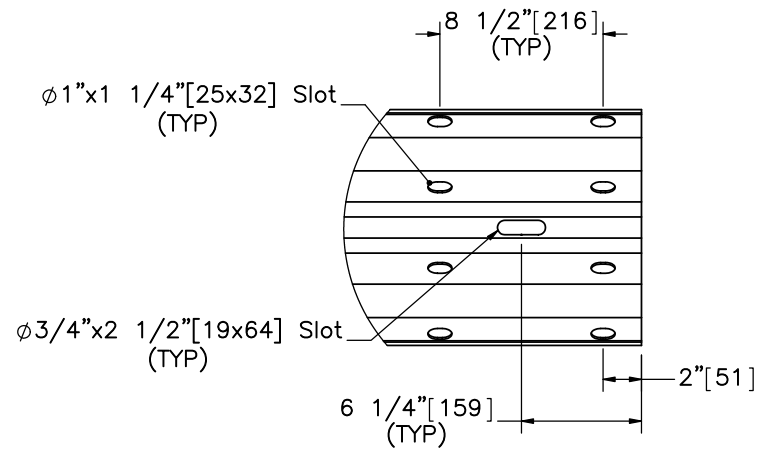
6"x3" [152x76] 10 Gauge [3.4] Strut

Yoke

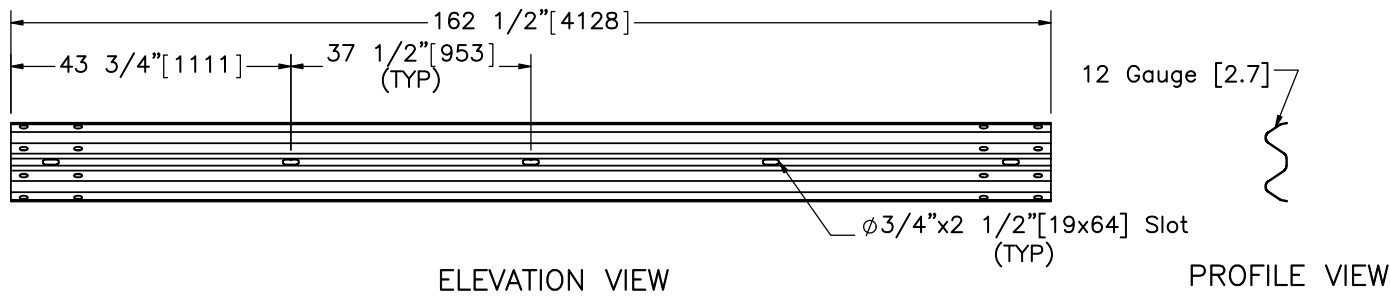
Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide	 <b>Midwest Roadside Safety Facility</b>	TL-2 Bridge Rail Test No. N2BR-1		SHEET: 21 of 27
h2	2	Ground Strut Assembly	ASTM A36	ASTM A123	PFP02			Ground Strut and Bearing Plate	
-	1	6"x3" [152x76] 10 Gauge [3.4] Strut	ASTM A36	-	-		DWG. NAME: NDOR_TL2BR_R10		DRAWN BY: MES/JEK
-	2	8 1/2"x5 1/2"x3" [216x140x76] Yoke	ASTM A36	-	-		SCALE: 1:16 UNITS: in.[mm]	REV. BY: JK/SR/RB/ RF/KL/JH	



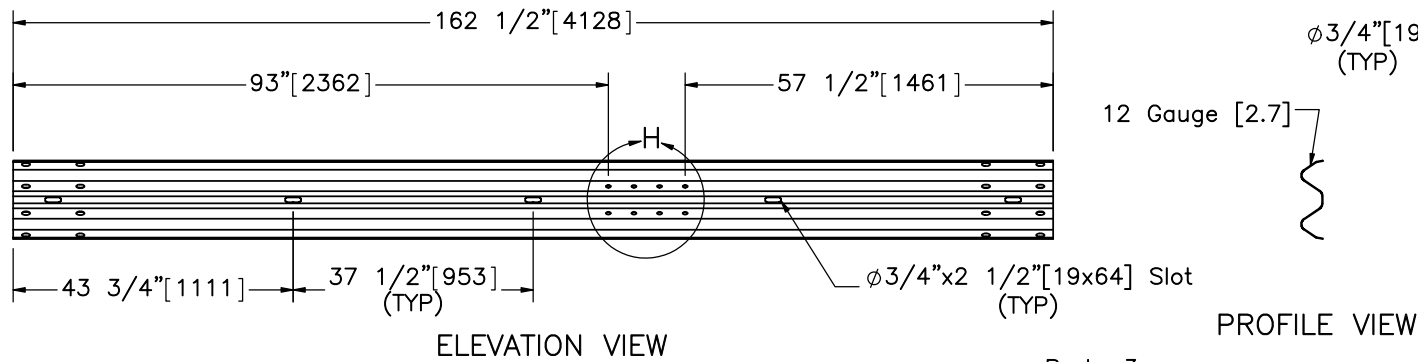
Part a1



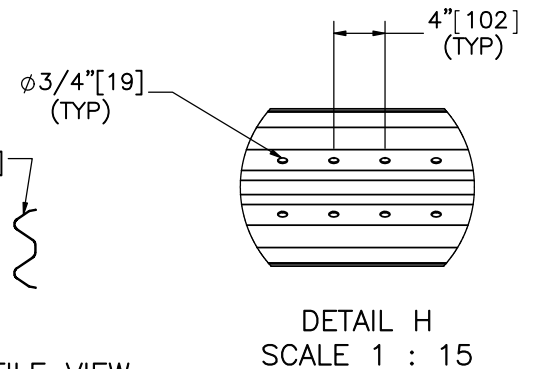
DETAIL G  
SCALE 1 : 10



Part a2



Part a3



DETAIL H  
SCALE 1 : 15



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Rail Section Details

DWG. NAME.  
NDOR\_TL2BR\_R10

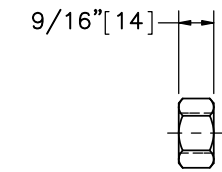
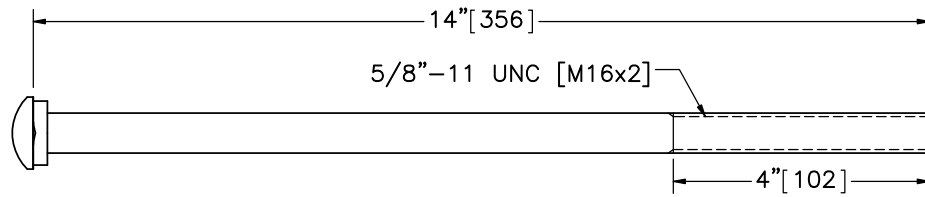
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UNITS: in.[mm]

SHEET:  
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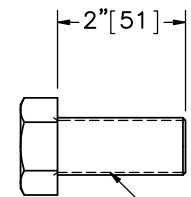
DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH

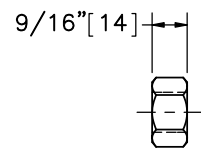
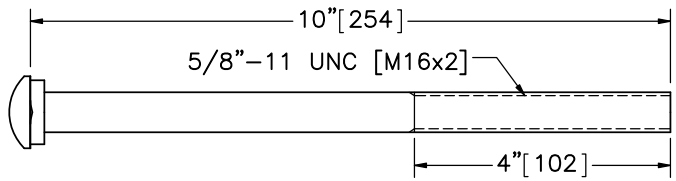


Part e1

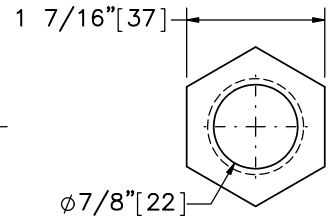
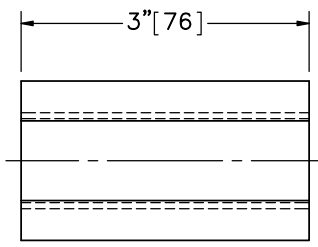


7/8"-9 UNC [M22x2.5]

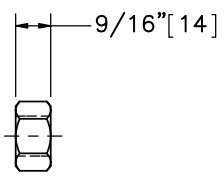
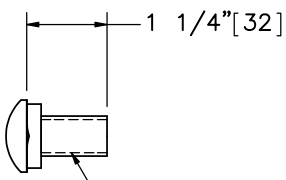
Part e6



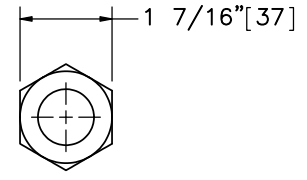
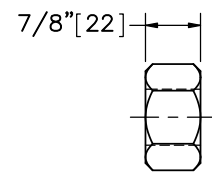
Part e2



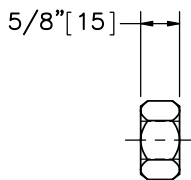
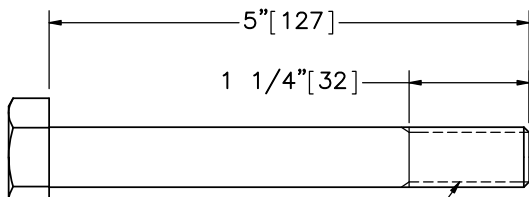
Part e7



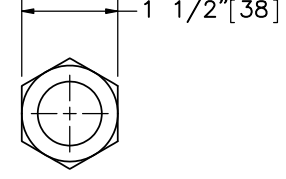
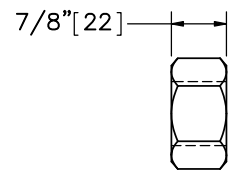
Part e3



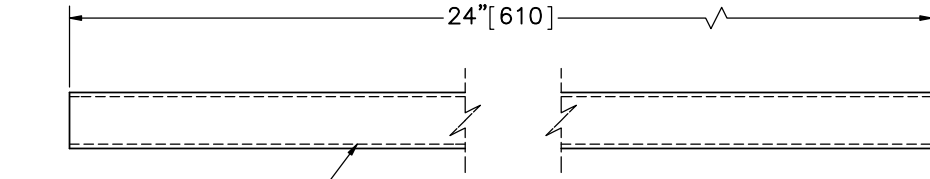
Part e8



Part e4



Part e9



7/8"-9 UNC [M22x2.5]

Part e5



Midwest Roadside Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

System Hardware

DWG. NAME:  
NDOR\_TL2BR\_R10

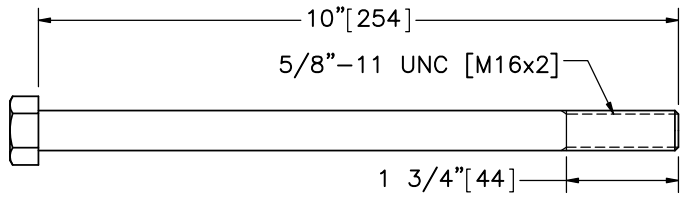
SCALE: 1:3  
UNITS: in.[mm]

SHEET:  
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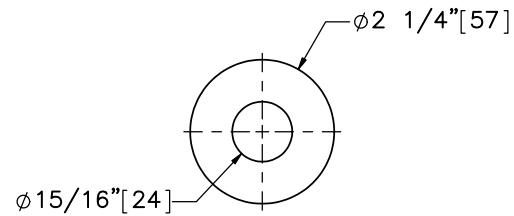
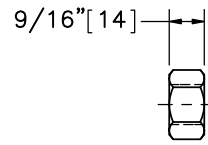
DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

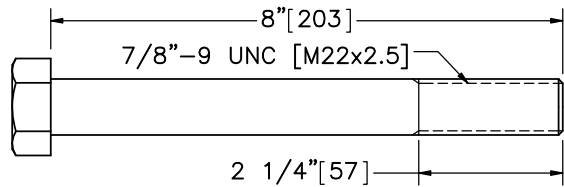
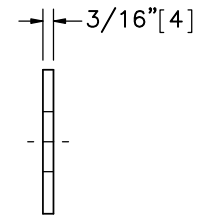
REV. BY:  
JK/SR/RB/  
RF/KL/JH



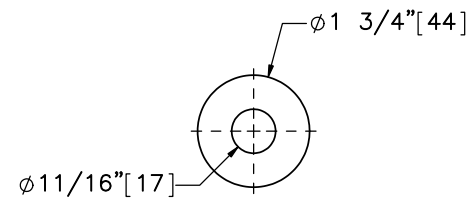
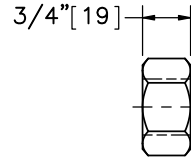
Part e10



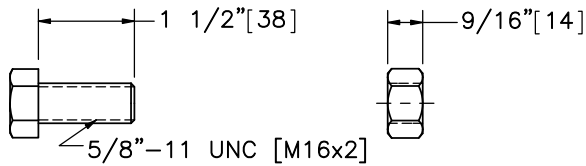
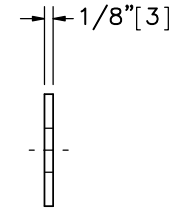
Part f2



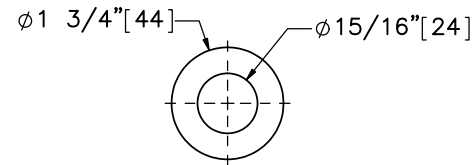
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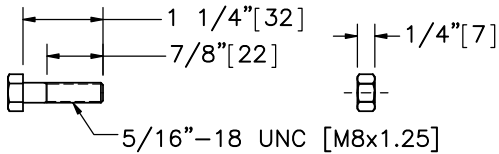
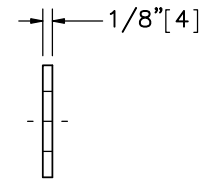
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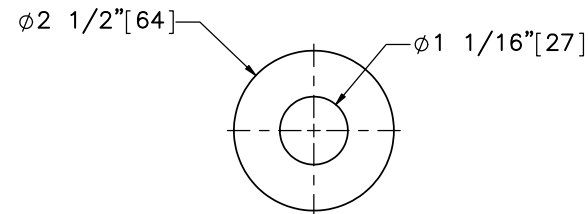
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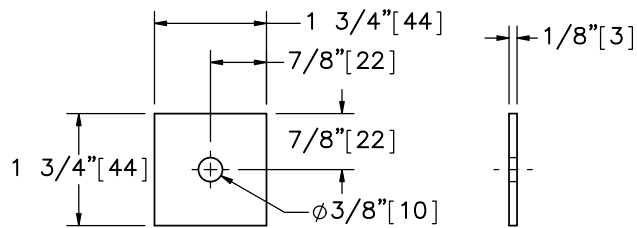
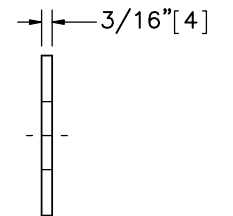
Part f4



Part e13



Part f5



Part f1



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

System Hardware

DWG. NAME:  
NDOR\_TL2BR\_R10

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

SHEET:  
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DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH



Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
a1	1	6'-3" [1,905] 12-gauge [2.7] W-Beam MGS Section	AASHTO M180	ASTM A123 or A653	RWM04a
a2	12	12'-6" [3,810] 12-gauge [2.7] W-Beam MGS Section	AASHTO M180	ASTM A123 or A653	RWM04a
a3	2	12'-6" [3,810] 12-gauge [2.7] W-Beam MGS End Section	AASHTO M180	ASTM A123 or A653	RWM14a
b1	4	72" [1,829] Long Foundation Tube	ASTM A500 Gr. B	ASTM A123	PTE06
b2	4	BCT Timber Post – MGS Height	SYP Grade No. 1 or better (No knots 18" [457] above or below ground tension face)	–	–
b3	13	W6x8.5 [W152x12.6] or W6x9 [W152x13.4], 72" Long [1,829] Steel Post	ASTM A992 Gr. 50	ASTM A123	PWE06
b4	13	6"x12"x14 1/4" [152x305x368] Timber Blockout for Steel Posts	SYP Grade No.1 or better	–	PDB10a
b5	48	2 3/4"x1"x1/4" [70x25x6] Post Standoff	ASTM A36	–	–
b6	12	S3x5.7 [S76x8.5], 39" [991] Long Steel Post	ASTM A992 Gr. 50	–	–
c1	12	10"x7"x1/2" [254x178x13] Steel Plate	ASTM A572 Gr. 50	–	–
c2	12	10"x2 3/4"x1/4" [254x70x6] Plate Washer	ASTM A36	ASTM A123	–
c3	12	HSS4"x4"x3/8" [102x102x10], 6 5/8" [168] Long Square Tube	ASTM A500 Gr. B	–	–
c4	12	3 1/2"x1"x1/8" [89x25x4]	ASTM A36	–	–
c5	4	C7x9.8 [C178x14.3], 225" [5,715] Long C-Channel	ASTM A36	–	–
c6	24*	6 5/8"x2"x1/8" [168x51x3] Shim Plate	ASTM A36	ASTM A123	–
d1	7	#4 [13] Bar, 896 1/2" [22,771] Long	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
d2	302	#4 [13] Bar, 32" [813] Long	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
d3	76	#4 [13] Bar, 16" [406] Long	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
d4	128	#4 [13] Bar, 18" [457] Long	ASTM A706 Gr. 60	–	–
e1	13	5/8"-11 UNC [M16x2], 14" [356] Long Guardrail Bolt and Nut	Bolt – ASTM A307 Gr. A Nut – ASTM A563A	ASTM A153 or B695 Class 55 or F2329	FBB06
e2	4	5/8"-11 UNC [M16x2], 10" [254] Long Guardrail Bolt and Nut	Bolt – ASTM A307 Gr. A Nut – ASTM A563A	ASTM A153 or B695 Class 55 or F2329	FBB03
e3	112	5/8"-11 UNC [M16x2], 1 1/4" [32] Long Guardrail Bolt and Nut	Bolt – ASTM A307 Gr. A Nut – ASTM A563A	ASTM A153 or B695 Class 55 or F2329	FBB01

\* Shim posts in deck region as necessary.



Midwest Roadside Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Bill of Materials

DWG. NAME:  
NDOR\_TL2BR\_R10

SCALE: None  
UNITS: in.[mm]

SHEET:  
25 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
e4	12	5/8"-11 UNC [M16x2], 5" [127] Long Heavy Hex Head Bolt and Nut	Bolt - ASTM F3125 Gr. A325 Type 1 or Equivalent Nut - ASTM A563DH or Equivalent	ASTM A153 or B695 Class 55 or F1136 Gr. 3 or F2329 or F2833 Gr. 1	FBX16b
e5	24	7/8"-9 UNC [M22x2.5], 24" [610] Long Threaded Rod	ASTM A449 or Equivalent	ASTM A153 or B695 Class 55 or F2329	-
e6	24	7/8"-9 UNC [M22x2.5], 2" [51] Long Heavy Hex Head Bolt	ASTM A449 or Equivalent	ASTM A153 or B695 Class 55 or F2329	FBX22b
e7	24	7/8" [22] Dia. Heavy Hex Coupling Nut	ASTM A563DH or Equivalent	ASTM A153 or B695 Class 55 or F2329	-
e8	48	7/8" [22] Dia. Heavy Hex Nut	ASTM A563DH or Equivalent	ASTM A153 or B695 Class 55 or F2329	FNX22b
e9	4	1" [25] Dia. Hex Nut	ASTM A563A	ASTM A153 or B695 Class 55 or F2329	FBX24a
e10	4	5/8"-11 UNC [M16x2], 10" [254] Long Hex Head Bolt and Nut	Bolt - ASTM A307 Gr. A or Equivalent Nut - ASTM A563A or Equivalent	ASTM A153 or B695 Class 55 or F2329	FBX16a
e11	4	7/8"-9 UNC [M22x2.5], 8" [203] Long Hex Head Bolt and Nut	Bolt - ASTM A307 Gr. A or Equivalent Nut - ASTM A563A or Equivalent	ASTM A153 or B695 Class 55 or F2329	-
e12	16	5/8"-11 UNC [M16x2], 1 1/2" [38] Long Hex Head Bolt and Nut	Bolt - ASTM A307 Gr. A or Equivalent Nut - ASTM A563A or Equivalent	ASTM A153 or B695 Class 55 or F2329	FBX16a
e13	12	5/16"-18 UNC [M8x1.25], 1 1/4" [32] Long Hex Head Bolt and Nut	Bolt - ASTM A307 Gr. A or Equivalent Nut - ASTM A563A or Equivalent	ASTM A153 or B695 Class 55 or F2329	FBX08a
e14	15	16D Double Head Nail	-	-	-
f1	12	1 3/4"x1 3/4"x1/8" [44x44x3] Square Washer	ASTM A36	ASTM A123	FWR01
f2	8	7/8" [22] Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	-
f3	44	5/8" [16] Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	FWC16a
f4	24	7/8" [22] Dia. Hardened Flat Washer	ASTM F436	ASTM A153 or B695 Class 55 or F1136 Gr. 3 or F2329	FWC24b
f5	4	1" [25] Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	FWC24a
g1	2	BCT Anchor Cable End Swaged Fiting	Fitting - ASTM A576 Gr. 1035 Stud - ASTM F568 Class C	Fitting - ASTM A153 Stud - ASTM A153 or B695	-
g2	2	3/4" [190] Dia. 6x19, 24 1/2" [622] Long IWRC IPS Wire Rope	IPS	ASTM A741 Type II Class A	-
g3	4	115-HT Mechanical Splice - 3/4" [19] Dia.	As Supplied	-	-
g4	4	Crosby Heavy Duty HT - 3/4" [19] Dia. Cable Thimble	Stock No. 1037773	As Supplied	-



Midwest Roadside  
Safety Facility

TL-2 Bridge Rail  
Test No. N2BR-1

Bill of Materials

DWG. NAME:  
NDOR\_TL2BR\_R10

SCALE: None  
UNITS: in.[mm]

SHEET:  
26 of 27

DATE:  
2/9/2018

DRAWN BY:  
MES/JEK

REV. BY:  
JK/SR/RB/  
RF/KL/JH

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
g5	4	Crosby G2130 or S2130 Bolt Type Shackle – 1 1/4" [32] Dia. with thin head bolt, nut, and cotter pin, Grade A, Class 3	Stock Nos. 1019597 and 1019604 – As Supplied	–	–
g6	4	Chicago Hardware Drop Forged Heavy Duty Eye Nut – Drilled and Tapped 1 1/2" [38] Dia. – UNC 6 [M36x4]	Stock No. 107 – As Supplied	–	–
g7	2	TLL-50K-PTB Load Cell	–	–	–
g8	2	8"x8"x5/8" [203x203x16] Anchor Bearing Plate	ASTM A36	ASTM A123	FPB01
g9	2	2 3/8" [60] O.D. x 6" [152] Long BCT Post Sleeve	ASTM A53 Gr. B Schedule 40	ASTM A123	FMM02
h1	2	Anchor Bracket Assembly	ASTM A36	ASTM A123	FPA01
h2	2	Ground Strut Assembly	ASTM A36	ASTM A123	PFPO2
–	1	Concrete	Min. f'c = 6,000 psi [41.4 MPa] NE Mix 47BD	–	–
i1	1	Grade Beam	Min f'c = 4,000 psi [27.6 MPa]	–	–



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27 of 27

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REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
0	1/25/2017	–	Drawing created from TL2BR_Bogie_Deck_R10 drawing and notes from Scott.	–	MES
1	1/29/2018	–	Moved sheets 6–8 to sheets 3–5. Added test no.	JEK	MES
		1	Flipped section view. Edited notes 2 and 4.		
		2	Edited part callout and dimensions. Renamed section view		
		3	Flipped section A–A orientation and added note 1.		
		5	Edited note 1.		
		6	Added bill of materials. Edited note one. Edited dimensions and annotations.		
		7	Edited note and annotations.		
		8	Edited annotations. Hid post socket assembly in plan and elevation view. Added weld note and dimesions. Material for part no. e7. Hid hardware in profile view. Changed sheet name.		
		10	Edited sheet name.		
		11	Edited sheet name. Edited material for steel post.		
		11–13	Edited annotations.		
		14	Changed view breaks and flipped profile view.		
		15	Changed part length. Added bill of materials.		
		19	Changed scale for part d4. Changed sheet name. Added lap length to bill of bars.		
		20	Edited dimensions for part no. e5–e7.		
21	Added dimensions for part no. f1.				
BOM	Removed part no. f3. Edited description for part nos. b6, c3, c4, e5, e6, e12, and f1. Edited material specs for part nos. b6, e1–e3, e7, e8, f2–f4. Edtied treatment specs for part nos. e4 and e8. Edited hardware guide nos. for part nos. b2, b6,e5, and e13. Reorderd part nos. f4 and f5.				
2	1/30/2018	1	Edited note 2.	JEK	MES
		2	Edited annotation.		
		6–7	Flipped profile view.		
		8	Edited annotations and edited bill of materials.		
		11	Corrected assembly quantity in bill of materials.		
		12	Edited bill of materials.		
		14	Added dimension.		
		16–17	Added bill of materials for assembly.		
		19	Removed lap length in bill of bars.		

		20	Edited dimesions.		
		21	Removed 1" part f3 as it belongs to assembly.		
		BOM	Edited description for part no. b1 and c4. Edited material and treatment spec for part nos. e7 and e8.		
3	1/30/2018	7	Note edit (typo).	JEK	JEK
		8	Weld adds/edits.		
		16	Table edits (item no, material).		
		17	Table edits (qty, material).		
		19	Part d4 quantity edit.		
4	1/31/2018	1	Edited annotation and removed note 4.	SKR	MES
		2	Added note 2. Changed part no. b3 and b5 placement.		
		6	Made new page with all of concrete deck components.		
		7	Adjusted placement of part no. d3. Edited dimensions.		
		8	Hid concrete deck. Exploded views to separate assembles. Added weld notes.		
		9	Eliminated all non-welded hardware from view. Added dimensions.		
		11	Corrected placement of the top standoff plate in post assembly.		
		12	Added plan view and edited weld note.		
		19	Changed length of part no. d3. and reduced the part quantity.		
BOM	Added part no. i1. Updated part quantity and description for part no. d3.				
5	2/1/2018	2	Relabeled assemblies. Edited note 2.	SKR/JEK	MES
		6	Added in deck assembly to BOM. Edited sheet name.		
		8	Exploded more hardware. Removed weld notes.		
		9	Added dimensions. Corrected weld notes. Added note.		
		10	Moved previous sheet 15 to sheet 10.		
		14	Edited weld notes. Corrected description for part no. c4.		
		BOM	Edited material spec for part no. b3. Corrected part description for part no. c4 and bridge deck concrete.		
6	2/5/2018	2	Added dimension.	RWB/JEK	MES
		4	Added load cell assembly.		
		5	Added note 2.		
		8	Edited dimensions.		
		9	Edited note one.		
		14	Edited weld notes.		
		16-18	Added in load cell assembly and components.		

		BOM	Added in part nos. g1-g7. Changed part nos. g2-g3 to g8-g9.		
7	2/5/2018	-	Added in 1" washer and nut. Part e9 and f5. Reordered part nos. e9-e13 to e10-e14.	JEK	MES
		5	Added part callouts.		
		16	Edited part g2 in table. Removed HWG column.		
		17	Edited dimensions and added part callouts.		
		18	Edited dimensions.		
		23	Added part no. e9.		
		24	Added part no. f5.		
		BOM	Added in 1" washer and nut. Part e9 and f5. Reordered part nos. e9-e13 to e10-e14.		
8	2/7/2018	-	New part: c6. Page re-arrangement. Section/detail renumbering.	RKF	JEK
		2	Dim add/remove. Note 1 edit. Grade beam label edit. General shift.		
		6	Dim add.		
		10	Part c6 add. Scale change. General shift.		
		23-24	Thread metric add.		
		BOM	New: c6.		
9	2/9/2018	3	Note 3 add.	SKR	JEK
		5	Explode edit, coupler nut not part of C-channel assembly. Label add.		
		6	Coupling nut removed from assembly. Related dimensions removed.		
		23	Part e7 length corrected.		
		BOM	Treatment: e7.		
10	2/9/2018	BOM	Description: e1-6, e10-13.	KAL/JCH	JEK