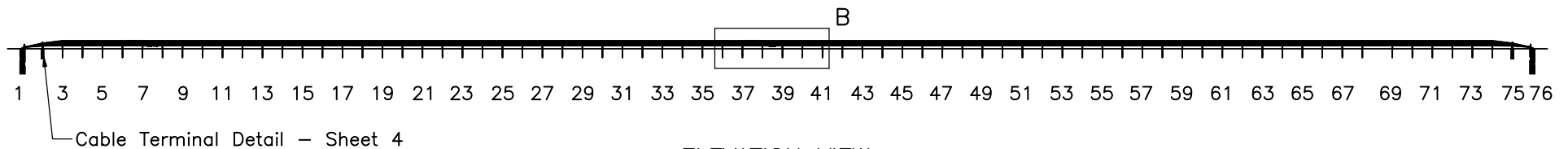


PLAN VIEW



ELEVATION VIEW

- Notes: (1) Test shall be performed according to test designation no. 3-10 of MASH criteria.
- (2) At a minimum, critical post nos. 26-48 are placed in 18" [457] diameter hole backfilled and tamped in well compacted soil.
- (3) Test cable tensions of 2500 ± 200 lb [11.1 ± 0.890 kN].
- (4) Bottom cable on impact side.
- (5) Span between posts 68 and 69 is 144" [3658].



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

System Layout

DWG. NAME:
MWP-5_R3

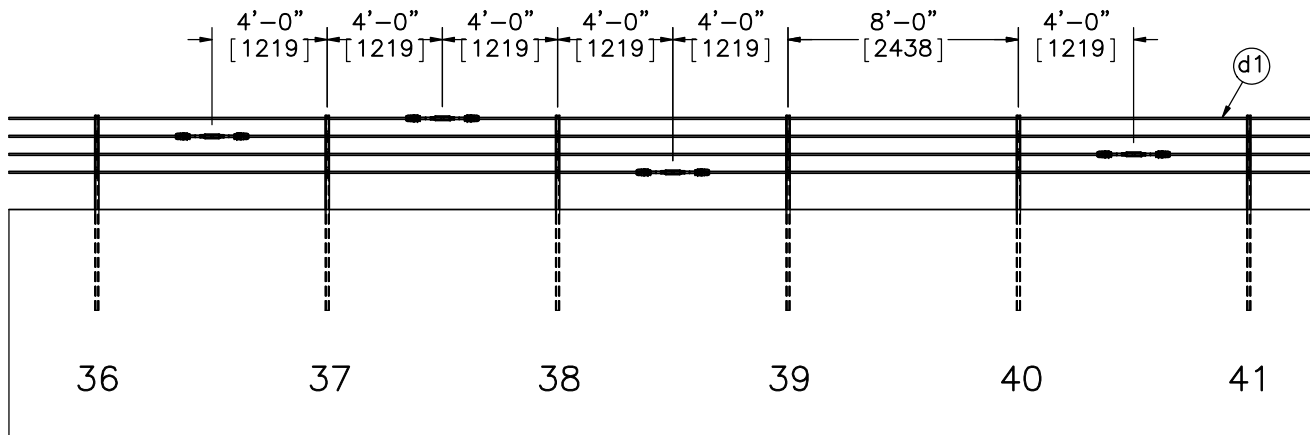
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UNITS: in.[mm]

SHEET:
1 of 24

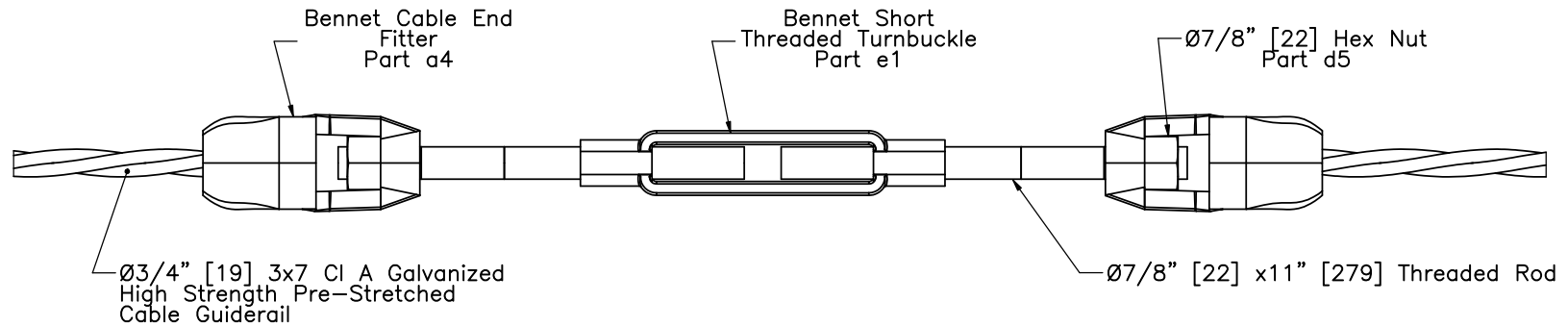
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

REV. BY:
KAL




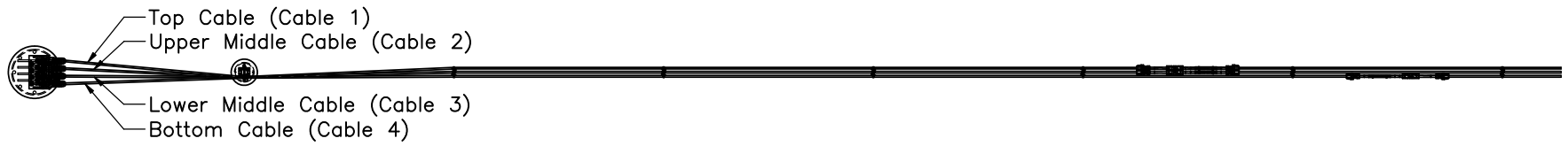
DETAIL B
Cable Splice Location Detail



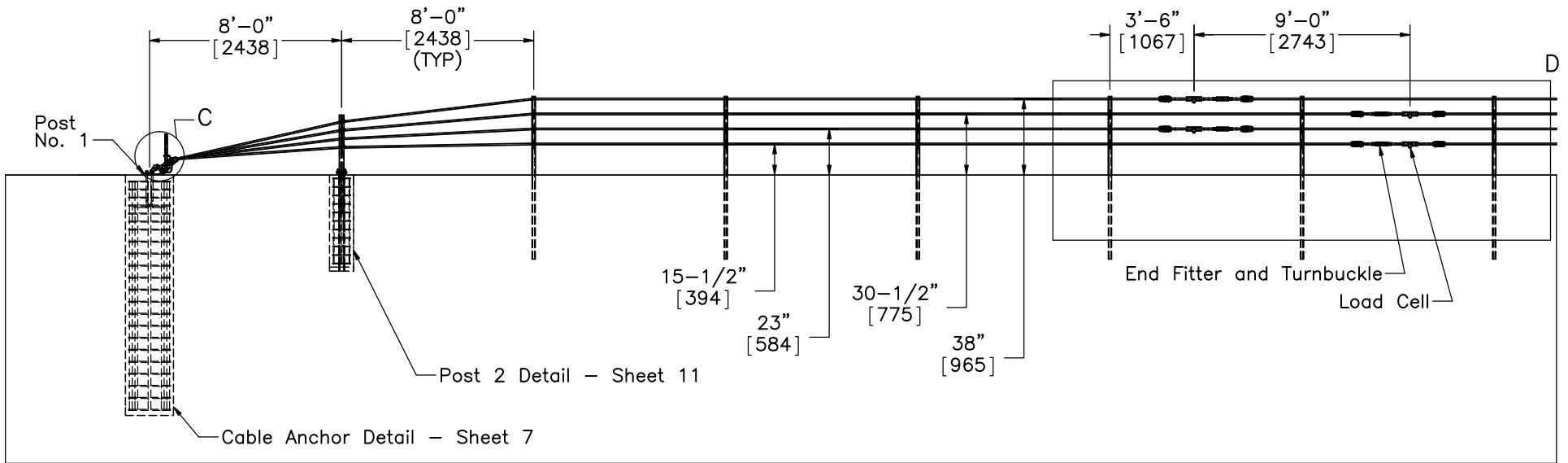
Cable Splice Detail
SCALE 1:6

Notes: (1) The splice locations may be moved as long as two adjacent cable splices are not located on top of one another.

	Midwest 4-Cable Barrier System		SHEET: 2 of 24
			DATE: 06/23/2015
Midwest Roadside Safety Facility	Cable Splice Location and Detail		DRAWN BY: SDB/JEK
	DWG. NAME: MWP-5_R3	SCALE: 1:80 UNITS: in.[mm]	REV. BY: KAL



PLAN VIEW



ELEVATION VIEW



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Cable Terminal Detail

DWG. NAME:
MWP-5_R3

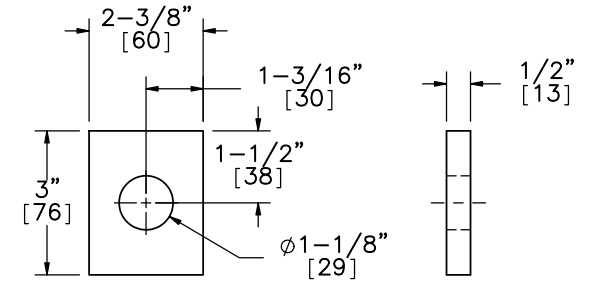
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SHEET:
3 of 24

DATE:
06/23/2015

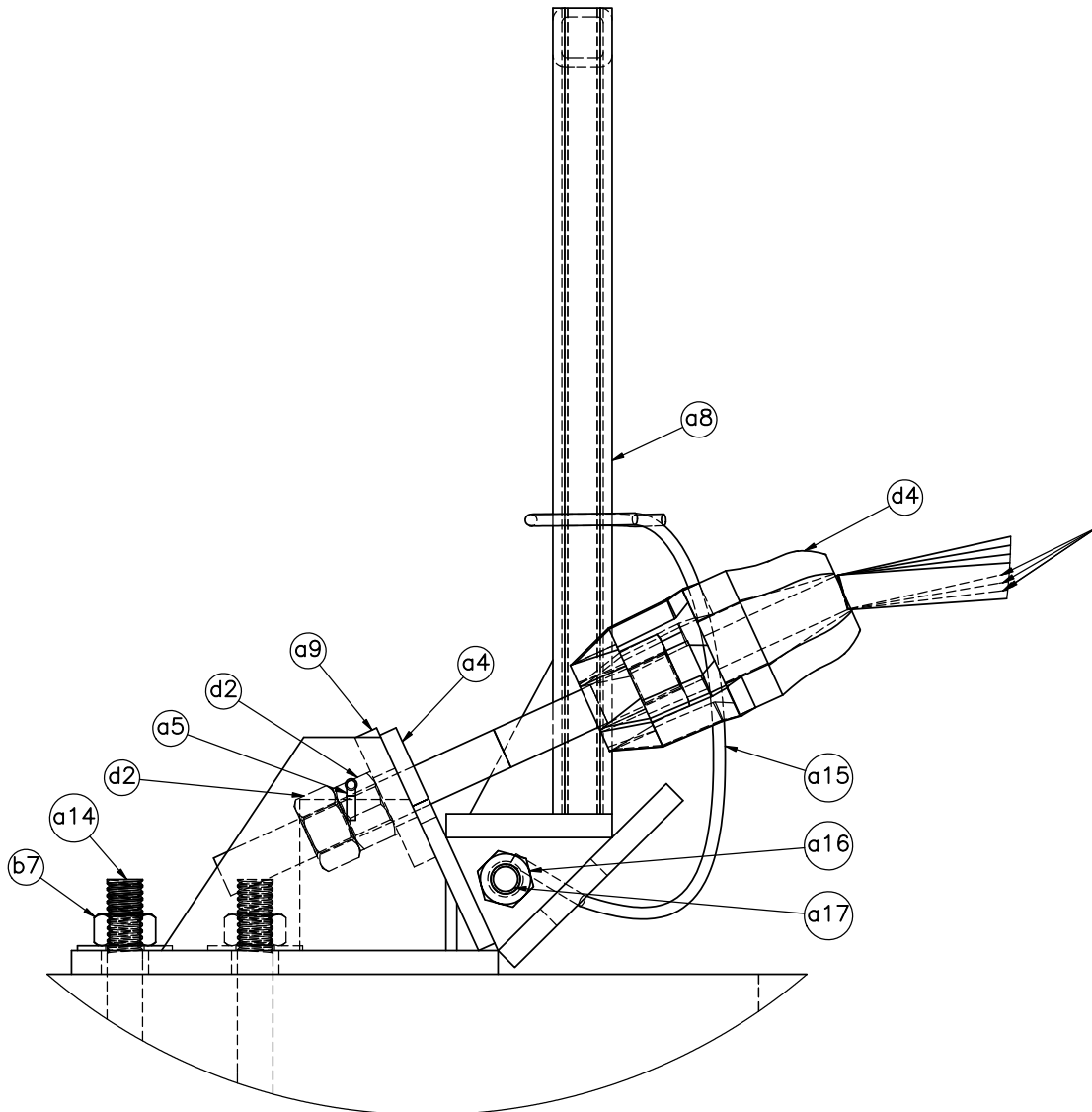
DRAWN BY:
SDB/JEK

REV. BY:
KAL



ELEVATION VIEW PROFILE VIEW

Part a9
Cable Anchor Plate Washer



All cables run over the foot of the cable release lever. The middle two cables run through the lever uprights.

DETAIL C



Midwest 4-Cable Barrier System

Midwest Roadside Safety Facility

Cable Anchor Detail

DWG. NAME:
MWP-5_R3

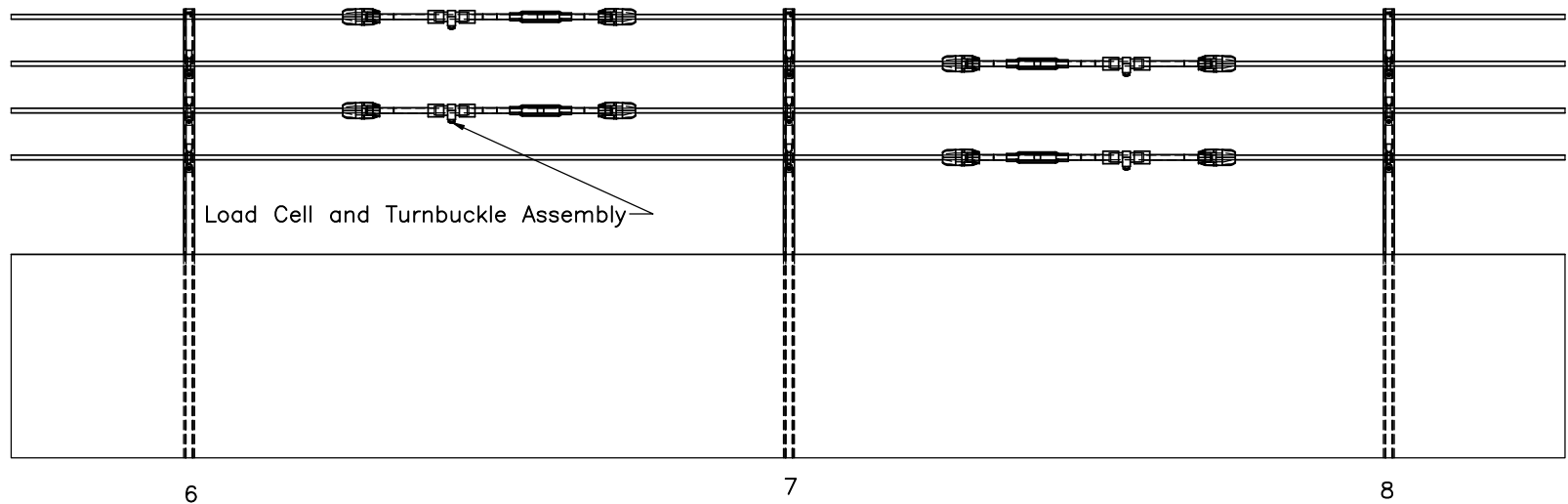
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SHEET:
4 of 24

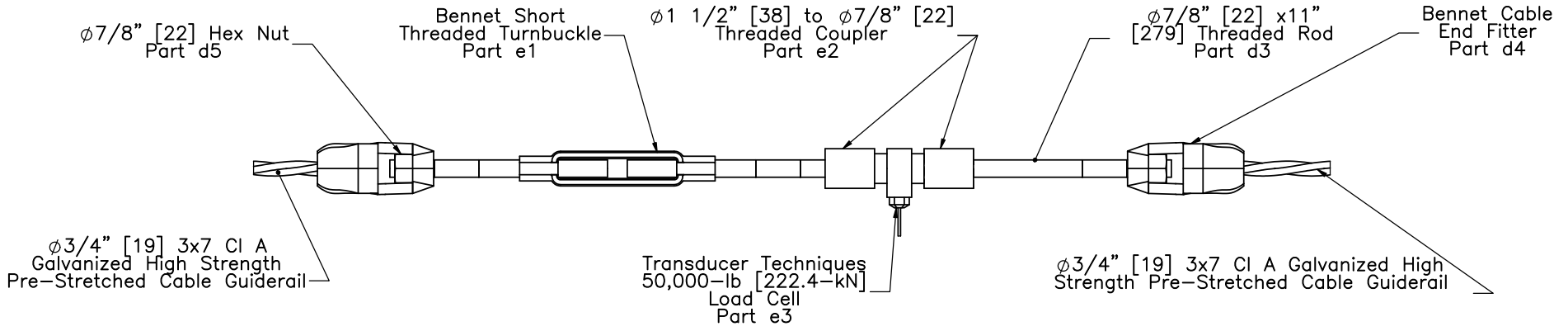
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

REV. BY:
KAL



DETAIL D
SCALE 1 : 30



Notes: (1) Two RH-threaded rods and one LH-threaded rod required for load cell and turnbuckle assembly.



Midwest Roadside Safety Facility

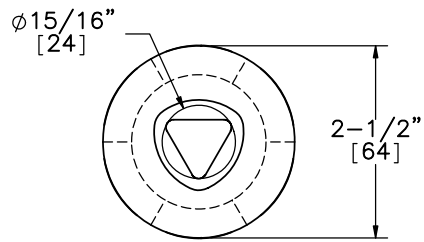
Midwest 4-Cable Barrier System

Load Cell and Turnbuckle Configuration

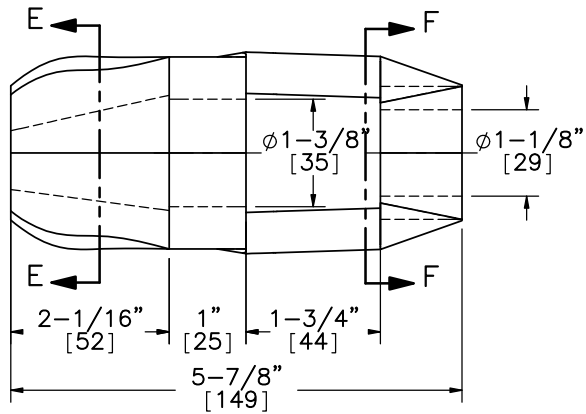
DWG. NAME:
MWP-5_R3

SCALE: 1:8
UNITS: in.[mm]

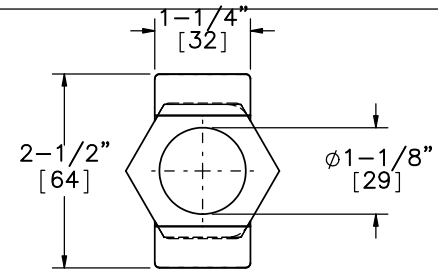
SHEET:
5 of 24
DATE:
06/23/2015
DRAWN BY:
SDB/JEK
REV. BY:
KAL



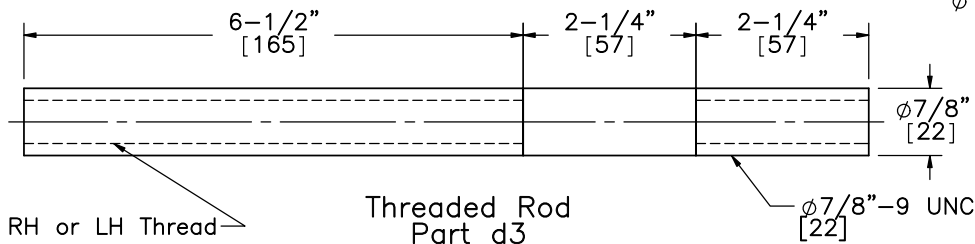
SECTION E-E



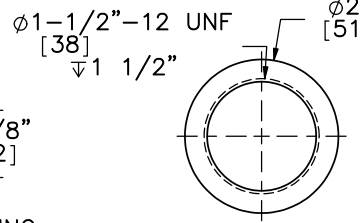
ELEVATION VIEW
Part d4



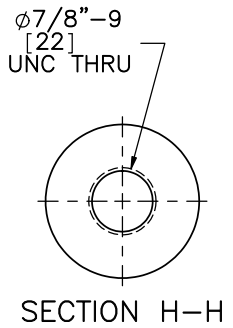
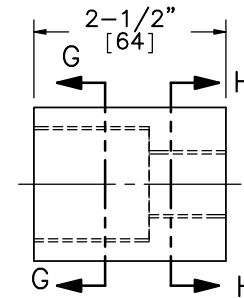
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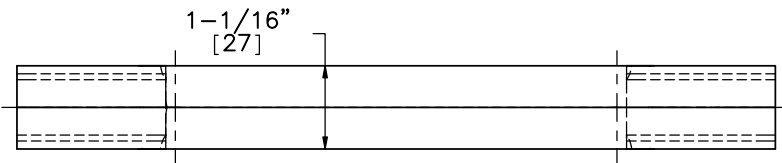
Threaded Rod
Part d3



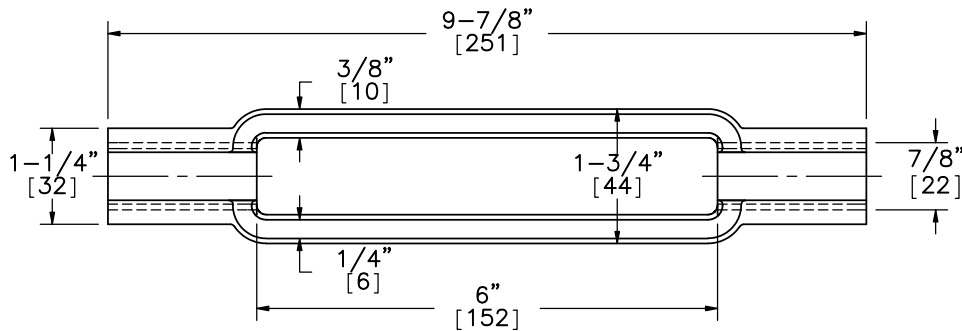
SECTION G-G



SECTION H-H

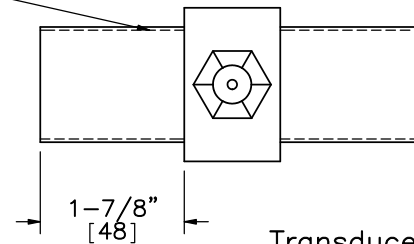


PLAN VIEW

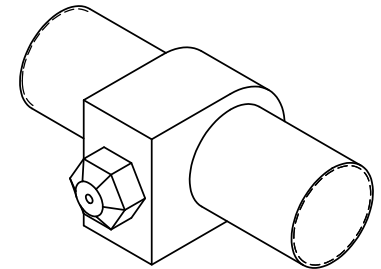


ELEVATION VIEW
Part e1

$\phi 1\frac{1}{2}$ -12 UNF Threaded Both Sides [38]



Transducer Techniques
50000-lb [222.4-kN] Rated Load Cell
Model# TLL-50K
Part e3



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Load Cell Assembly Component
Details

DWG. NAME:
MWP-5_R3

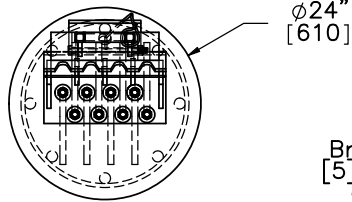
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UNITS: in.[mm]

SHEET:
6 of 24

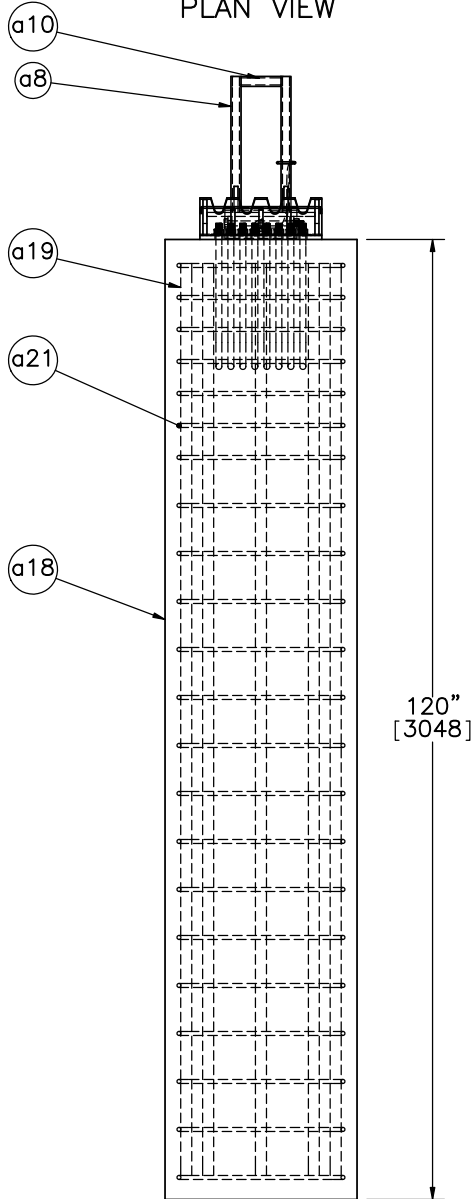
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

REV. BY:
KAL

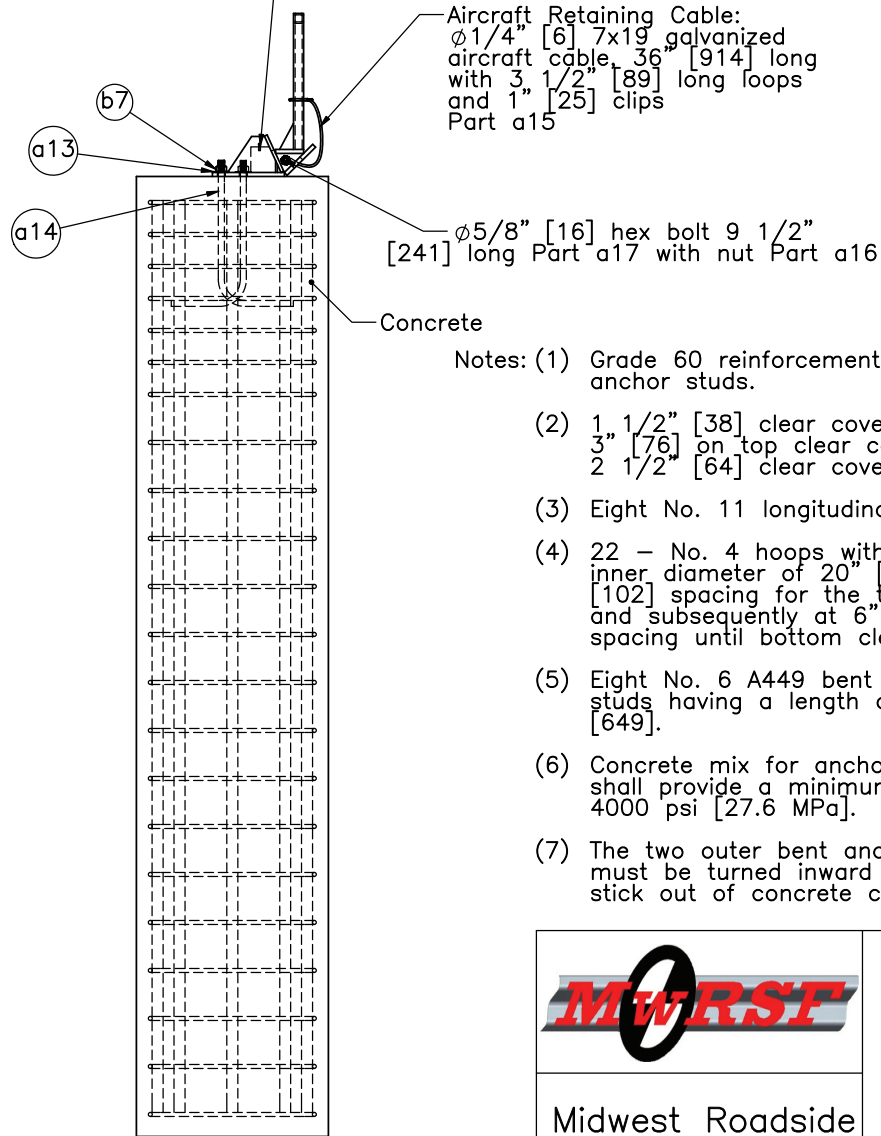


PLAN VIEW



PROFILE VIEW

Brass Keeper Rod $\phi 3/16"$
[5] x 16" [406] long. Bend
ends of rod to secure.
Part a5



ELEVATION VIEW

Note:

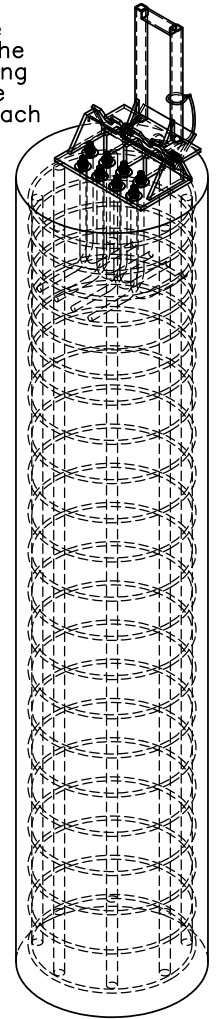
Brass rod to be placed after all cables are installed and tensioned. Slide rod through the $1/4"$ [6] holes in the Anchor Bracket, leaving a minimum of 1" [25] on each side of the Anchor Bracket. Bend brass rod down on each side of Anchor Bracket to secure.

Aircraft Retaining Cable:
 $\phi 1/4"$ [6] 7x19 galvanized
aircraft cable, 36" [914] long
with $3 1/2"$ [89] long loops
and 1" [25] clips
Part a15

$\phi 5/8"$ [16] hex bolt $9 1/2"$
[241] long Part a17 with nut Part a16

Concrete

- Notes: (1) Grade 60 reinforcement, except bent anchor studs.
- (2) $1 1/2"$ [38] clear cover on sides, $3"$ [76] on top clear cover, and $2 1/2"$ [64] clear cover on bottom.
- (3) Eight No. 11 longitudinal bars.
- (4) 22 - No. 4 hoops with an inner diameter of $20"$ [508] at $4"$ [102] spacing for the top $24"$ [610] and subsequently at $6"$ [152] spacing until bottom clear cover.
- (5) Eight No. 6 A449 bent anchor studs having a length of $25 9/16"$ [649].
- (6) Concrete mix for anchor and posts shall provide a minimum f'_c of 4000 psi [27.6 MPa].
- (7) The two outer bent anchor studs must be turned inward so they do not stick out of concrete cover.



ISOMETRIC VIEW



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Cable Anchor Detail Post Nos.
1 & 76

DWG. NAME:
MWP-5_R3

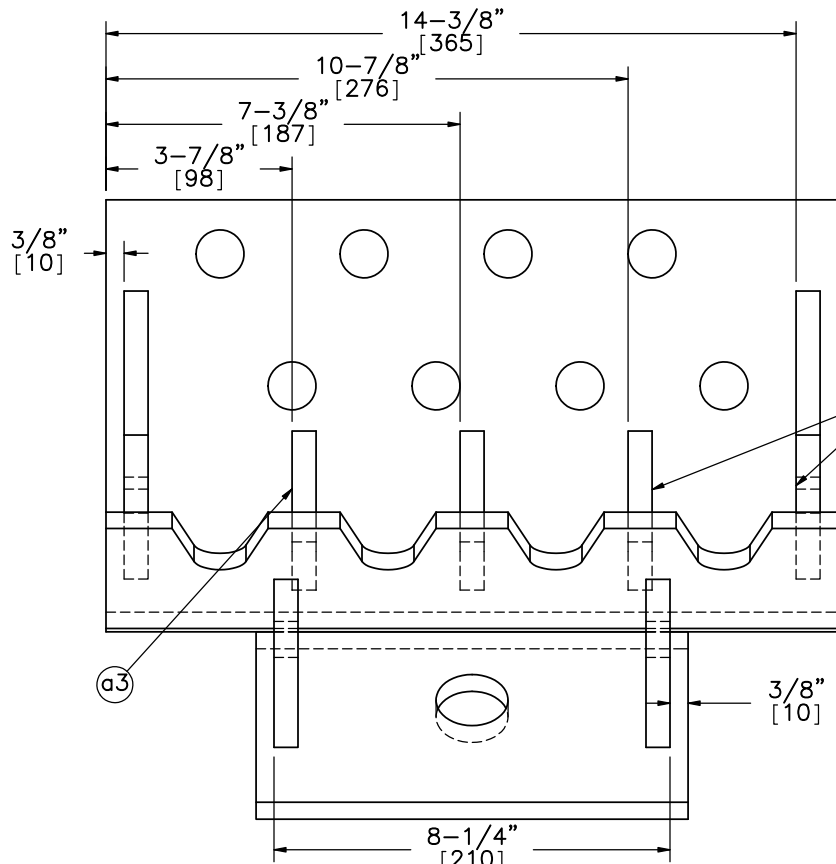
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UNITS: in.[mm]

SHEET:
7 of 24

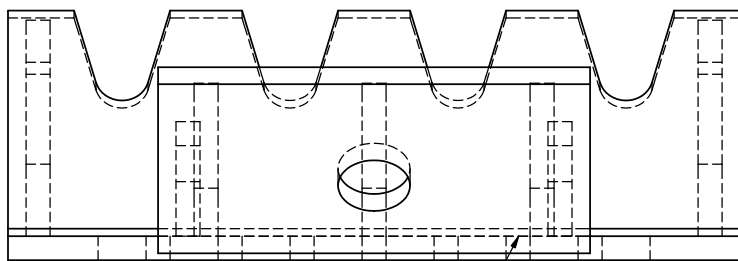
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

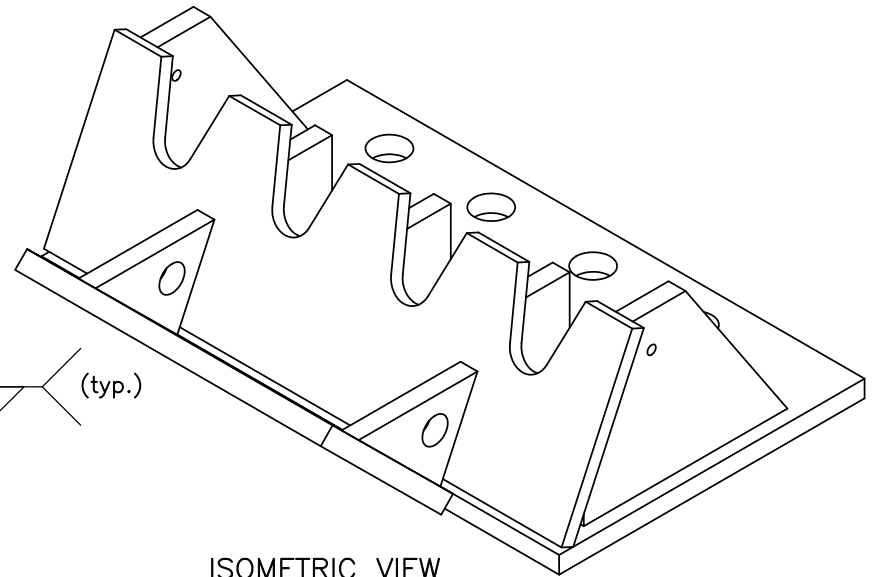
REV. BY:
KAL



PLAN VIEW

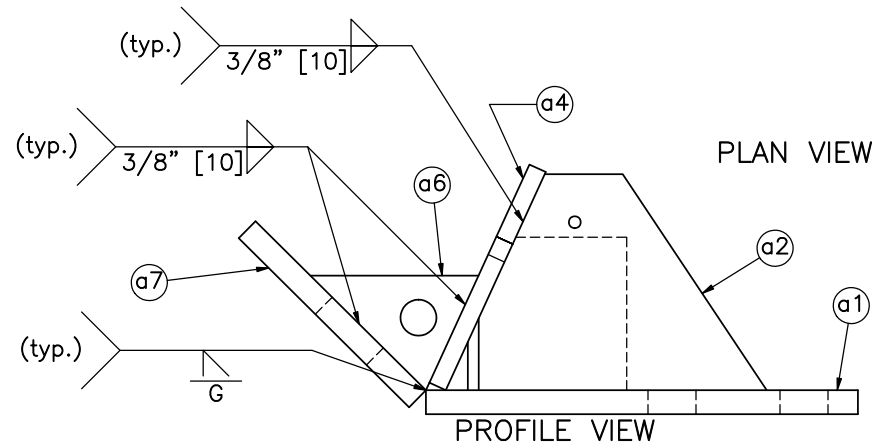


ELEVATION VIEW

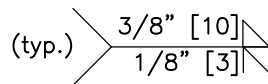


ISOMETRIC VIEW

- Notes: (1) All steel plates conform to ASTM A36.
 (2) The cable anchor bracket is to be galvanized following fabrication.



PROFILE VIEW



Midwest 4-Cable Barrier System

Midwest Roadside Safety Facility

Cable Anchor Bracket

DWG. NAME:
MWP-5_R3

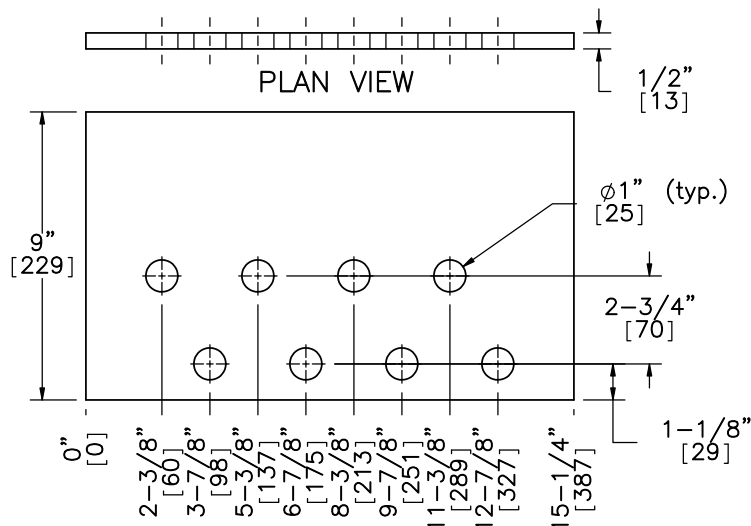
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SHEET:
8 of 24

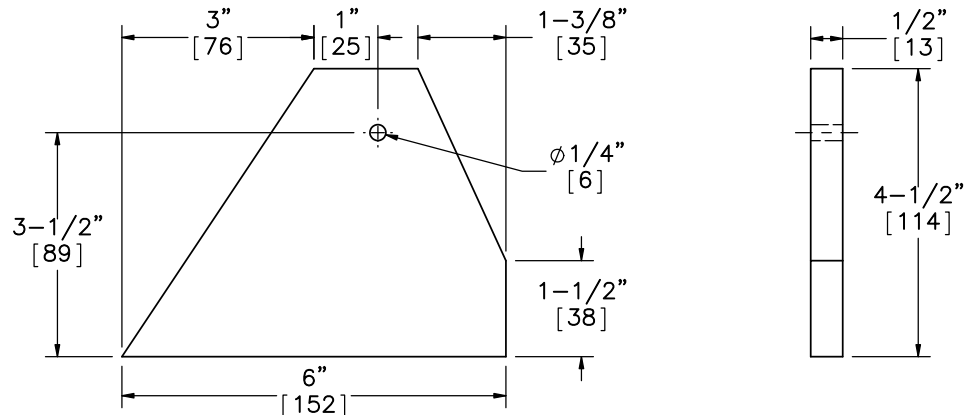
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

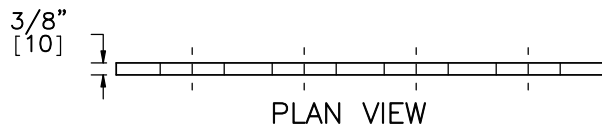
REV. BY:
KAL



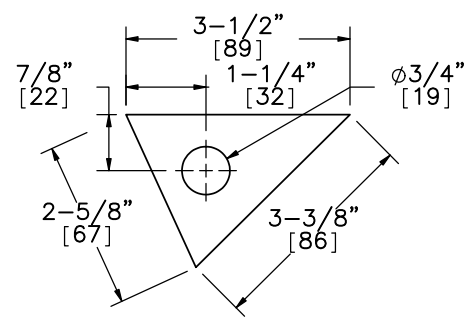
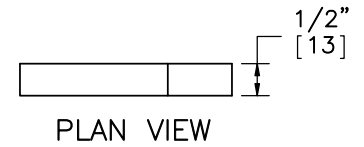
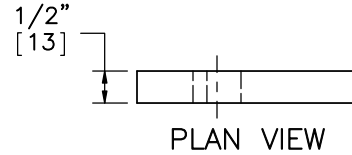
ELEVATION VIEW
Part a1



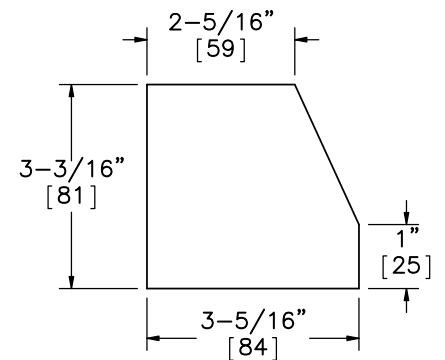
SCALE 1:3
Part a2



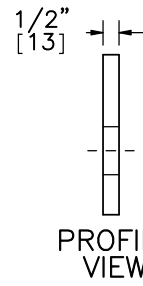
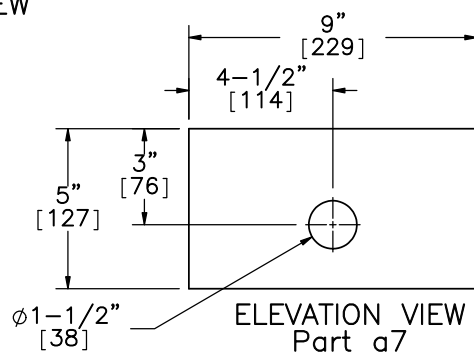
ELEVATION VIEW
Part a4



SCALE 1:3
Part a6



SCALE 1:3
Part a3



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Cable Anchor Bracket
Components

DWG. NAME:
MWP-5_R3

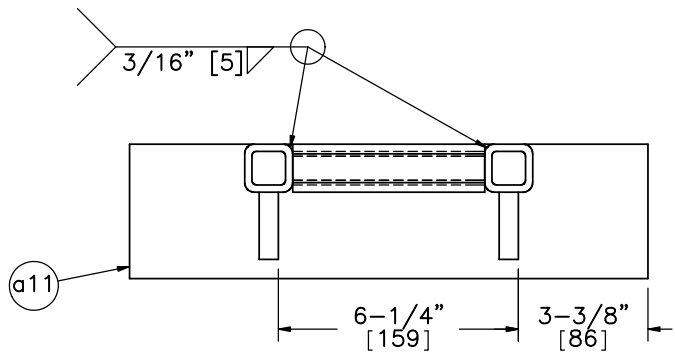
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UNITS: in.[mm]

SHEET:
9 of 24

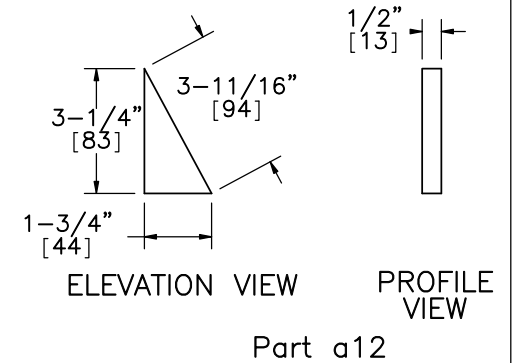
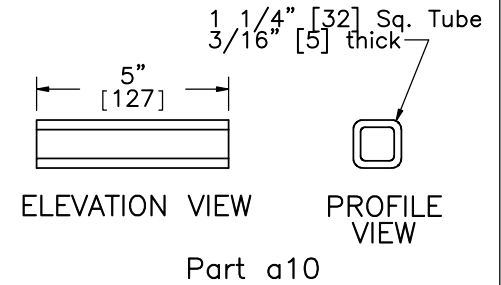
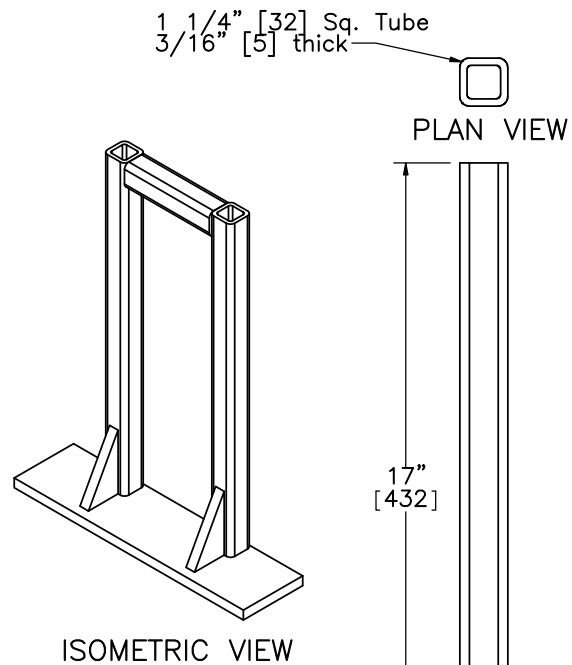
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

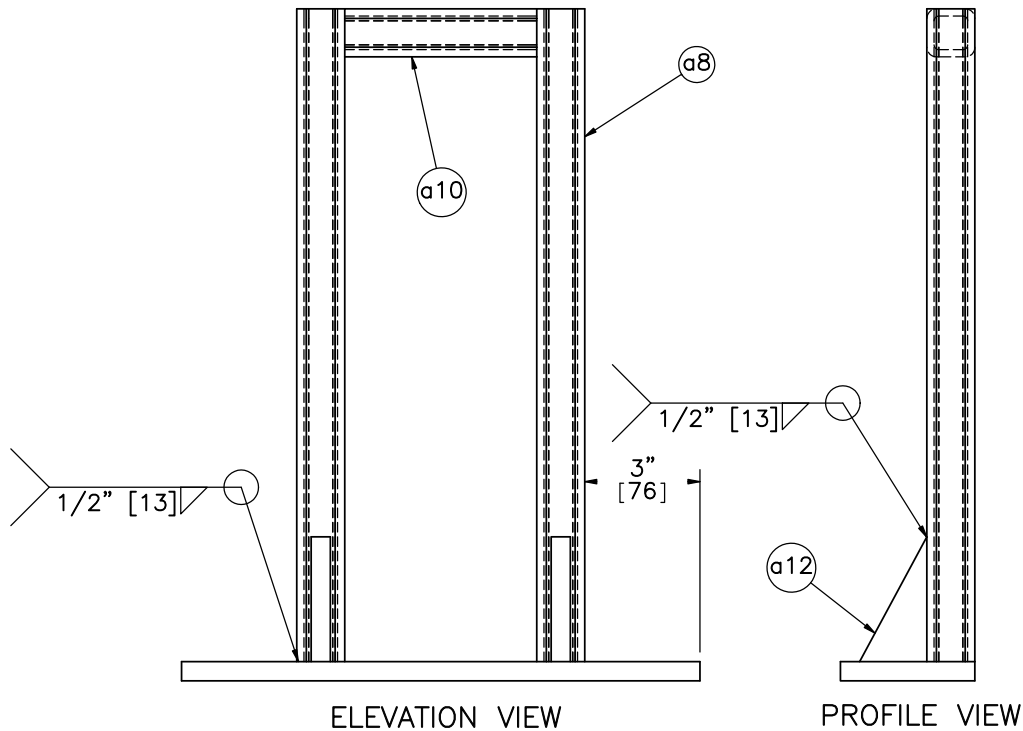
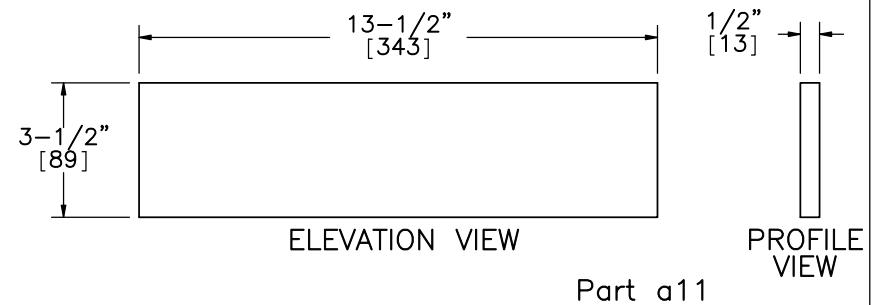
REV. BY:
KAL




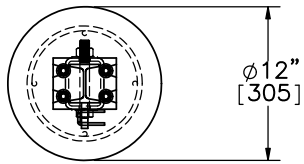
- Notes: (1) The kicker lever should be flush with the top of the kicker plate.
 (2) The 3 1/4" [83] leg of the kicker plate gusset should line up with the kicker lever.
 (3) The bottom of the cable release lever should rest upon part a6.
 (4) All steel plates conform to ASTM A36.
 (5) All steel tubing conforms to ASTM A500 Grade B.



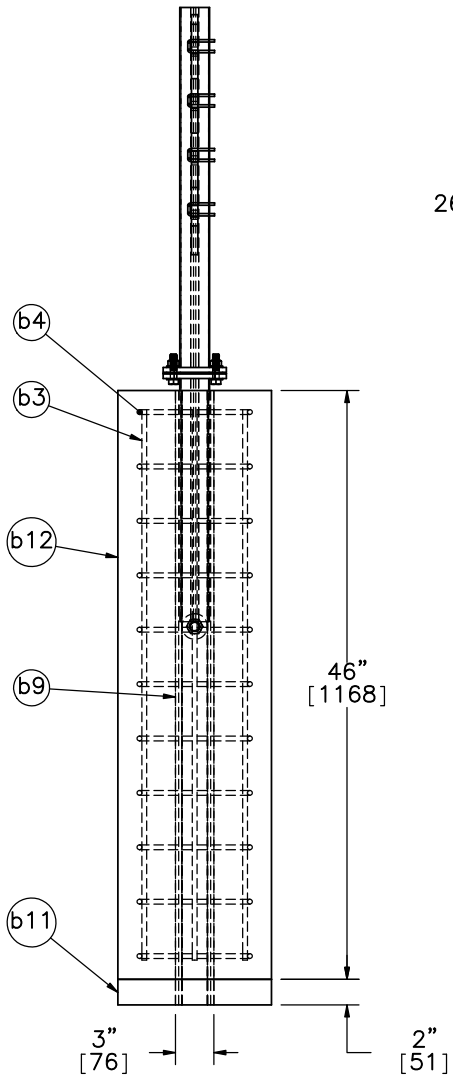
ELEVATION VIEW
Part a8



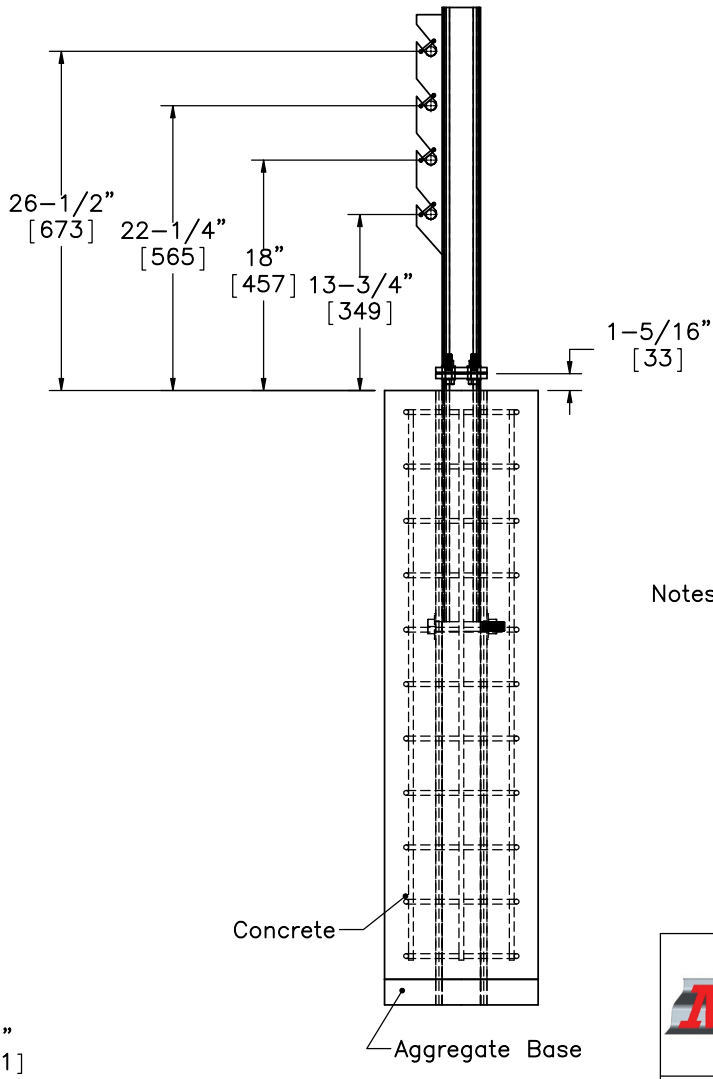
	Midwest 4-Cable Barrier System	SHEET: 10 of 24
	Cable Release Lever	DATE: 06/23/2015
Midwest Roadside Safety Facility	DWG. NAME: MWP-5_R3	DRAWN BY: SDB/JEK
	SCALE: 1:5 UNITS: in.[mm]	REV. BY: KAL



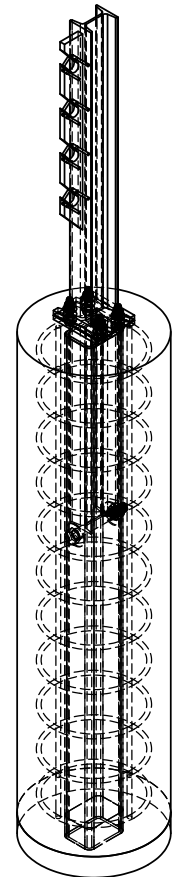
PLAN VIEW



ELEVATION VIEW



PROFILE VIEW



ISOMETRIC VIEW

- Notes:
- (1) Grade 60 Reinforcement.
 - (2) 1 1/2" [38] clear cover.
 - (3) 11 No. 3 hoops with an inner diameter of 7 1/4" [184] and a vertical spacing of 4 1/4" [108].
 - (4) 4 No. 3 longitudinal bars.
 - (5) Concrete mix for anchor posts shall provide a minimum f'_c of 4000 psi [27.6 MPa].

Cable Support Post
Post 2 & 39 Only



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Second Post Detail
Post Nos 2 & 75

DWG. NAME.
MWP-5_R3

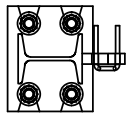
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SHEET:
11 of 24

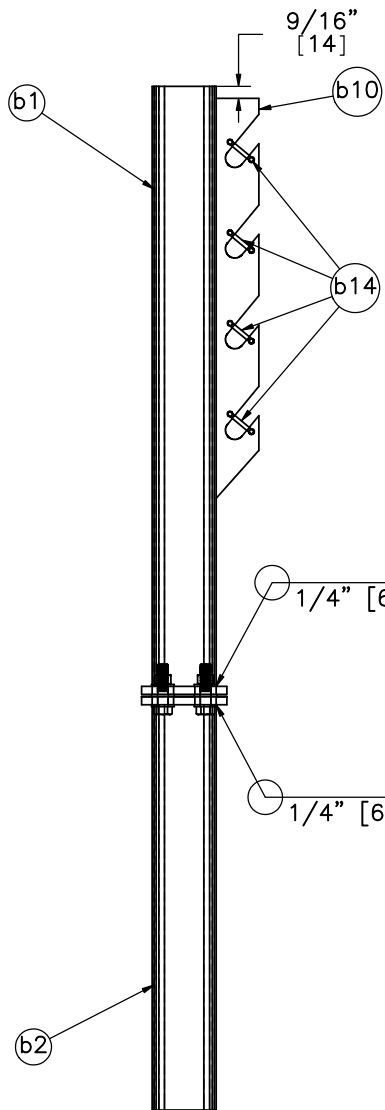
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

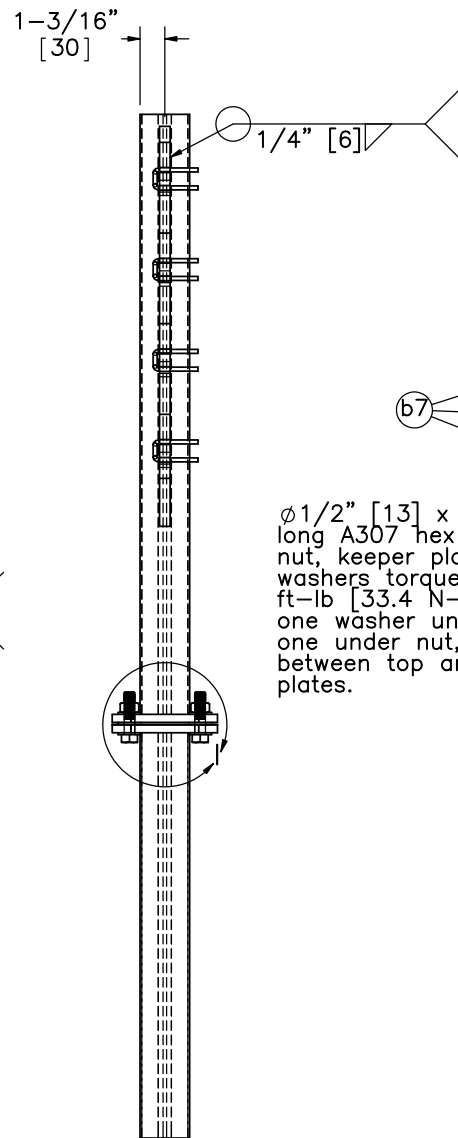
REV. BY:
KAL



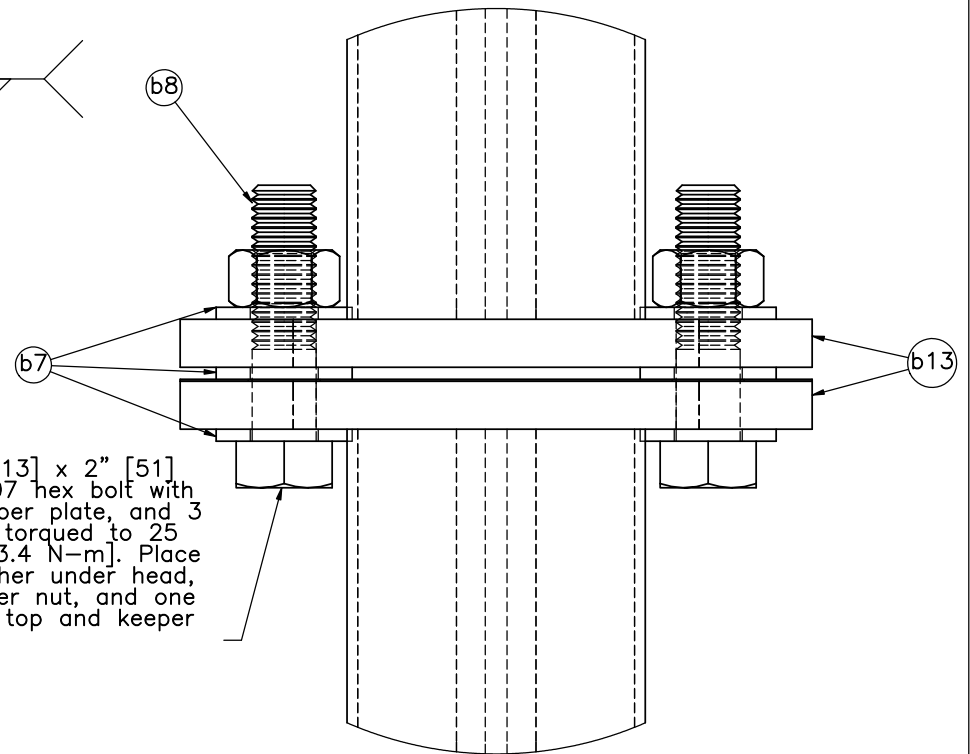
PLAN VIEW



ELEVATION VIEW



PROFILE VIEW



Ø1/2" [13] x 2" [51] long A307 hex bolt with nut, keeper plate, and 3 washers torqued to 25 ft-lb [33.4 N-m]. Place one washer under head, one under nut, and one between top and keeper plates.

DETAIL 1
SCALE 2:3

Notes: (1) Brass cable retainers (b14) should be inserted into designated holes, and the ends of the retainers should be bent to retain retainers in the holes.



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Cable Hanger Assembly
Post Nos. 2 & 75

DWG. NAME:
MWP-5_R3

SCALE: 1:9
UNITS: in.[mm]

SHEET:
12 of 24

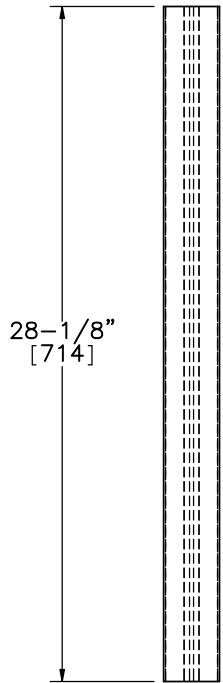
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06/23/2015

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SDB/JEK

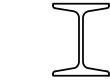
REV. BY:
KAL



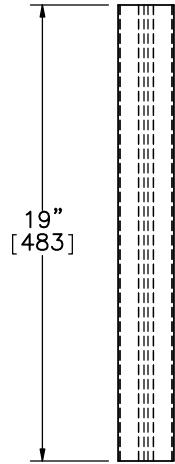
PLAN VIEW



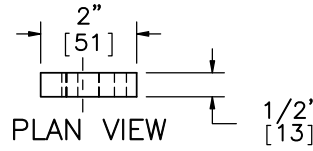
ELEVATION VIEW Part b1



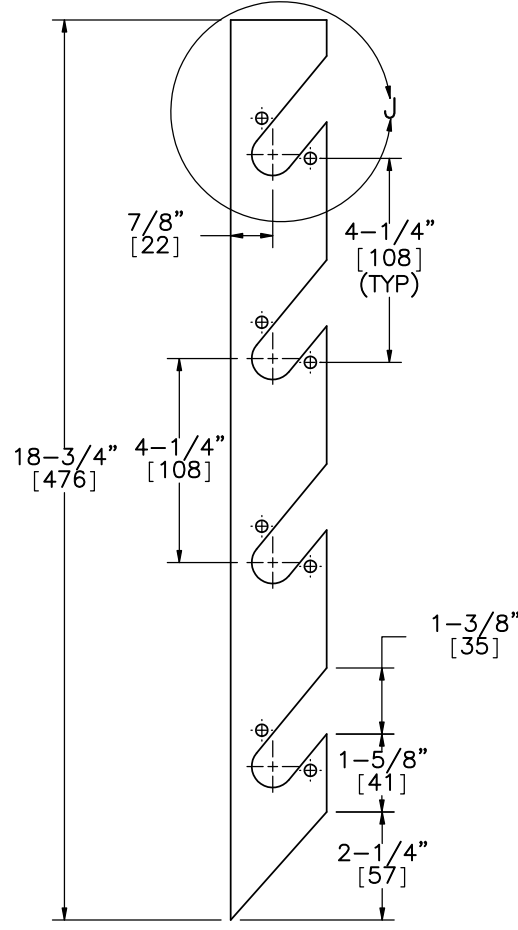
PLAN VIEW



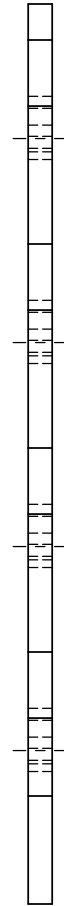
ELEVATION VIEW Part b2



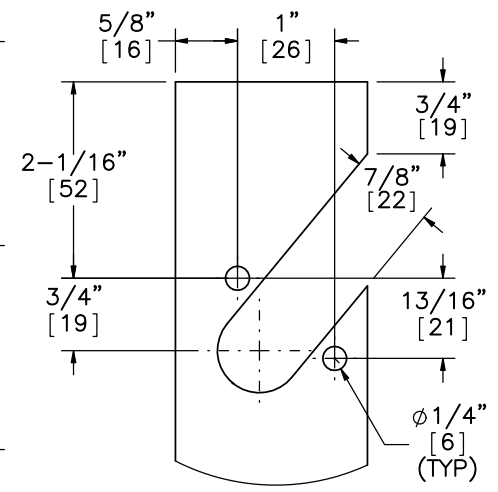
PLAN VIEW



ELEVATION VIEW TYP. Part b10



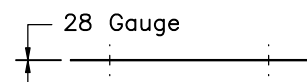
PROFILE VIEW



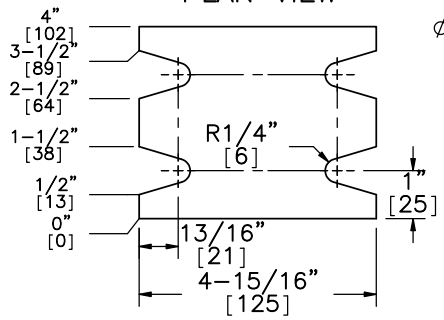
DETAIL J SCALE 1 : 2



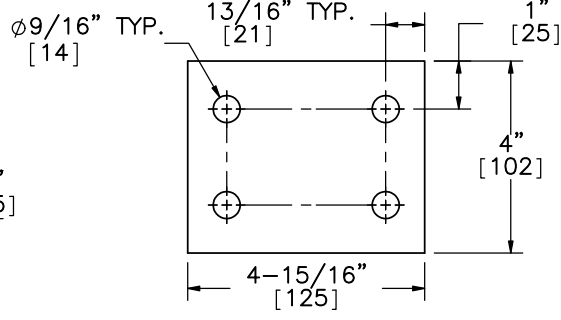
PLAN VIEW



PLAN VIEW



ELEVATION VIEW Part b13



ELEVATION VIEW Part b5



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Cable Hanger Assembly Post Nos. 2 & 75

DWG. NAME: MWP-5_R3

SCALE: 1:8 UNITS: in.[mm]

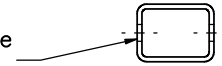
SHEET: 13 of 24

DATE: 06/23/2015

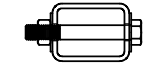
DRAWN BY: SDB/JEK

REV. BY: KAL

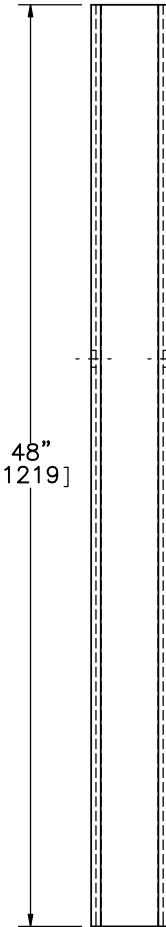
4" [102] x 3" [76] x 1/4" [6] tube
 ASTM A500 Grade B



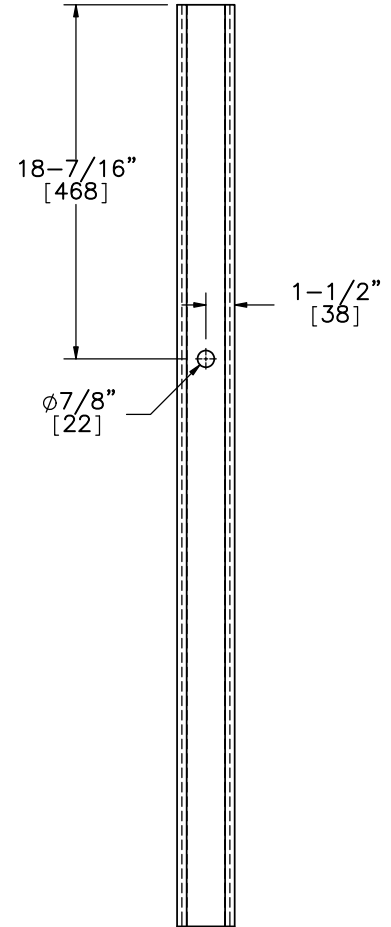
PLAN VIEW



PLAN VIEW

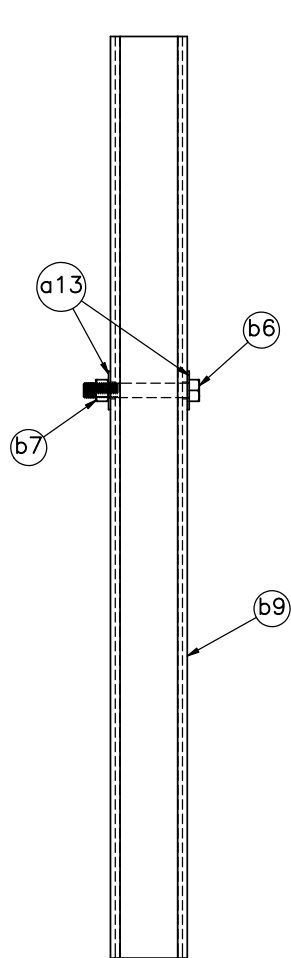


ELEVATION VIEW

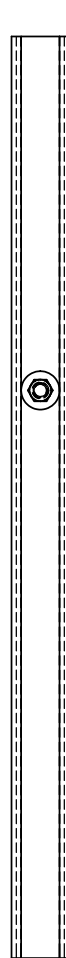


PROFILE VIEW

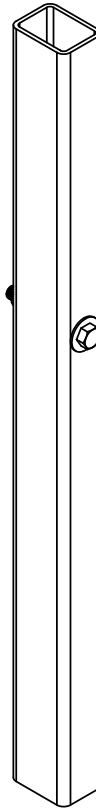
Part b9



ELEVATION VIEW



PROFILE VIEW



ISOMETRIC VIEW



Midwest Roadside
 Safety Facility

Midwest 4-Cable Barrier
 System

Foundation Tube Assembly
 Post Nos. 2 & 75

DWG. NAME:
 MWP-5_R3

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

SHEET:
 14 of 24

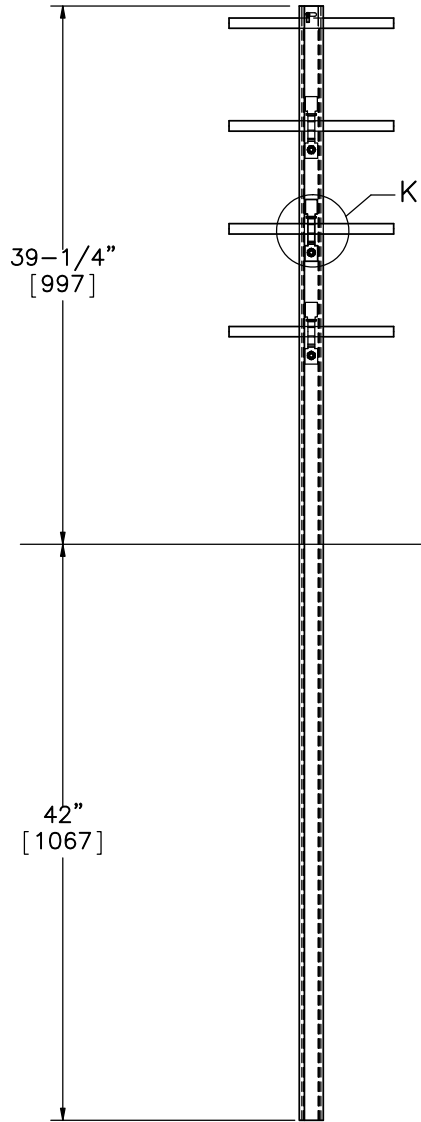
DATE:
 06/23/2015

DRAWN BY:
 SDB/JEK

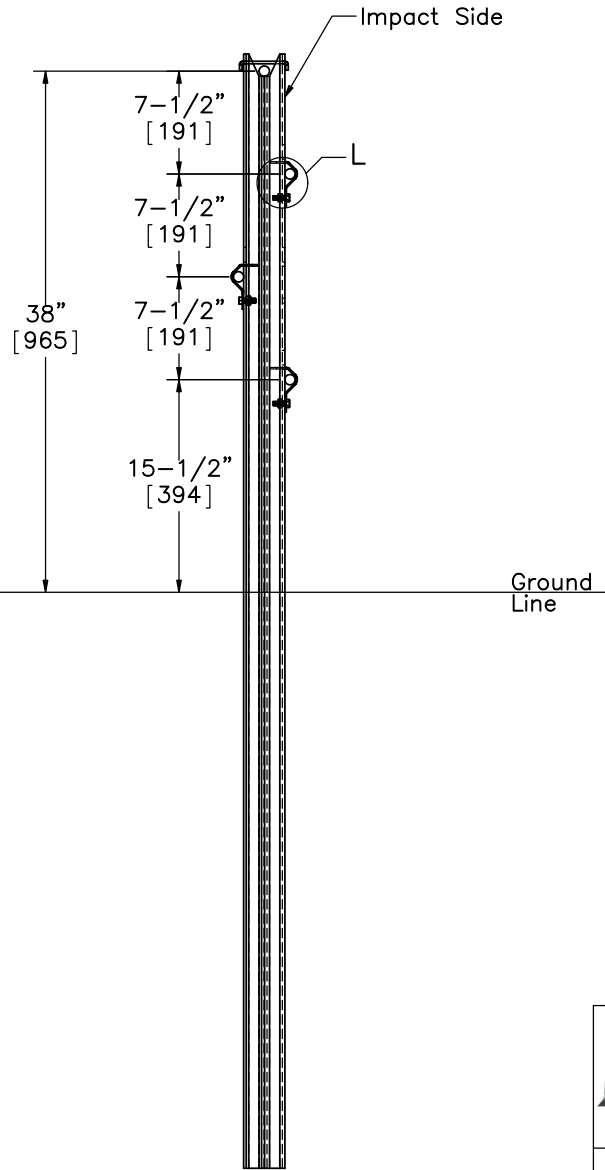
REV. BY:
 KAL



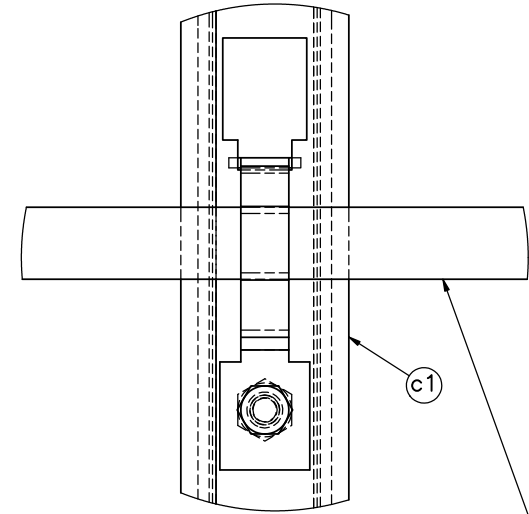
PLAN VIEW



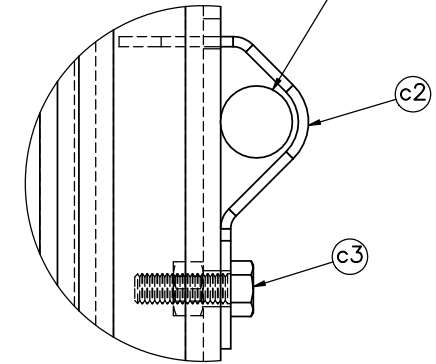
ELEVATION VIEW



PROFILE VIEW



DETAIL K
SCALE 1 : 2



DETAIL L
SCALE 1 : 2

Cable



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Z-Post

DWG. NAME.
MWP-5_R3

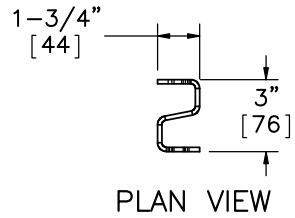
SCALE: 1:14
UNITS: in.[mm]

SHEET:
15 of 24

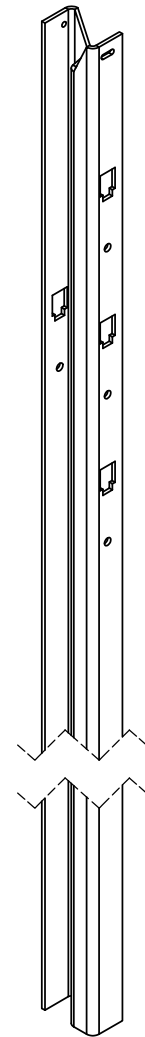
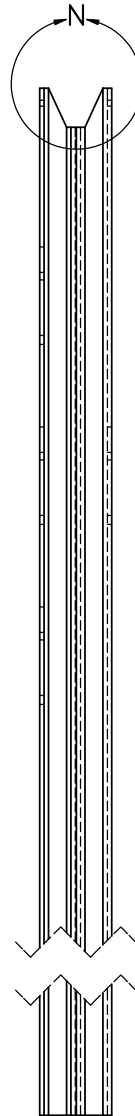
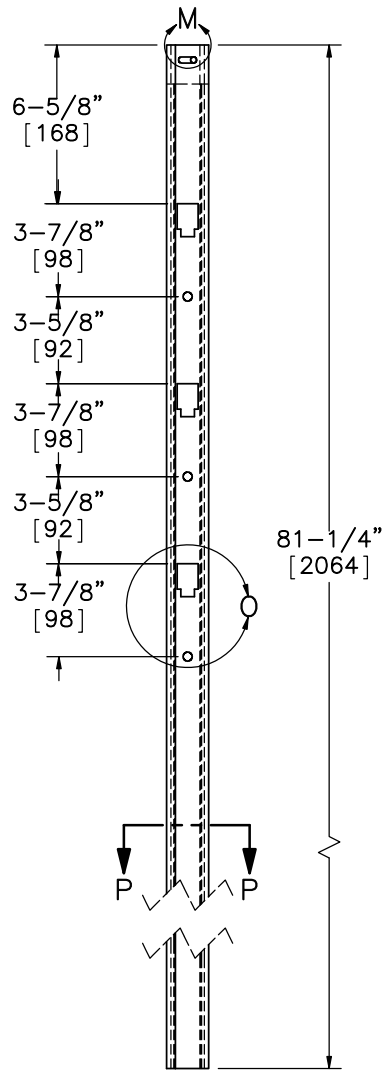
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

REV. BY:
KAL



Unbent width = 7.0453"



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Z-Post

DWG. NAME:
MWP-5_R3

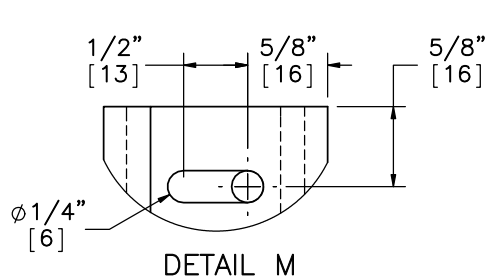
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SHEET:
16 of 24

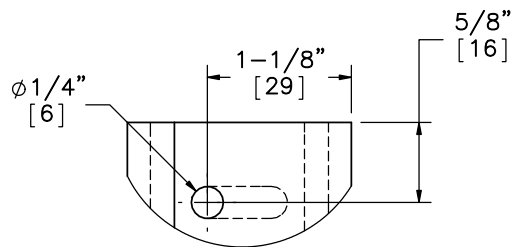
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

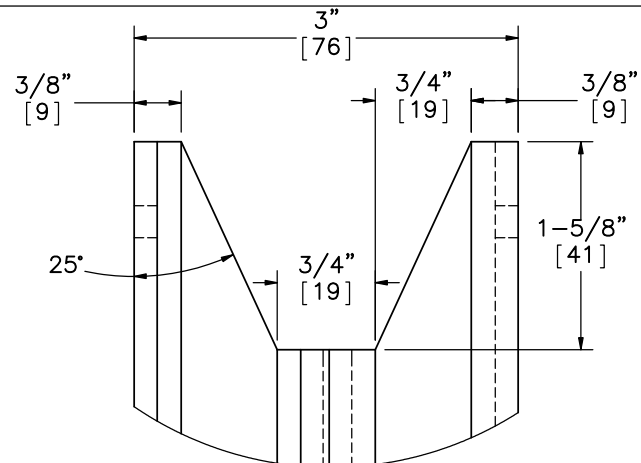
REV. BY:
KAL



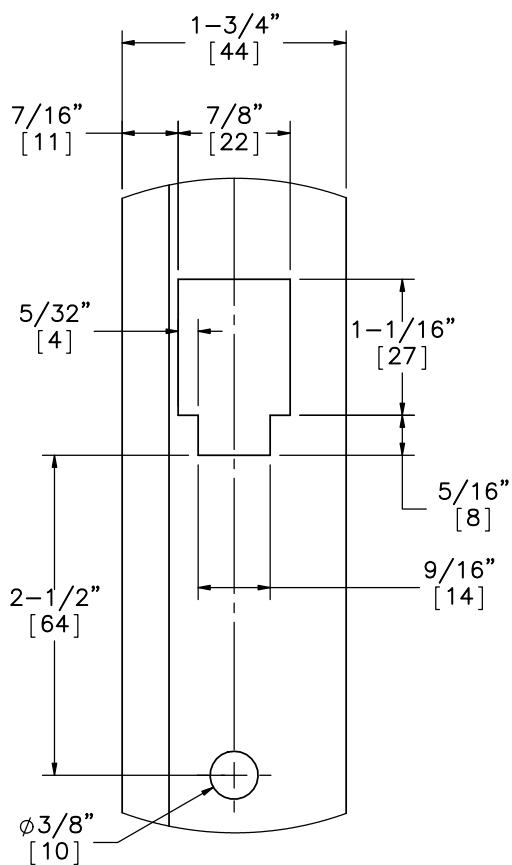
DETAIL M



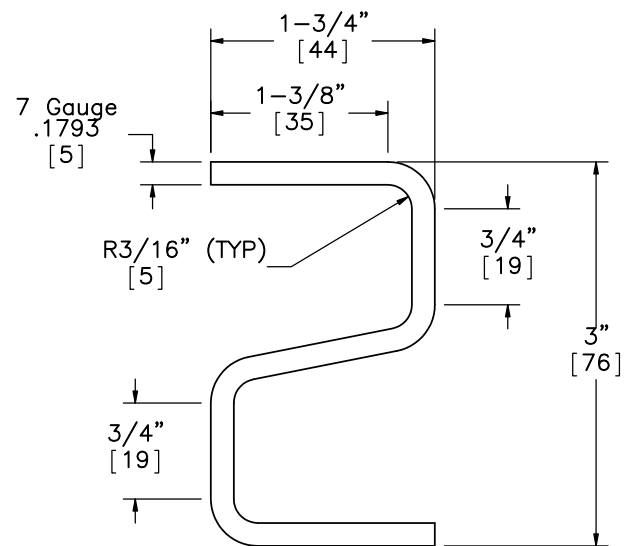
DETAIL M BACKSIDE



DETAIL N



DETAIL O



SECTION P-P



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Z-Post Details

DWG. NAME:
MWP-5_R3

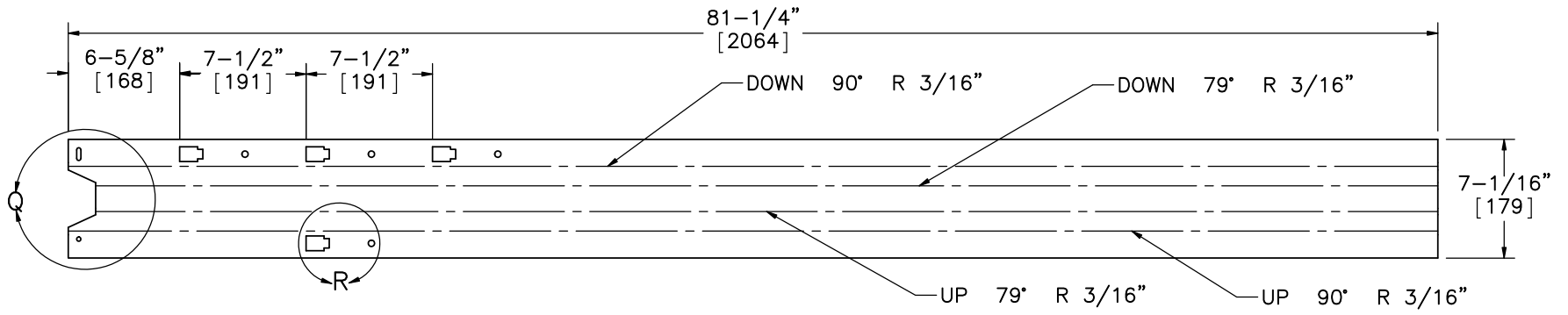
SCALE: 2:3
UNITS: in.[mm]

SHEET:
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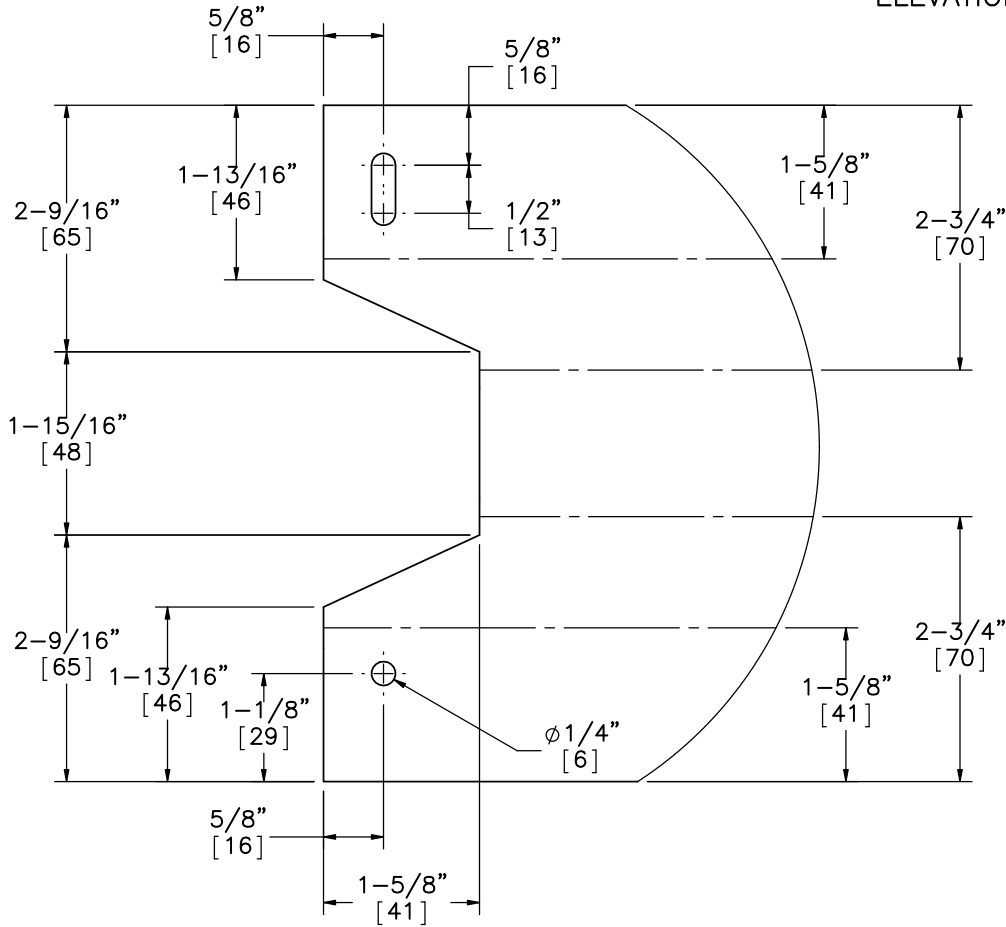
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06/23/2015

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SDB/JEK

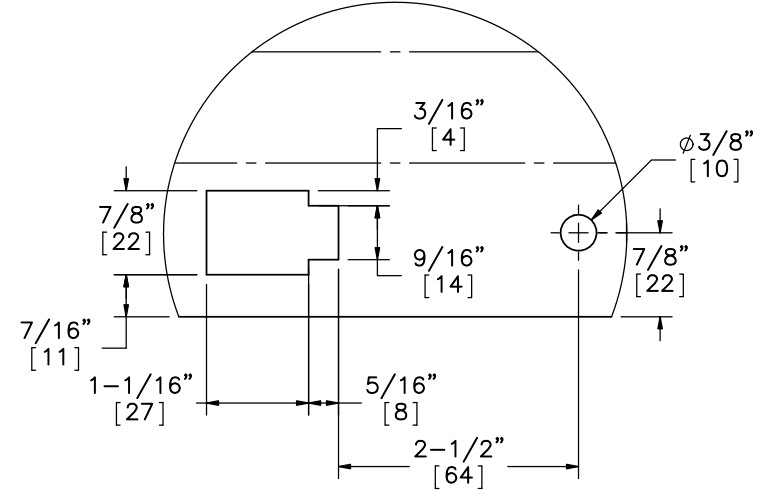
REV. BY:
KAL



ELEVATION VIEW



DETAIL Q
SCALE 1 : 2



DETAIL R
SCALE 1 : 2



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Z-Post Flat Pattern

DWG. NAME.
MWP-5_R3

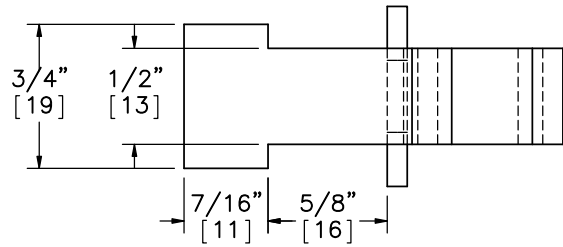
SCALE: 1:10
UNITS: in.[mm]

SHEET:
18 of 24

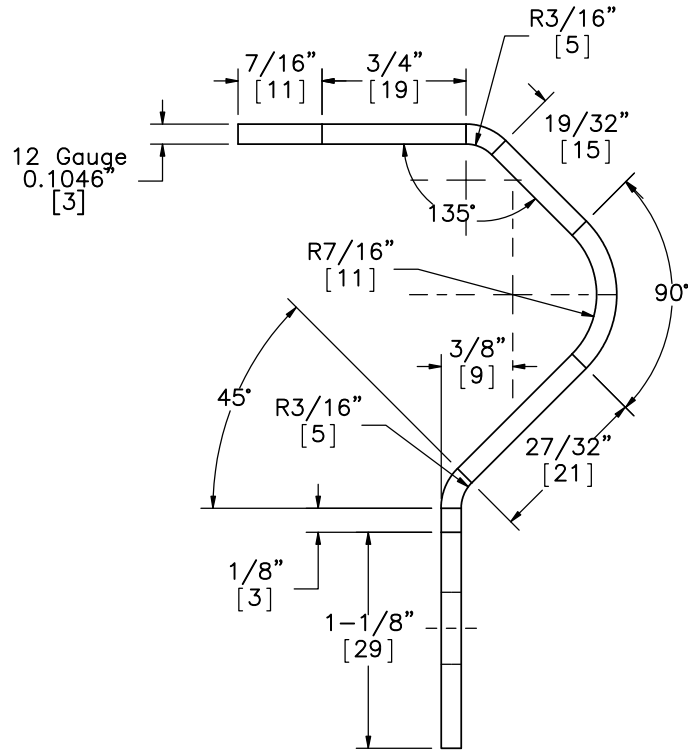
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

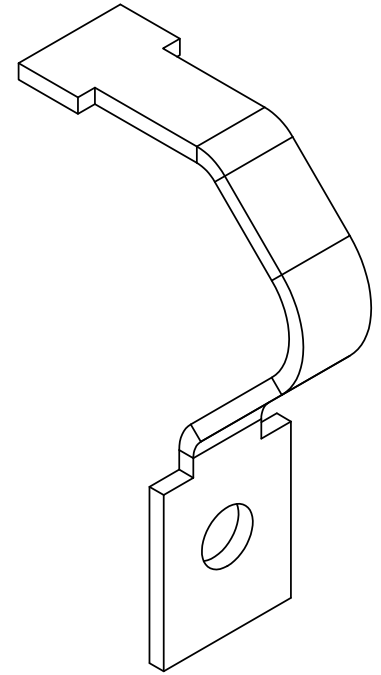
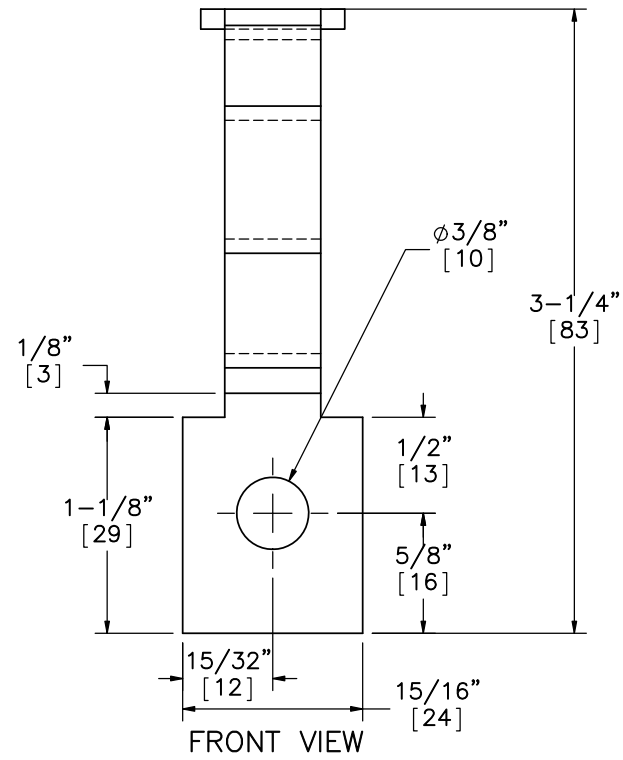
REV. BY:
KAL



TOP VIEW



SIDE VIEW
Tabbed Bracket Version 10
Part c2



ISOMETRIC VIEW



Midwest Roadside
Safety Facility

Midwest 4-Cable Barrier
System

Tabbed Bracket Version 10
(12 Gauge)

DWG. NAME:
MWP-5_R3

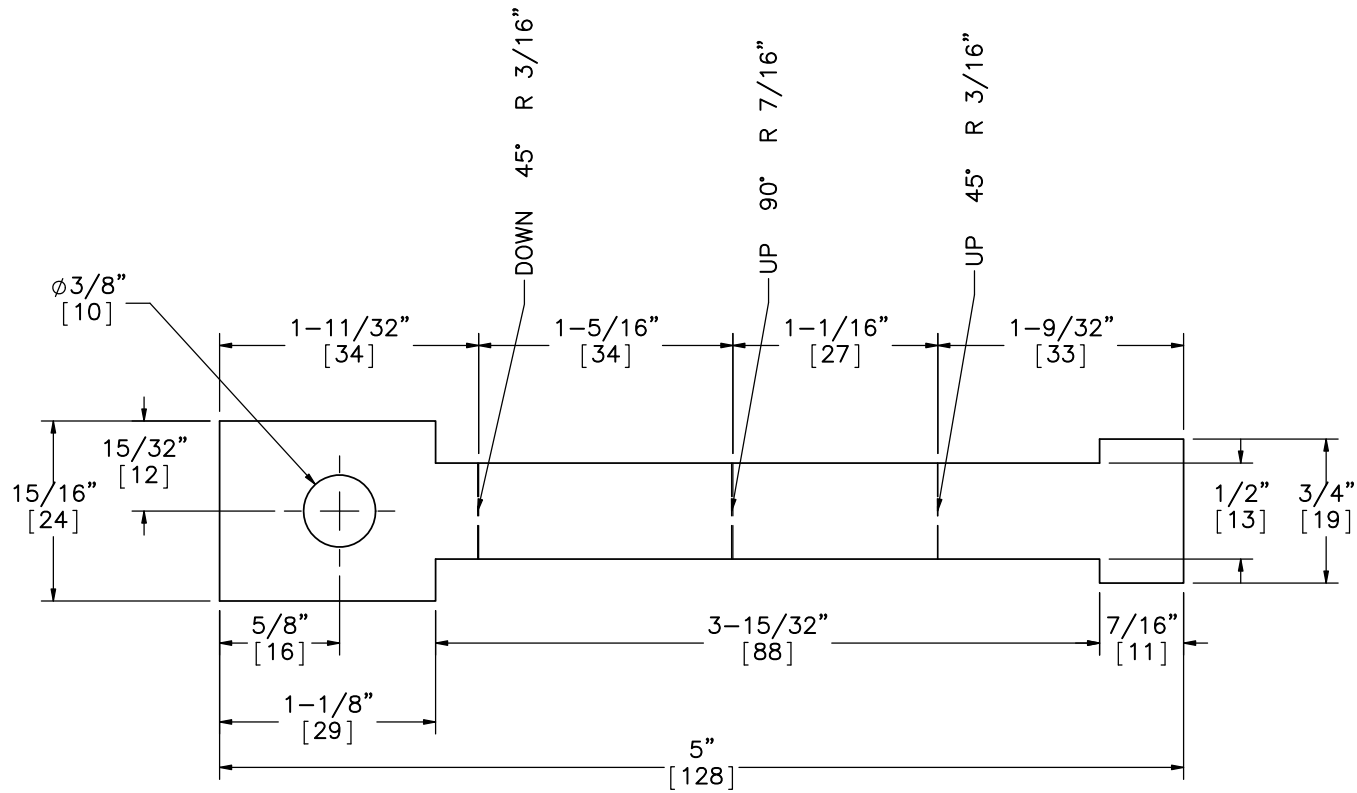
SCALE: 1:1
UNITS: in.[mm]

SHEET:
19 of 24

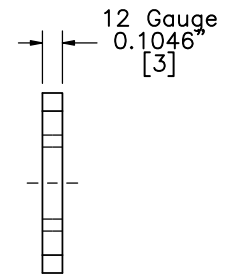
DATE:
06/23/2015

DRAWN BY:
SDB/JEK

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KAL



FLAT PATTERN FRONT/BACK
 Tabbed Bracket Version 10
 Part c2



FLAT PATTERN
 SIDE VIEW



Midwest Roadside
 Safety Facility

Midwest 4-Cable Barrier
 System

Tabbed Bracket Version 10
 Flat Pattern

DWG. NAME:
 MWP-5_R3

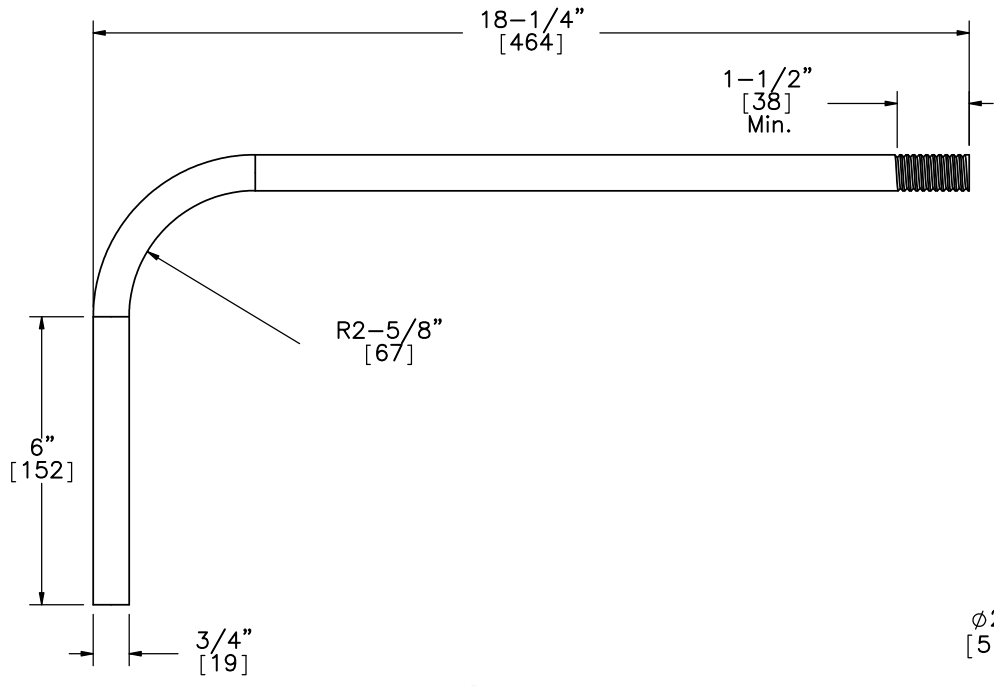
SCALE: 1:1
 UNITS: in.[mm]

SHEET:
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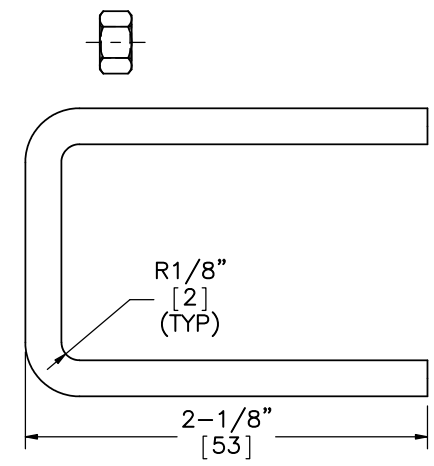
DATE:
 06/23/2015

DRAWN BY:
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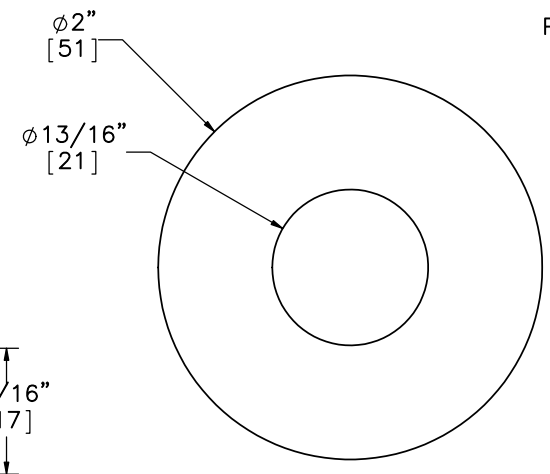
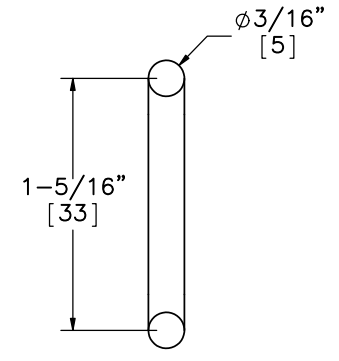
REV. BY:
 KAL



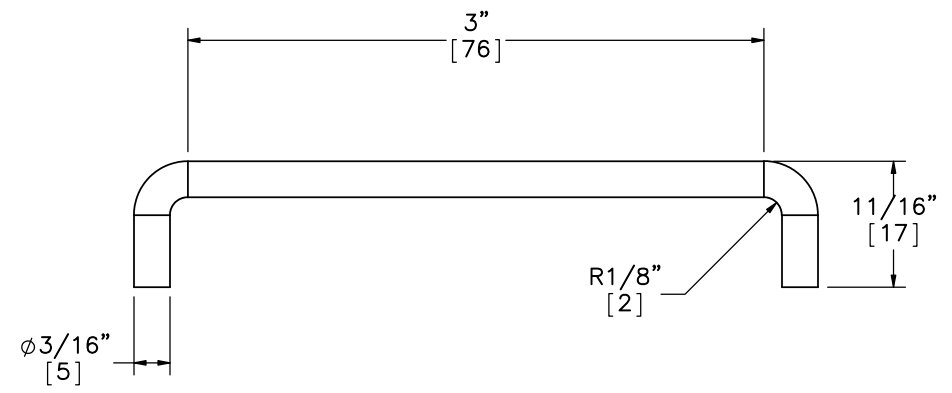
Part a14
SCALE 1:4



Part b14




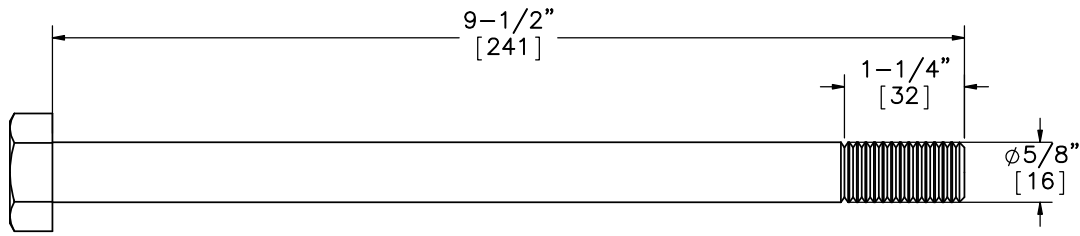
Part a13



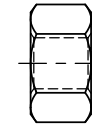
Part c4

Note: (1) Total length of part a14 is 25 9/16" [649].
 (2) Total length of part c4 is 4 1/4" [108].

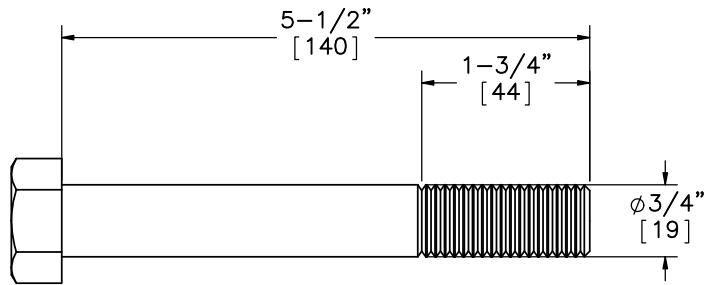
 Midwest Roadside Safety Facility	Midwest 4-Cable Barrier System	SHEET: 21 of 24
	J-Hook Anchor and Brass Cable Clip	DATE: 06/23/2015
DWG. NAME: MWP-5_R3	SCALE: 1:1 UNITS: in.[mm]	DRAWN BY: SDB/JEK
		REV. BY: KAL



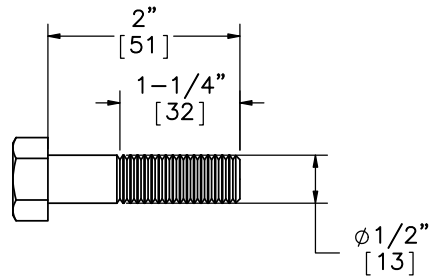
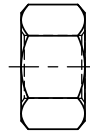
Part a17



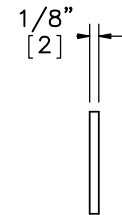
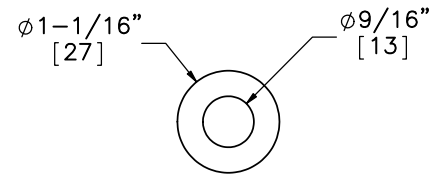
Part a16



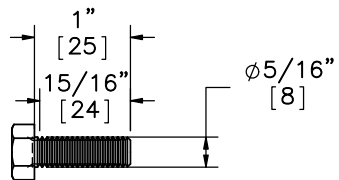
Part b6



Part b8



Part b7



Part c3



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Hardware

DWG. NAME:
MWP-5_R3

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

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DATE:
06/23/2015

DRAWN BY:
SDB/JEK

REV. BY:
KAL

Item No.	QTY.	Description	Material Specification
a1	2	Cable Anchor Base Plate	ASTM A36
a2	4	Exterior Cable Plate Gusset	ASTM A36
a3	6	Interior Cable Plate Gusset	ASTM A36
a4	2	Anchor Bracket Plate	ASTM A36
a5	2	3/16" [5] Dia. Brass Keeper Rod, 14" [356] long	Brass
a6	4	Release Gusset	A36 Steel
a7	2	Release Lever Plate	A36 Steel
a8	4	1.25x1.25x0.1875" [32x32x5] TS CT Kicker Lever Tube	ASTM A500 Gr. B
a9	8	CMB High Tension Anchor Plate Washer	ASTM A36
a10	2	1.25x1.25x0.1875" [32x32x5] TS CT Kicker Lever Connecting Tube	ASTM A 500 Gr. B
a11	2	3x10x0.5" [76x254x13] Kicker Plate	ASTM A36
a12	4	CT kicker – gusset	ASTM A36
a13	20	3/4" [19] Dia. Flat Washer	ASTM F844
a14	16	3/4" [19] Dia. UNC J–Hook Anchor and Hex Nut	J–Hook ASTM A449/Nut ASTM A563 DH
a15	2	1/4" [6] Dia. Aircraft Retaining Cable, 36" [914] long	7x19 Galv.
a16	2	5/8" [16] Dia. Heavy Hex Nut	ASTM A563C
a17	2	5/8" [16] Dia. UNC, 9 1/2" [241] Long Hex Bolt	ASTM A449 or SAE J429 Gr. 5
a18	2	24" [610] Dia. Concrete Anchor, 120" [3048] long	4,000 psi f'c
a19	16	#11 Straight Rebar, 114" [2896] long	Grade 60
a20	44	#4 Anchor Hoop Rebar with 21" [533] Dia.	Grade 60
b1	2	S3x5.7 [S76x8.5] Post by 28 1/8" [714]	ASTM A572 GR50–07, ASTM A709 GR50–09A, ASTM A992–06A
b2	2	S3x5.7 [S76x8.5] Post by 19" [483]	ASTM A572 GR50–07, ASTM A709 GR50–09A, ASTM A992–06A
b3	8	#3 Straight Rebar, 43" [1092] long	Grade 60
b4	22	7 1/4" [184] Dia. No. 3 Hoop Reinforcement	Grade 60
b5	2	2nd Post Keeper Plate, 28 Gauge	ASTM A36
b6	2	3/4" [19] Dia. UNC, 5 1/2" [140] Long Hex Bolt and Nut	Bolt ASTM A307 Gr. A/Nut ASTM A563A
b7	24	1/2" [13] Dia. Washer with 1 1/16" [27] OD	ASTM F844
b8	8	1/2" [13] Dia. UNC, 2" [51] long Hex Bolt and Nut	Bolt ASTM A307 Gr. A/Nut ASTM A563A
b9	2	4x3x1/4" [102x76x6] Foundation Tube, 48" [1168] long	ASTM A500 Grade B
b10	2	2nd Post Cable Hanger	ASTM A36
b11	2	2nd Post Anchor Aggregate 12 in, Depth	–
b12	2	12" Dia. 2nd Post Concrete Anchor, 46" long	4,000 psi f'c
b13	4	2nd Post Base Plate	ASTM A36
b14	8	3/16" [5] Dia. 5 1/4" [133] Long Brass Rod	ASTM B16–00



Midwest Roadside
Safety Facility

Midwest 4–Cable Barrier
System

Bill of Materials

DWG. NAME.
MWP–5_R3

SCALE: NONE
UNITS: in.[mm]

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DATE:
06/23/2015
DRAWN BY:
SDB/JEK
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KAL

Item No.	QTY.	Description	Material Spec
c1	72	3"x1-3/4"x7 Gauge [76x44x4.6], 81 1/4" [2064] Long Bent Z-Section Post	Hot-Rolled ASTM A1011 HSLA Gr. 50
c2	216	12 Gauge Tabbed Bracket - Version 10	Hot-Rolled ASTM A1011 HSLA Grade 50
c3	216	5/16" [8] Dia. UNC, 1" [25] Long Hex Cap Screw and Nut	Bolt SAE J429 Gr. 5 or ASTM A449/Nut ASTM A563 DH
c4	72	Straight Rod - ϕ 3/16" [5] Cable Clip	ASTM B16 Brass C36000 Half Hard (H02), ROUND. TS \geq 68.0 ksi, YS \geq 52.0 ksi
d1	1	3/4" [19] Dia. 3x7 Cable Guiderail	AASHTO M30-92(2000)/ASTM A741-98 Type 1 Class A coating except with Type 1 minimum breaking strength = 39 kips [173.5 kN]
d2	16	7/8" [22] Dia. Hex Nut	ASTM A563C
d3	28	Cable End Threaded Rod	ASTM A449
d4	24	Bennet Cable End Fitter	ASTM A47
d5	24	7/8" [22] Dia. Hex Nut	SAE J429 Gr. 5
e1	8	Bennet Short Threaded Turnbuckle	Not Specified
e2	8	Threaded Load Cell Coupler	N/A
e3	4	50,000-lb [222.4-kN] Load Cell	N/A



Midwest Roadside Safety Facility

Midwest 4-Cable Barrier System

Bill of Materials

DWG. NAME:
MWP-5_R3

SCALE: NONE
UNITS: in.[mm]

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06/23/2015
DRAWN BY:
SDB/JEK
REV. BY:
KAL

REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVISED BY
R0	10/31/2014	-	Derived from MWP-4_R0. Post Spacing changed to 8'.	SDB
R1	12/11/2014	-	Mash designation changed to 3-10. Cables flipped (Bottom moved to impact side)	SDB
		1	Mash designation changed to 3-10	
		15	Cables flipped (Bottom moved to impact side)	
R2	12/11/2014	15	Detail K Moved to different cable clip.	SDB
R3	6/23/2015	7	Post numbers corrected in page description.	JEK
		11	Post numbers corrected in page description.	
		12	Post numbers corrected in page description.	
		13	Post numbers corrected in page description.	
		14	Post numbers corrected in page description.	