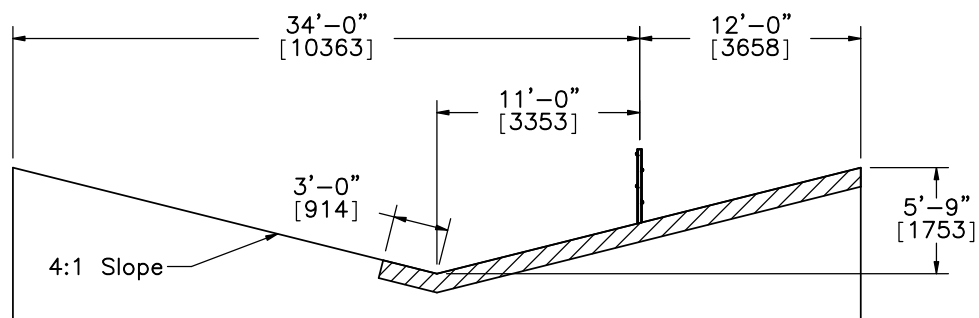
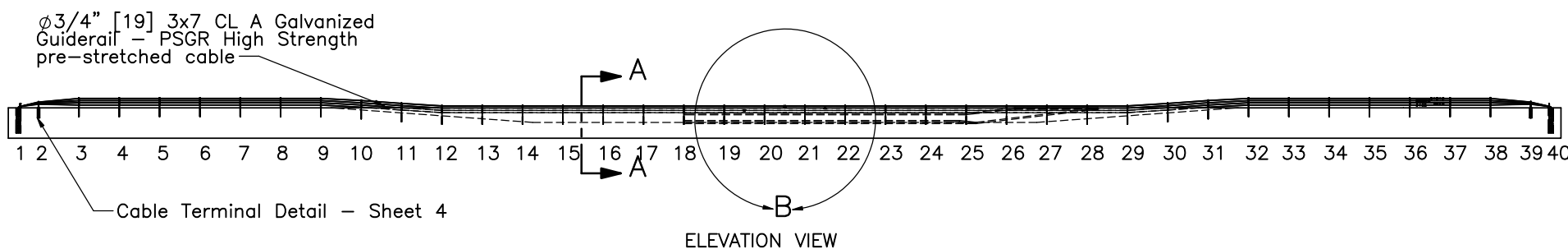
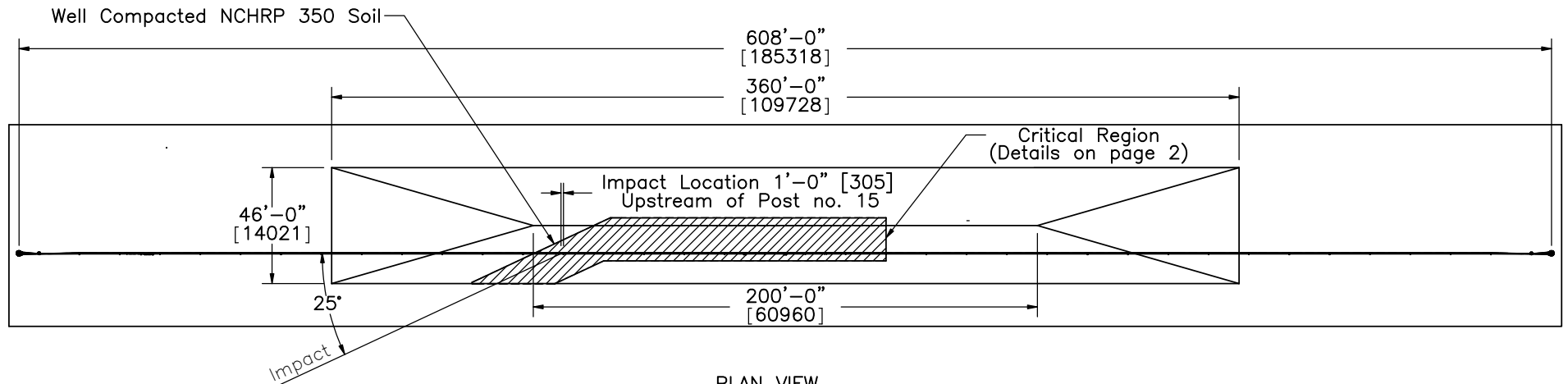
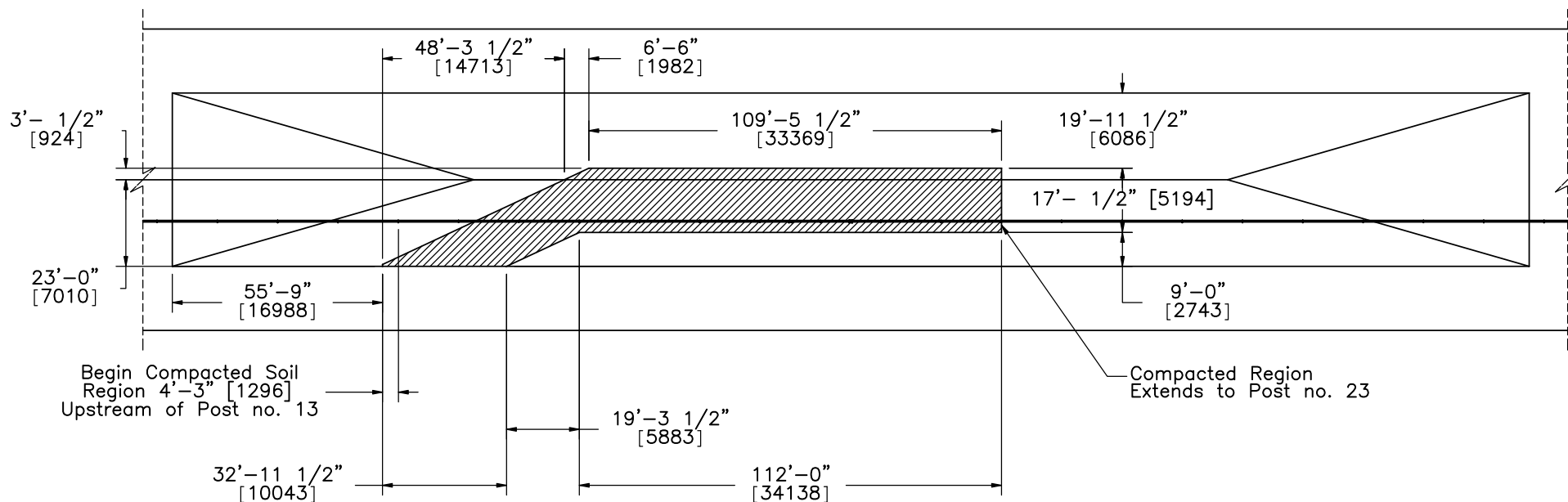




SECTION A-A
SCALE 1:125

- Notes: (1) Impact point at 1' [305] upstream of post no. 15
 (2) Post nos. 14-23 placed in 18" [457] diameter hole backfilled and tamped in well compacted NCHRP 350 soil.
 (3) Test cable tensions of 4200 ± 200 lb [18.7 ± 0.889 kN].
 (4) Pos nos. 3-11 and 27-38 are made with oversized keyway hole geometry with a base hole geometry of $\varnothing 3/8$ " [10] rather than $\varnothing 5/16$ " [8].

	4-Cable Median Barrier		SHEET: 1 of 21
	System Layout - 4CMB-5		DATE: 11/17/11
Midwest Roadside Safety Facility	2270P Test		DRAWN BY: MDM/KAL/ JGP/RJT
	DWG. NAME: 4CMB-5_R10	SCALE: 1:750 UNITS: in./mm	REV. BY: KAL/JCH/ RWB



Note: (1) Slope in critical region must be within testing tolerance of 1/4" [6.4].



Midwest Roadside
Safety Facility

4-Cable Median Barrier

Well Compacted Soil Region
Detail

DWG. NAME.
4CMB-5_R10

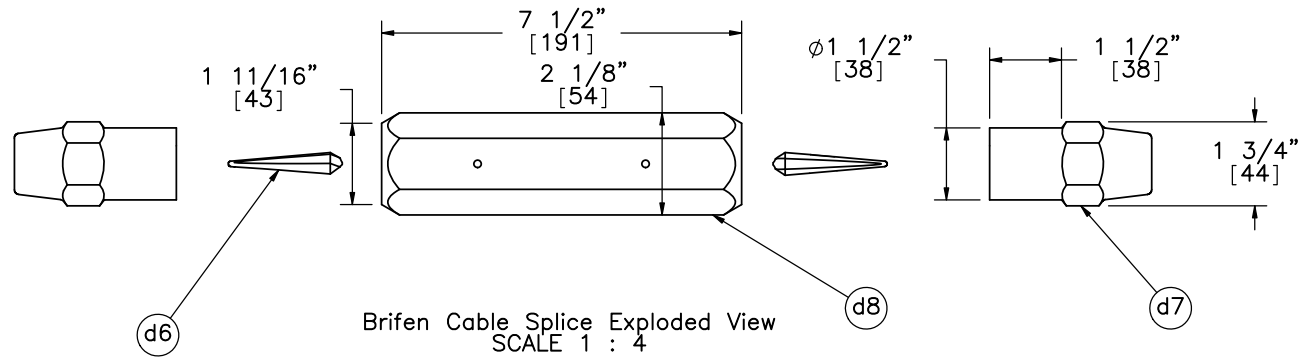
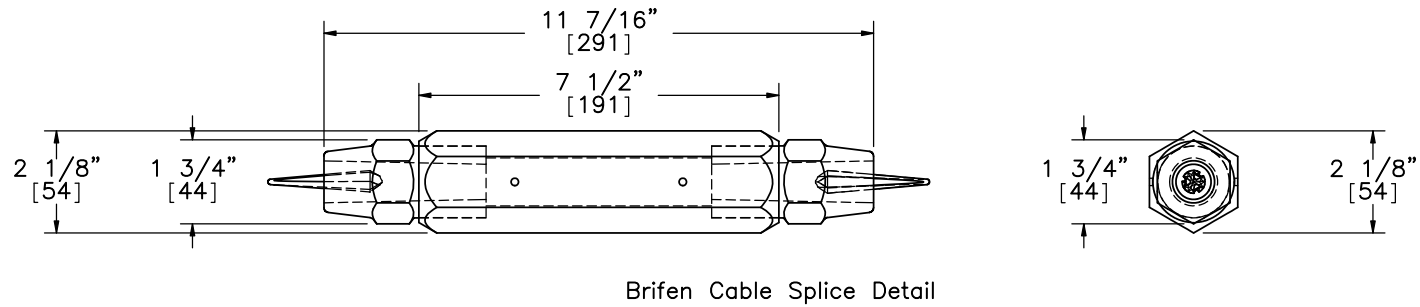
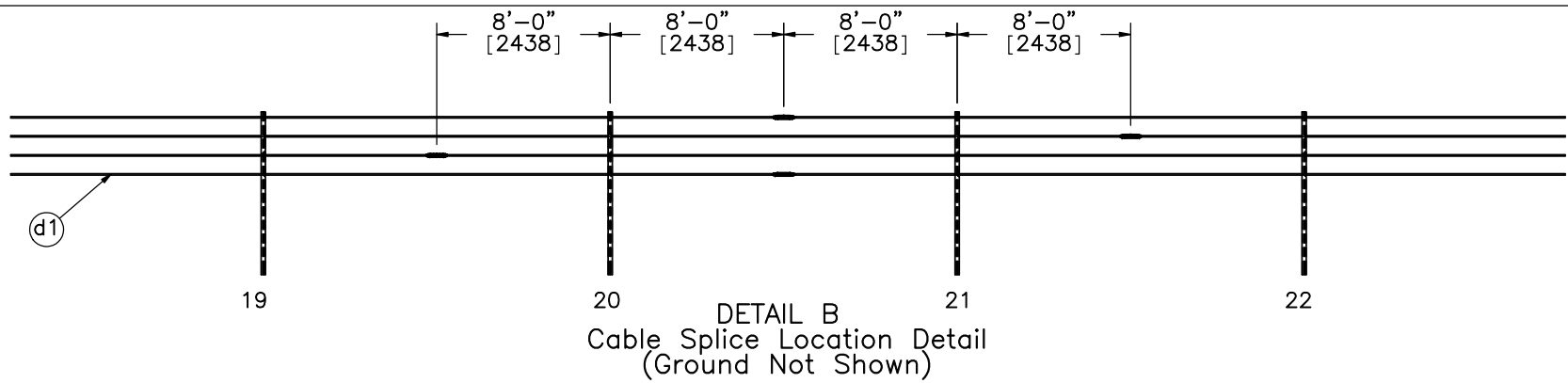
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UNITS: in.[mm]

SHEET:
2 of 21

DATE:
11/17/11

DRAWN BY:
MDM/KAL/
JGP/RJT

REV. BY:
KAL/JCH/
RWB



Midwest Roadside
Safety Facility

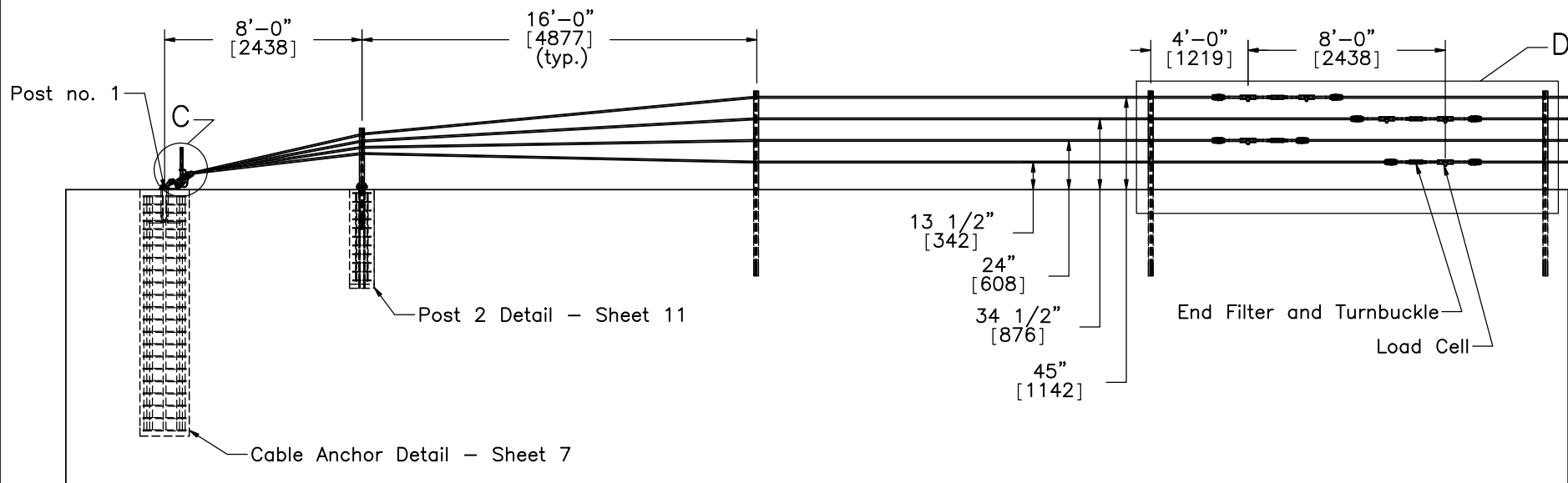
4-Cable Median Barrier
Cable Splice Location and Detail

DWG. NAME.
4CMB-5_R10

SCALE: 1:100
UNITS: in.[mm]

SHEET:
3 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB

Top Cable
2nd Cable
3rd Cable
Bottom Cable



Midwest Roadside
Safety Facility

4-Cable Median Barrier

Cable Terminal Detail
As Built

DWG. NAME.
4CMB-5_R10

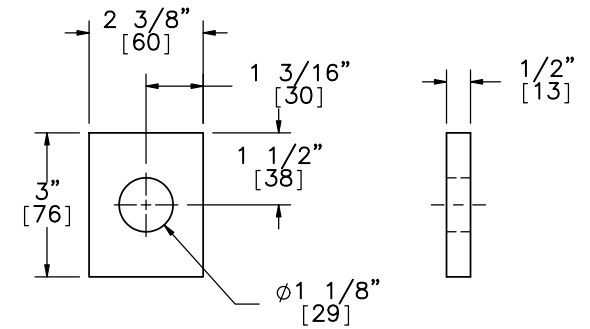
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SHEET:
4 of 21

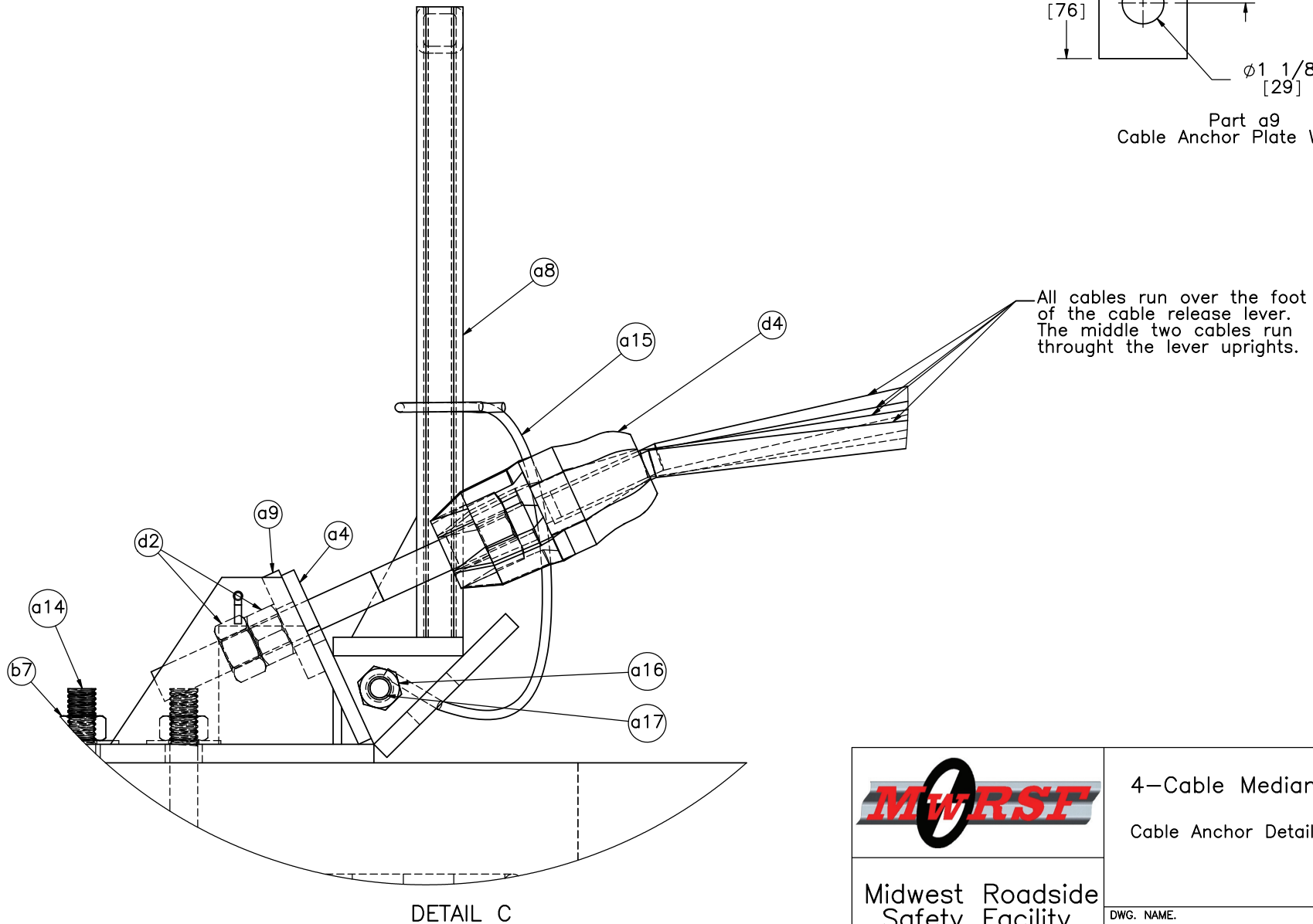
DATE:
11/17/11

DRAWN BY:
MDM/KAL/
JGP/RJT

REV. BY:
KAL/JCH/
RWB



Part a9
Cable Anchor Plate Washer



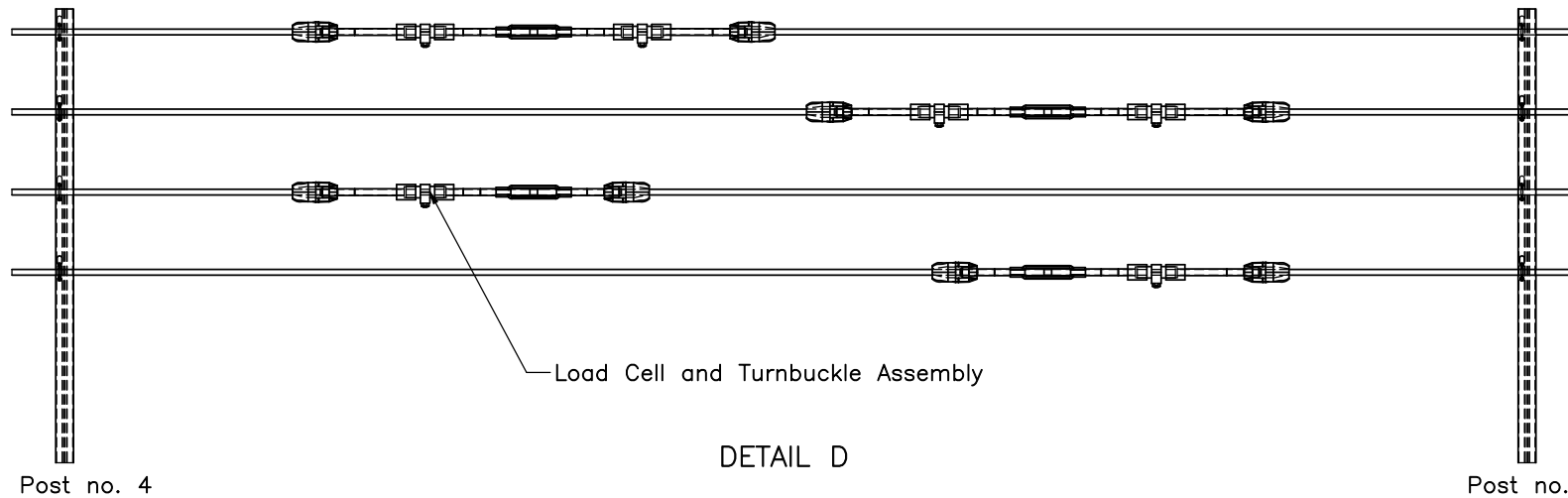
Midwest Roadside
Safety Facility

4-Cable Median Barrier
Cable Anchor Details

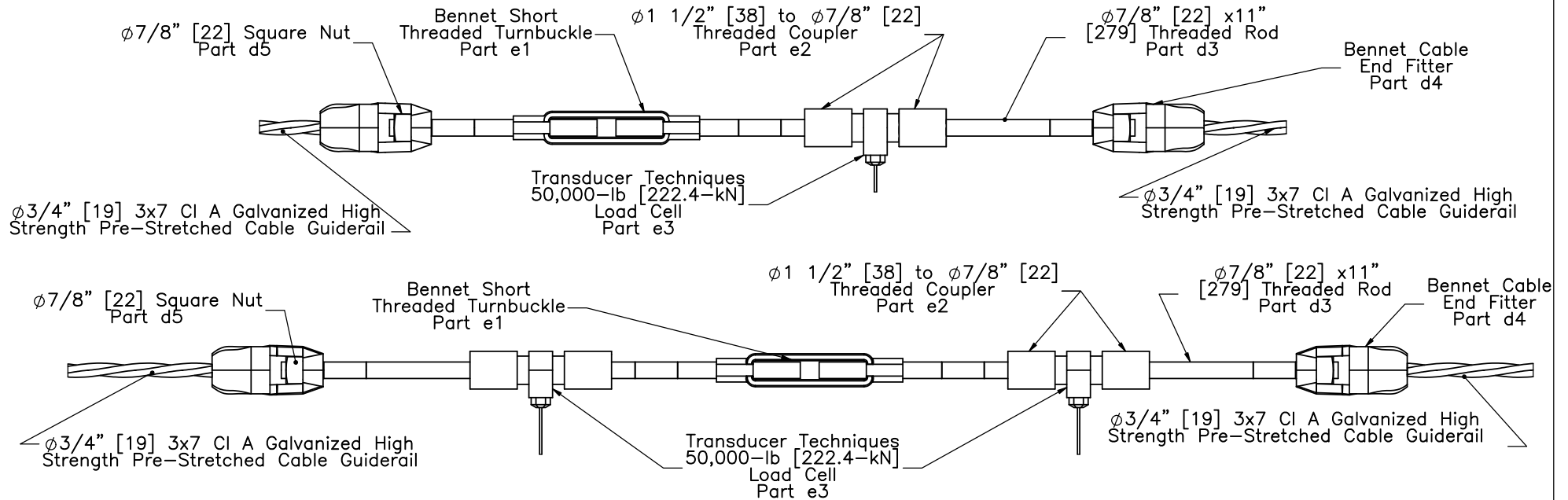
DWG. NAME.
4CMB-5_R10

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

SHEET:
5 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB



DETAIL D



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

(2) Two load cells were used in the turnbuckle assemblies for the two upper cables.



Midwest Roadside
Safety Facility

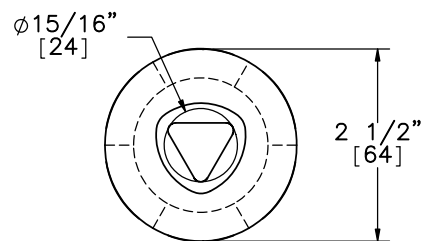
4-Cable Median Barrier

Load Cell and Turnbuckle
Configuration

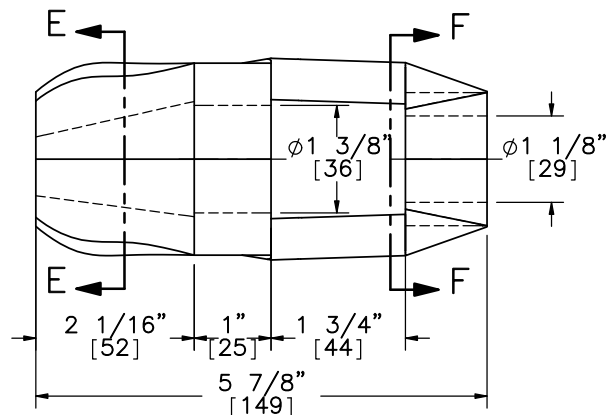
DWG. NAME.
4CMB-5_R10

SCALE: 1:25
UNITS: in./mm

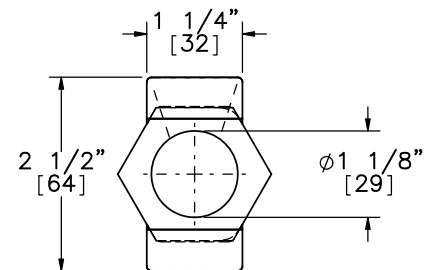
SHEET:
6 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB



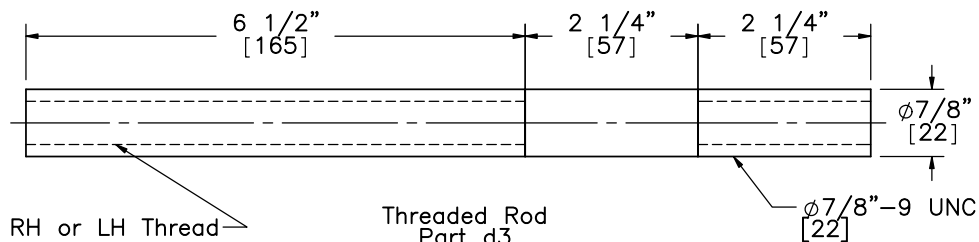
SECTION E-E



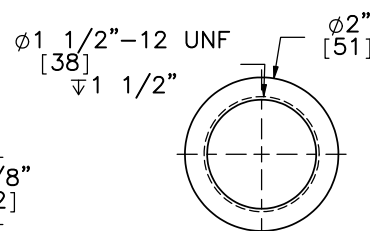
Bennet Cable End Fitter
Part d4



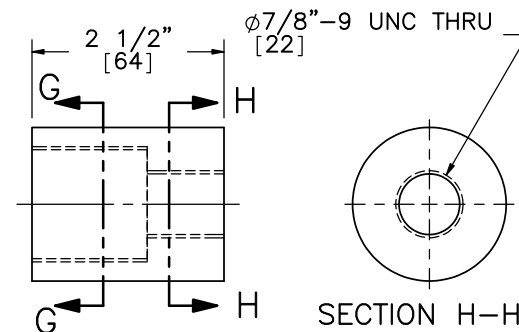
SECTION F-F



Threaded Rod
Part d3

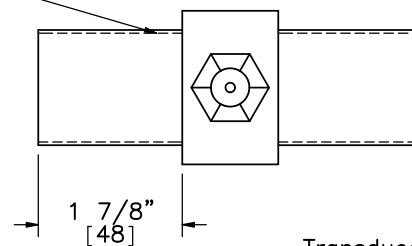


SECTION G-G

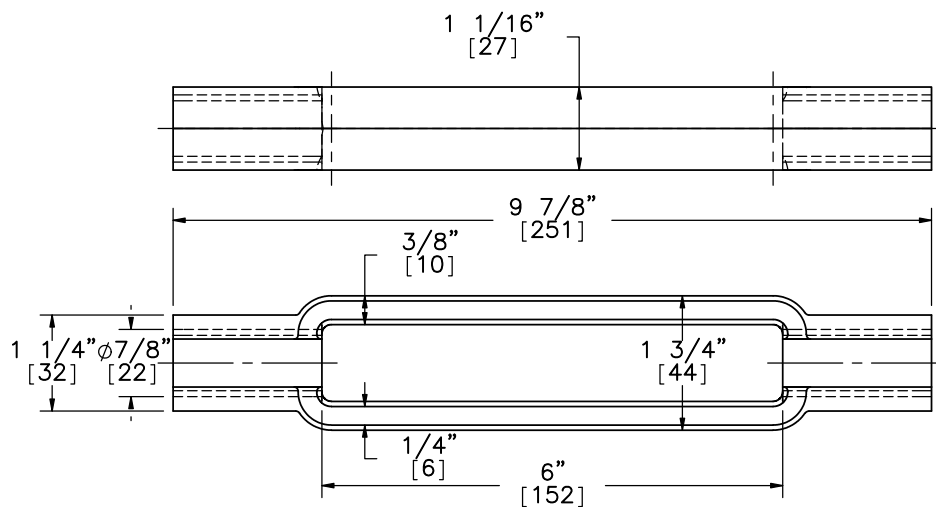
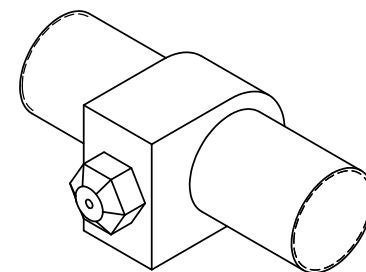


SECTION H-H

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



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



Bennet Threaded Turnbuckle
Part e1



Midwest Roadside
Safety Facility

4-Cable Median Barrier

Load Cell Assembly
Component Details

DWG. NAME.
4CMB-5_R10

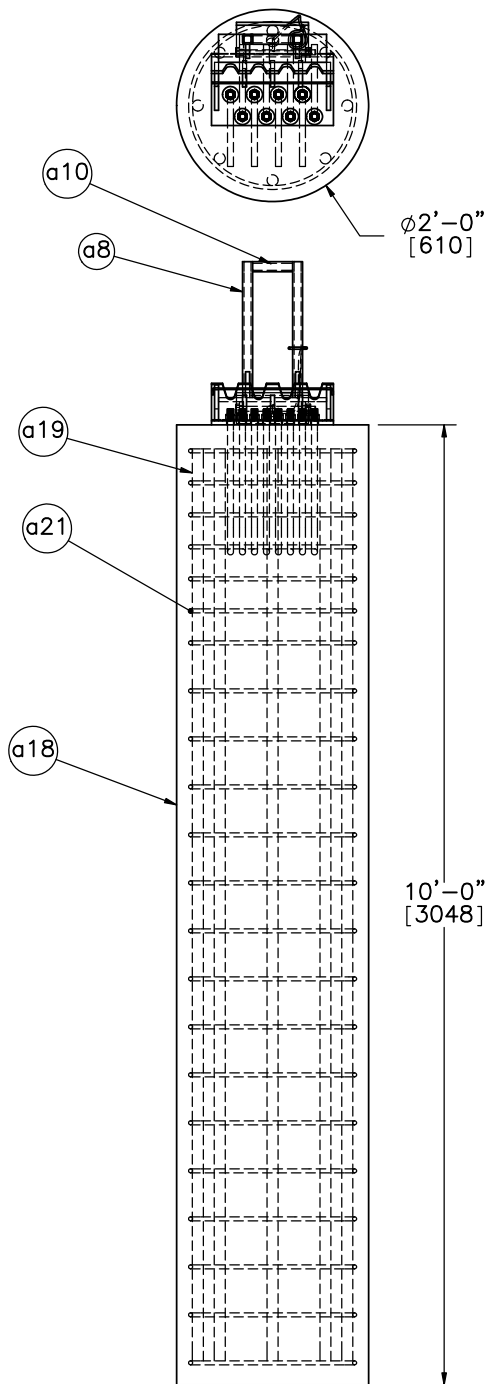
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UNITS: in.[mm]

SHEET:
7 of 21

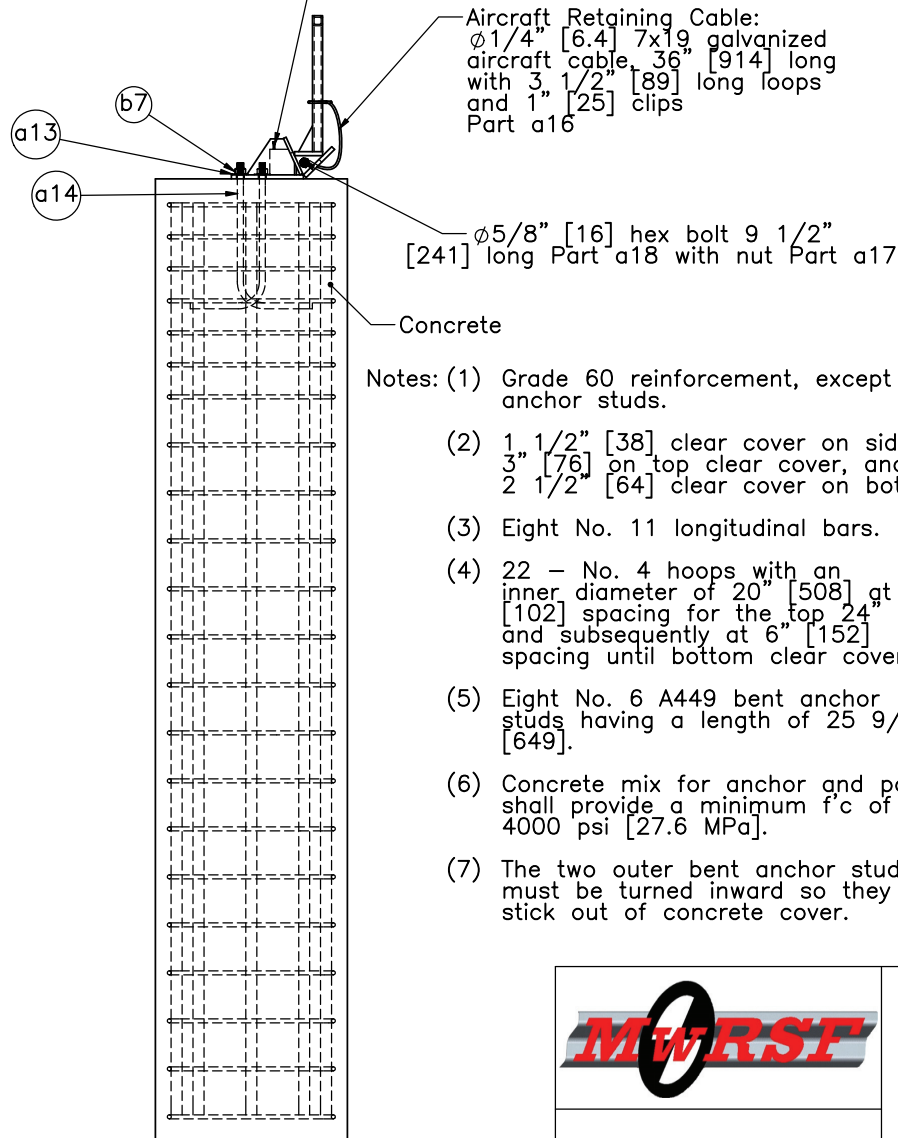
DATE:
11/17/11

DRAWN BY:
MDM/KAL/
JGP/RJT

REV. BY:
KAL/JCH/
RWB



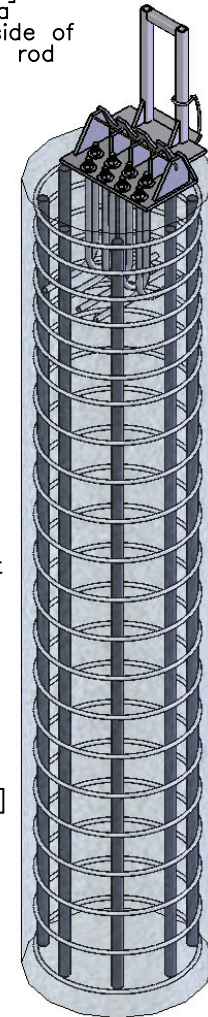
Brass Keeper Rod
 $\phi 3/16"$ [4.8] x 16" [406]
 long. Bend ends of rod
 to secure.
 Part a5



Note: Brass rod to be placed after all cables are installed and tensioned. Slide rod through the 1/4" [6.4] 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:
 $\phi 1/4"$ [6.4] 7x19 galvanized aircraft cable, 36" [914] long with 3 1/2" [89] long loops and 1" [25] clips
 Part a16

$\phi 5/8"$ [16] hex bolt 9 1/2" [241] long Part a18 with nut Part a17



Midwest Roadside
 Safety Facility

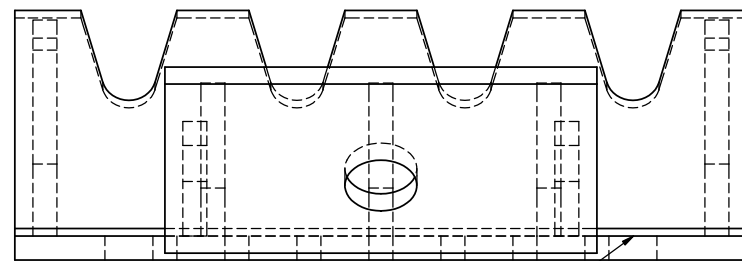
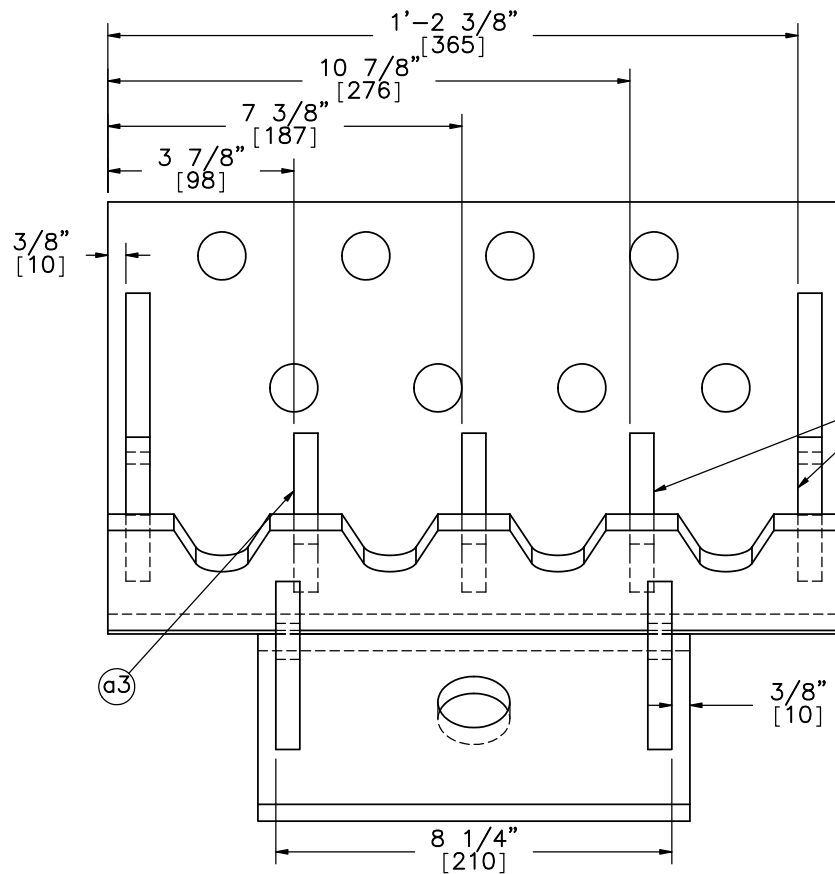
4-Cable Median Barrier

Cable Anchor Detail
 Post Nos. 1 & 40
 As Built

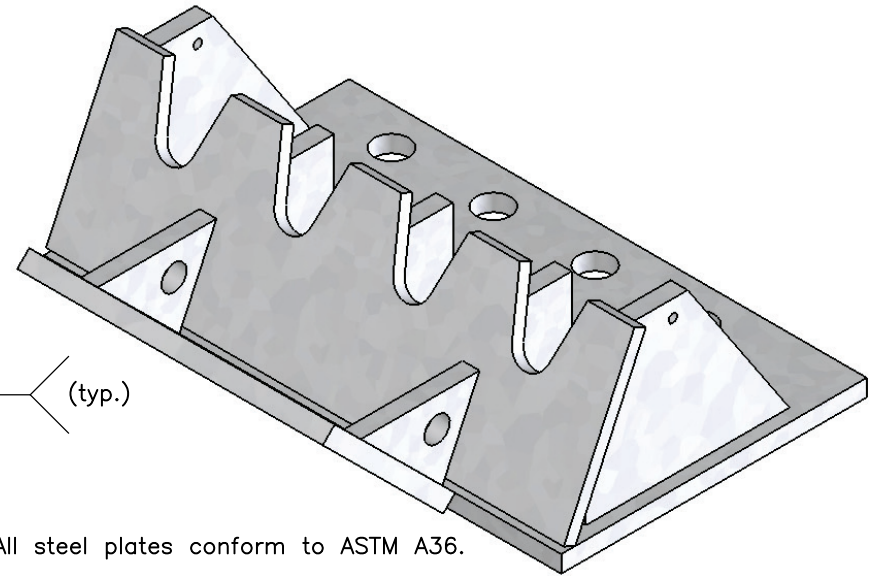
DWG. NAME.
 4CMB-5_R10

SCALE: 1:24
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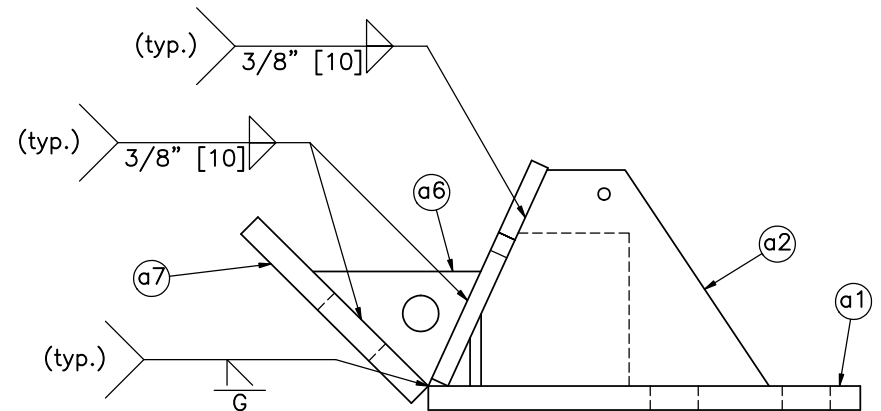
SHEET:
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 DATE:
 11/17/11
 DRAWN BY:
 MDM/KAL/
 JGP/RJT
 REV. BY:
 KAL/JCH/
 RWB



(typ.) 3/8" [10]
1/8" [3]



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



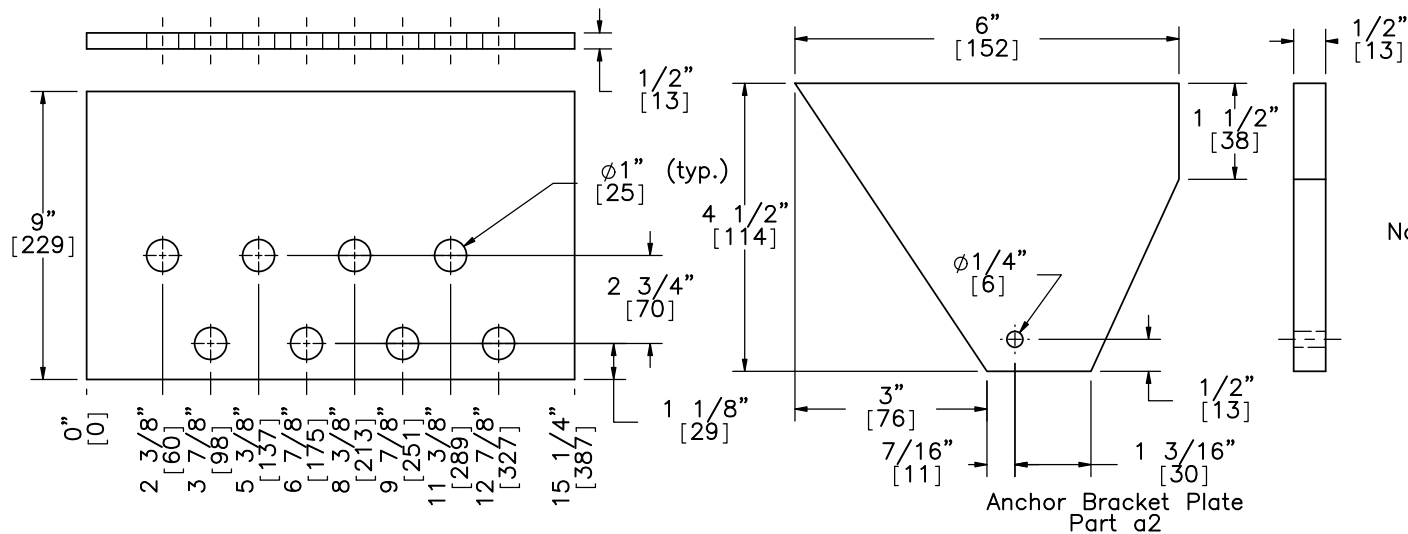
Midwest Roadside
Safety Facility

4-Cable Median Barrier
Cable Anchor Bracket

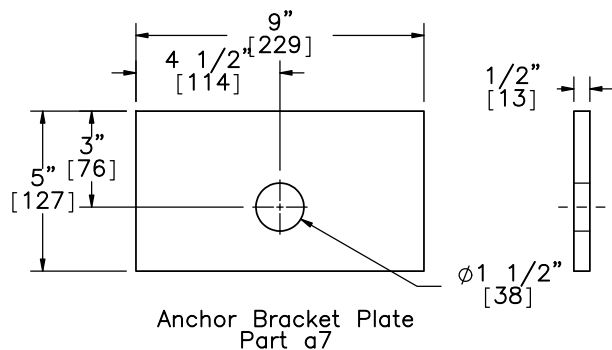
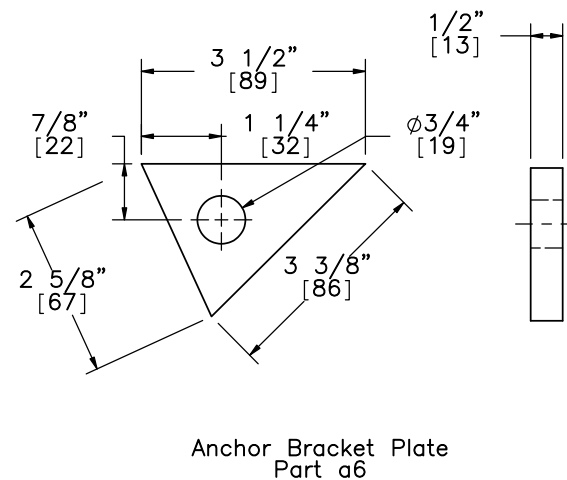
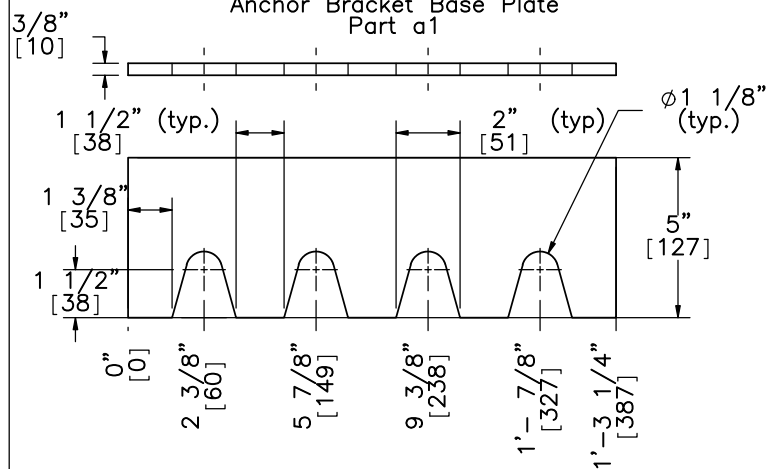
DWG. NAME.
4CMB-5_R10

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

SHEET:
9 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB



Note: All steel plates conform to ASTM A36.



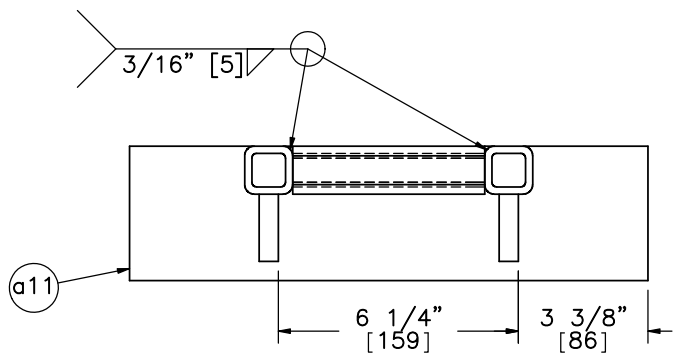
Midwest Roadside
Safety Facility

4-Cable Median Barrier
Cable Anchor Bracket

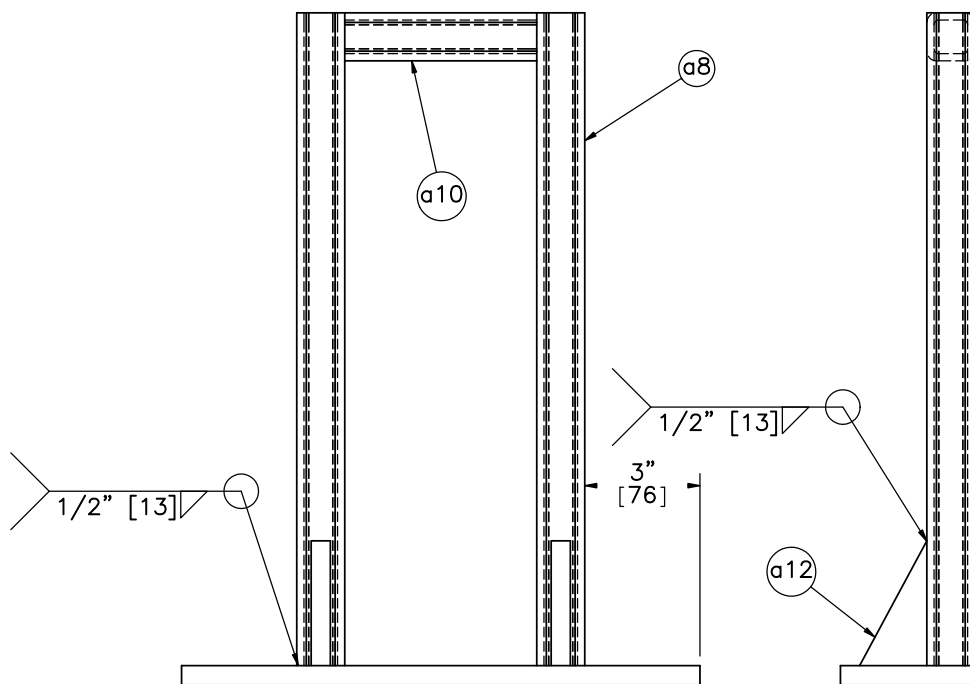
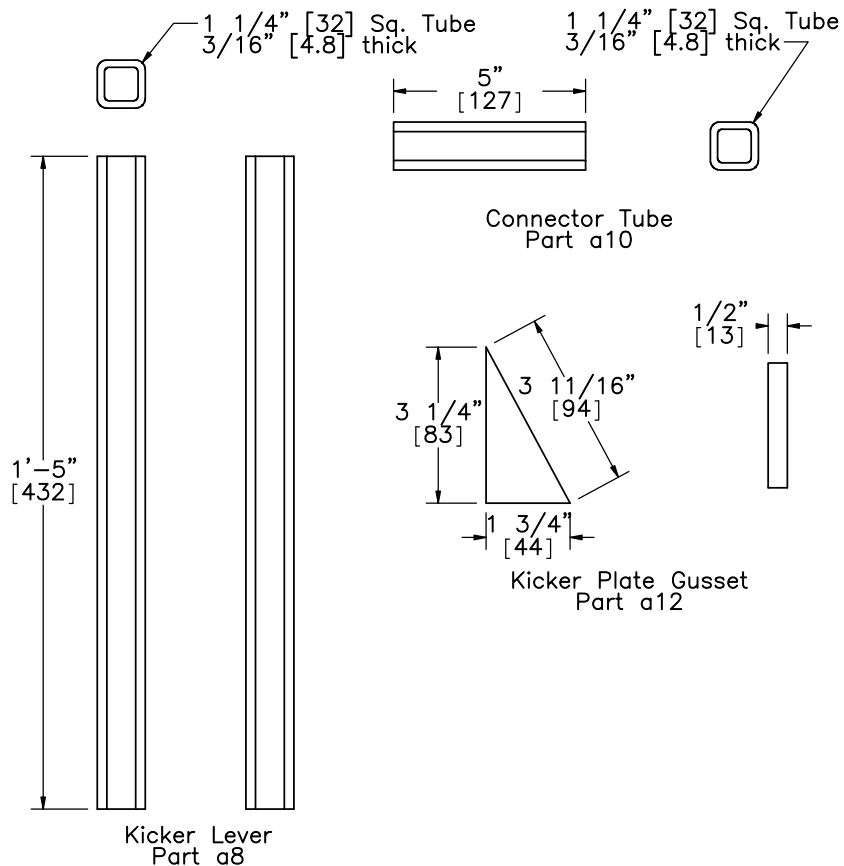
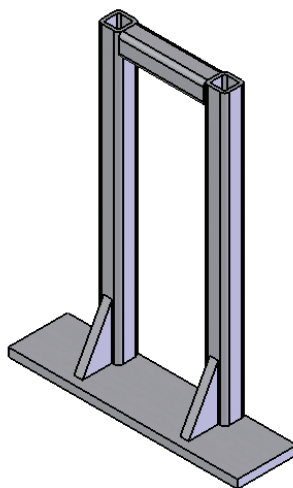
DWG. NAME.
4CMB-5_R10

SCALE: 1:6
UNITS: in./mm

SHEET:
10 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB



- 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.



Cable Release Lever



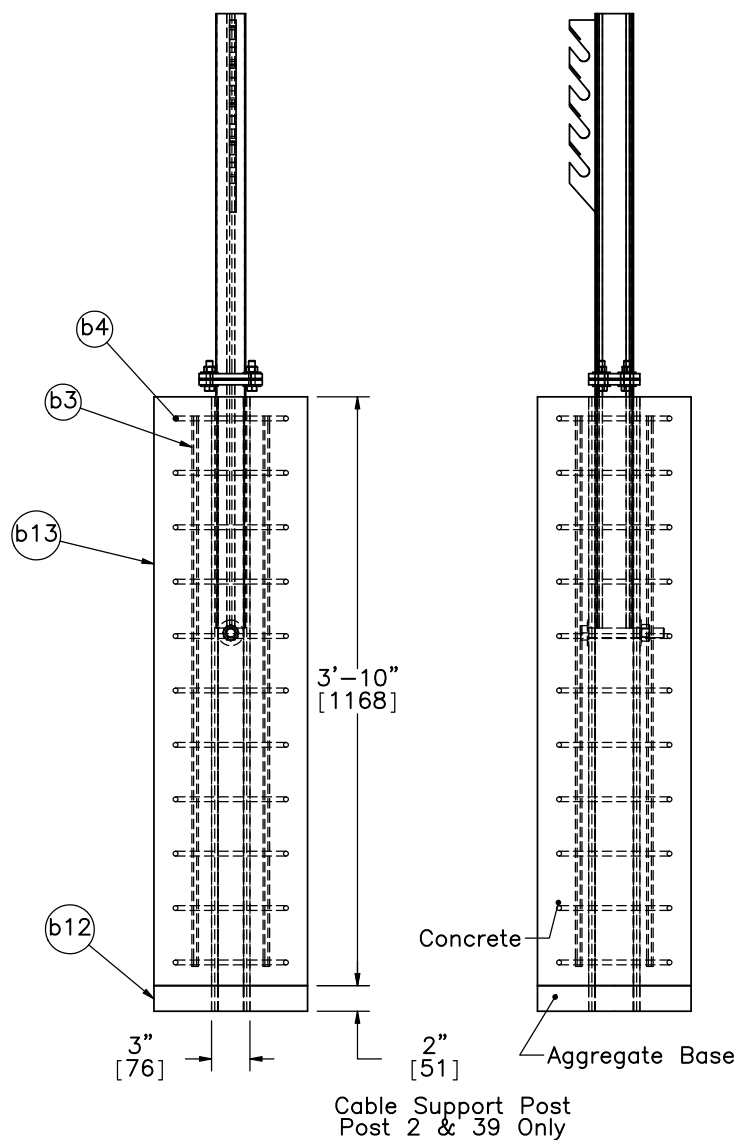
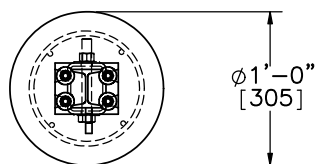
Midwest Roadside
Safety Facility

4-Cable Median Barrier
Cable Release Lever

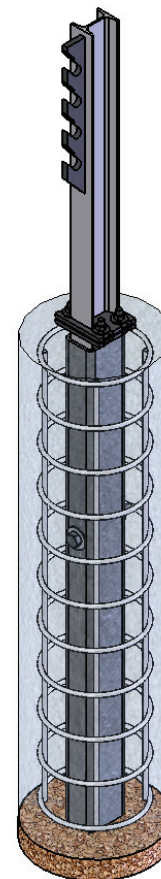
DWG. NAME.
4CMB-5_R10

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

SHEET:
11 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB



- 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].



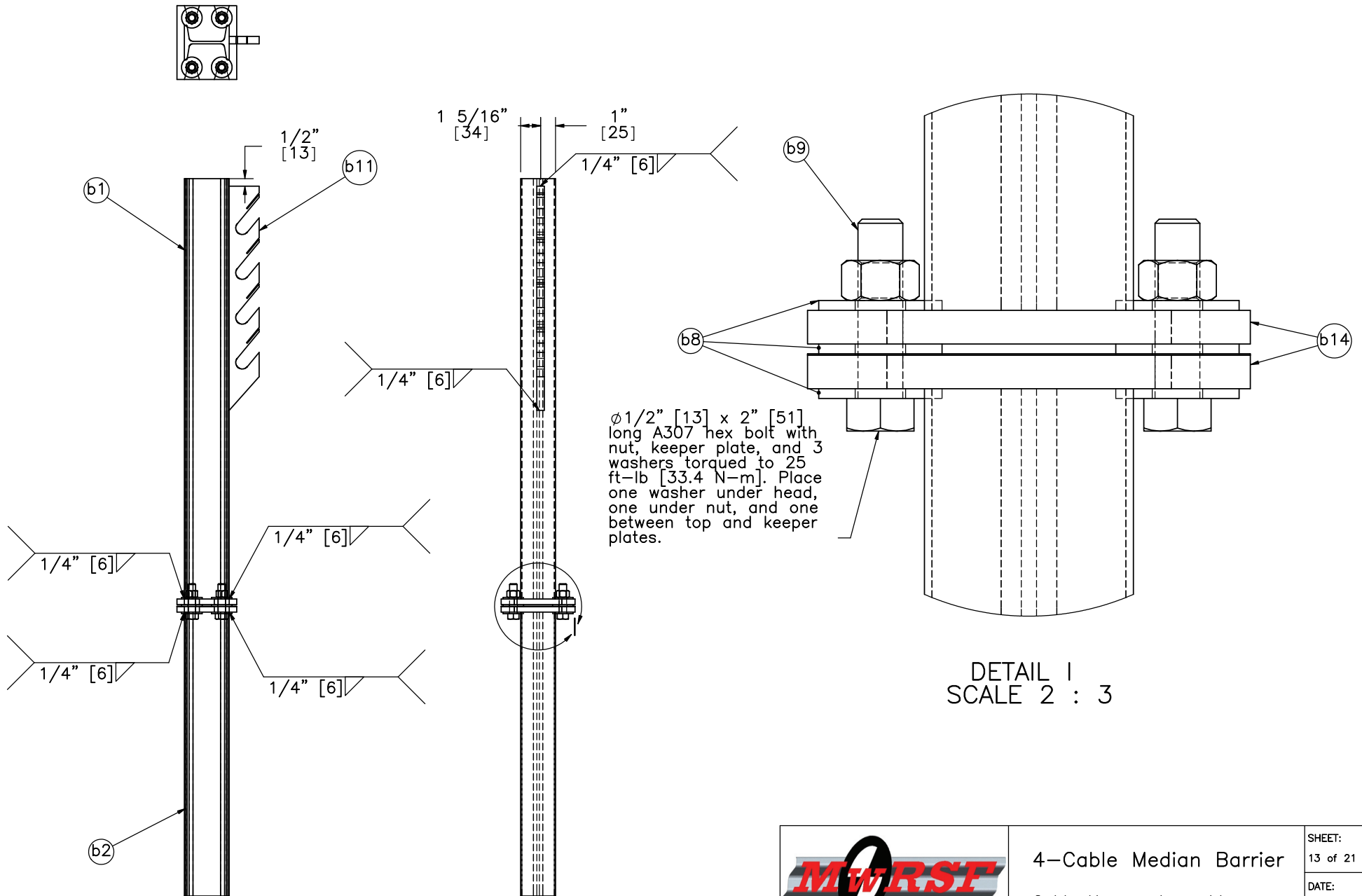
4-Cable Median Barrier

Second Post Detail
Post Nos. 2 & 39
As Built

DWG. NAME.
4CMB-5_R10

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

SHEET:
12 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB



Midwest Roadside
Safety Facility

4-Cable Median Barrier

Cable Hanger Assembly
Post Nos. 2 & 39

DWG. NAME.
4CMB-5_R10

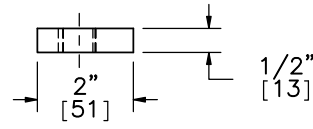
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UNITS: in.[mm]

SHEET:
13 of 21

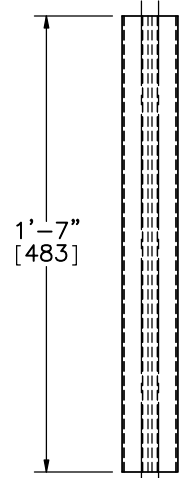
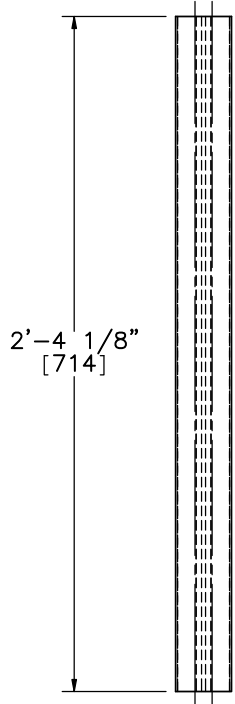
DATE:
11/17/11

DRAWN BY:
MDM/KAL/
JGP/RJT

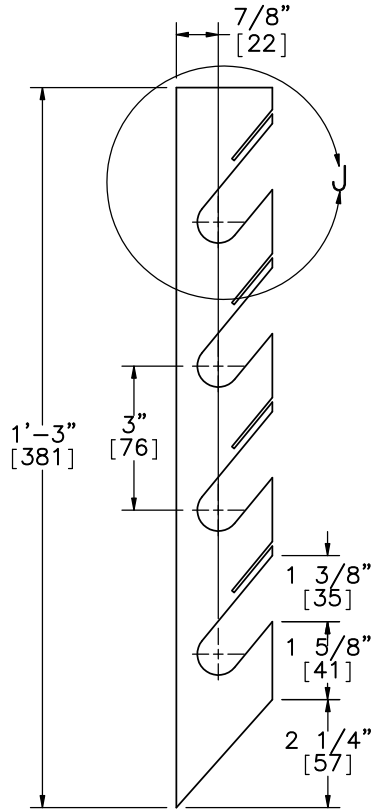
REV. BY:
KAL/JCH/
RWB



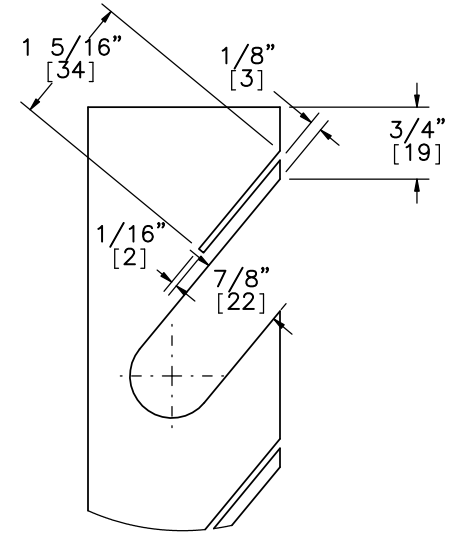
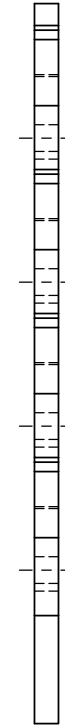
Note: Tabs to be bent after all cables have been installed and tensioned to secure.



S3x5.7 [S76 x 8.5] Post
Part b2



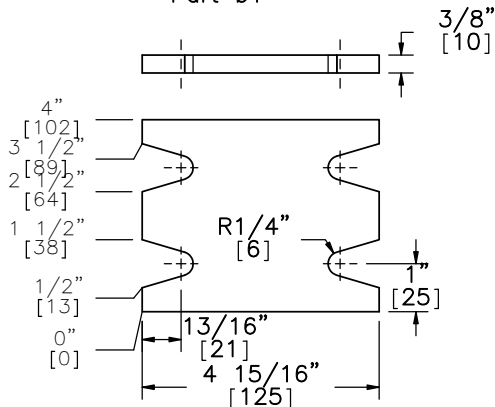
Cable Hanger
Part c12



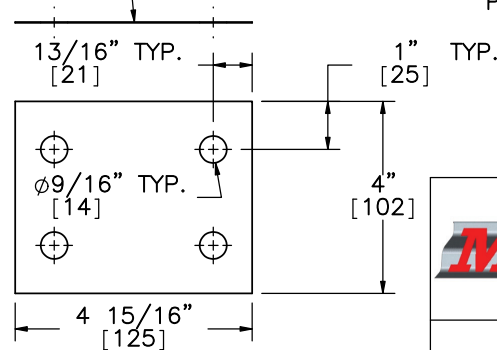
DETAIL J

S3x5.7 [S76 x 8.5] Post
Part b1

28 Gauge A36 Steel



2nd Post Base Plate
Part b14



2nd Post Keeper Plate
Part b5



Midwest Roadside
Safety Facility

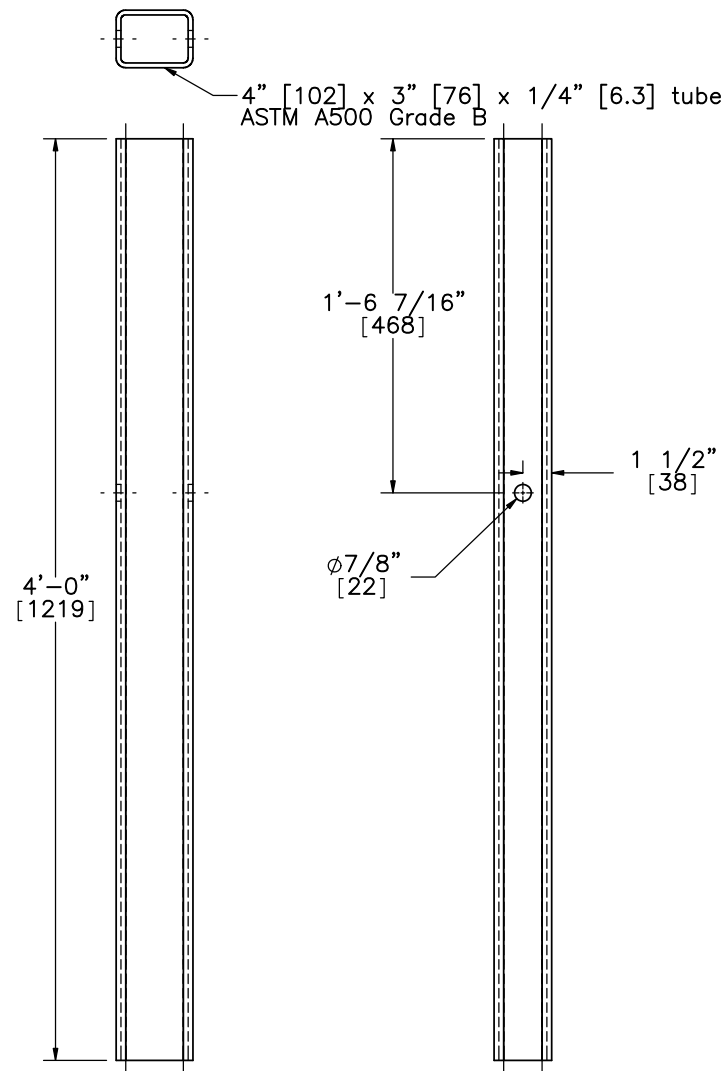
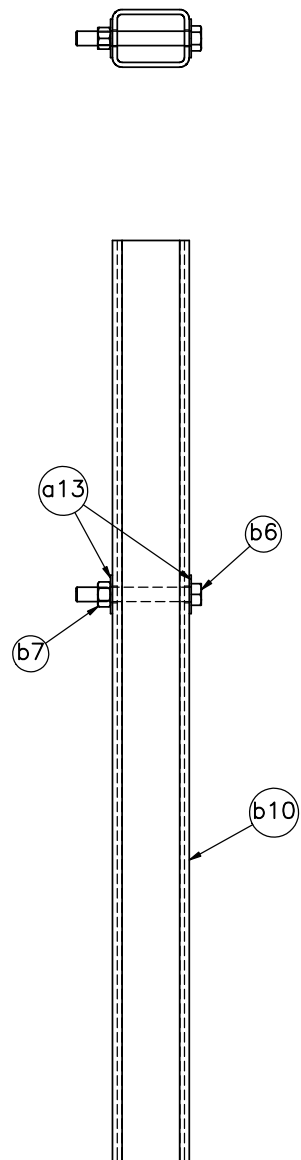
4-Cable Median Barrier

Cable Hanger Assembly
Post Nos. 2 & 39

DWG. NAME.
4CMB-5_R10

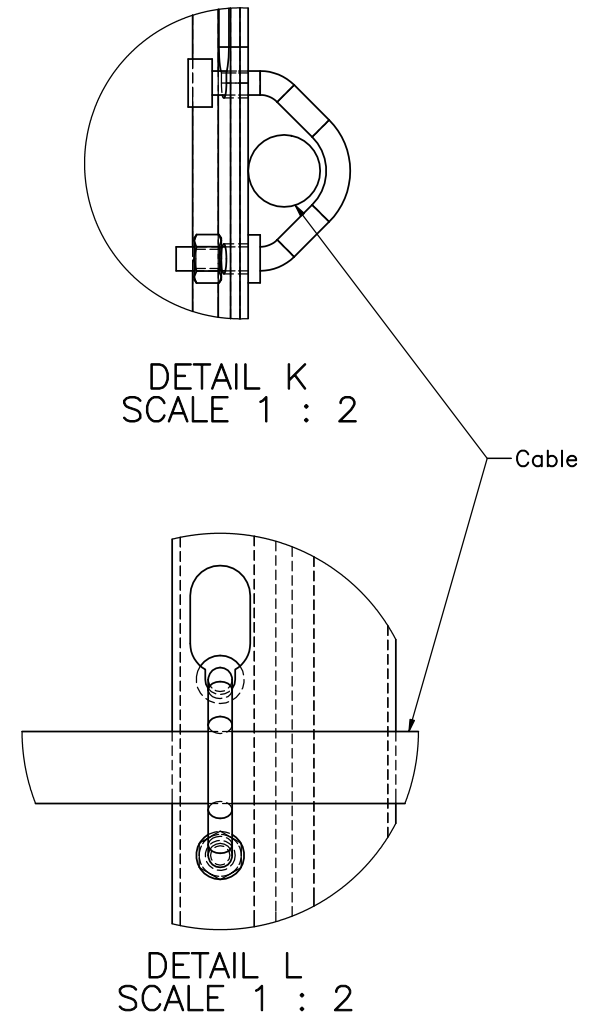
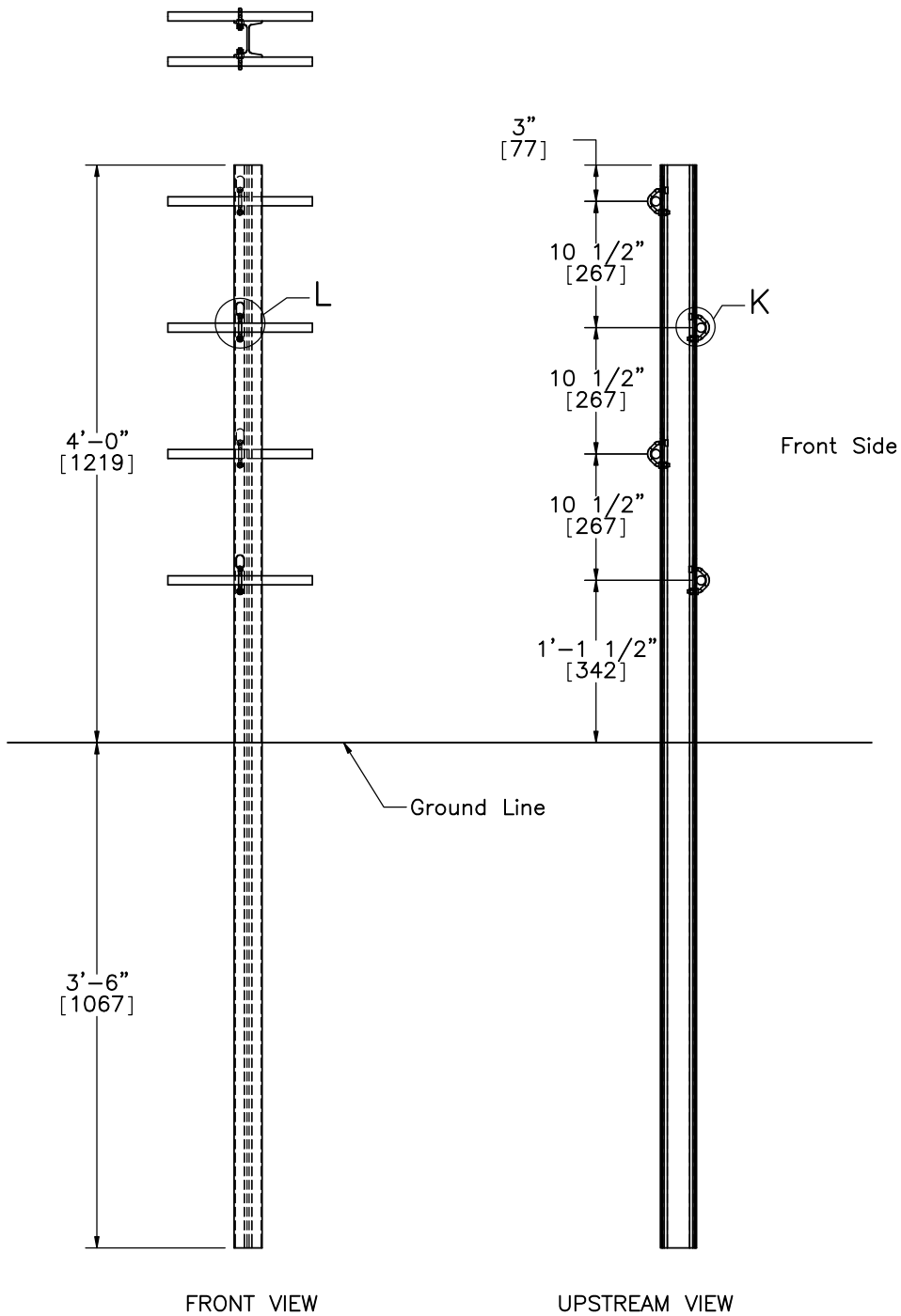
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UNITS: in./mm

SHEET:
14 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB



2nd Post Foundation Tube
Part b11

	4-Cable Median Barrier		SHEET: 15 of 21
	Foundation Tube Assembly Post Nos. 2 & 39		DATE: 11/17/11
Midwest Roadside Safety Facility	DWG. NAME: 4CMB-5_R10		DRAWN BY: MDM/KAL/ JGP/RJT
	SCALE: 1:10 UNITS: in.[mm]		REV. BY: KAL/JCH/ RWB



Midwest Roadside
Safety Facility

4-Cable Median Barrier
S3x5.7 Post Assembly

DWG. NAME.
4CMB-5_R10

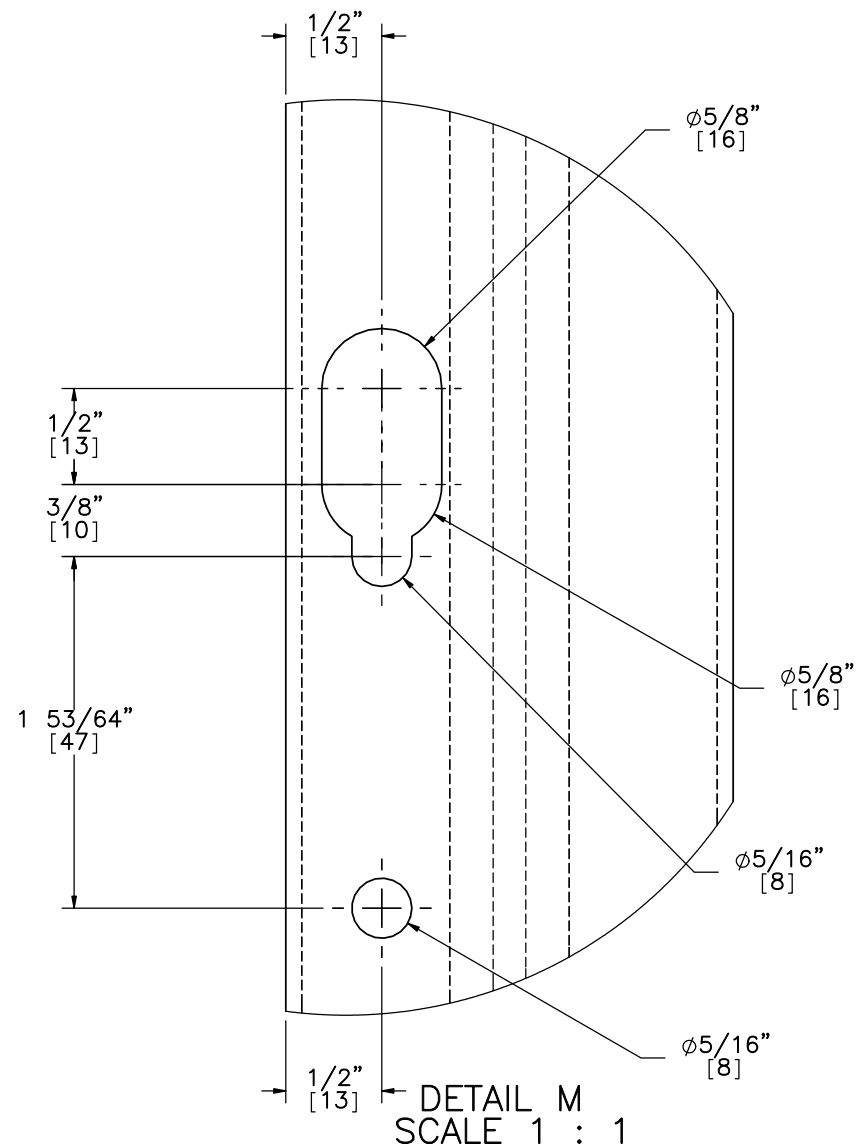
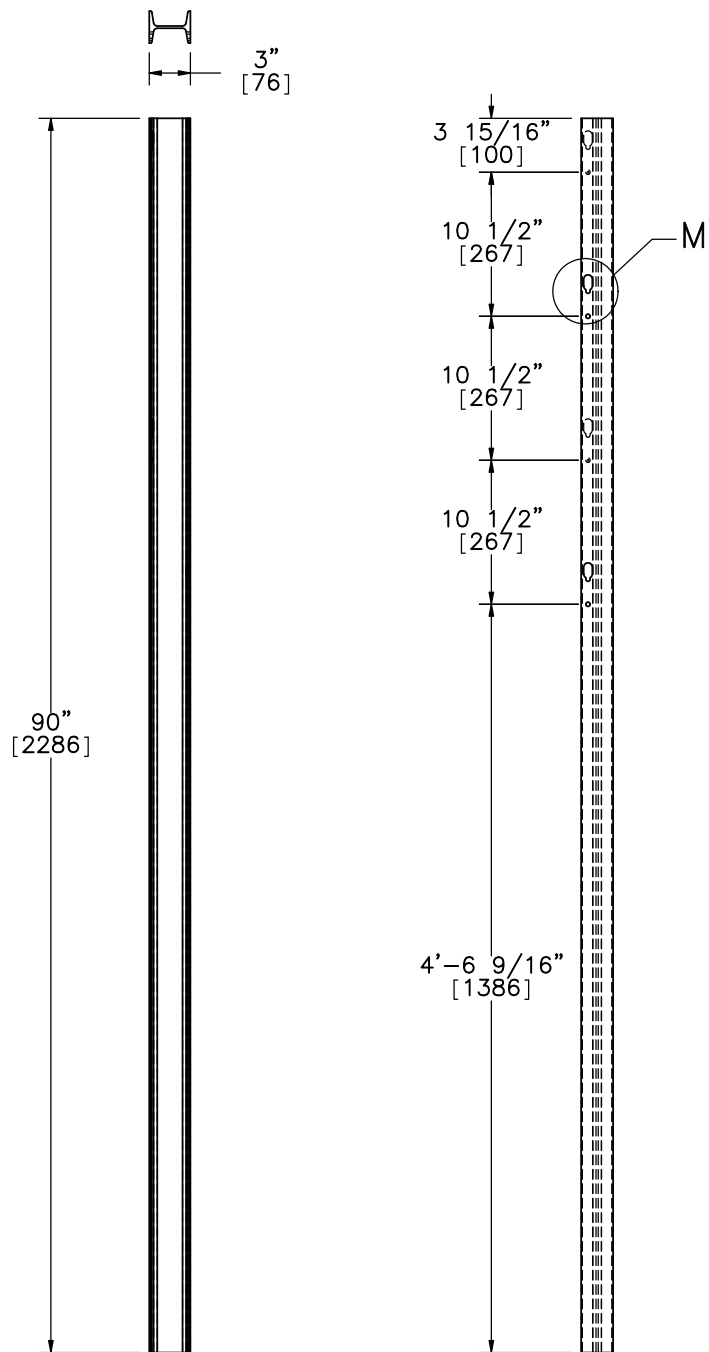
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SHEET:
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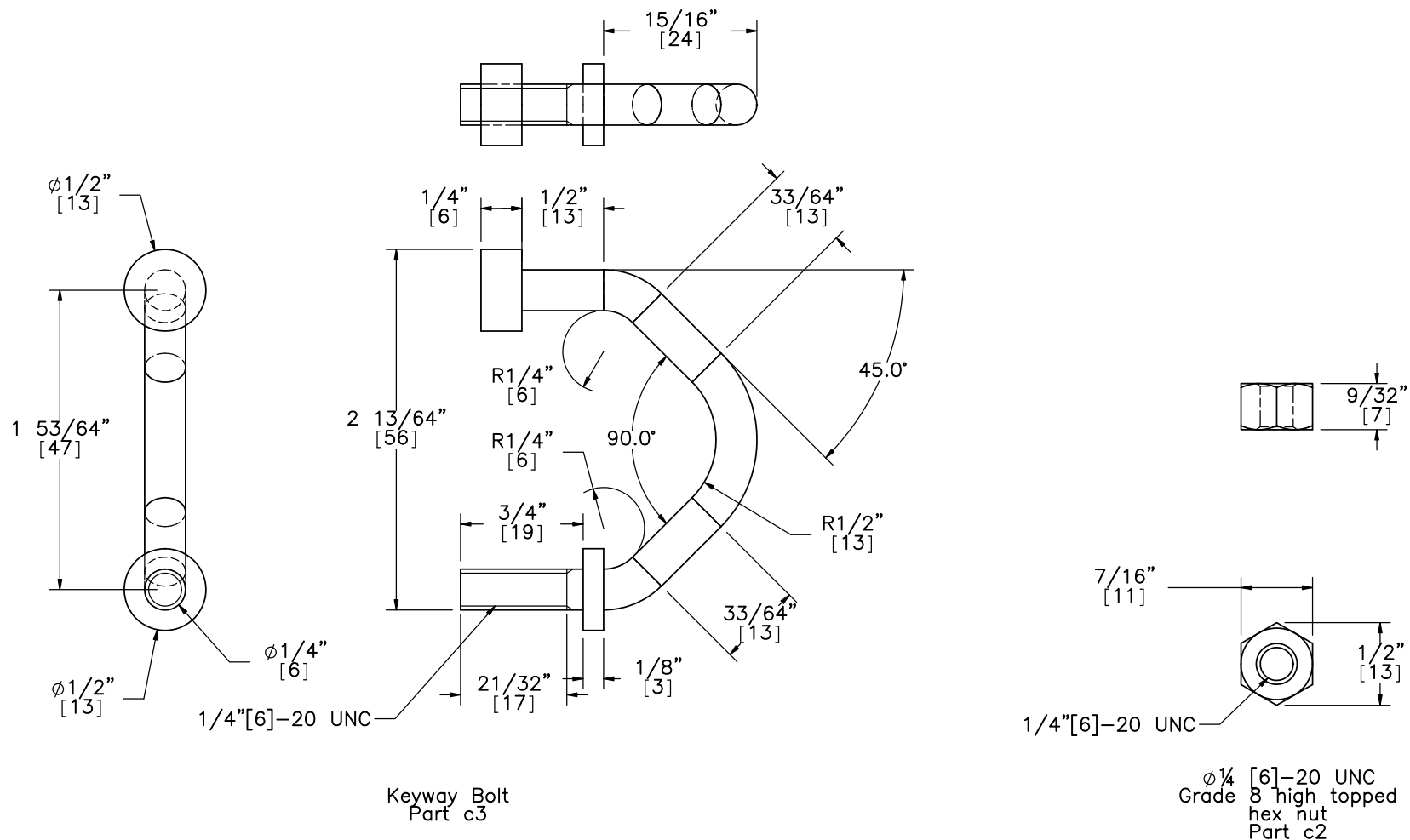
DATE:
11/17/11

DRAWN BY:
MDM/KAL/
JGP/RJT

REV. BY:
KAL/JCH/
RWB



	4-Cable Median Barrier		SHEET: 17 of 21
	S3x5.7 90 in. Post		DATE: 11/17/11
Midwest Roadside Safety Facility	DWG. NAME: 4CMB-5_R10		DRAWN BY: MDM/KAL/ JGP/RJT
	SCALE: 1:14 UNITS: in.[mm]		REV. BY: KAL/JCH/ RWB



Notes: (1) A449 steel should be used to fabricate the custom keyway bolts. This material has a yield strength of 92 ksi [634 MPa], and ultimate strength of 120 ksi [827 MPa], and a 16% elongation to fracture.



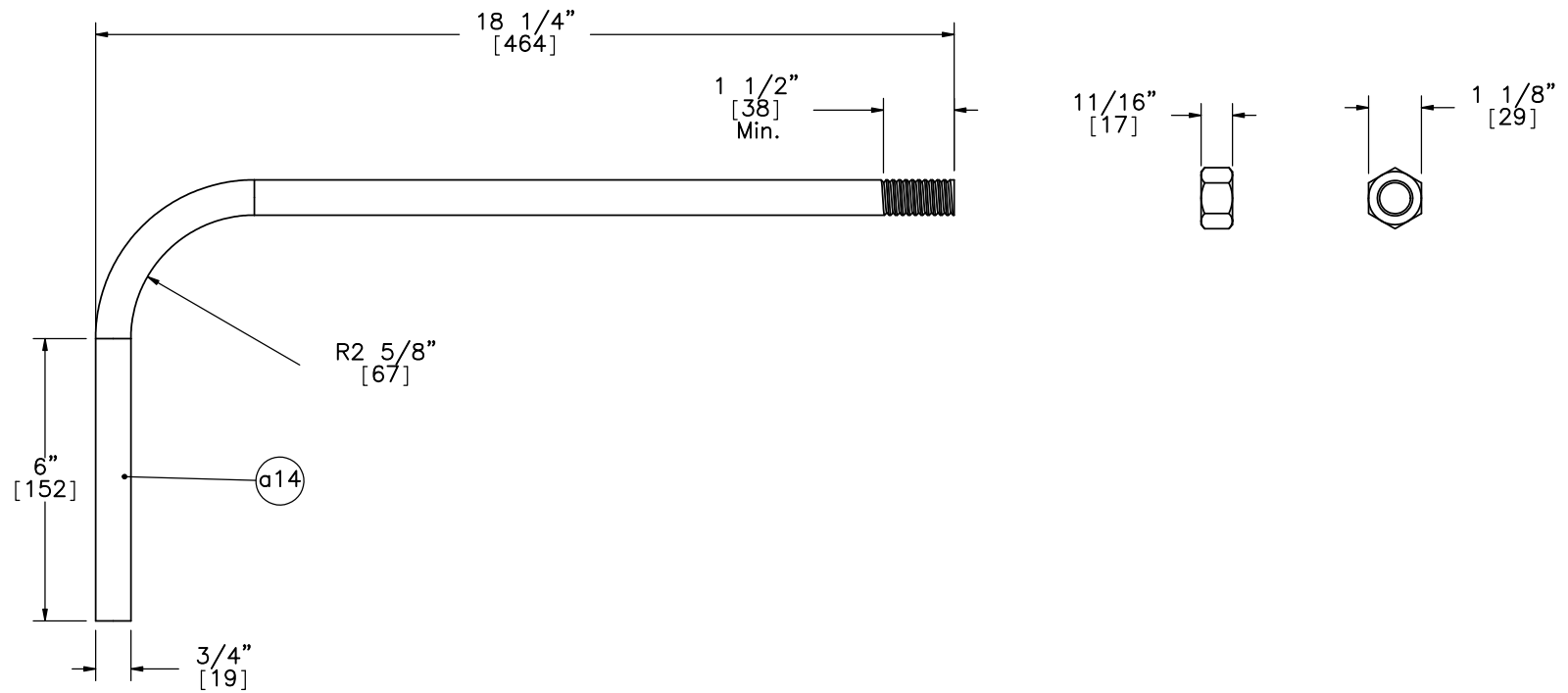
Midwest Roadside
Safety Facility

4-Cable Median Barrier
Keyway Bolt Details

DWG. NAME.
4CMB-5_R10

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

SHEET:
18 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB



Note: Total length is 25 9/16" [649].

	4-Cable Median Barrier		SHEET: 19 of 21
	J-Hook Anchor Stud and Nut – Part a14		DATE: 11/17/11
Midwest Roadside Safety Facility	DWG. NAME: 4CMB-5_R10		DRAWN BY: MDM/KAL/ JGP/RJT
	SCALE: 1:4 UNITS: in.[mm]		REV. BY: KAL/JCH/ RWB

Item No.	QTY.	Description	Material Spec	Hardware Guide
a1	2	Cable Anchor Base Plate	A36 Steel	FPA02
a2	4	Exterior Cable Plate Gusset	A36 Steel	FPA02
a3	6	Interior Cable Plate Gusset	A36 Steel	FPA02
a4	2	Anchor Bracket Plate	A36 Steel	FPA02
a5	2	3/16" Dia. Brass Keeper Rod, 14" long	Brass	—
a6	4	Release Gusset	A36 Steel	—
a7	2	Release Lever Plate	A36 Steel	—
a8	4	1.25x1.25x0.1875" TS CT Kicker Lever Tube	ASTM A500 Grade B	—
a9	8	CMB High Tension Anchor Plate Washer	A36 Steel	—
a10	2	1.25x1.25x0.1875" TS CT Kicker Lever Connecting Tube	ASTM A 500 Grade B	—
a11	2	3x10x0.5" Kicker Plate	A36 Steel	—
a12	4	CT kicker – gusset	A36 Steel	—
a13	20	3/4" Dia. Flat Washer	Grade 2	FWC20a
a14	16	3/4" Dia. J-Hook Anchor and Nut	A449	FRJ16a
a15	2	1/4" Dia. Aircraft Retaining Cable, 36" long	7x19 galvanized	—
a16	2	5/8" Dia. Heavy Hex Nut	Grade 5	—
a17	2	5/8" Dia. x 9 1/2" long Hex Bolt	Grade 5	—
a18	2	24" Dia. Concrete Anchor, 120" long	4,000 psi f'c	—
a19	16	#11 Straight Rebar, 114" long	Grade 60	—
a20	44	#4 Anchor Hoop Rebar with 21" Dia.	Grade 60	—
b1	2	S3x5.7 Post by 28 1/8"	ASTM A572 GR50-07, ASTM A709 GR50-09A, ASTM A992-06A	—
b2	2	S3x5.7 Post by 19"	ASTM A572 GR50-07, ASTM A709 GR50-09A, ASTM A992-06A	—
b3	8	#3 Straight Rebar, 43" long	Grade 60	—
b4	22	7 1/4" Dia. No. 3 Hoop Reinforcement	Grade 60	—
b5	2	2nd Post Keeper Plate, 28 Gauge	A36	—
b6	2	3/4" Dia. x 6" long Hex Bolt and Nut	A307	FBX20a
b7	18	3/4" Dia. Hex Nut	Grade 2	FNX20a
b8	24	1/2" Dia. Washer	A307	FWC14a
b9	8	1/2" Dia. x 2" long Hex Bolt and Nut	A307	FBX14a
b10	2	4x3x1/4" Foundation Tube, 48" long	ASTM A500 Grade B	—
b11	2	2nd Post Cable Hanger	A36	—
b13	2	12" Dia. 2nd Post Concrete Anchor, 46" long	4,000 psi f'c	—
b14	4	2nd Post Base Plate	A36	—
c1	36	S3x5.7 by 90"	ASTM A572 GR50-07, ASTM A709 GR50-09A, ASTM A992-06A	—
c2	144	1/4" Dia. – 20 UNC High Topped Hex Nut	Grade 8 – Galvanized	—
c3	144	1/4" Dia. Keyway bolt	A449 – Galvanized	—



Midwest Roadside
Safety Facility

4-Cable Median Barrier
Bill of Materials

DWG. NAME.
4CMB-5_R10

SCALE: None
UNITS: in./mm

SHEET:
20 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB

Item No.	QTY.	Description	Material Spec	Hardware Guide
d1	4	3/4" Dia. High Strength Pre-Stretched Cable Guiderail	3x7 Cl A Galvanized	RCM01
d2	16	7/8" Dia. Hex Nut	A563	RCE03
d3	22	Cable End Threaded Rod	ASTM-A449	RCE03
d4	16	Bennet Cable End Fitter	ASTM-A47	RCE03
d5	16	7/8" Dia. Square Nut	Grade 5	FNS20
d6	8	Brifen Cable Splice Wedge	Brass (unknown)	—
d7	8	Brifen Cable Splice Threaded Cable Clamp	Steel (unknown)	—
d8	4	Brifen Cable Splice	Steel (unknown)	—
e1	4	Bennet Short Threaded Turnbuckle	Not Specified	—
e2	12	Threaded Loadcell Coupler	N/A	—
e3	6	50,000-lb Load Cell	N/A	—



Midwest Roadside
Safety Facility

4-Cable Median Barrier
Bill of Materials Continued

DWG. NAME.
4CMB-5_R10

SCALE: None
UNITS: in./mm

SHEET:
21 of 21
DATE:
11/17/11
DRAWN BY:
MDM/KAL/
JGP/RJT
REV. BY:
KAL/JCH/
RWB