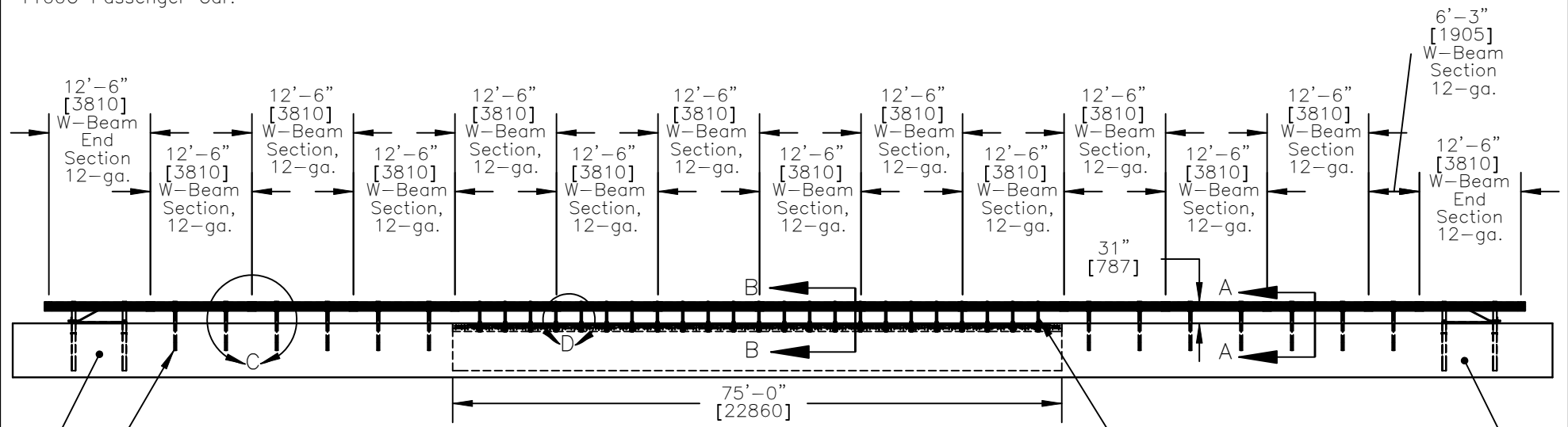


PLAN VIEW



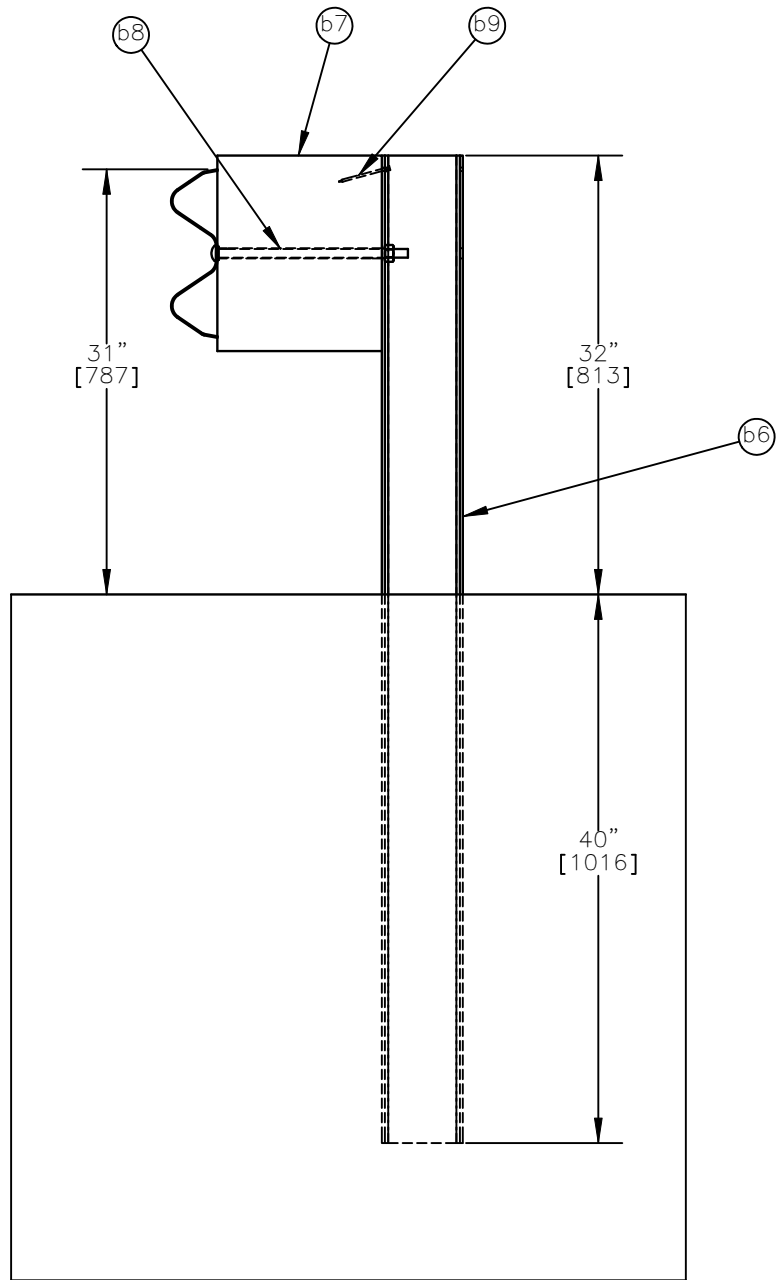
ELEVATION VIEW

BCT post in 6' [1829] Long (Galvanized) Foundation Tubes, Ground Line Strut, and BCT Cable Anchor

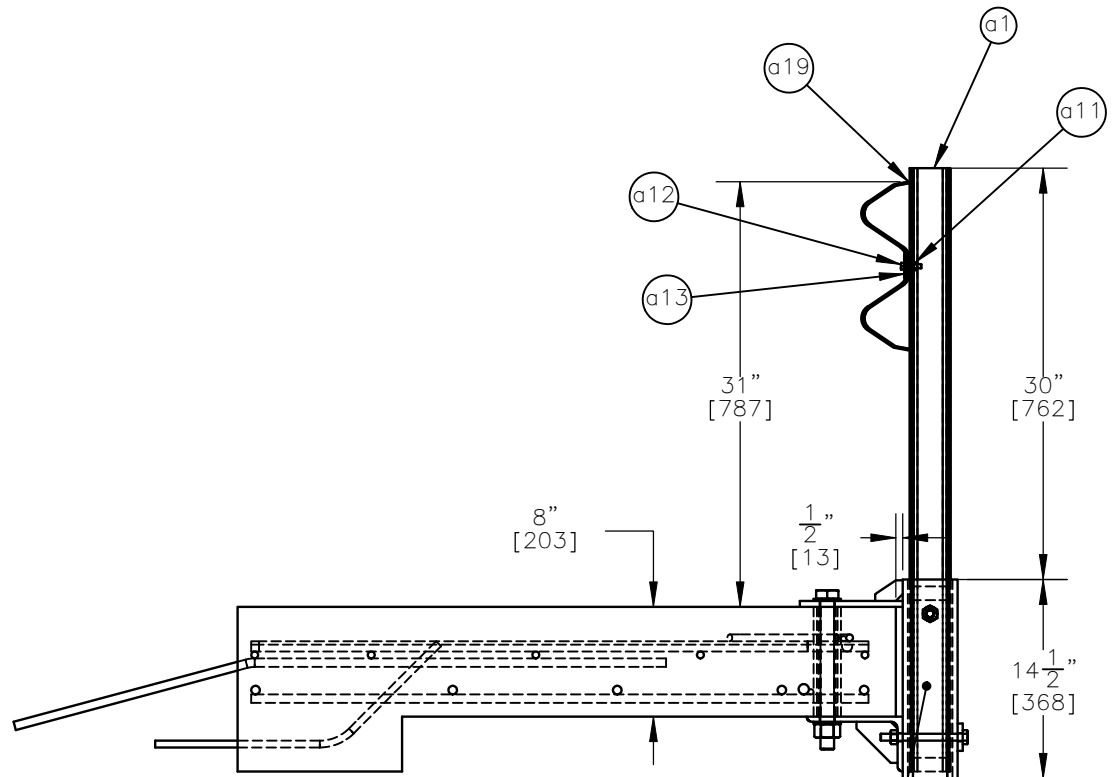
- Notes: (1) Posts nos. 7, 32, and 33 are placed in 3' [914] diameter holes. Post no. 8 has to be placed in a 2' [610] diameter hole due to the location of the bridge pit, the center of post is 1' [305] away from bridge pier.
- (2) All remaining posts in the transition have 2' [610] diameter holes.

Midwest Roadside Safety Facility

MGS Bridge Rail - 2		SHEET: 1 of 26
System Layout		DATE: 6/24/2009
		DRAWN BY: MW/RJT
DWG. NAME: MGS Bridge Rail-2_V1	SCALE: 1:225 UNITS: In./mm	REV. BY: KAL/EJ/RF



SECTION A-A



SECTION B-B

Weak Post Assembly



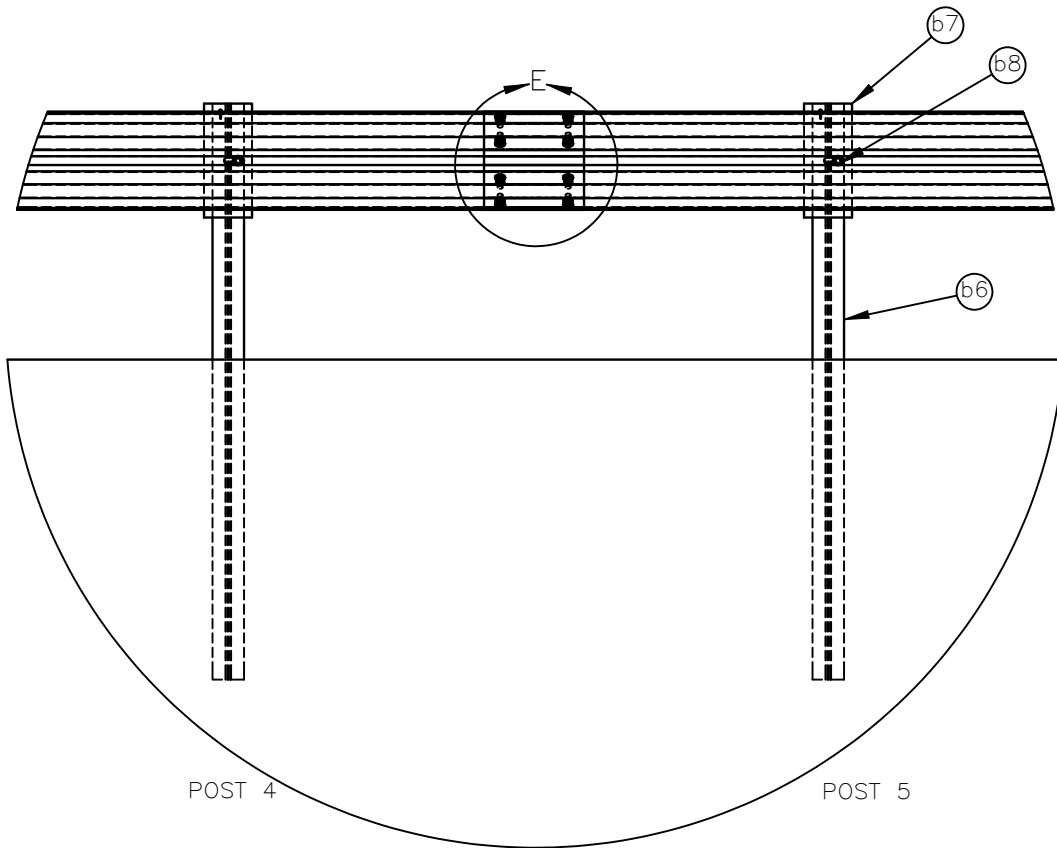
Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Post Details

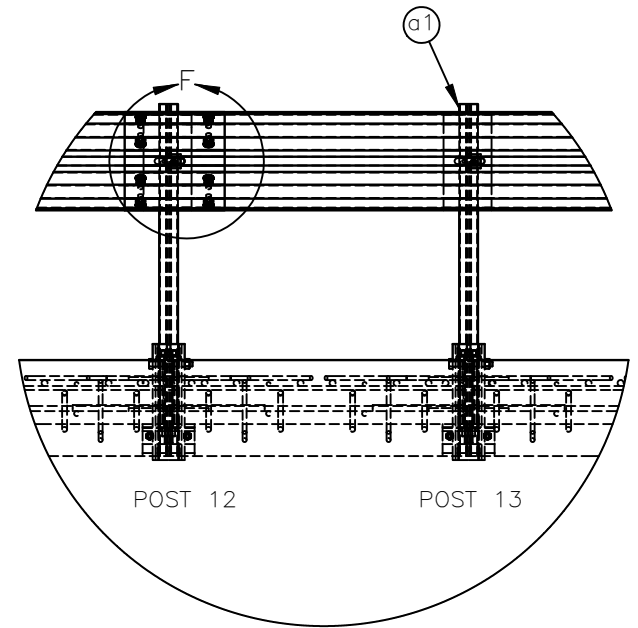
DWG. NAME:
MGS Bridge Rail-2_V1

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

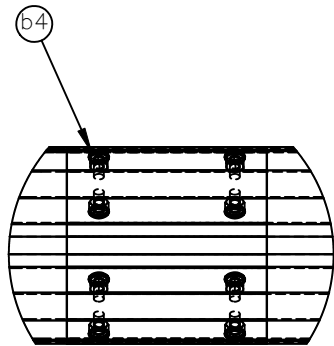
SHEET:
2 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF



SECTION C
END SECTION SPLICE DETAILS

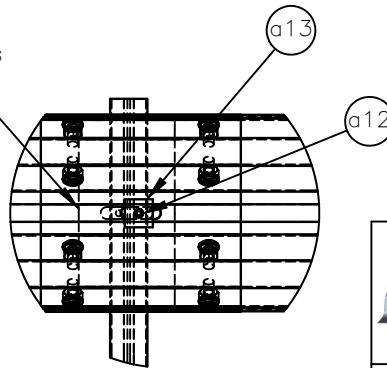


SECTION D
BRIDGE RAIL SECTIONSPLICE DETAILS

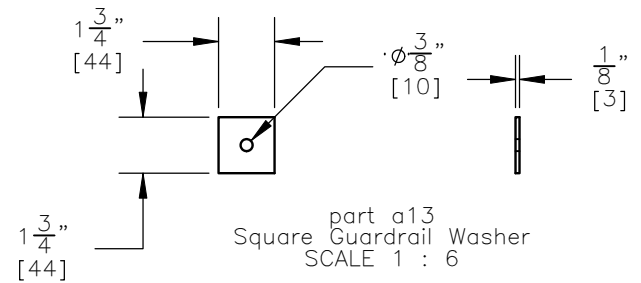


DETAIL E
SCALE 1 : 12

part a19
6" [152] long W-Beam
backup plate placed
between guardrail sections
and post at every bridge
post location



DETAIL F
SCALE 1 : 12



part a13
Square Guardrail Washer
SCALE 1 : 6



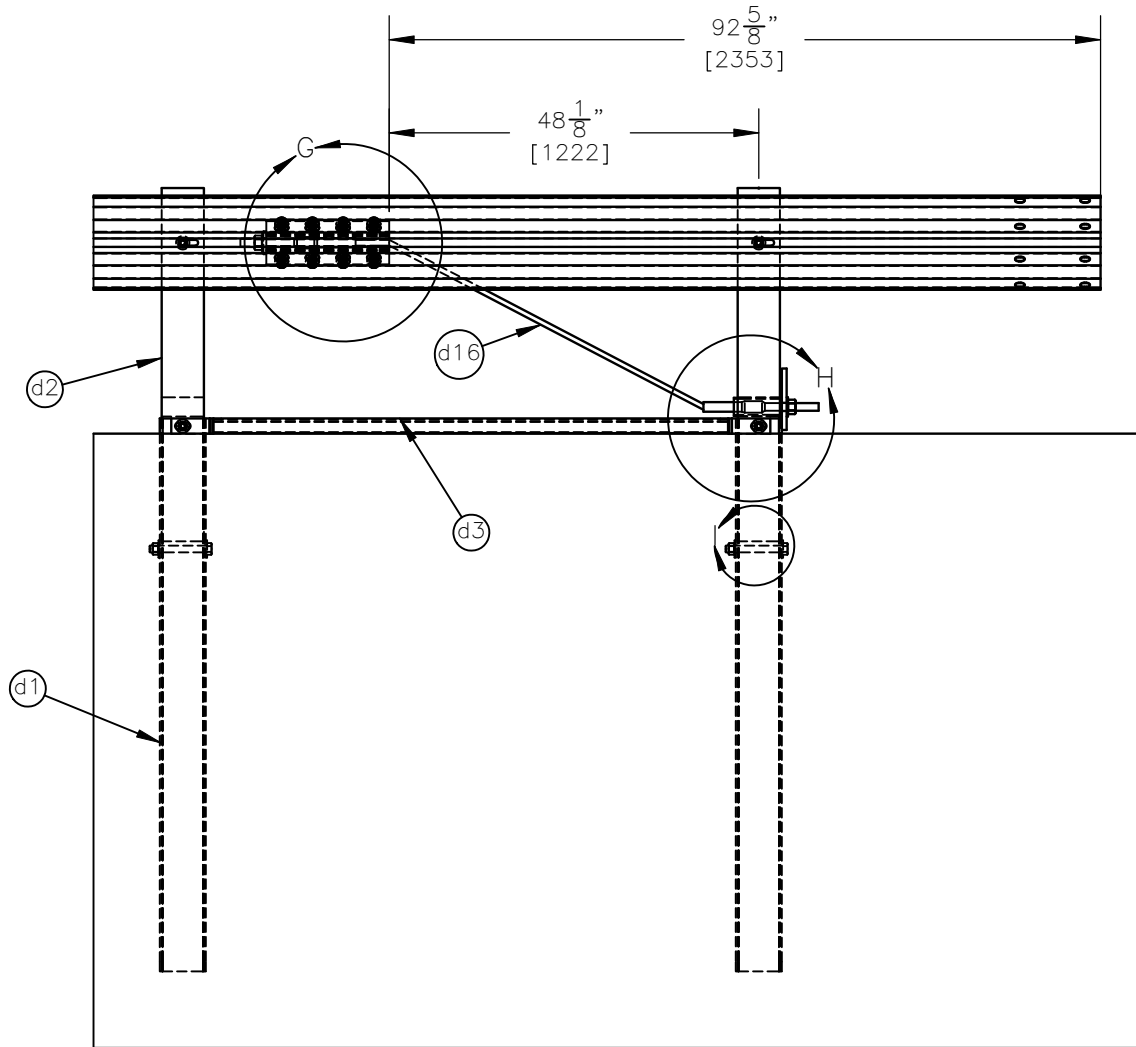
Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Splice Details

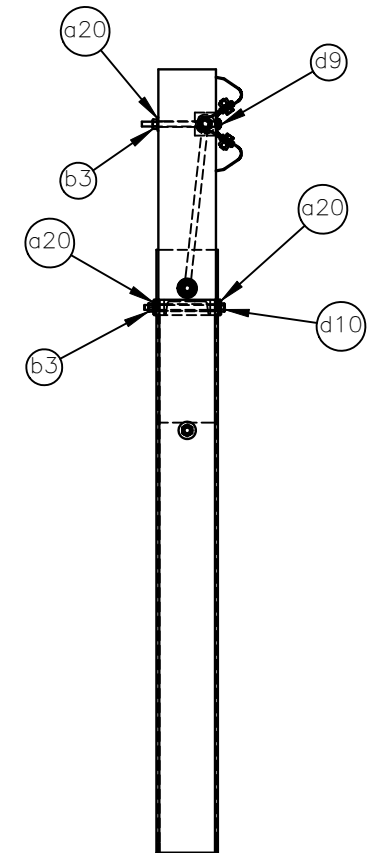
DWG. NAME.
MGS Bridge Rail-2_V1

SCALE: 1:24
UNITS: In.[mm]

SHEET:
3 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF



FRONT VIEW



SIDE VIEW



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
End Rail Details

SHEET:
4 of 26

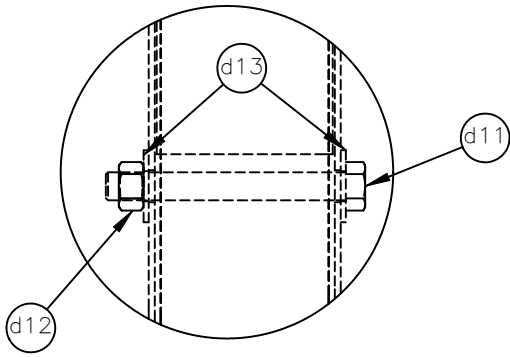
DATE:
6/24/2009

DRAWN BY:
MW/RJT

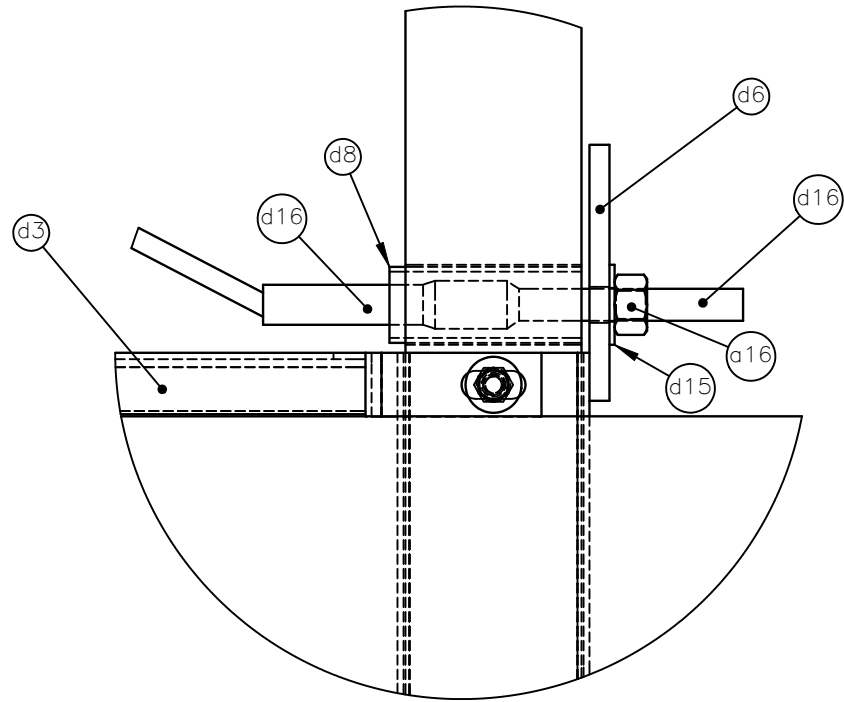
DWG. NAME:
MGS Bridge Rail-2_V1

SCALE: 1:25
UNITS: In.[mm]

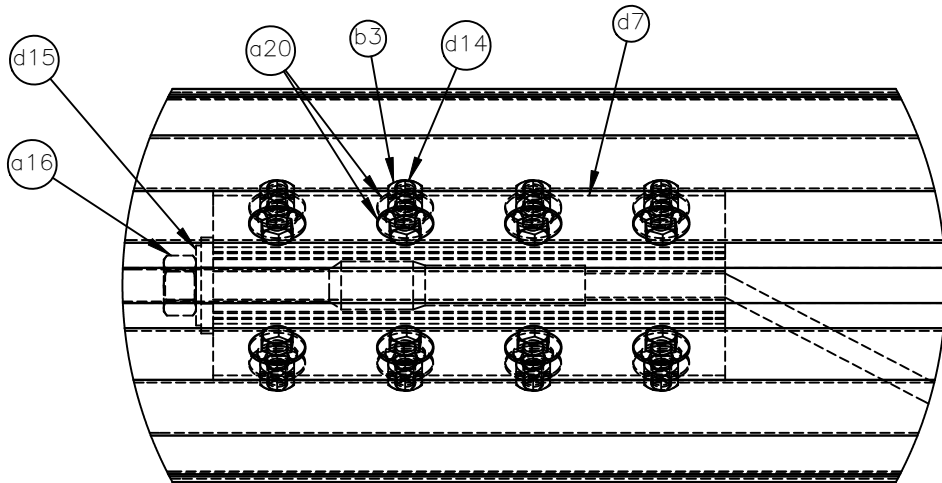
REV. BY:
KAL/EJ/RF



DETAIL I



DETAIL H



DETAIL G



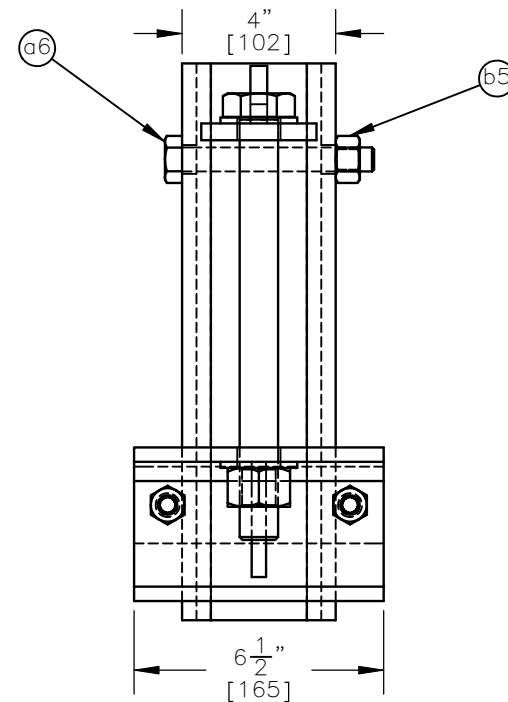
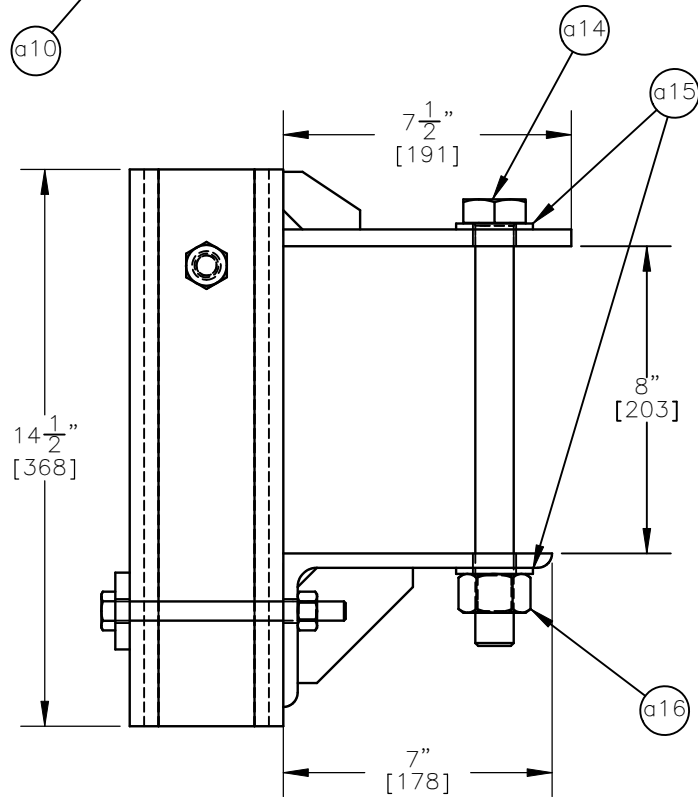
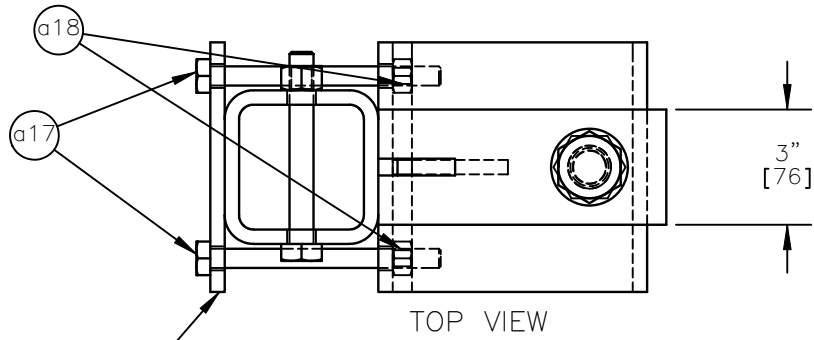
Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Anchor Details

DWG. NAME.
MGS Bridge Rail-2_V1

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

SHEET:
5 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF



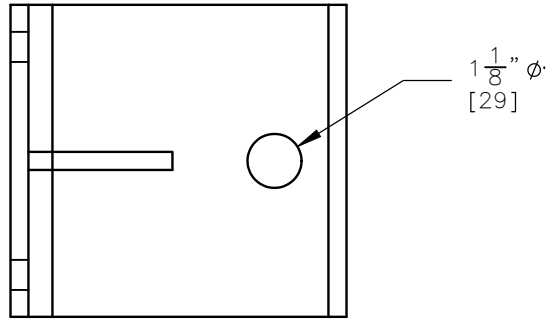
Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Weak Post Assembly

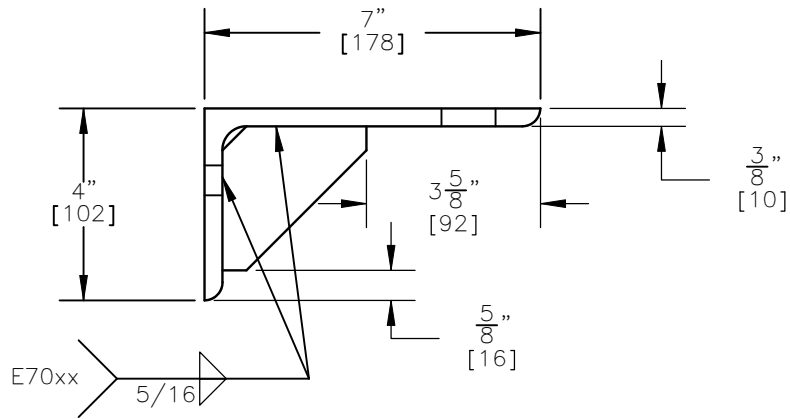
DWG. NAME:
MGS Bridge Rail-2_V1

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

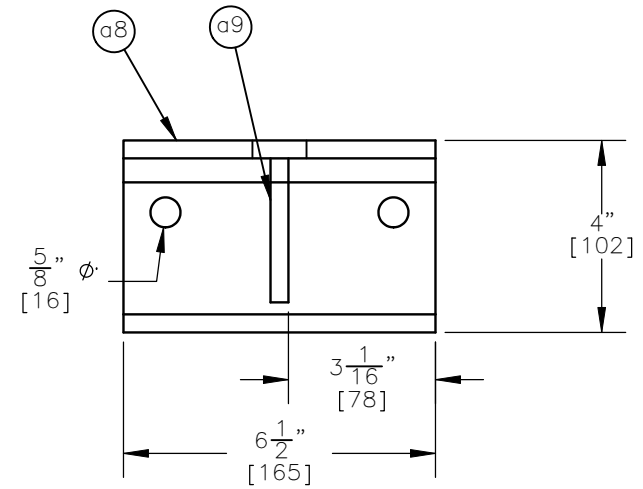
SHEET:
6 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF



TOP VIEW



SIDE VIEW



FRONT VIEW



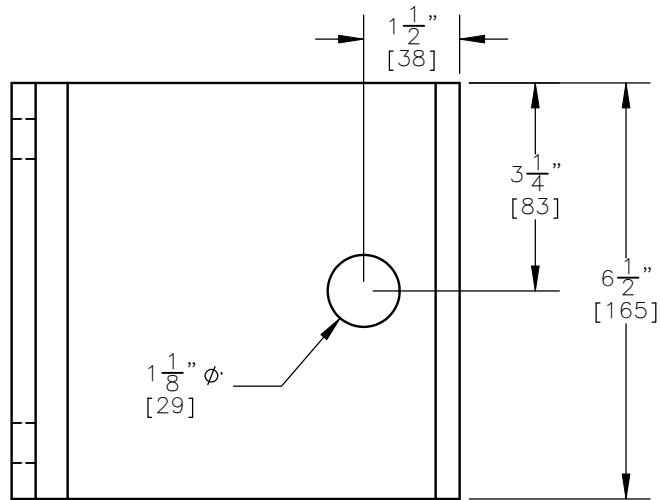
Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Weack Post Mounting
Bracket-Bottom Assembly

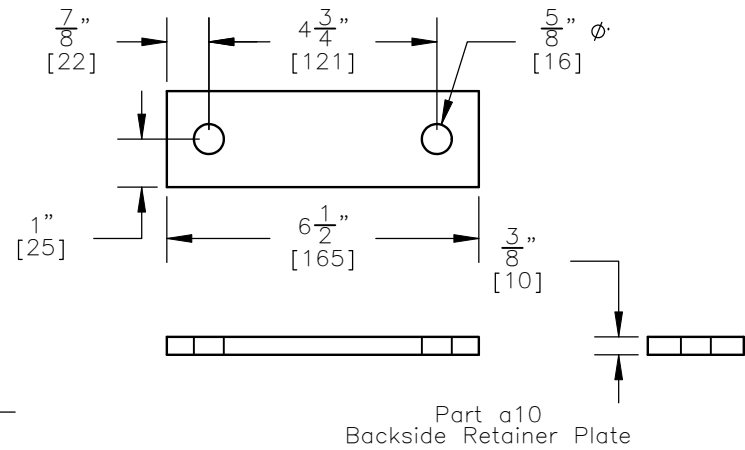
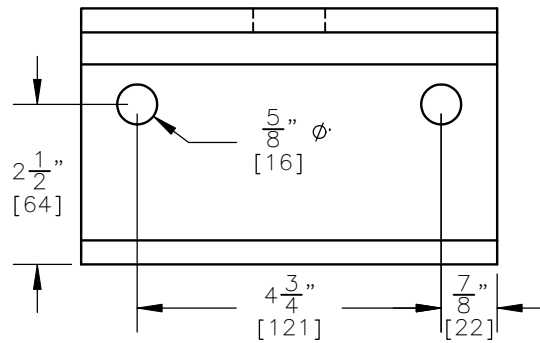
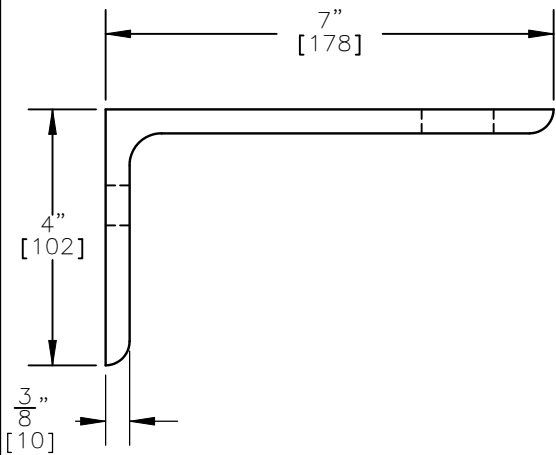
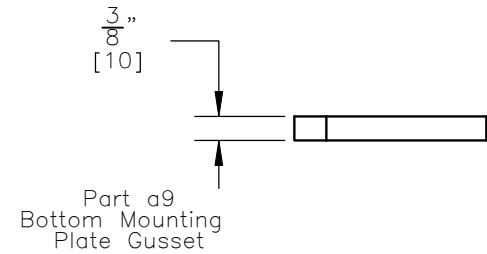
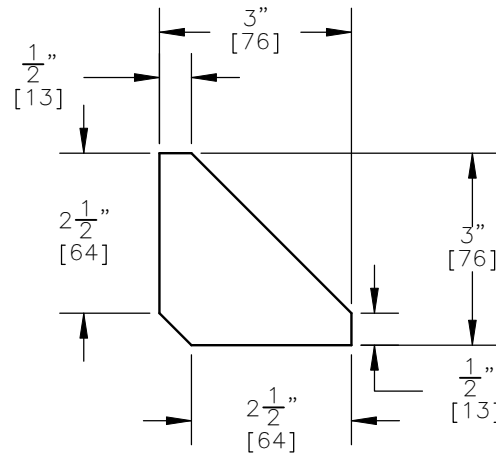
DWG. NAME.
MGS Bridge Rail-2_V1

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

SHEET:
7 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF

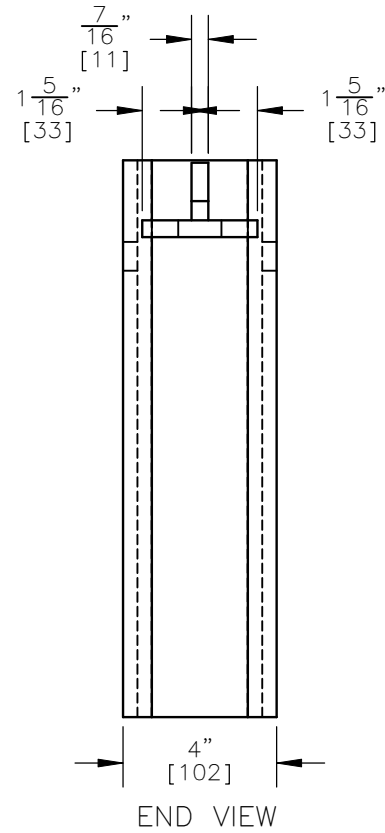
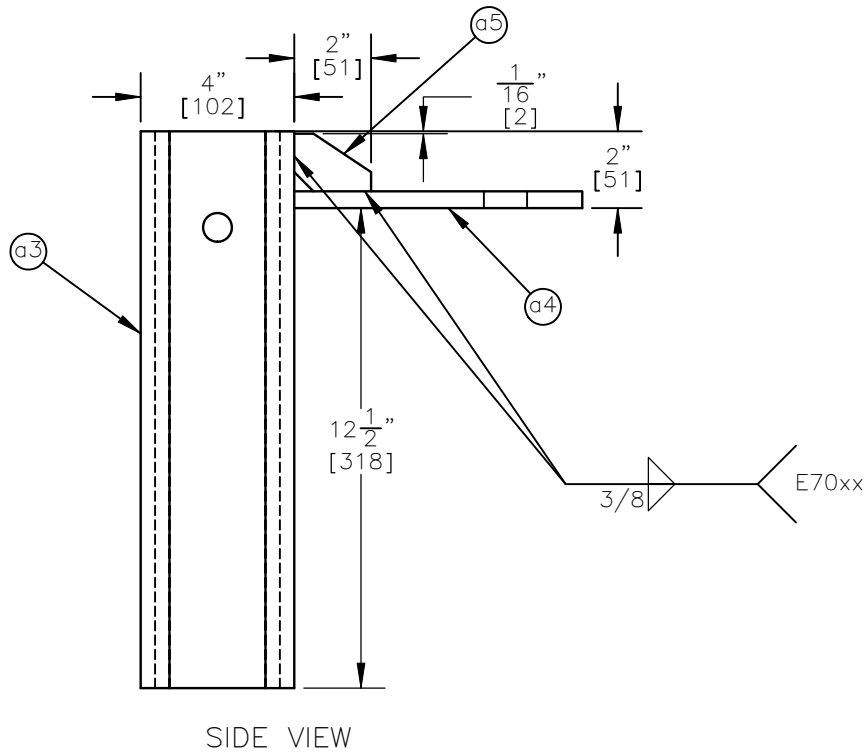
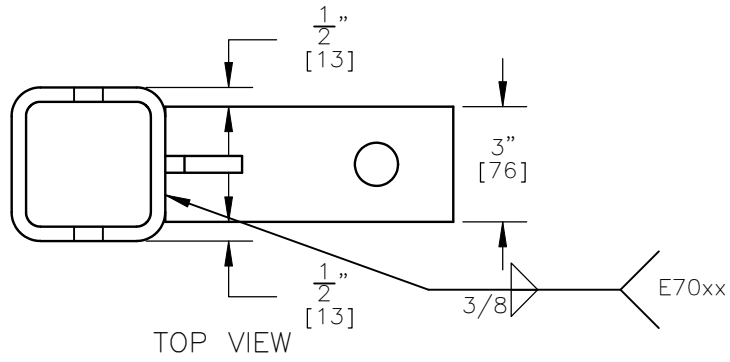


Part a8
Bottom Mounting Plate




Midwest Roadside
Safety Facility

MGS Bridge Rail - 2		SHEET: 8 of 26
Weak Post Mounting		DATE: 6/24/2009
Bracket-Bottom Assembly Details		DRAWN BY: MW/RJT
DWG. NAME: MGS Bridge Rail-2_V1	SCALE: 1:3 UNITS: In.[mm]	REV. BY: KAL/EJ/RF



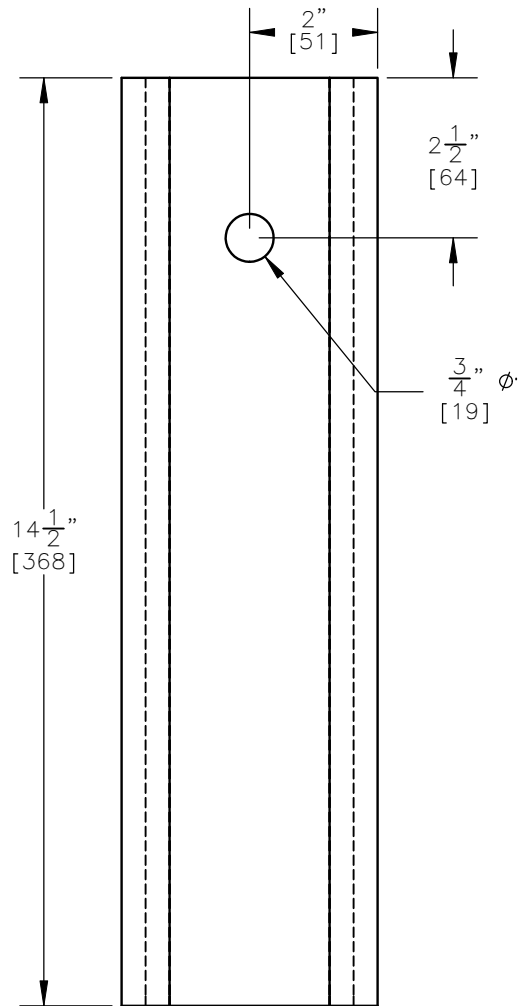
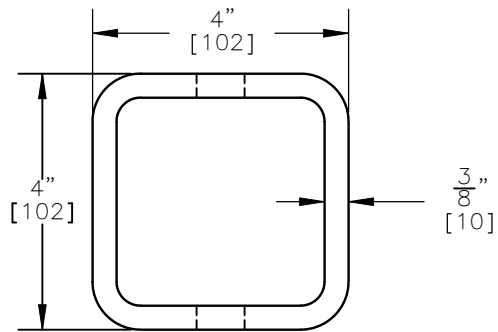
Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Weak Post Mounting
Bracket-Top Assembly

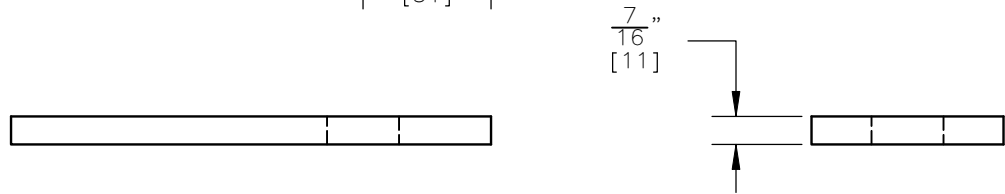
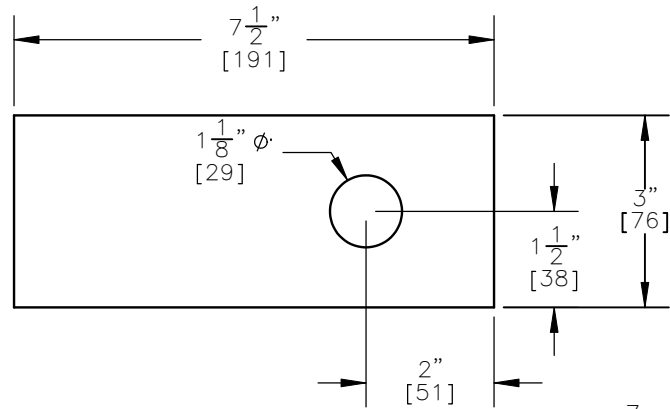
DWG. NAME.
MGS Bridge Rail-2_V1

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

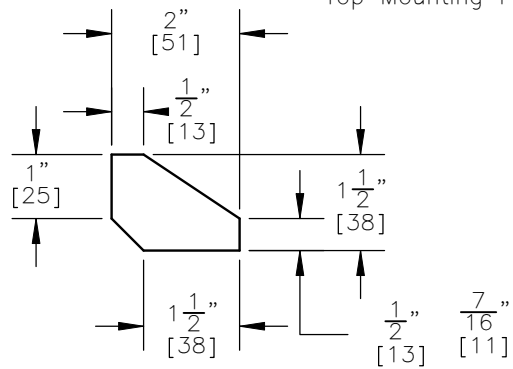
SHEET:
9 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF



Part a3
4x4x0.375 Square Tube



Part a4
Top Mounting Plate



Part a5
Top Mounting Plate Gusset



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2

Weak Post Mounting
Bracket-Top Assembly Details

DWG. NAME:
MGS Bridge Rail-2_V1

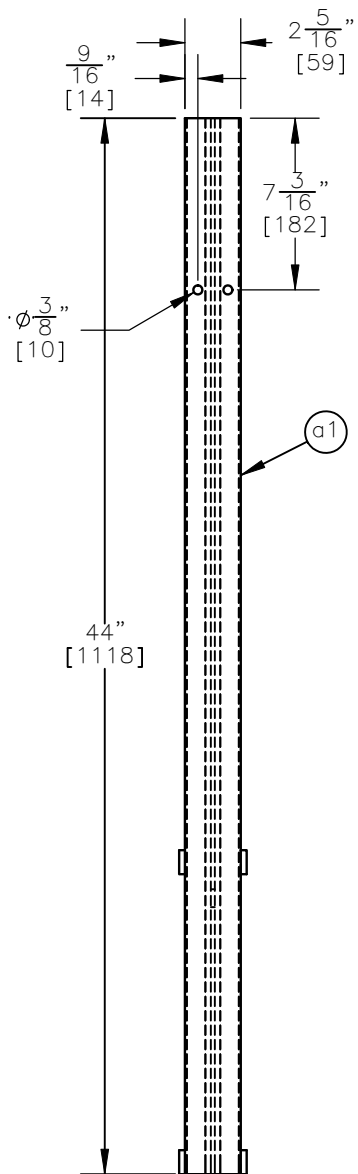
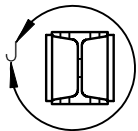
SCALE: 1:3
UNITS: In.,[mm]

SHEET:
10 of 26

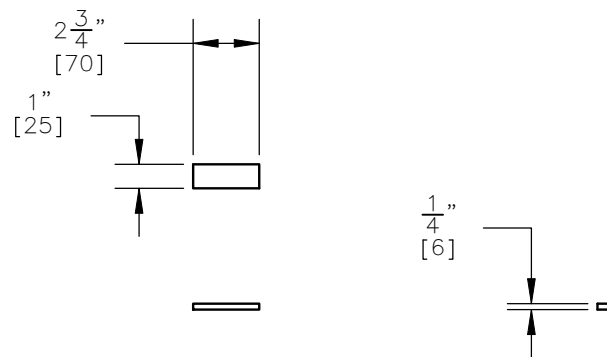
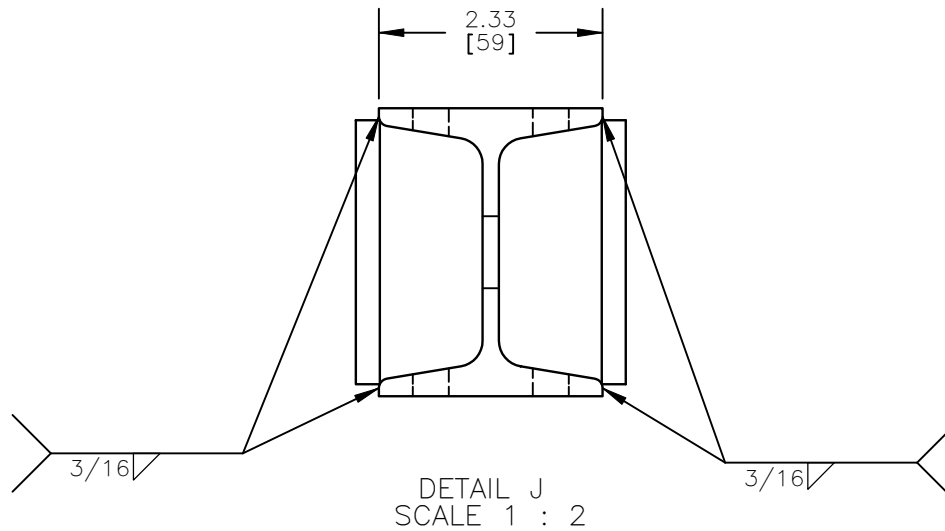
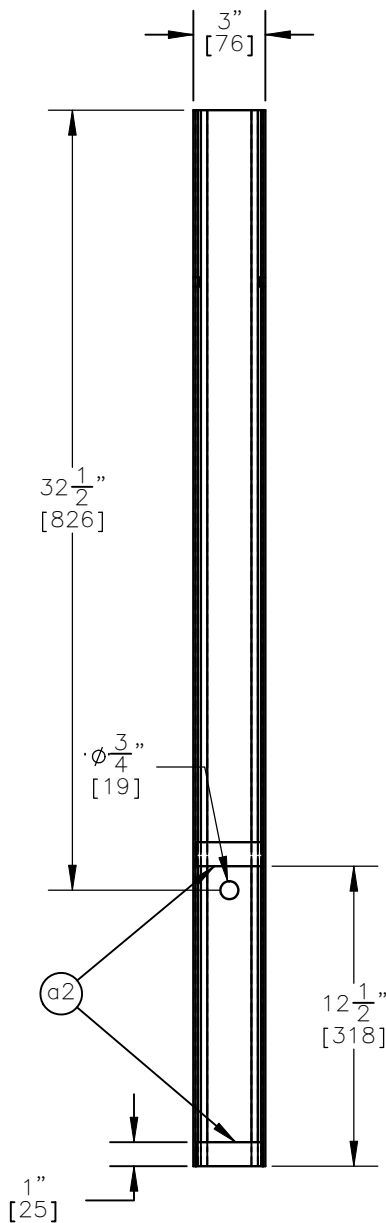
DATE:
6/24/2009

DRAWN BY:
MW/RJT

REV. BY:
KAL/EJ/RF



Part a1
S3x5.7 Post



Part a2
Post Standoff



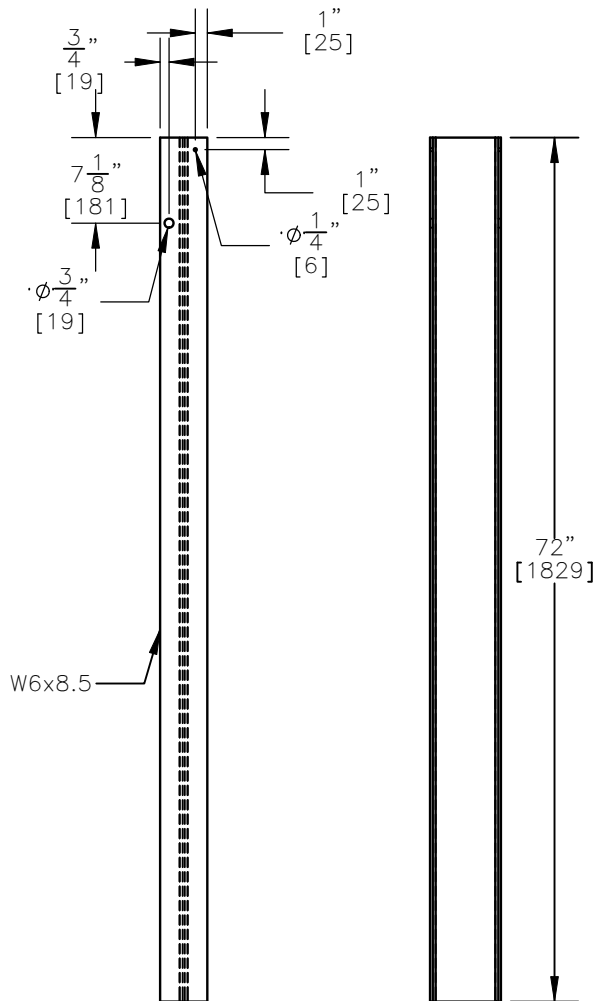
Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
S3x5.7 Post and Standoff Details

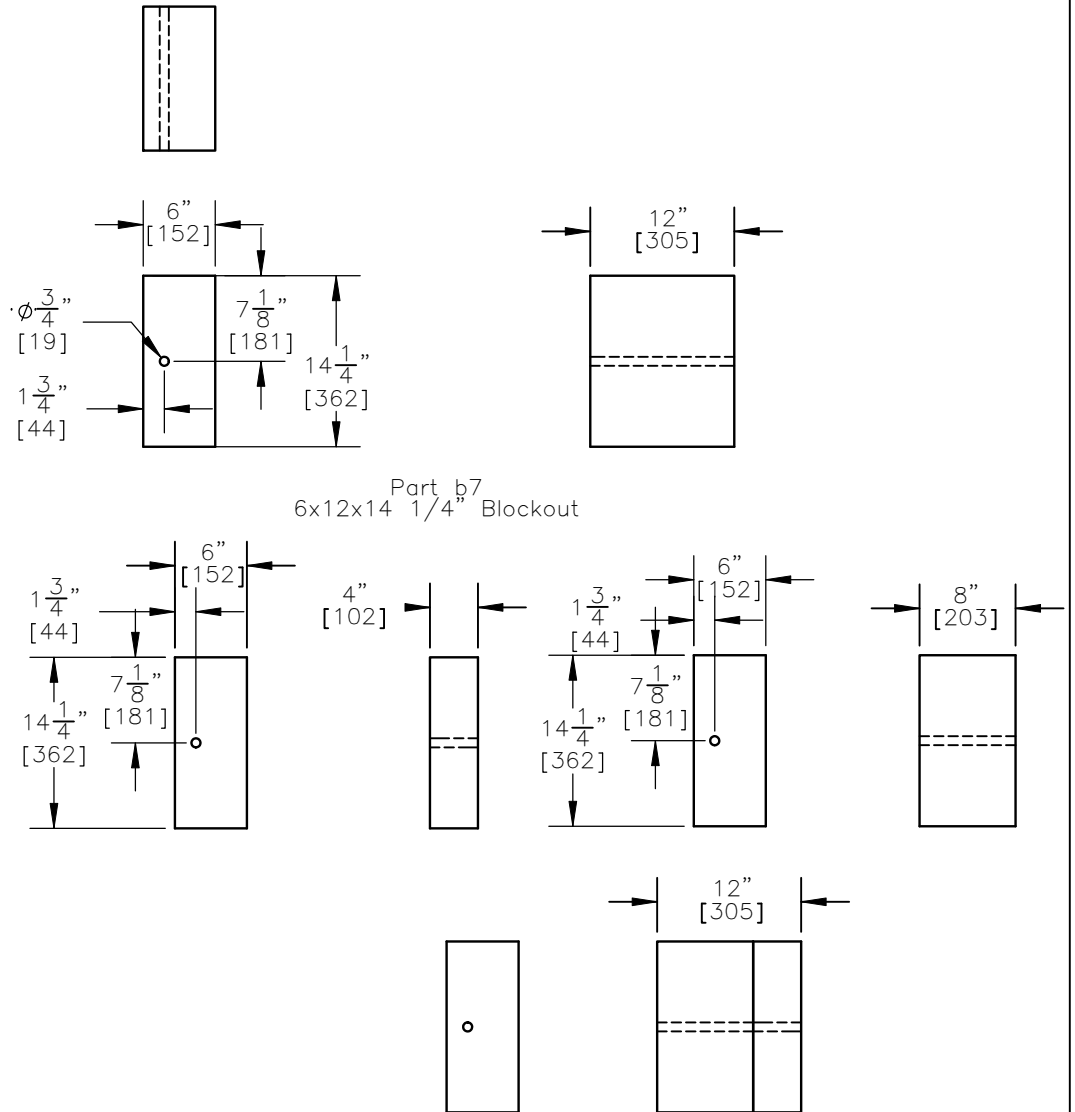
DWG. NAME:
MGS Bridge Rail-2_V1

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

SHEET:
11 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF



Part b6
Line Post



Part b7
6x12x14 1/4" Blockout

Alternate Combined Blockout Option:
6x4x14 1/4" and 6x8x14 1/4" Blockouts



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Posts 3-8 and 32-37 Details

SHEET:
12 of 26

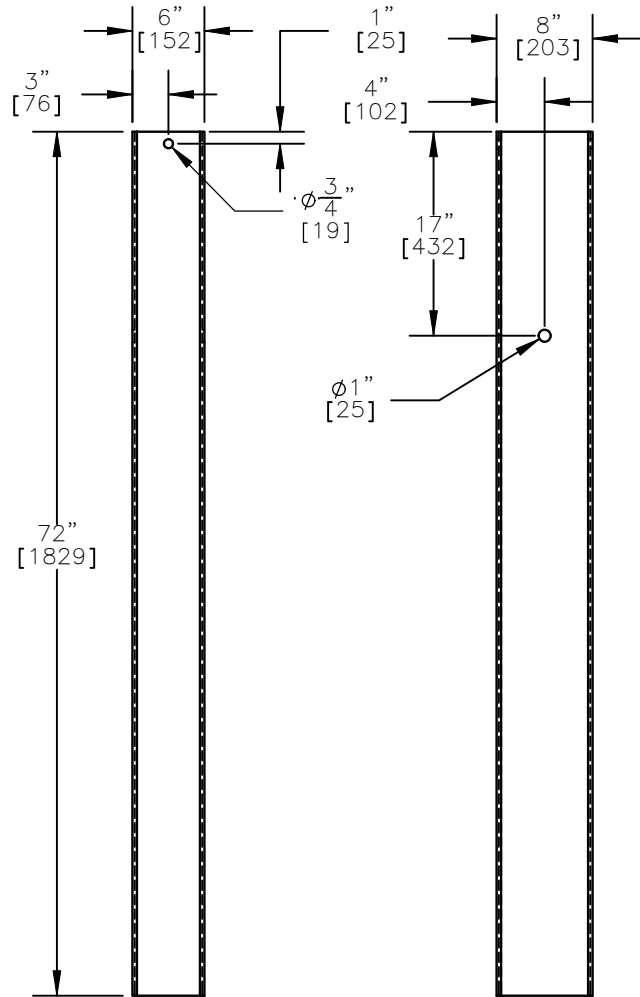
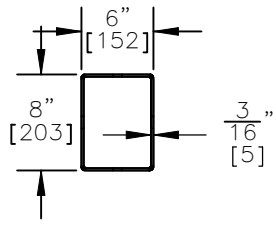
DATE:
6/24/2009

DRAWN BY:
MW/RJT

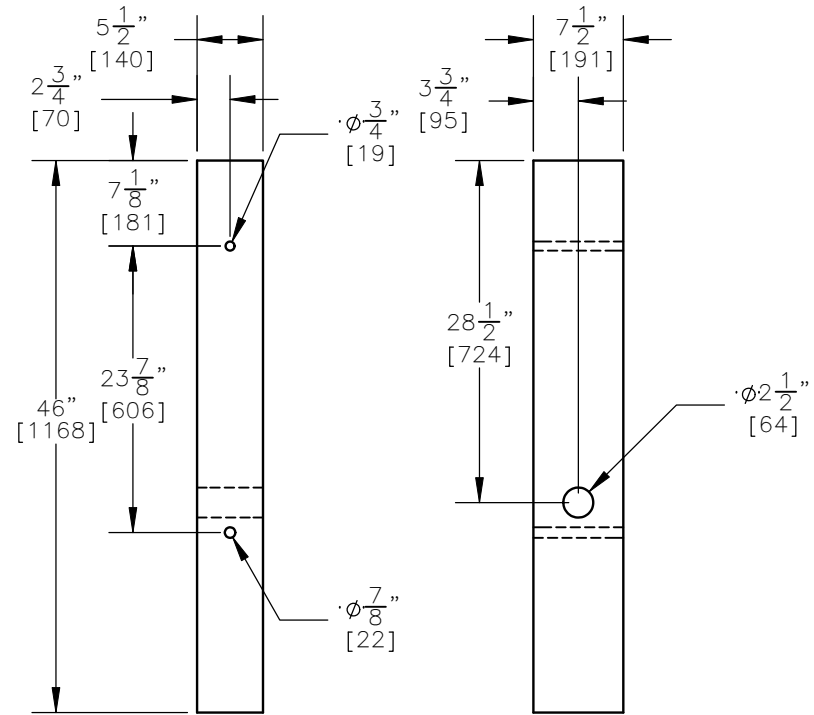
DWG. NAME:
MGS Bridge Rail-2_V1

SCALE: 1:16
UNITS: In.[mm]

REV. BY:
KAL/EJ/RF



Part d1
Foundation Tube



Part d2
BCT (MGS) Timber Post



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2

BCT Timber Posts &
Foundation Tube Details

DWG. NAME:
MGS Bridge Rail-2_V1

SCALE: 1:16
UNITS: In.[mm]

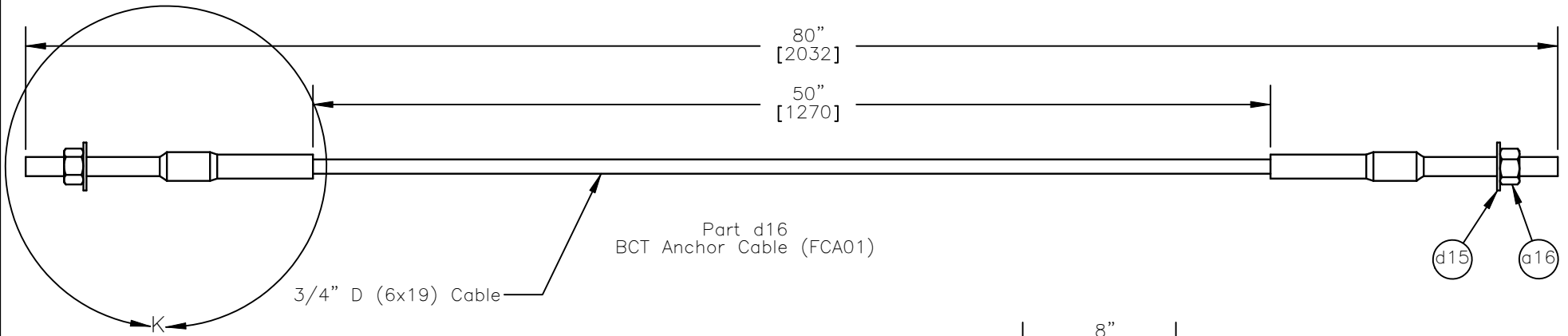
SHEET:
13 of 26

DATE:
6/24/2009

DRAWN BY:
MW/RJT

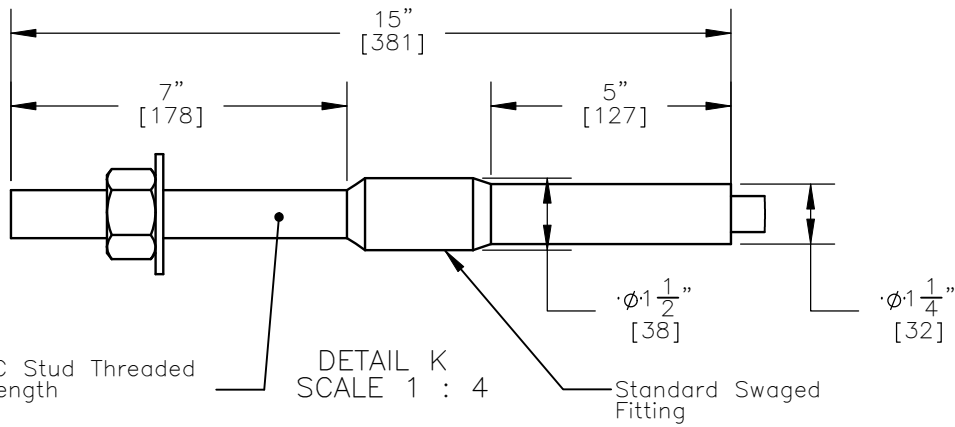
REV. BY:
KAL/EJ/RF

Note: (1) 6x19 and 6x25 IWRC cables are equivalent.



Part d16
BCT Anchor Cable (FCA01)

d15
a16



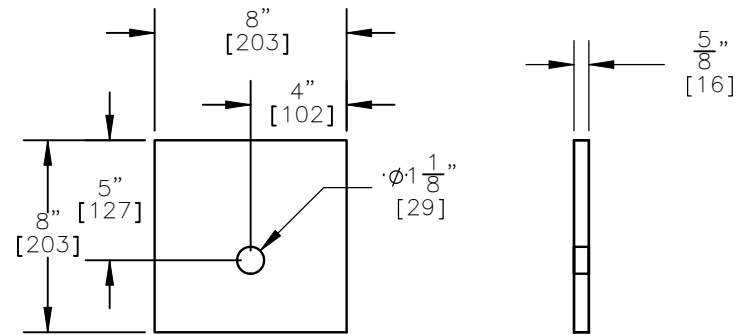
1"-8UNC Stud Threaded
Entire Length

DETAIL K
SCALE 1 : 4

Standard Swaged
Fitting

$\phi 1 \frac{1}{2}$ "
[38]

$\phi 1 \frac{1}{4}$ "
[32]



Part d6
Anchor Cable Bearing Plate



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2

BCT Anchor Cable

SHEET:
14 of 26

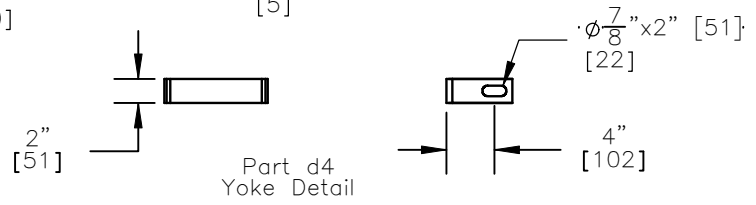
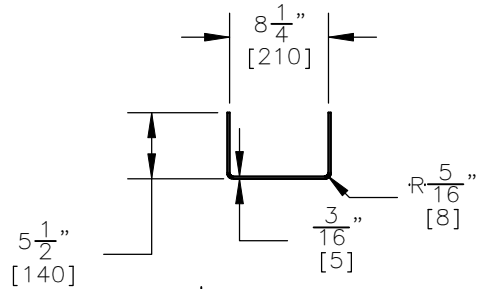
DATE:
6/24/2009

DRAWN BY:
MW/RJT

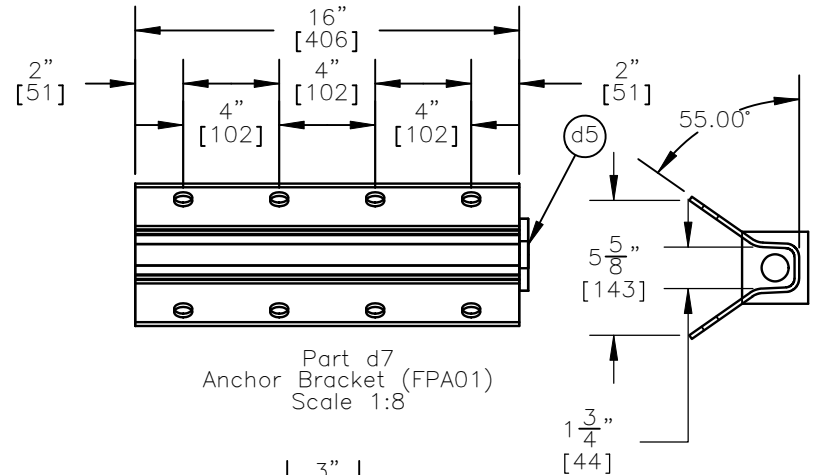
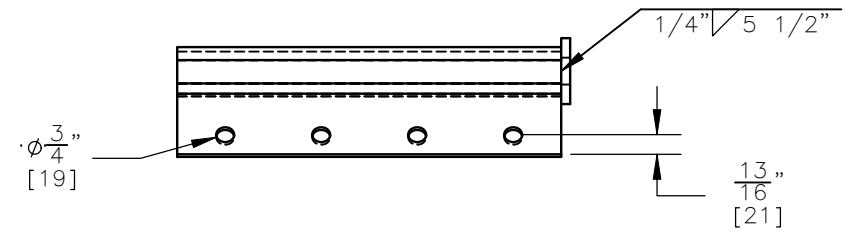
DWG. NAME:
MGS Bridge Rail-2_V1

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

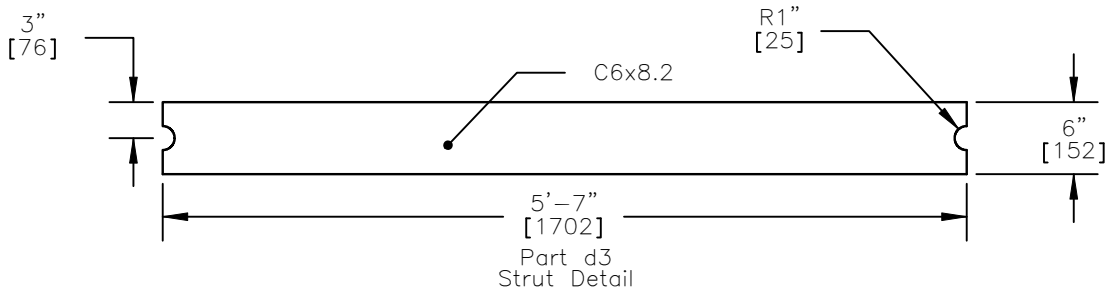
REV. BY:
KAL/EJ/RF



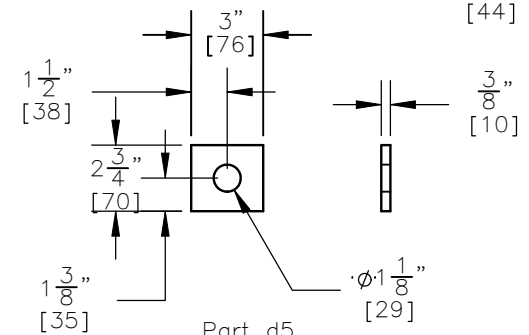
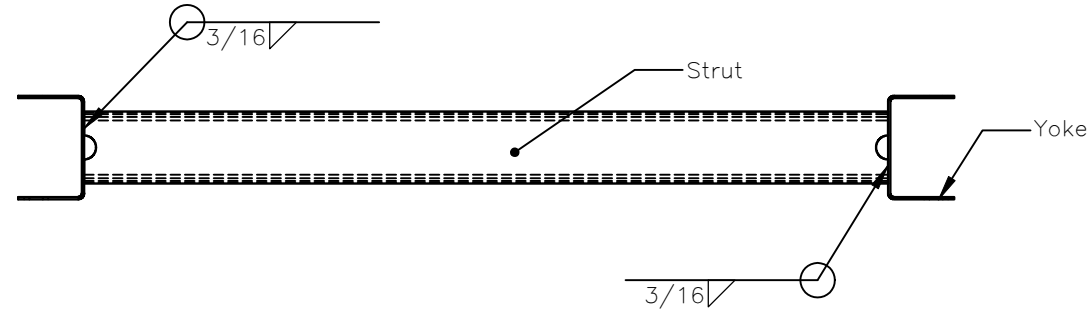
Part d4
Yoke Detail



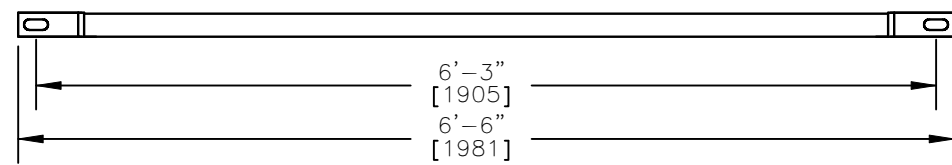
Anchor Part d7
Bracket (FPA01)
Scale 1:8



Part d3
Strut Detail



Part d5
Anchor Bracket
Bearing Plate
Scale 1:8

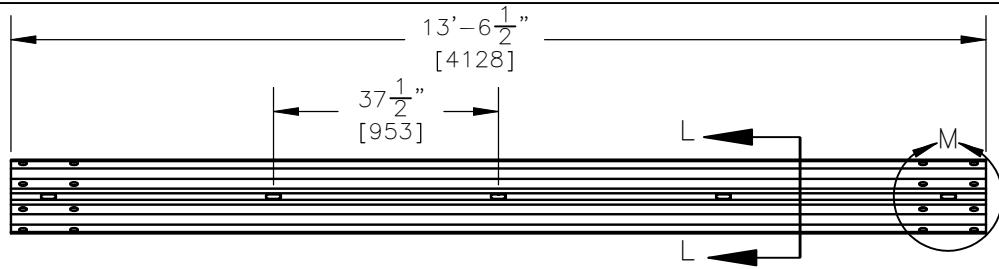


Ground Strut

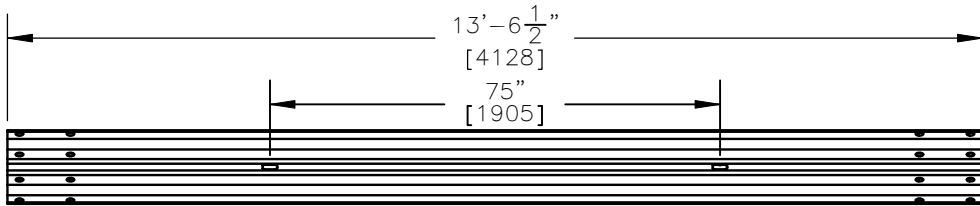


Midwest Roadside
Safety Facility

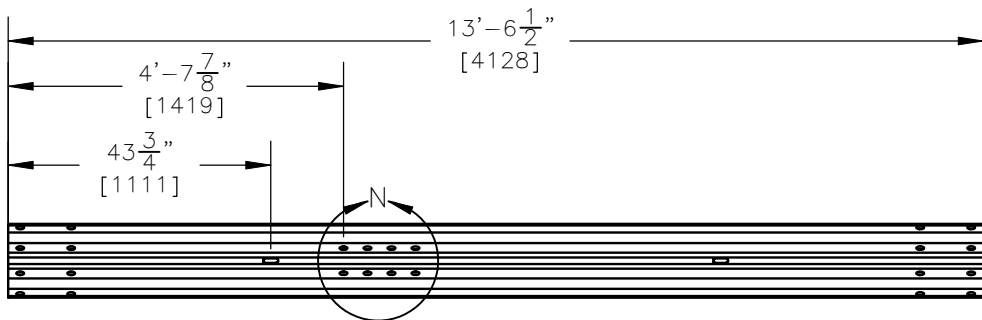
MGS Bridge Rail - 2		SHEET: 15 of 26
Ground Strut & Anchor Bracket Details		DATE: 6/24/2009
DWG. NAME: MGS Bridge Rail-2_V1		DRAWN BY: MW/RJT
SCALE: 1:16	UNITS: In.[mm]	REV. BY: KAL/EJ/RF



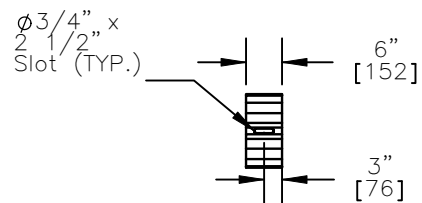
part a7
12'-6" [3810] W-Beam Section, 12 gauge, Half Post Spacing



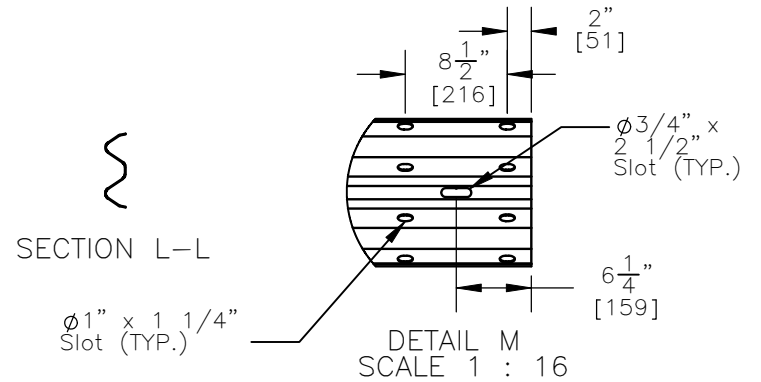
part b1
12'-6" [3810] W-Beam Section, 12 gauge, Full Post Spacing



part b5
12'-6" [3810] W-Beam Section, 12 gauge, End Section

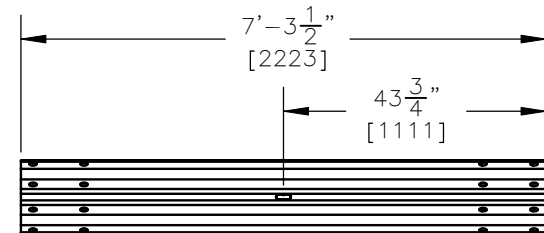


part a19
6" [152] W-Beam Backup Plate, 12 gauge

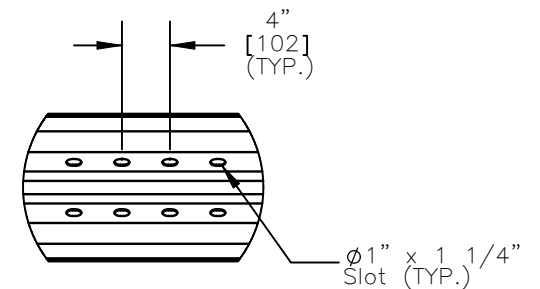


SECTION L-L

DETAIL M
SCALE 1 : 16



part b2
6'-3" [1905] W-Beam Section, 12 gauge, Full Post Spacing



DETAIL N
SCALE 1 : 16



Midwest Roadside
Safety Facility

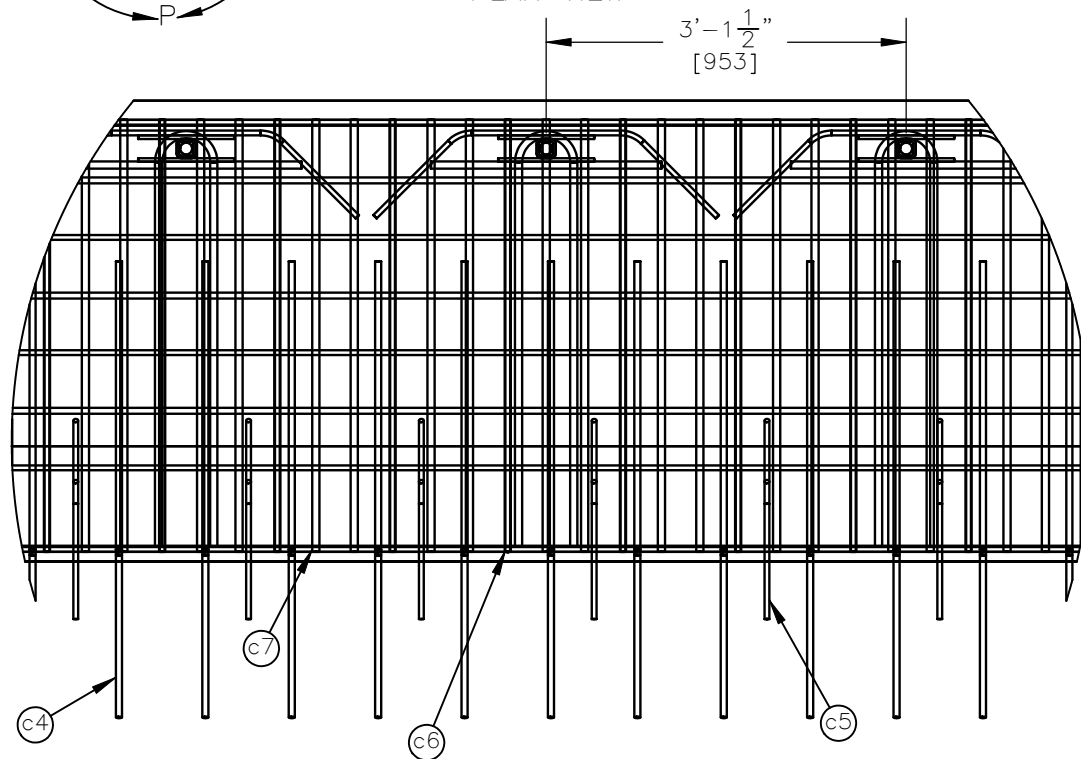
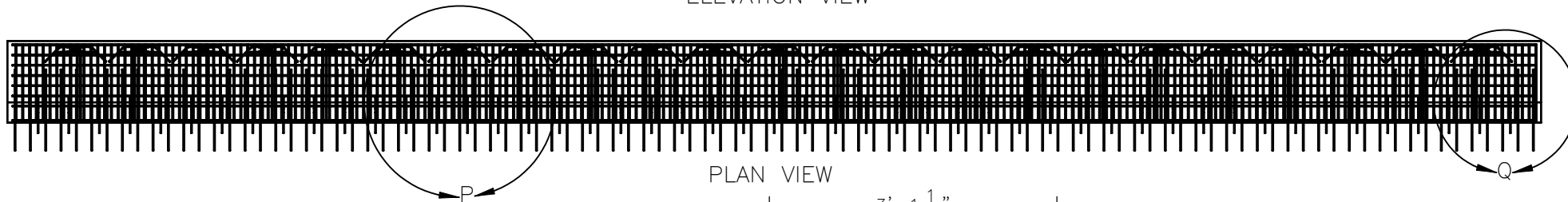
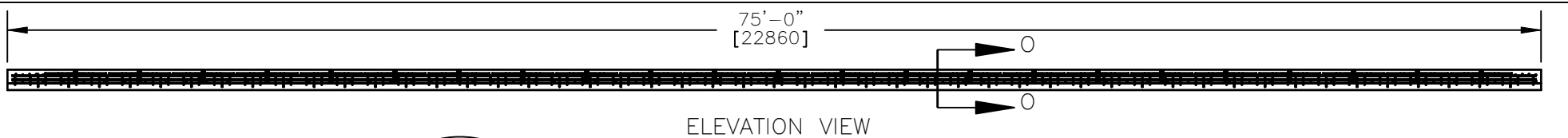
MGS Bridge Rail - 2
Rail Section Details

DWG. NAME:
MGS Bridge Rail-2_V1

SCALE: 1:32
UNITS: In.[mm]

SHEET:
16 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT

REV. BY:
KAL/EJ/RF



DETAIL P
SCALE 1 : 20

- NOTES: (1) The concrete for the bridge deck should have a minimum 28-day concrete compressive strength of 4,000 psi [27.6 MPa].
- (2) Shift transverse bars which interfere with vertical bolt sleeves to the side of the tubes, as needed.
- (3) For c1 and c2, use any number of pieces to fit the length with a minimum of 18" and 24" laps, respectively.



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Bridge Deck Details

DWG. NAME:
MGS Bridge Rail-2_V1

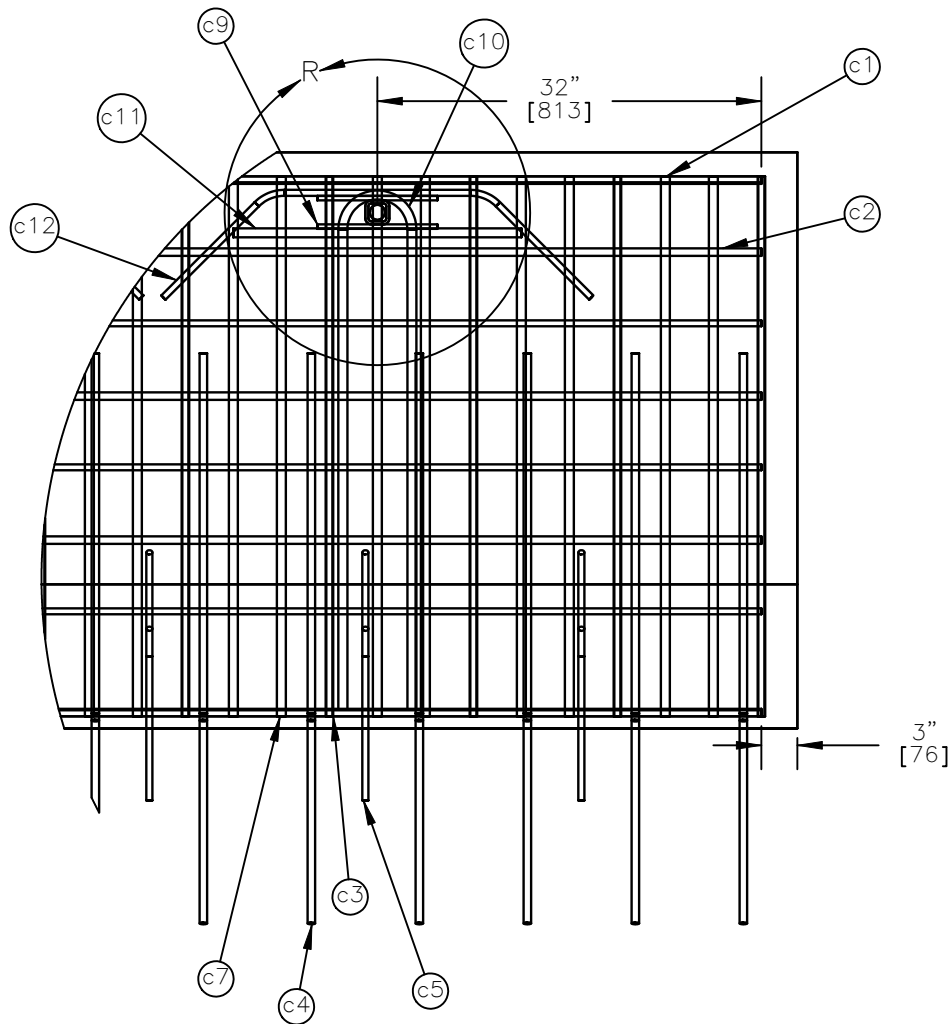
SCALE: 1:90
UNITS: In.[mm]

SHEET:
17 of 26

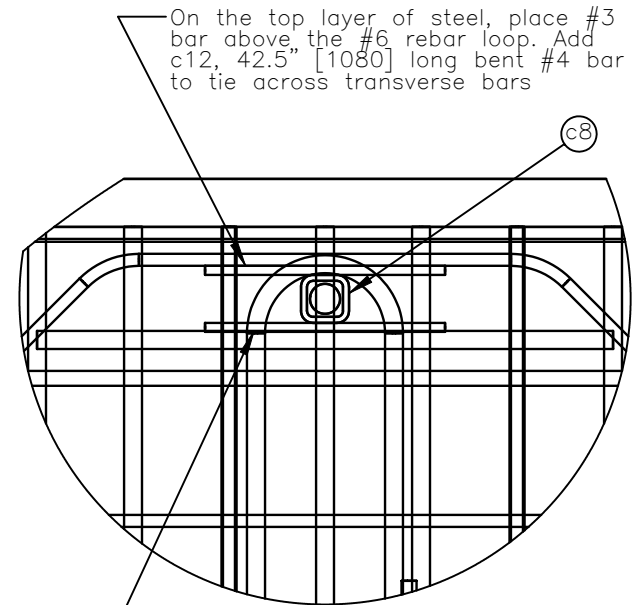
DATE:
6/24/2009

DRAWN BY:
MW/RJT

REV. BY:
KAL/EJ/RF



DETAIL Q
SCALE 1 : 16



On the top layer of steel, place #3 bar above the #6 rebar loop. Add c12, 42.5" [1080] long bent #4 bar to tie across transverse bars

DETAIL R
SCALE 1 : 8

On the bottom layer of steel, tie #3 bar above the #6 bars. These bars are tied to the #5 bars in the deck. Add c11, 24" [610] long #6 bar



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Bridge Deck Details

DWG. NAME:
MGS Bridge Rail-2_V1

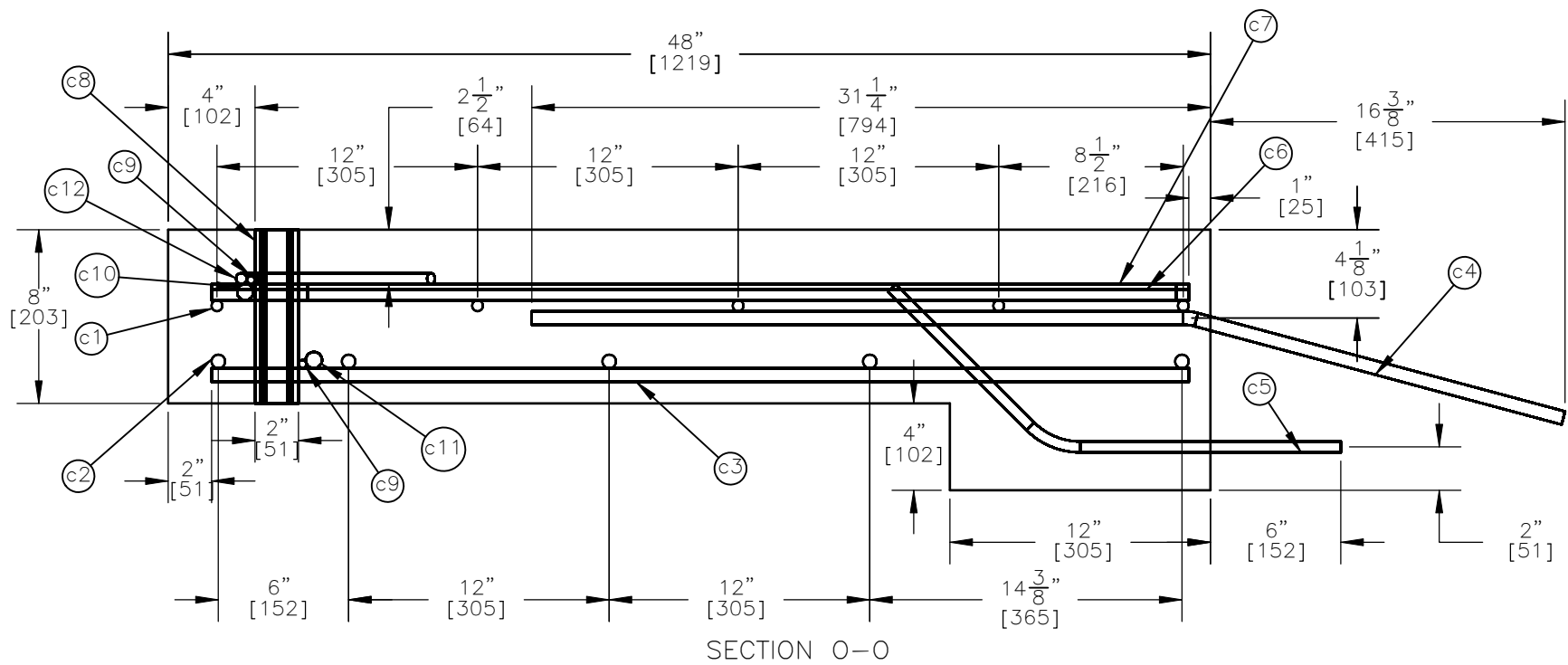
SCALE: 1:16
UNITS: In.[mm]

REV. BY:
KAL/EJ/RF


SHEET:
18 of 26

DATE:
6/24/2009

DRAWN BY:
MW/RJT

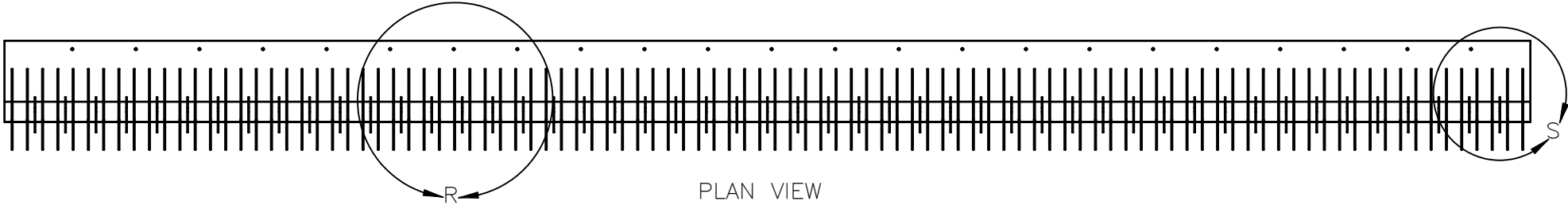


- Notes: (1) Tie #4 and #6 bars to #3 bars after placement in the deck.
 (2) The bottom of #4 and #6 bars are tied at the same plane as the bottom of the #3 bars. These bars are not centered.
 (3) For c1 and c2 use any number of pieces to fit the length with a minimum of 18" and 24" laps, respectively.

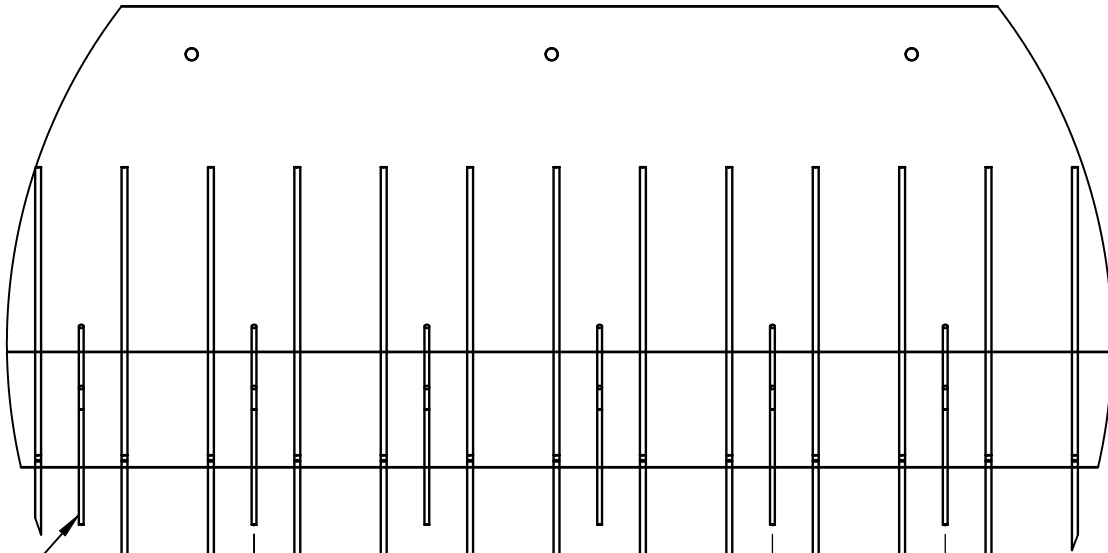
 Midwest Roadside Safety Facility	MGS Bridge Rail - 2 Bridge Deck Details		SHEET: 19 of 26
	DWG. NAME: MGS Bridge Rail-2_V1		DATE: 6/24/2009
		SCALE: 1:8 UNITS: In.[mm]	DRAWN BY: MW/RJT
			REV. BY: KAL/EJ/RF



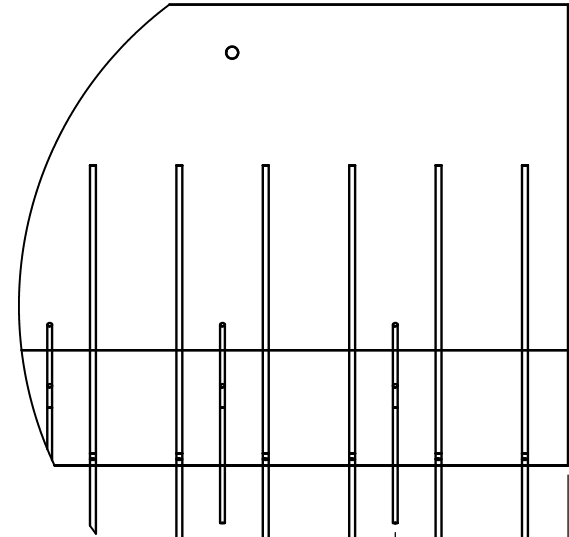
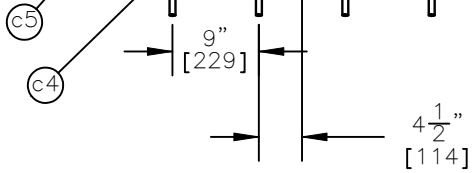
ELEVATION VIEW



PLAN VIEW



DETAIL R
SCALE 1 : 20



DETAIL S
SCALE 1 : 20



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2

Bridge Deck Dowels

SHEET:
20 of 26

DATE:
6/24/2009

DRAWN BY:
MW/RJT

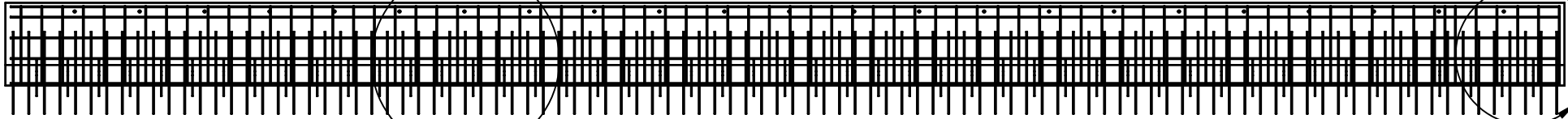
DWG. NAME:
MGS Bridge Rail-2_V1

SCALE: 1:90
UNITS: In.[mm]

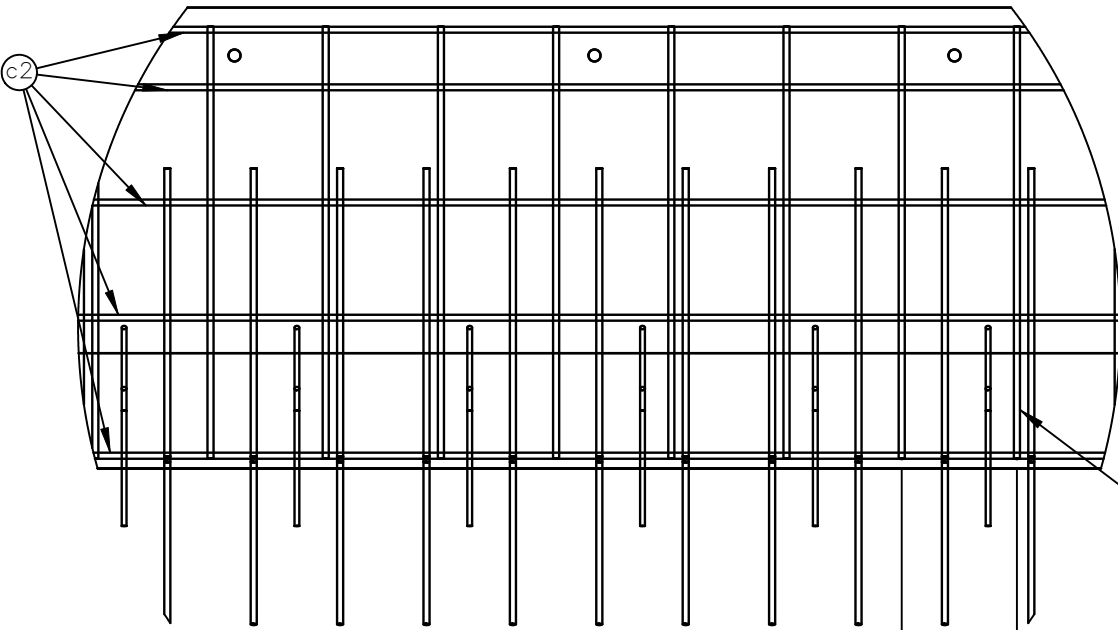
REV. BY:
KAL/EJ/RF



ELEVATION VIEW

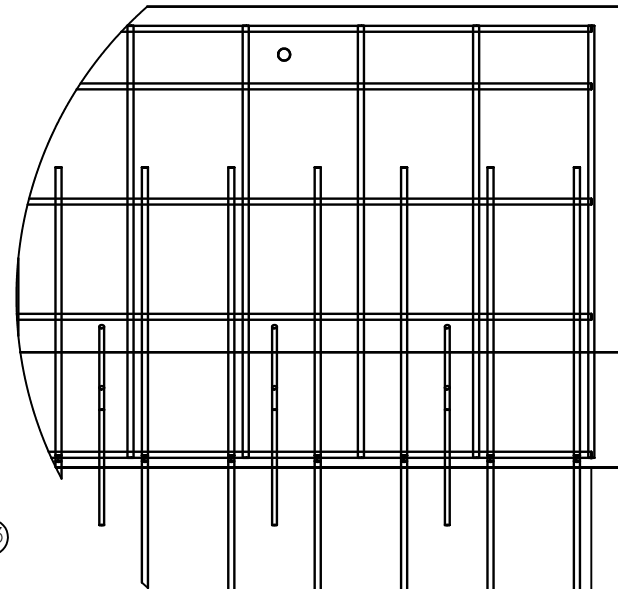


PLAN VIEW



DETAIL T
SCALE 1 : 20

12"
[305]



DETAIL U
SCALE 1 : 20

3"
[76]



Midwest Roadside
Safety Facility

MGS Bridge Rail - 2

Bridge Deck Bottom Rebar
with Dowels

SHEET:
21 of 26

DATE:
6/24/2009

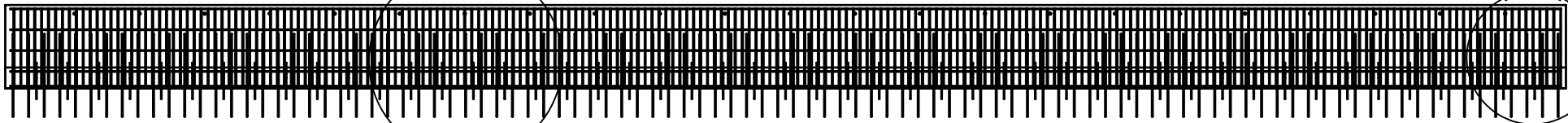
DRAWN BY:
MW/RJT

DWG. NAME:
MGS Bridge Rail-2_V1

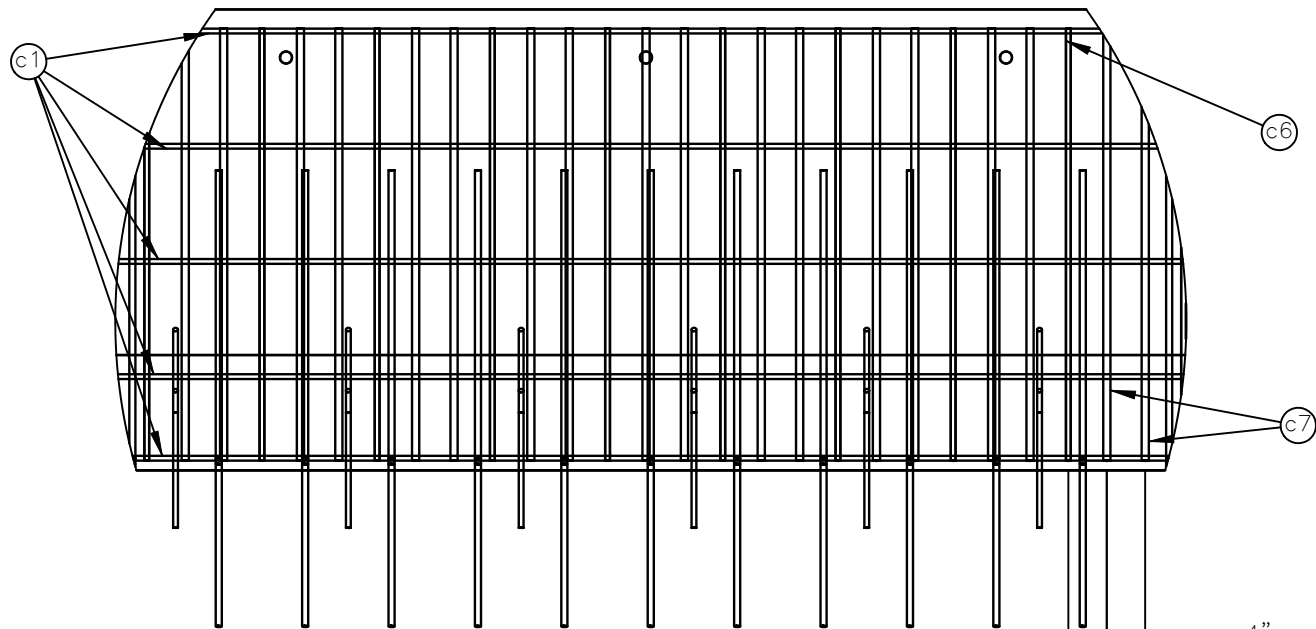
SCALE: 1:90
UNITS: In.[mm] REV. BY:
KAL/EJ/RF



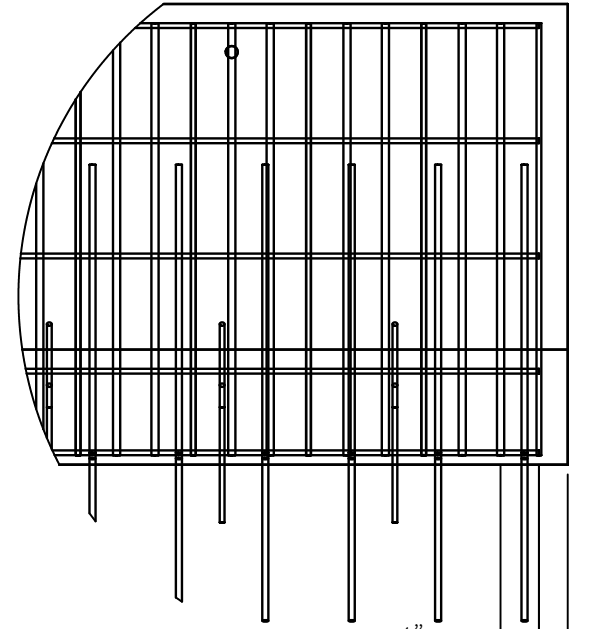
ELEVATION VIEW



PLAN VIEW



DETAIL V
SCALE 1 : 20



DETAIL W
SCALE 1 : 20



Midwest Roadside
Safety Facility

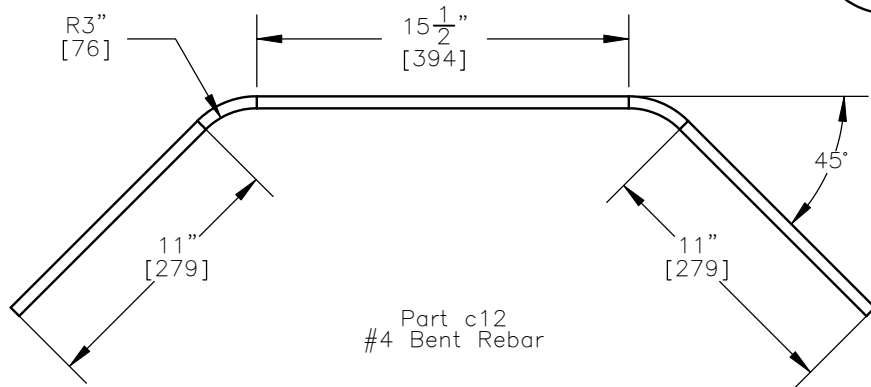
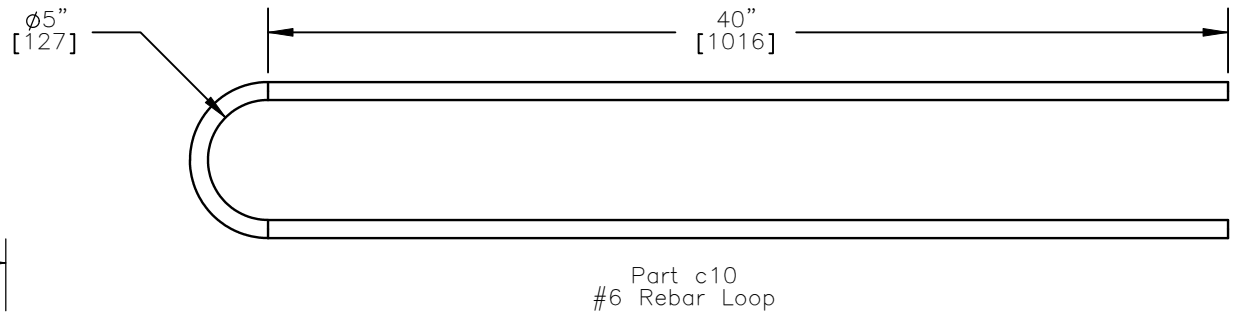
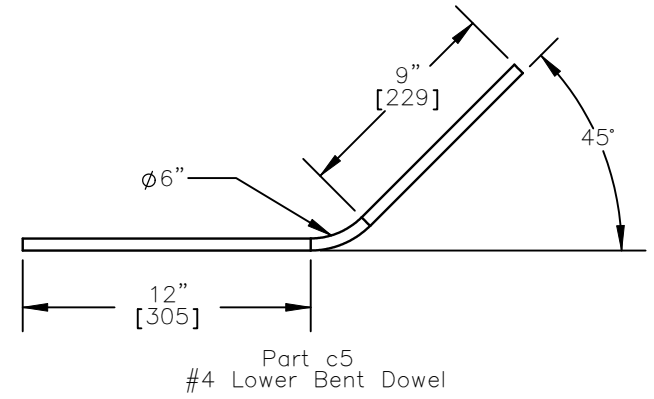
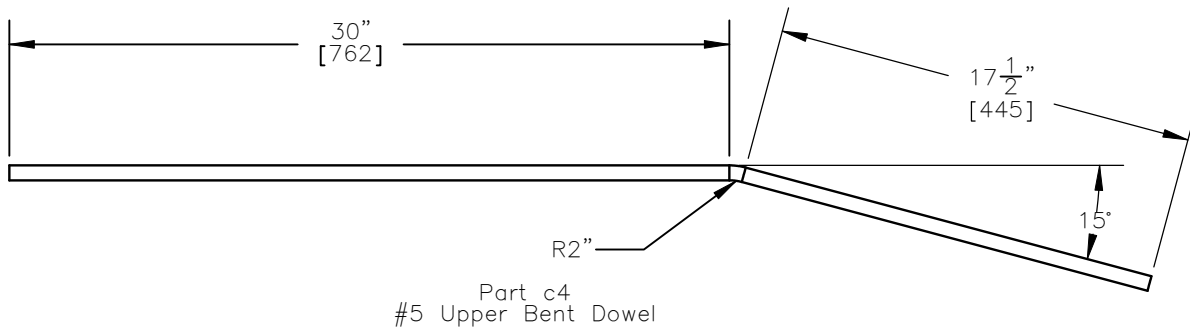
MGS Bridge Rail - 2
Bridge Deck Top Rebar with
Dowels

DWG. NAME.
MGS Bridge Rail-2_V1

SCALE: None
UNITS: In.[mm]

SHEET:
22 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT

REV. BY:
KAL/EJ/RF



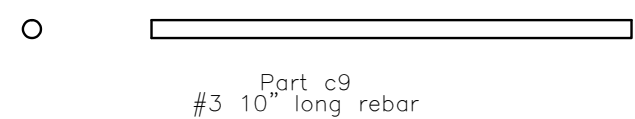
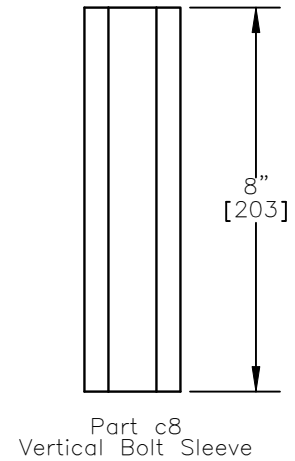
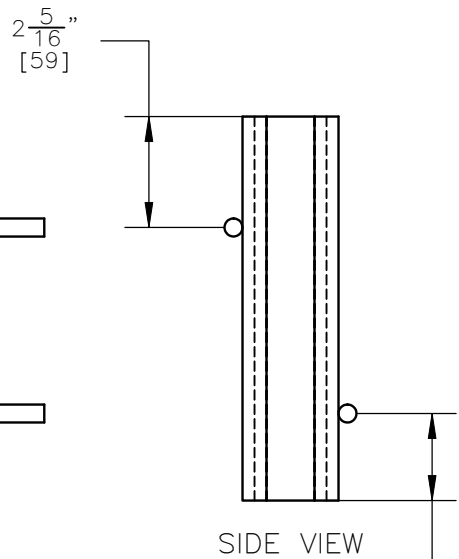
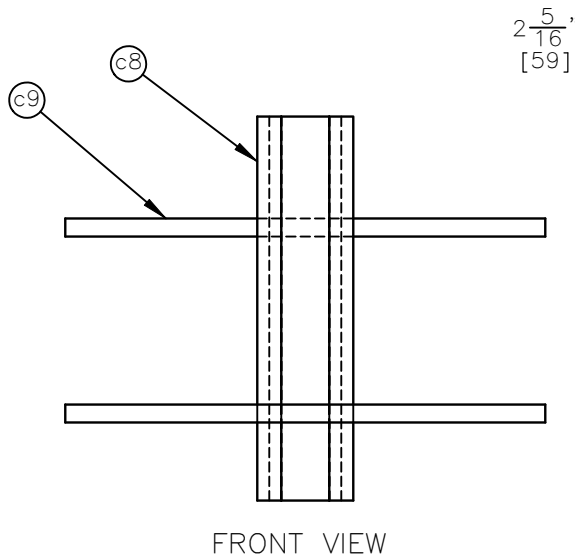
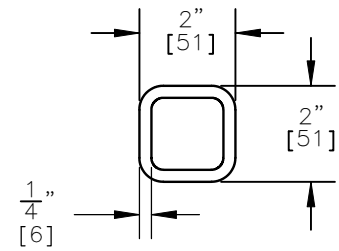
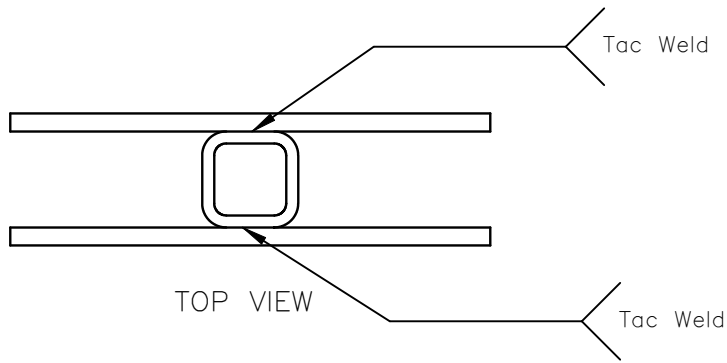
Midwest Roadside
Safety Facility

MGS Bridge Rail - 2
Bent Rebar

DWG. NAME.
MGS Bridge Rail-2_V1

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

SHEET:
23 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF



- Notes: (1) Vertical Bolt Sleeve to be galvanized after fabrication.
 (2) For placement in construction, weld #3 bars onto tube prior to galcanization.



Midwest Roadside Safety Facility

MGS Bridge Rail - 2
Vertical Bolt Sleeve Assembly

DWG. NAME:
MGS Bridge Rail-2_V1

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

SHEET:
24 of 26
DATE:
6/24/2009
DRAWN BY:
MW/RJT
REV. BY:
KAL/EJ/RF

MGS Bridge Rail System				
Item No.	QTY.	Description	Material Spec	Hardware Guide
a1	23	S3x5.7 by 40" long Post	A36 Steel Galvanized	-
a2	92	2.75x1x0.25 S3x5.7 Post Standoff	A36 Steel Galvanized	-
a3	23	4x4x0.375" SQ Tube	A500 Grade B Steel Galvanized	-
a4	23	7.5x3x0.4375 Top Mounting Plate	A572 Grade 50 Steel Galvanized	-
a5	23	Top Mounting Plate Gusset	A36 Steel Galvanized	-
a6	23	Hex Bolt 0.625-11x5x1.25	ASTM A325 Type 1 Galvanized	FBX16a
a7	6	12'-6" W-Beam MGS Section 1/2 Post Spacing	12 gauge AASHTO M180	-
a8	23	L7x4x0.375 Bottom Mounting Plate	A36 Steel Galvanized	-
a9	23	L7x4x0.375 Bottom Mounting Plate Gusset	A36 Steel Galvanized	-
a10	23	6.5x2x0.375 Backside Retainer Plate	A36 Steel Galvanized	-
a11	23	0.3125" Dia. Hex Nut	Grade 5	-
a12	23	Hex Bolt 0.3125-18x1.25x1.25	Grade A307	FBX08a
a13	23	1.75x1.75x0.125 Square Guardrail Washer	A36 Steel	RWR01
a14	23	Hex Bolt 1-8x11x2.5	Grade 5	
a15	46	1" Flat Washer	F436 Grade 1 Galvanized	-
a16	27	1" Dia. Hex Nut	ASTM A563 DH Galvanized	FBX24a
a17	46	Hex Bolt 0.5-13x6x6	ASTM A325 Type 1 Galvanized	FBX14a
a18	46	0.5" Dia. Hex Nut	ASTM A563 DH Galvanized	FBX14a
a19	23	6" W-Beam Backup Plate	12 gauge AASHTO M180	-
a20	44	0.625" Dia. Flat Washer	F436 Grade 1	FWC166
b1	6	12'-6" W-Beam MGS Section Full Post Spacing	12 gauge AASHTO M180	-
b2	1	6'-3" W-Beam MGS Section	12 gauge AASHTO M180	-
b3	47	0.625" Dia. Hex Nut	ASTM A563 DH Galvanized	FBX16a
b4	112	0.625" Dia. x 1.5" Guardrail Bolt and Nut	Grade A307	FBB01
b5	2	12'-6" W-Beam MGS End Section	12 gauge AASHTO M180	RWM04a
b6	13	W6x8.5 72" long (W6x9 can be substituted)	A36 Steel	PWE06
b7	13	6x12x14 1/4" Blockout	SYP Grade No.1 or better	-
b8	13	0.625" Dia. x 14" long Guardrail Bolt and Nut	Grade A307	FBB06
b9	13	16D Double Head Nail	-	-
c1	5	#4 Straight Rebar, Total Lenght 74.5'	Grade 60	-
c2	5	#5 Straight Rebar, Total Lenght 74.5'	Grade 60	-
c3	76	#5 Straight Rebar, 45" long	Grade 60	-
c4	100	#5 Upper Bent dowel, total length unbent 42"	Grade 60	-
c5	49	#4 Lower Bent Dowel, total length unbent 23.5"	Grade 60	-
c6	75	#4 Transverse Bar, 45" long	Grade 60	-
c7	149	#6 Transverse Bar, 45" long	Grade 60	-
c8	23	Tube Housing	ASTM A500 Grade B	-
c9	46	#3 Straight Rebar, 10" long	Grade 60	-



Midwest Roadside Safety Facility

MGS Bridge Rail - 2

Bill of Materials

SHEET:
25 of 26

DATE:
6/24/2009

DRAWN BY:
MW/RJT

DWG. NAME.
MGS Bridge Rail-2_V1

SCALE: None
UNITS: In.[mm]

REV. BY:
KAL/EJ/RF

MGS Bridge Rail System

Item No.	QTY.	Description	Material Spec	Hardware Guide
c10	23	#6 Rebar Loop, Total Length Unbent 89"	Grade 60	-
c11	23	#6 Straight Rebar, 24" long	Grade 60	-
c12	23	#4 Bent Rebar, Total Length Unbent 42.5"	Grade 60	-
c13	1	Concrete Deck	f'c = 4,000 psi	-
d1	4	72" Foundation Tube	ASTM A53 Grade B Schedule 40	PTE05
d2	4	BCT Timber Post -MGS Height	SYP Grade No. 1 or better	PDF01
d3	2	Straight Ground Strut 67" long	C6x8.2 Channel Section A36 Steel	PFP01
d4	4	Yoke	A36 Steel	PFP01
d5	2	Anchor Bracket End Plate	A36 Steel	FPA01
d6	2	5x8x0.625" Anchor Bearing Plate	A36 Steel	FPB01
d7	2	Anchor Bracket	A36 Steel	FPA01
d8	2	2" Schedule 10 x 6" long BCT Hole Insert	ASTM A53 Grade B	FMM02
d9	4	0.625" Dia. x 10" long Guardrail Bolt	Grade A307	FBB03
d10	4	0.625" Dia. x 10" long Hex Head Bolt	A307	FBX16a
d11	4	0.875" Dia. x 7 1/2" long Hex Head Bolt	Grade 5	FBX22a
d12	4	0.875" Dia. Hex Nut	Grade 5	FBX22a
d13	8	0.875" Dia. Flat Washer	Grade 5	FWC22a
d14	16	0.625" Dia. x 1 1/2" long Hex Head Bolt	Grade A307	FBX16a
d15	4	1" Dia. Flat Washer	Grade 5	FWC24a
d16	2	BCT Anchor Cable Assembly	Ø0.75" 6x9 IWRC IPS Galvanized Wire Rope	FCA01-02



Midwest Roadside Safety Facility

MGS Bridge Rail - 2

Bill of Materials Continued

SHEET:
26 of 26

DATE:
6/24/2009

DRAWN BY:
MW/RJT

DWG. NAME:
MGS Bridge Rail-2_V1

SCALE: None
UNITS: In.[mm]

REV. BY:
KAL/EJ/RF