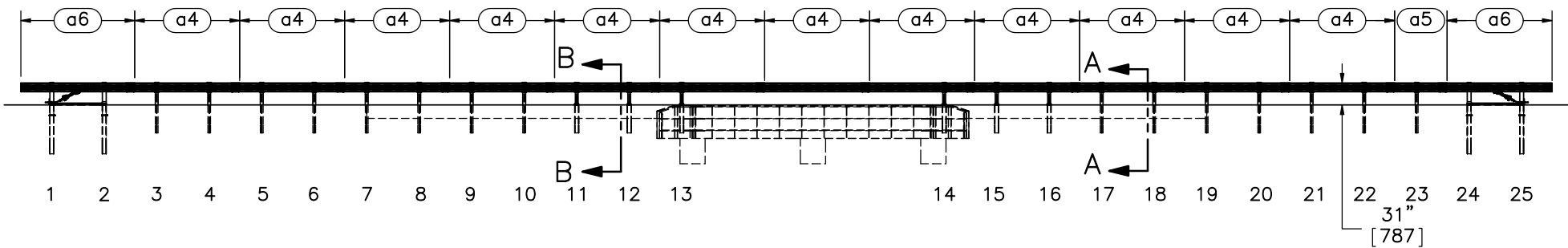


PLAN VIEW



ELEVATION VIEW

- Note:
- (1) Modified BCT Cable with load cell assembly to be installed at both end anchors.
 - (2) The impact location is at the centerline of post no. 11.
 - (3) BCT anchors are placed in $\phi 3'$ [914] holes, then backfilled and tamped with soil.
 - (4) The compacted slope shall be constructed prior to installing the posts. Auger holes, place posts, and backfill and compact soil around the posts.
 - (5) Modified BCT Cable with load cell assembly to be installed at both end anchors.



Midwest Roadside Safety Facility

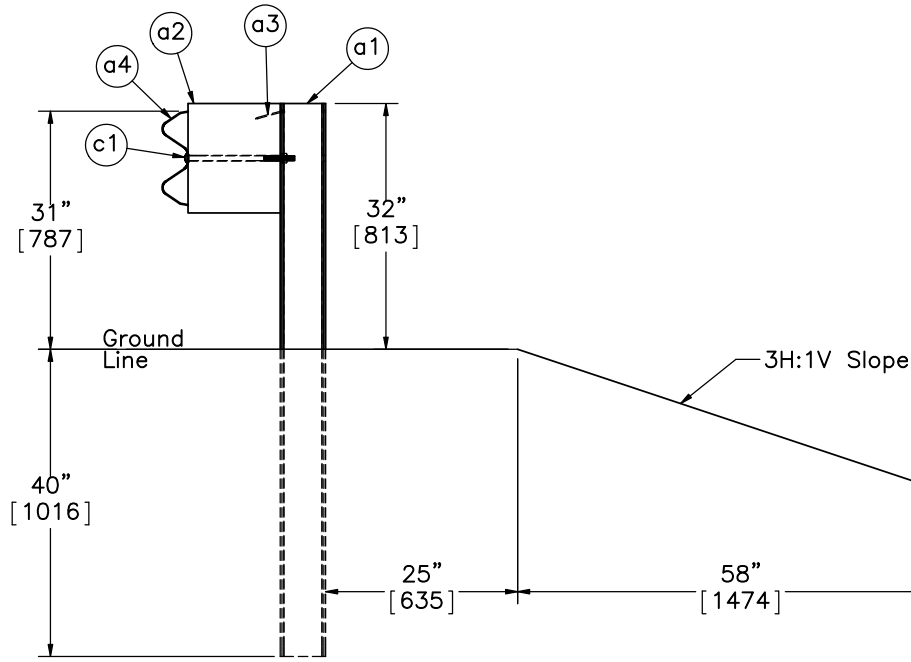
31'-3" MGS Long Span with UBSP

System Layout

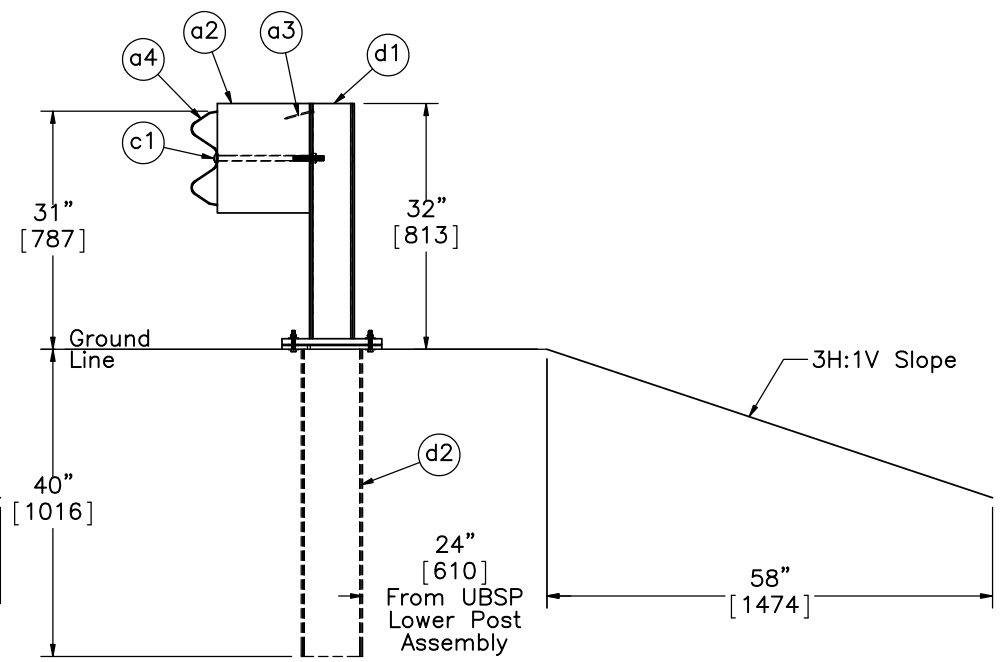
DWG. NAME.
MGS_LSW_R10

SCALE: 1:220
UNITS: Inches

SHEET:
1 of 22
DATE:
10/4/2016
DRAWN BY:
SDB/JGP/DTM
REV. BY:
KAL/SKR/JCH/RKF



SECTION A-A
Post Nos. 3-10 and 17-23



SECTION B-B
Post Nos. 11-16
Culvert Not Shown



Midwest Roadside
Safety Facility

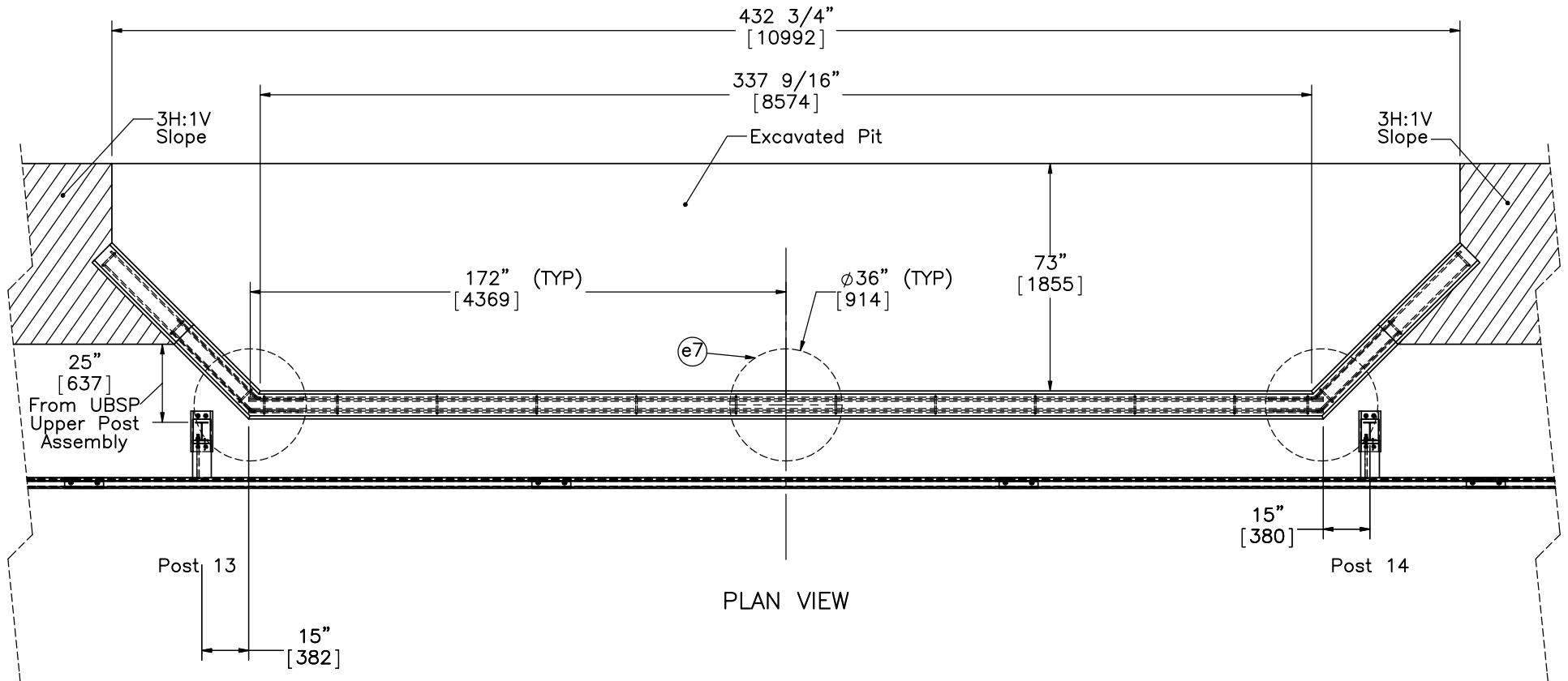
31'-3" MGS Long Span
with UBSP

Post Details


DWG. NAME:
MGS_LSW_R10

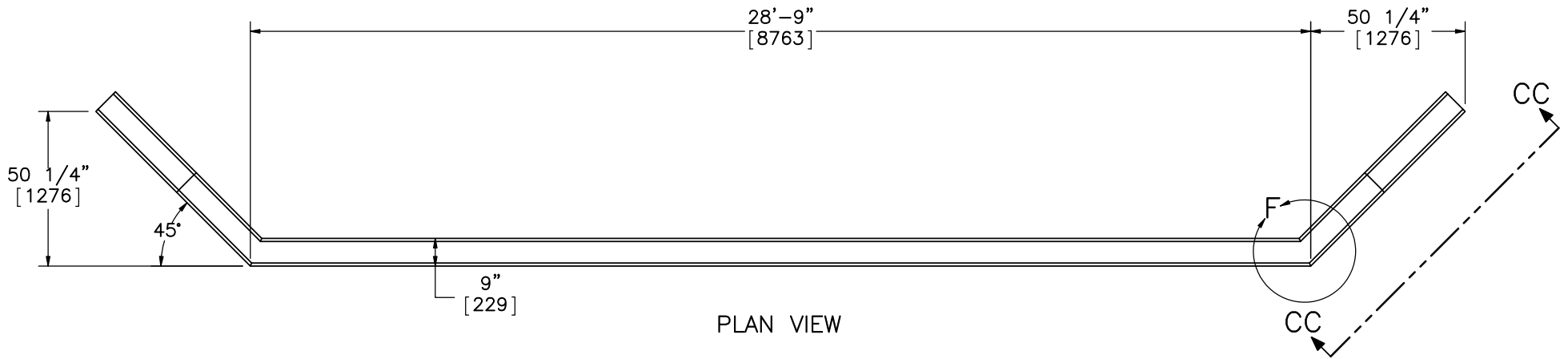
SCALE: 1:25
UNITS: Inches

SHEET:
2 of 22
DATE:
10/4/2016
DRAWN BY:
SDB/JGP/
DTM
REV. BY:
KAL/SKR/
JCH/RKF

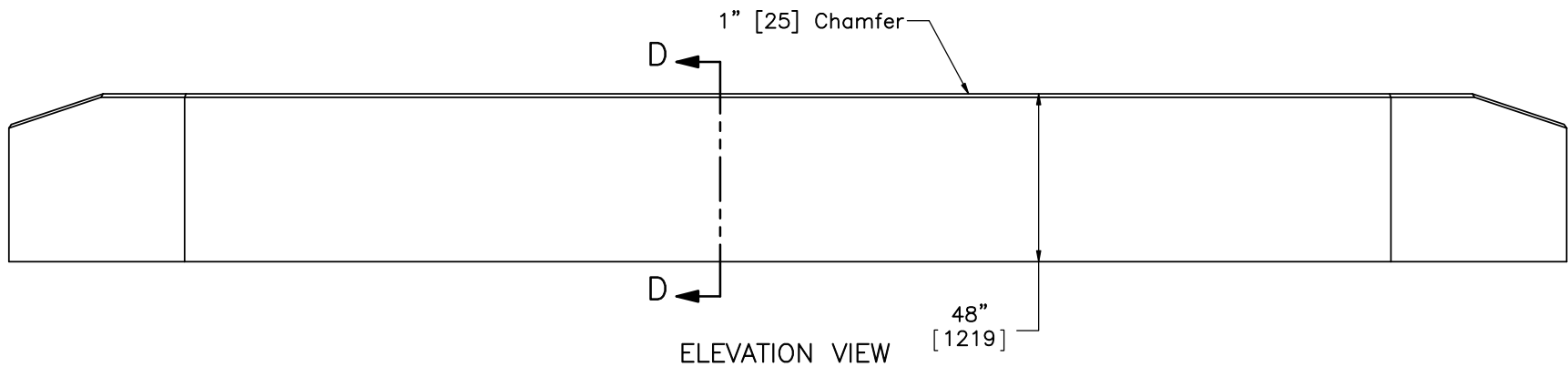


- Notes: (1) Back face of the UBSP Lower Post Assembly is placed flush with front face of headwall or 24" [610] away from the slope break point.
 (2) A 36" [914] diameter, 36" deep unreinforced concrete footer is placed underneath the headwall at the center and bend locations.

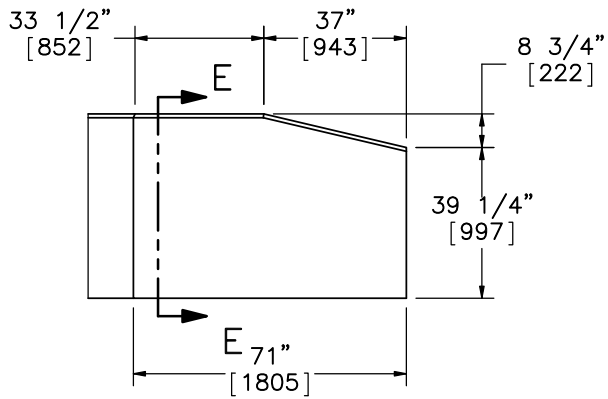
 Midwest Roadside Safety Facility	31'-3" MGS Long Span with UBSP	SHEET: 3 of 22
	Pit Details	DATE: 10/4/2016
DWG. NAME: MGS_LSW_R10	SCALE: 1:50 UNITS: Inches	DRAWN BY: SDB/JGP/ DTM
		REV. BY: KAL/SKR/ JCH/RKF



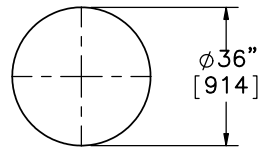
PLAN VIEW



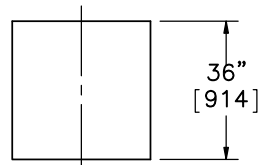
ELEVATION VIEW



VIEW CC-CC



PLAN VIEW



ELEVATION VIEW
Part e7



Midwest Roadside
Safety Facility

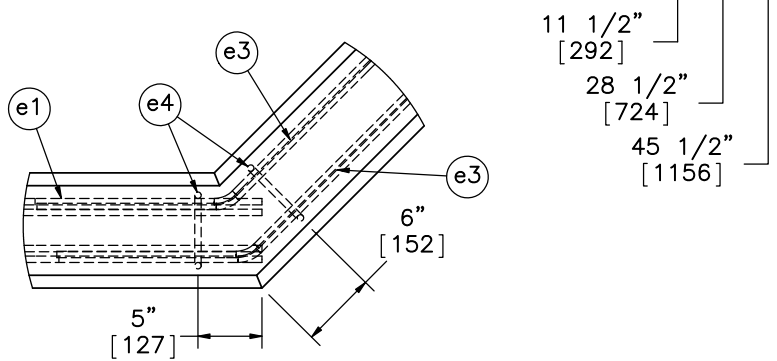
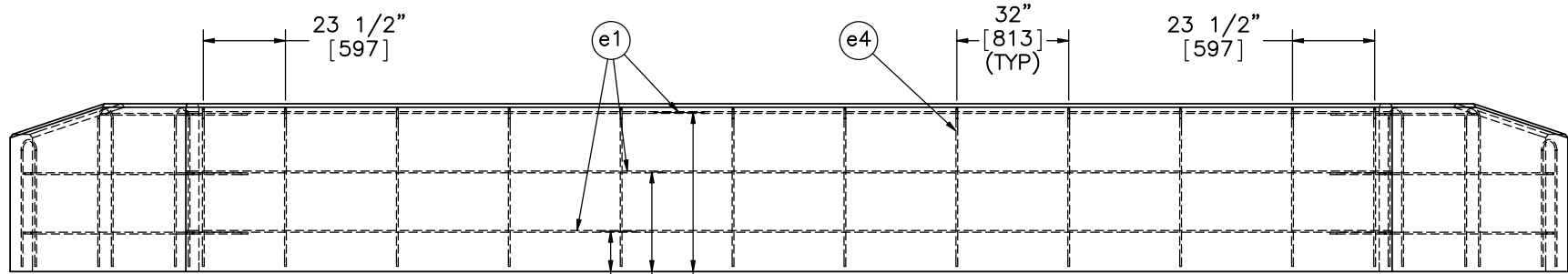
31'-3" MGS Long Span
with UBSP

Concrete Header Details

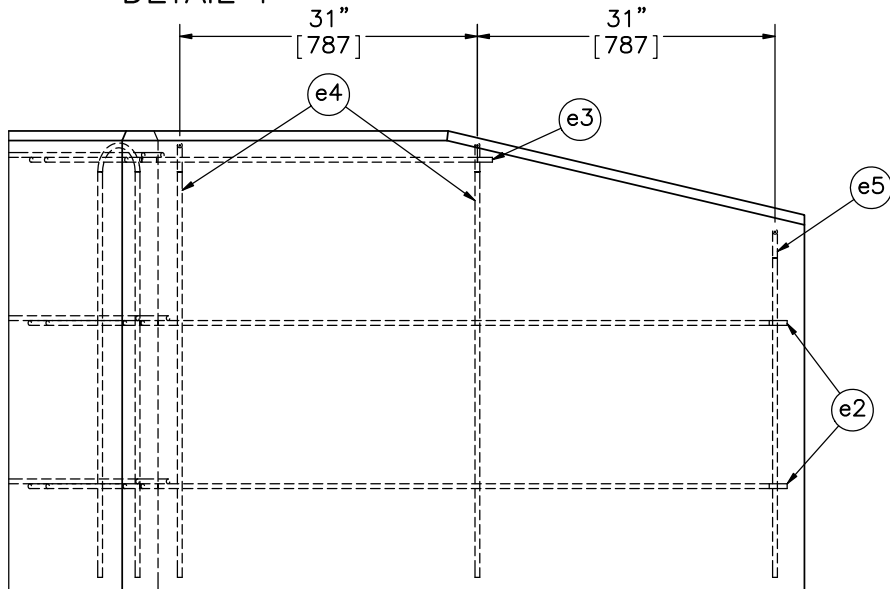
DWG. NAME:
MGS_LSW_R10

SCALE: 1:50
UNITS: Inches

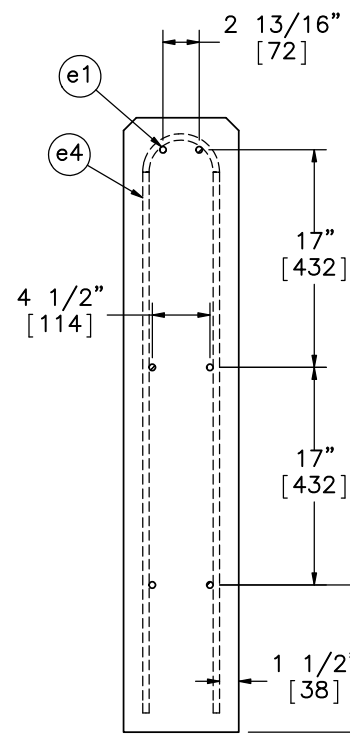
SHEET:
4 of 22
DATE:
10/4/2016
DRAWN BY:
SDB/JGP/
DTM
REV. BY:
KAL/SKR/
JCH/RKF



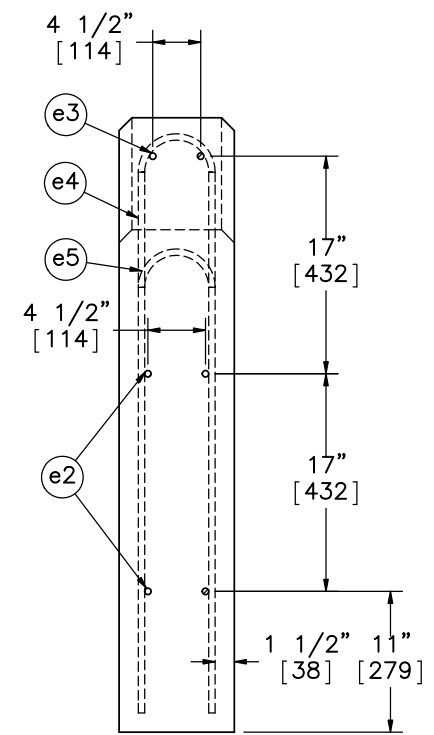
DETAIL F



VIEW CC-CC
SCALE 1 : 20



SECTION D-D



SECTION E-E

Notes: (1) 1 1/2" [38] clear cover for all rebar.



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

Rebar Assembly

DWG. NAME:
MGS_LSW_R10

SCALE: 1:15
UNITS: Inches

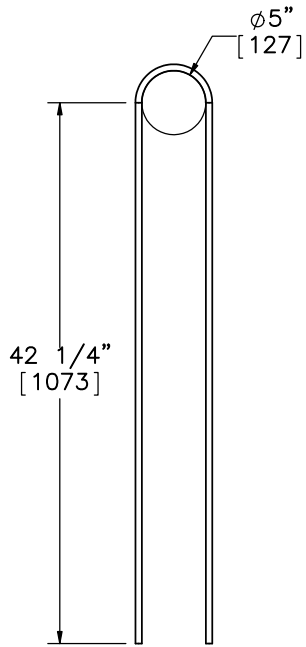
SHEET:
5 of 22

DATE:
10/4/2016

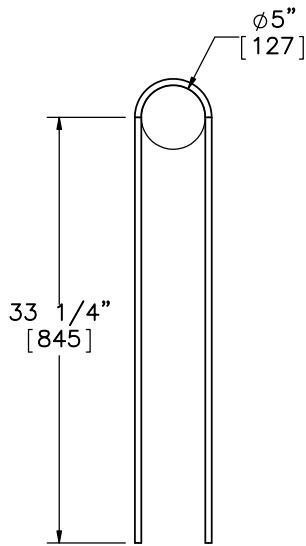
DRAWN BY:
SDB/JGP/
DTM

REV. BY:
KAL/SKR/
JCH/RKF

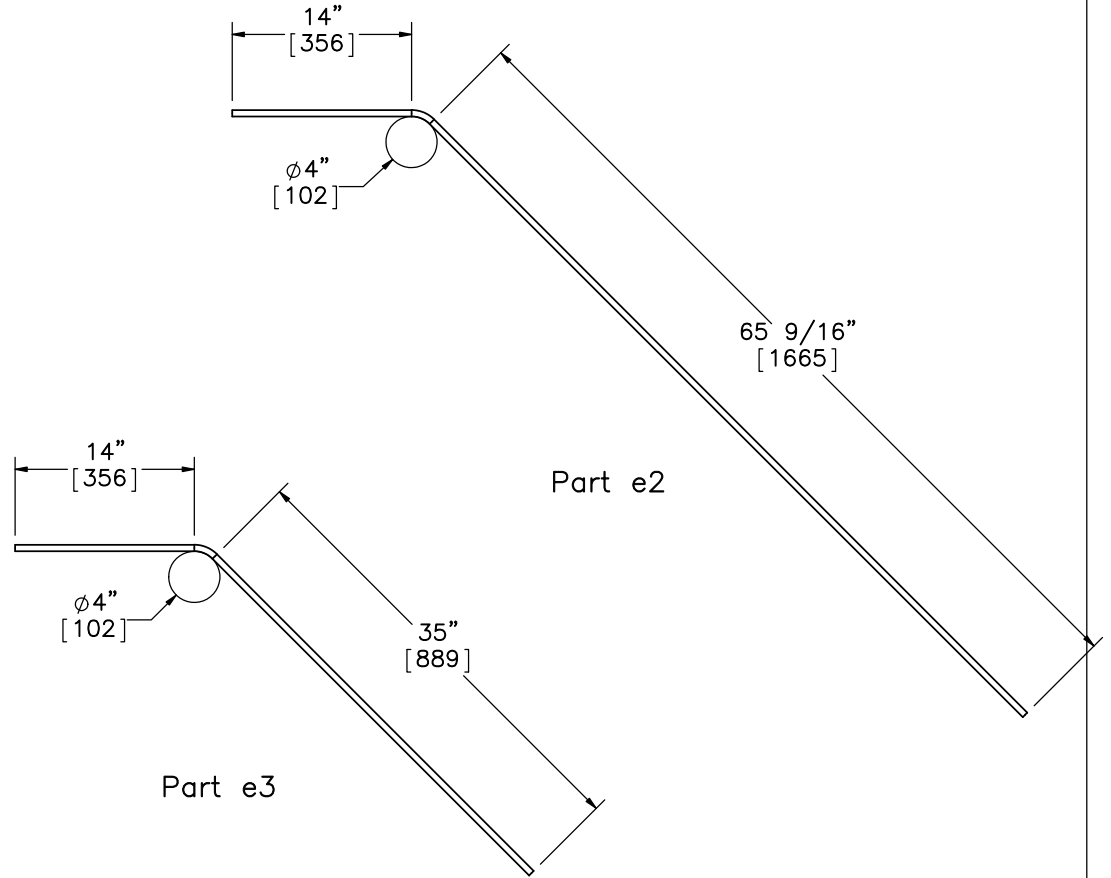
Bill of Bars		
Item No.	QTY.	Description
e1	6	#4 Bar - Longitudinal - 345" [8763] long
e2	8	#4 Bar - Bent Longitudinal - 80" [2032] long
e3	4	#4 Bar - Bent Longitudinal - 50" [1270] long
e4	16	#4 Bar - Stirrup - 93" [2362] long
e5	2	#4 Bar - Stirrup - 75" [1905] long



Part e4

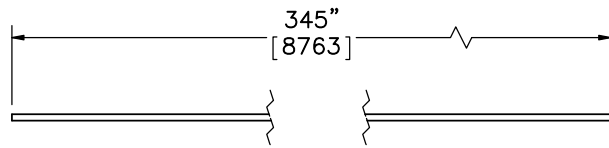


Part e5



Part e2

Part e3



Part e1



Midwest Roadside
Safety Facility

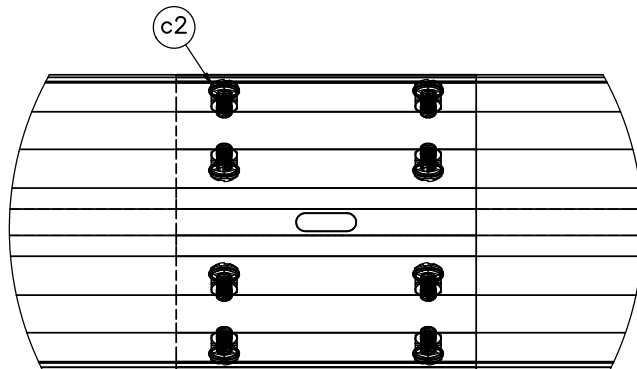
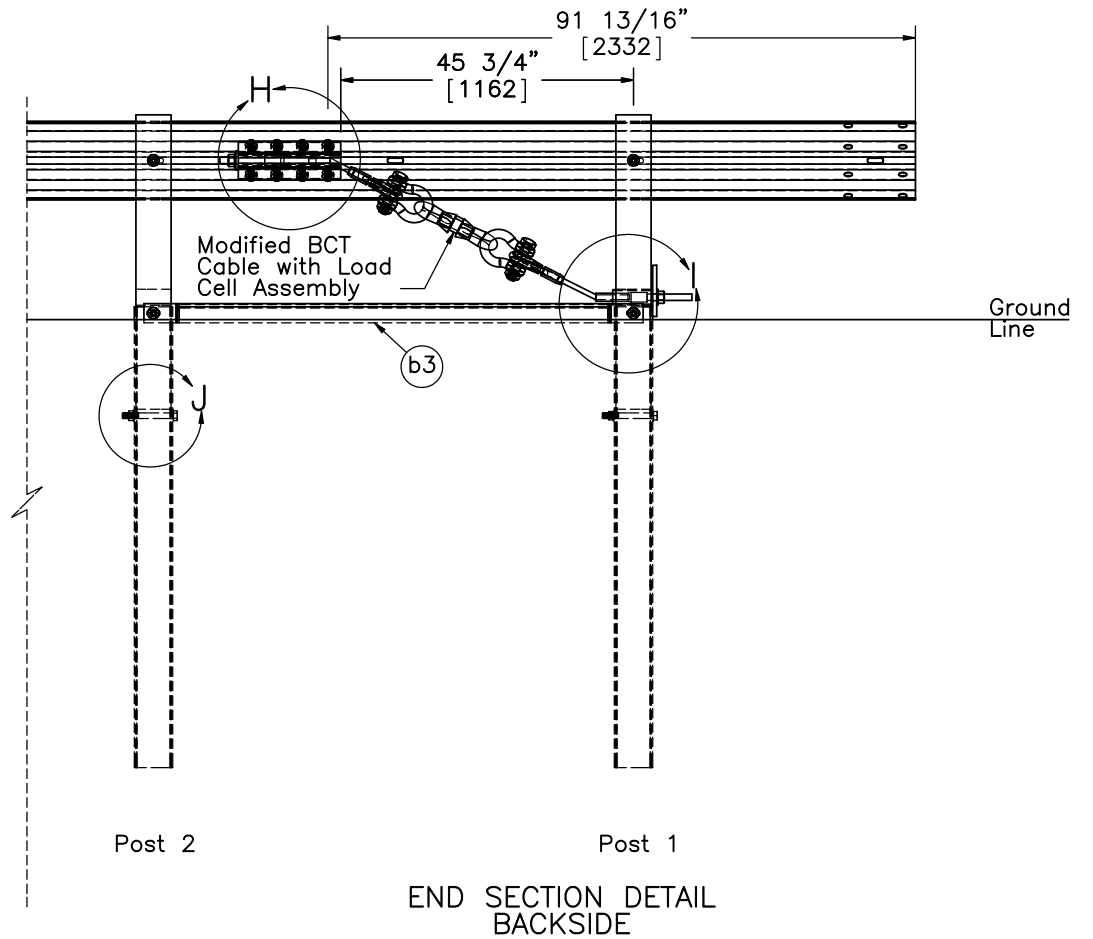
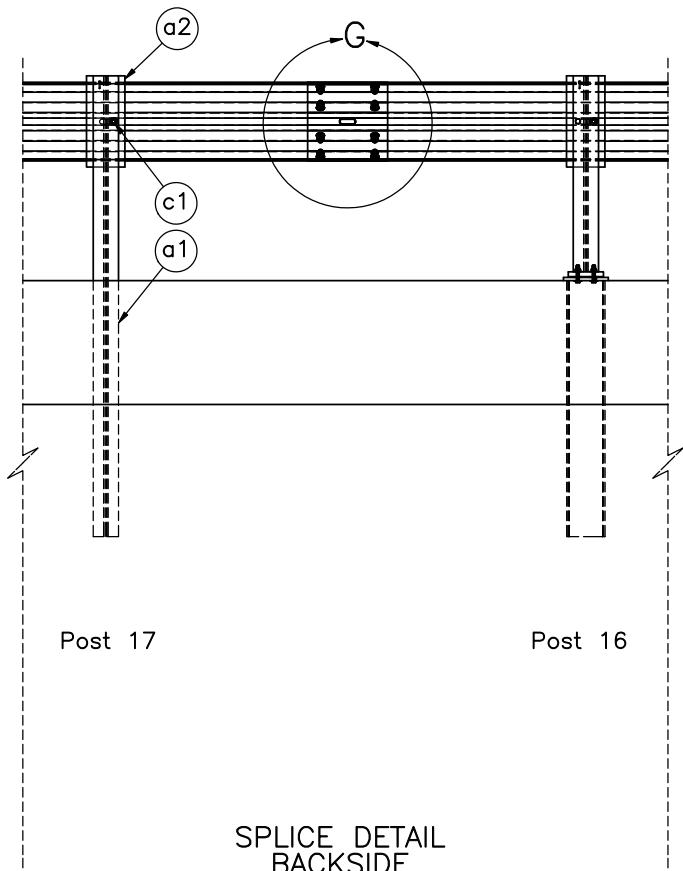
31'-3" MGS Long Span
with UBSP

Bill of Bars

DWG. NAME.
MGS_LSW_R10

SCALE: 1:15
UNITS: Inches

SHEET:
6 of 22
DATE:
10/4/2016
DRAWN BY:
SDB/JGP/
DTM
REV. BY:
KAL/SKR/
JCH/RKF



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

End Section & Splice Detail

DWG. NAME:
MGS_LSW_R10

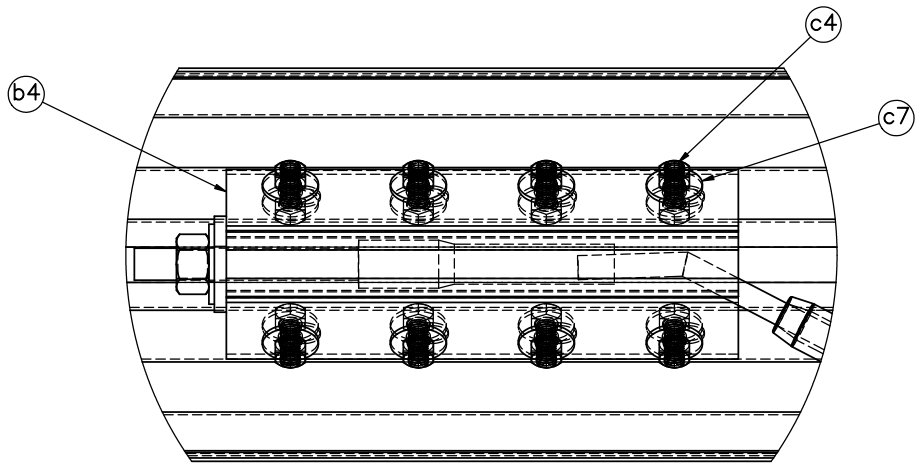
SCALE: 1:30
UNITS: Inches

SHEET:
7 of 22

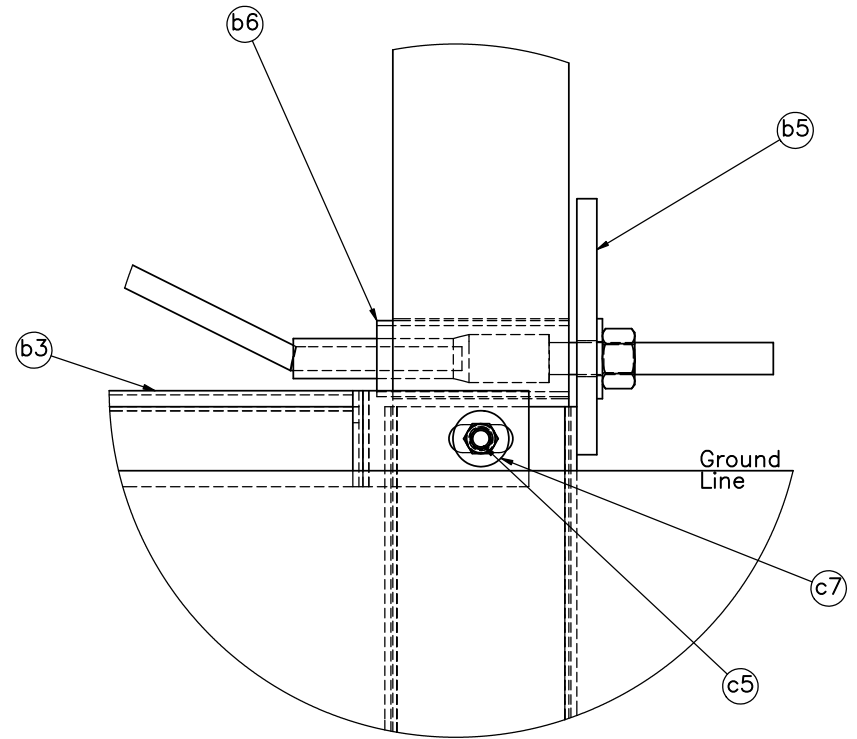
DATE:
10/4/2016

DRAWN BY:
SDB/JGP/
DTM

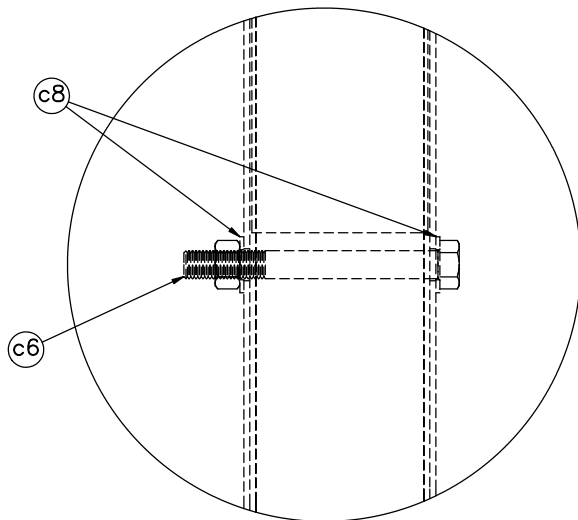
REV. BY:
KAL/SKR/
JCH/RKF



DETAIL H



DETAIL I



DETAIL J



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

BCT Anchor Details

DWG. NAME:
MGS_LSW_R10

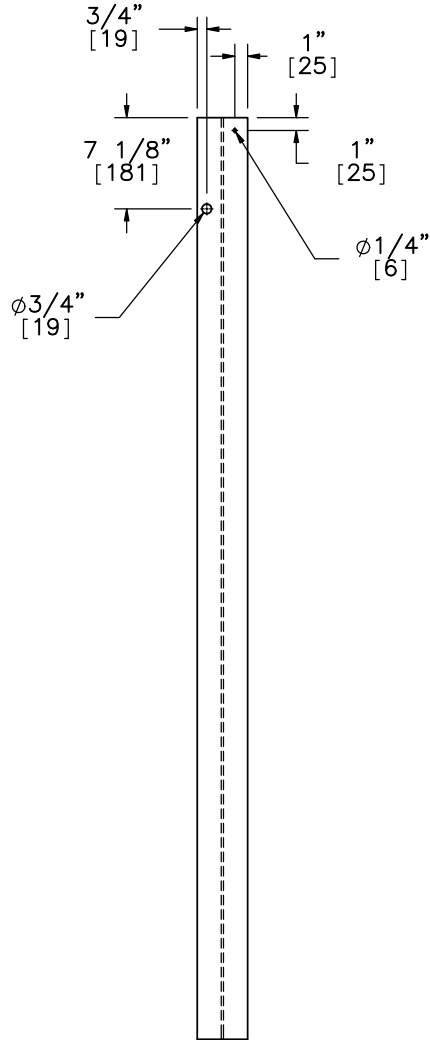
SCALE: 1:6
UNITS: Inches

SHEET:
8 of 22

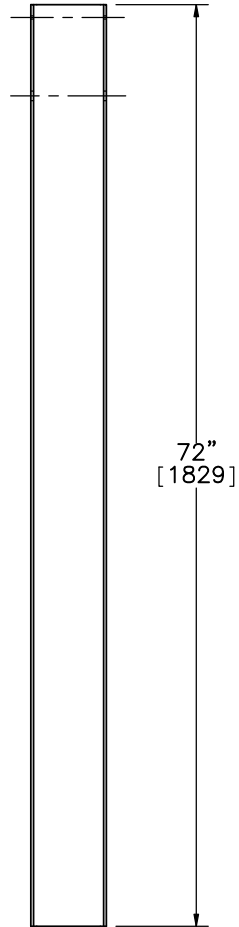
DATE:
10/4/2016

DRAWN BY:
SDB/JGP/
DTM

REV. BY:
KAL/SKR/
JCH/RKF

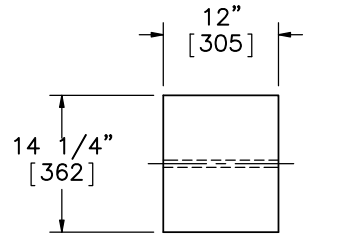


ELEVATION VIEW

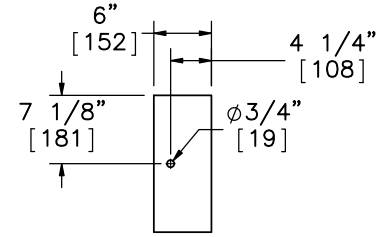


PROFILE VIEW

Part a1

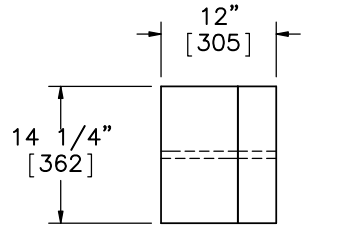


ELEVATION VIEW

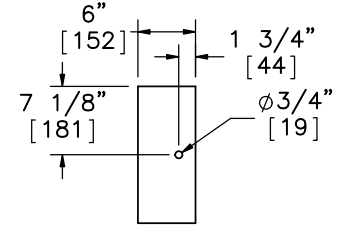


PROFILE VIEW

Part a2

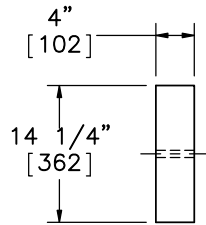


ELEVATION VIEW

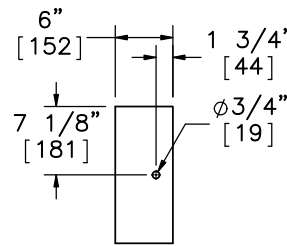


PROFILE VIEW

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

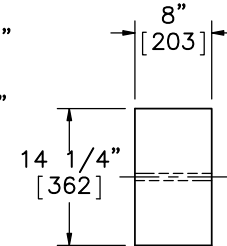


ELEVATION VIEW

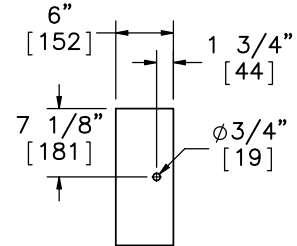


PROFILE VIEW

6"x4"x14 1/4"
 [152x102x362] Blockout



ELEVATION VIEW



PROFILE VIEW

6"x8"x14 1/4"
 [152x203x362] Blockout



Midwest Roadside
 Safety Facility

31'-3" MGS Long Span
 with UBSP

Post Nos. 3-10 and 17-23
 Components

DWG. NAME:
 MGS_LSW_R10

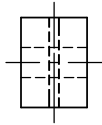
SCALE: 1:20
 UNITS: Inches

SHEET:
 9 of 22

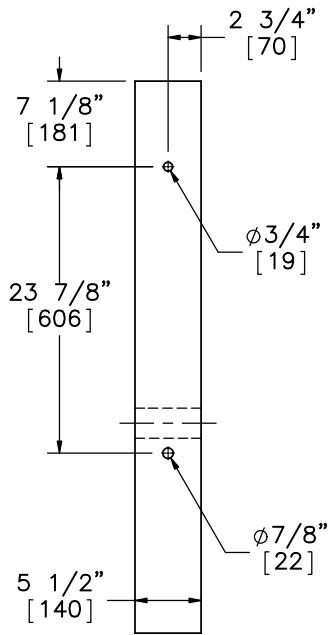
DATE:
 10/4/2016

DRAWN BY:
 SDB/JGP/
 DTM

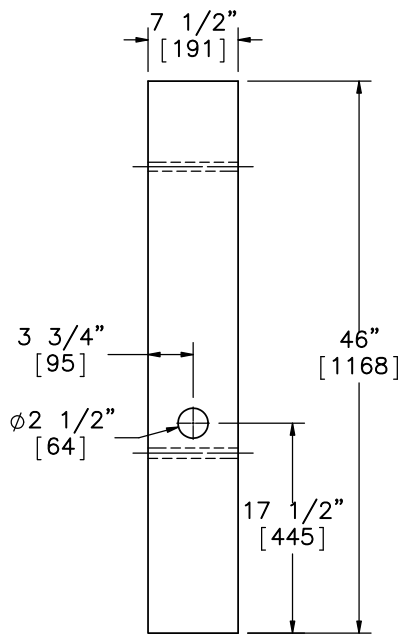
REV. BY:
 KAL/SKR/
 JCH/RKF



PLAN VIEW

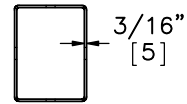


ELEVATION VIEW

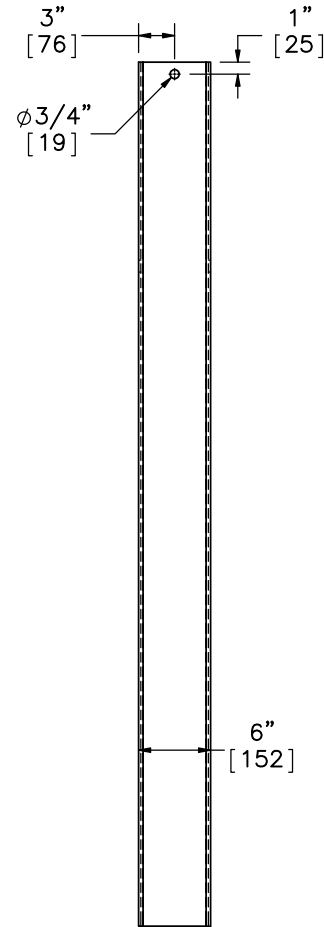


PROFILE VIEW

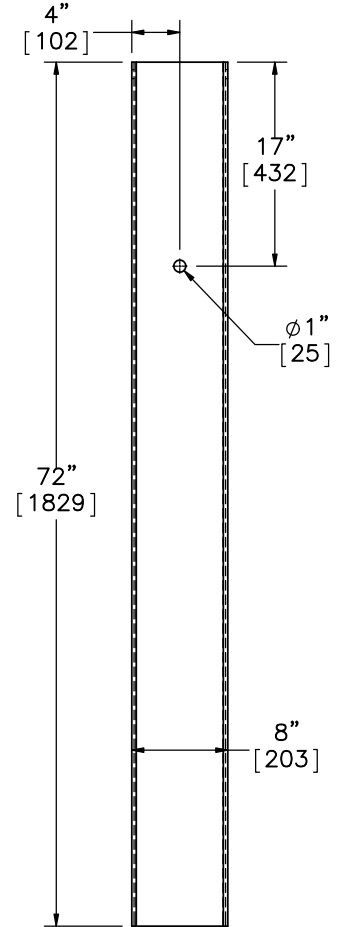
Part b1



PLAN VIEW



ELEVATION VIEW



PROFILE VIEW

Part b2



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

BCT Timber Post &
Foundation Tube Details

DWG. NAME:
MGS_LSW_R10

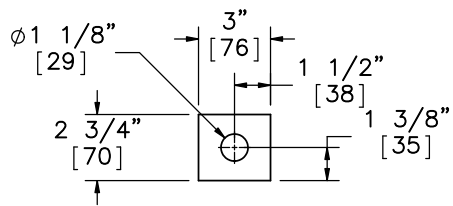
SCALE: 1:16
UNITS: Inches

SHEET:
10 of 22

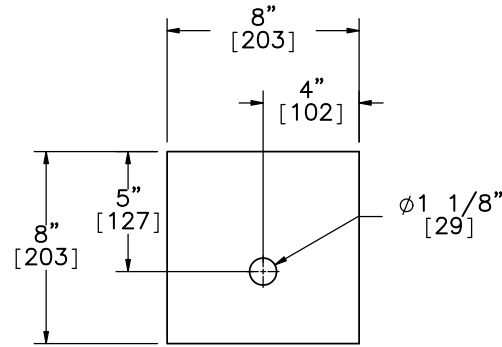
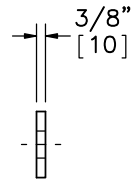
DATE:
10/4/2016

DRAWN BY:
SDB/JGP/
DTM

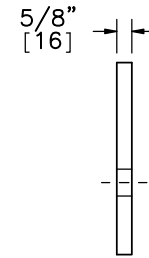
REV. BY:
KAL/SKR/
JCH/RKF



Anchor Bracket End Plate

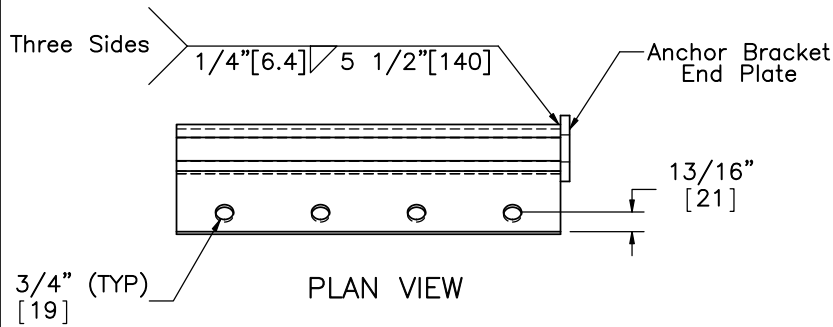


ELEVATION VIEW

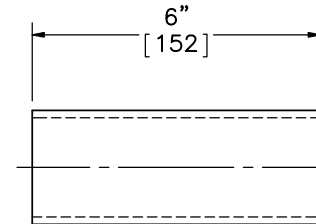


PROFILE VIEW

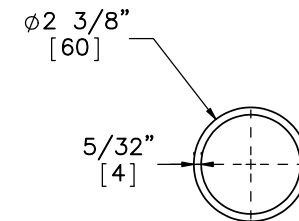
Part b5



PLAN VIEW

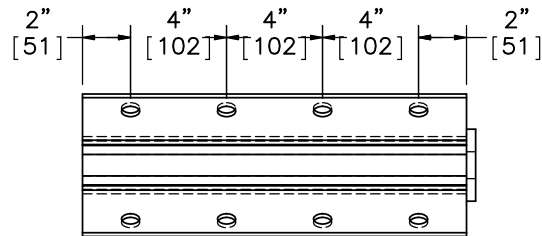


ELEVATION VIEW

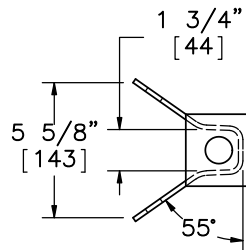


PROFILE VIEW

Part b6
SCALE 1:4



ELEVATION VIEW



PROFILE VIEW

Part b4



Midwest Roadside Safety Facility

31'-3" MGS Long Span with UBSP

BCT Post Components & Anchor Bracket

DWG. NAME:
MGS_LSW_R10

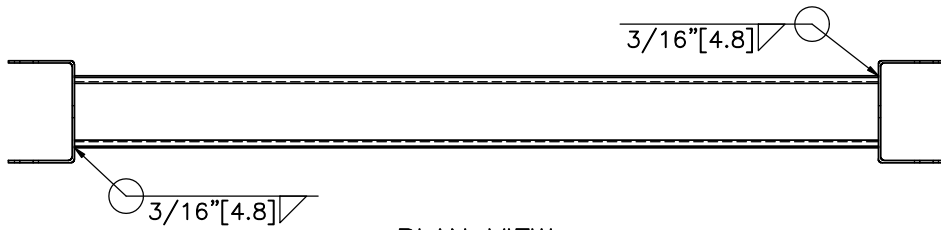
SCALE: 1:8
UNITS: Inches

SHEET:
11 of 22

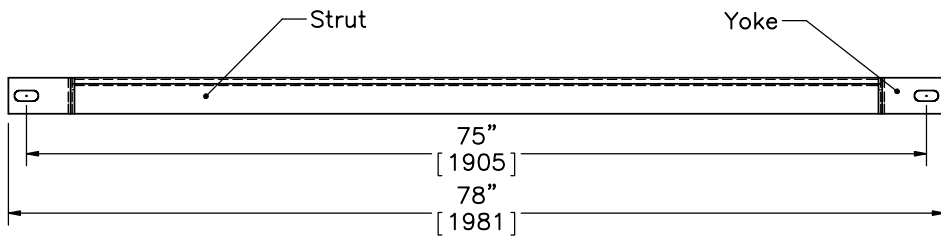
DATE:
10/4/2016

DRAWN BY:
SDB/JGP/DTM

REV. BY:
KAL/SKR/JCH/RKF

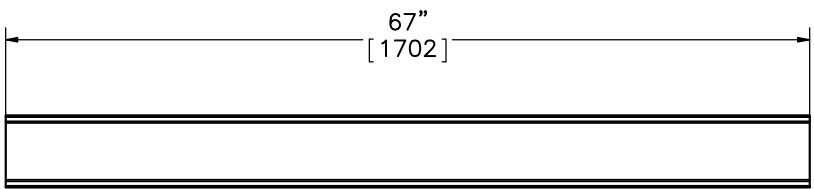


PLAN VIEW



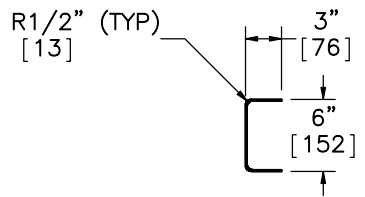
ELEVATION VIEW

Part b3

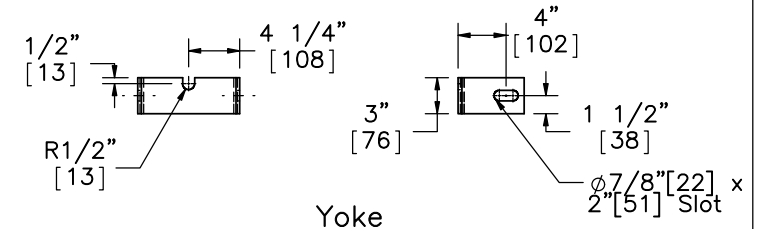
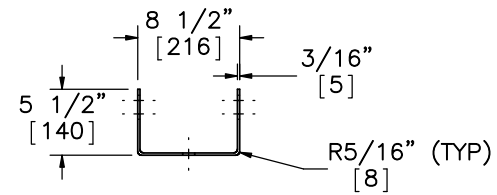


ELEVATION VIEW

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



PROFILE VIEW



Yoke



Midwest Roadside Safety Facility

31'-3" MGS Long Span with UBSP

Ground Strut Details

DWG. NAME: MGS_LSW_R10

SCALE: 1:16

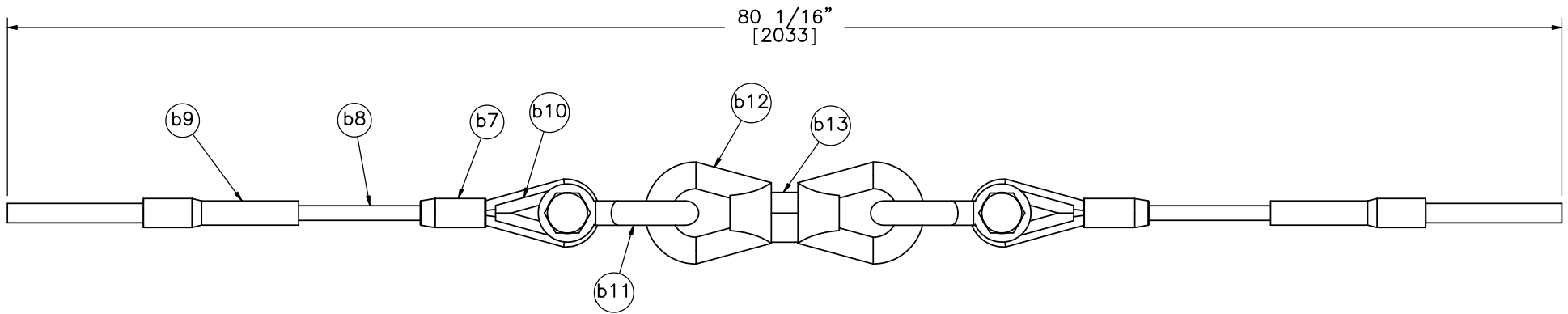
UNITS: Inches

SHEET: 12 of 22

DATE: 10/4/2016


DRAWN BY: SDB/JGP/DTM

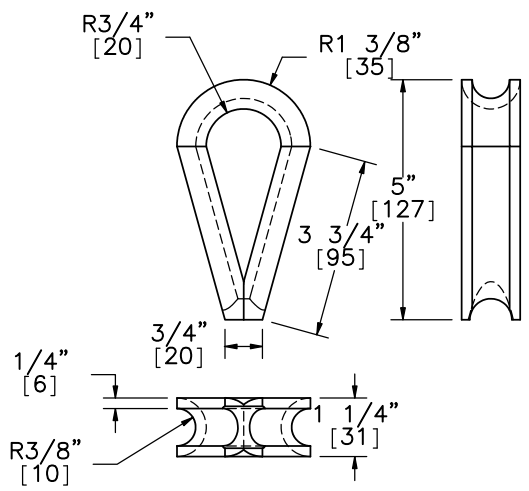
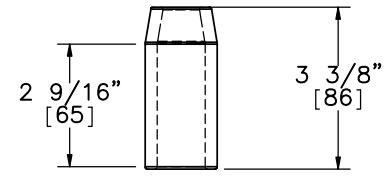
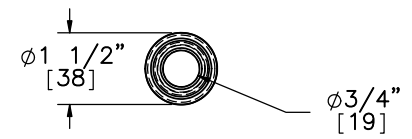
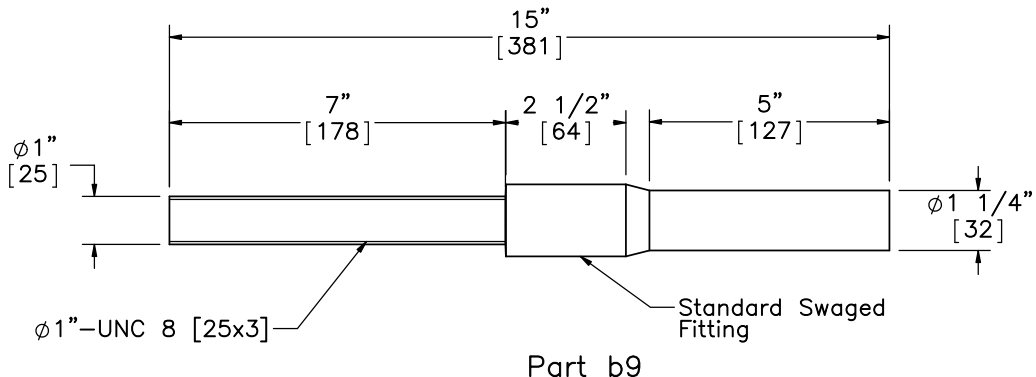
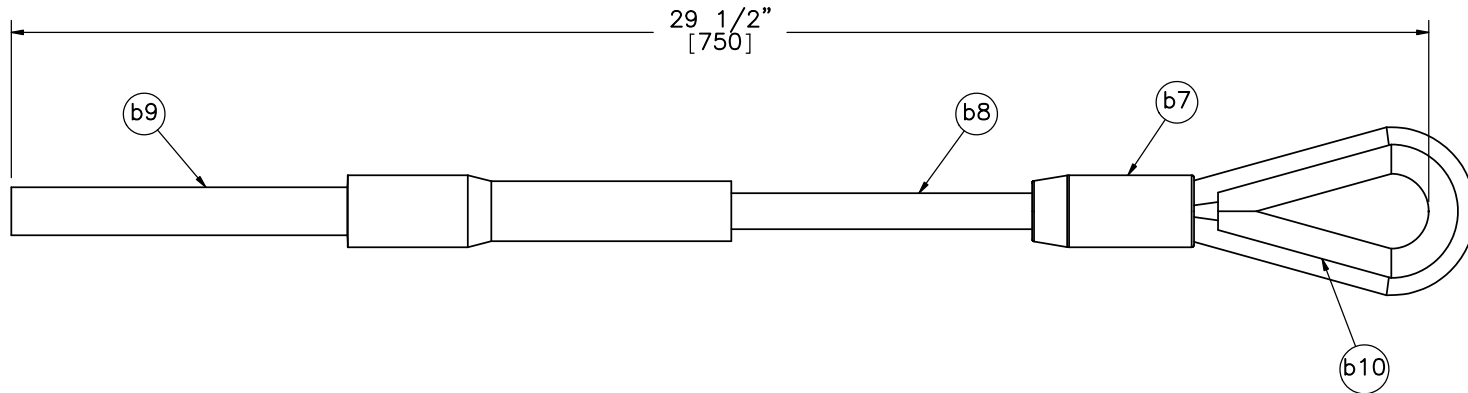
REV. BY: KAL/SKR/JCH/RKF




Modified BCT Cable with Load Cell Assembly

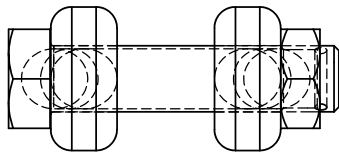
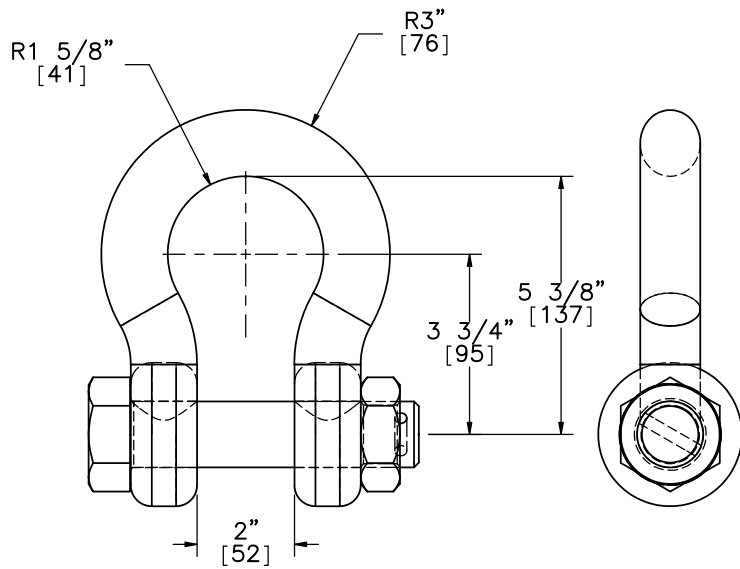
- Notes: (1) 6x25 IWRC IPS cables meet the minimum breaking strength of 42.7 kips [190 kN] and may be substituted for the 6x19 IWRC IPS cables.
- (2) The modified BCT cable was used for testing purposes in lieu of a standard BCT cable.

	31'-3" MGS Long Span with UBSP		SHEET: 13 of 22
	Modified BCT Cable with Load Cell Assembly		DATE: 10/4/2016
DWG. NAME: MGS_LSW_R10	SCALE: 1:8 UNITS: Inches	REV. BY: KAL/SKR/ JCH/RKF	
Midwest Roadside Safety Facility			

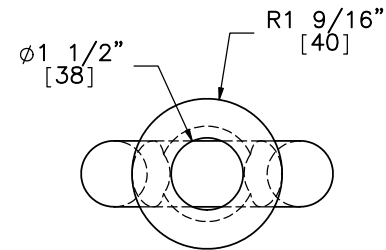
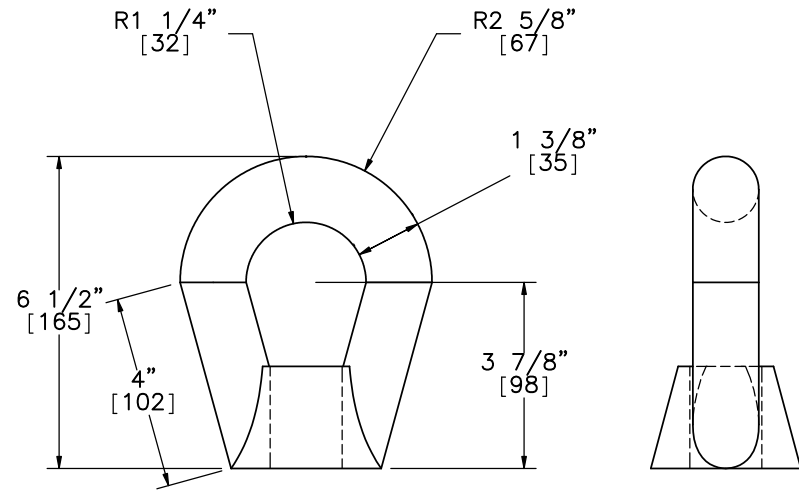


Note: (1) Dimensions are not necessarily representative of the part; see final part for actual dimensions

	31'-3" MGS Long Span with UBSP		SHEET: 14 of 22
	Modified BCT Cable		DATE: 10/4/2016
Midwest Roadside Safety Facility	DWG. NAME: MGS_LSW_R10	SCALE: 1:4 UNITS: Inches	DRAWN BY: SDB/JGP/DTM REV. BY: KAL/SKR/JCH/RKF



Part b11



Part b12



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

Shackle and Eye Nut

DWG. NAME:
MGS_LSW_R10

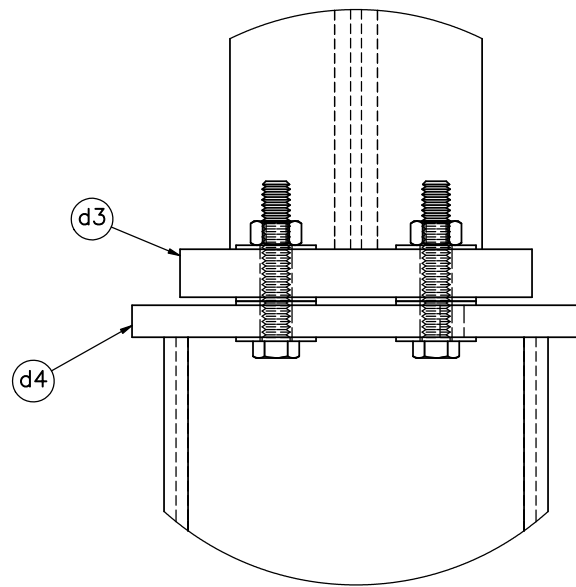
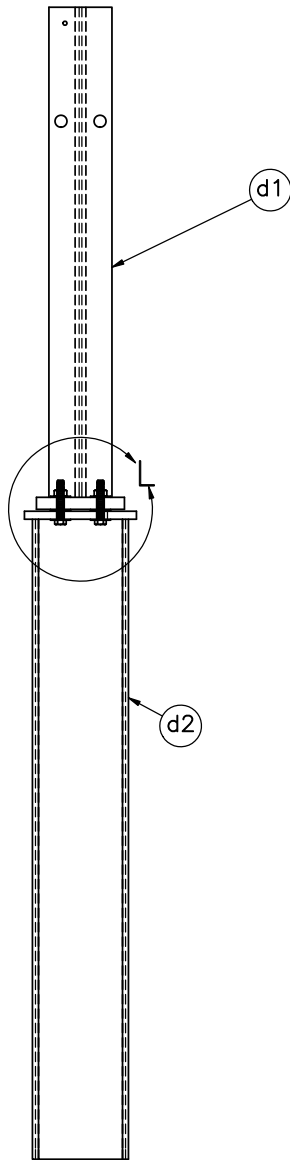
SCALE: 1:4
UNITS: Inches

SHEET:
15 of 22

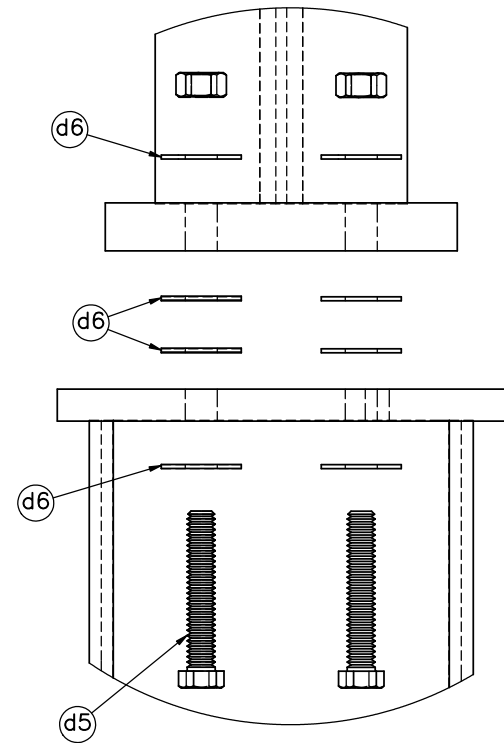
DATE:
10/4/2016

DRAWN BY:
SDB/JGP/
DTM

REV. BY:
KAL/SKR/
JCH/RKF



DETAIL L
SCALE 1 : 3



DETAIL L
(EXPLODED)
SCALE 1 : 3

Universal Breakaway Steel Post
Post Nos. 11-16
ELEVATION VIEW

Note: (1) Vertical through-bolts, Part d5, are to be torqued to approximately 60-75 ft-lb [81.3-101.7 N-m] for ASTM A325 grade bolts.



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

UBSP Post and Component
Details

DWG. NAME:
MGS_LSW_R10

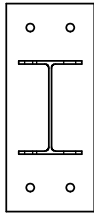
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SHEET:
16 of 22

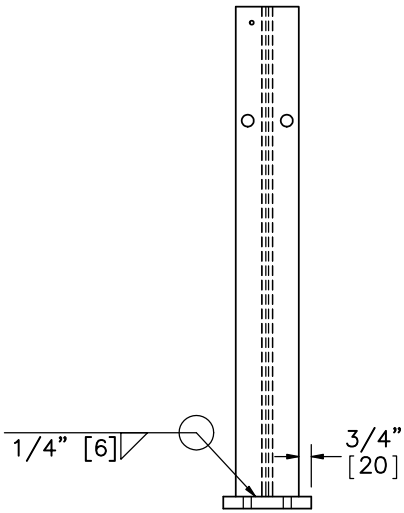
DATE:
10/4/2016

DRAWN BY:
SDB/JGP/
DTM

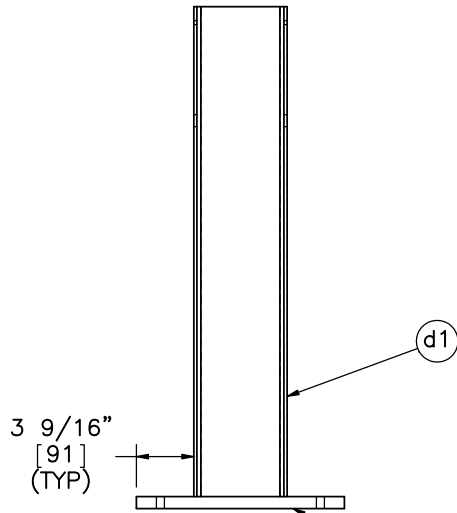
REV. BY:
KAL/SKR/
JCH/RKF



PLAN VIEW

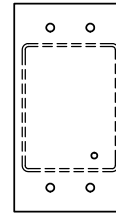


ELEVATION VIEW

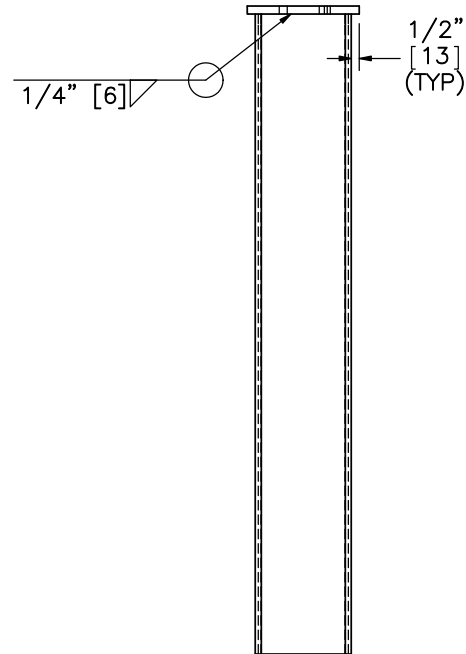


PROFILE VIEW

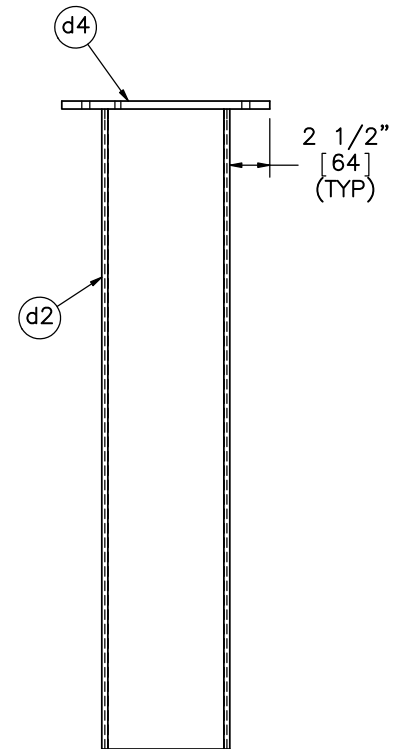
Universal Breakaway Steel Post
Upper Post Assembly



PLAN VIEW



ELEVATION VIEW



PROFILE VIEW

Universal Breakaway Steel Post
Lower Post Assembly



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

Upper and Lower Post
Assembly Details

DWG. NAME:
MGS_LSW_R10

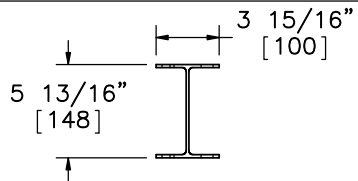
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SHEET:
17 of 22

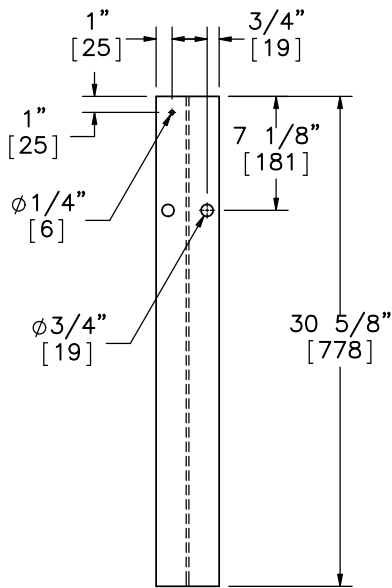
DATE:
10/4/2016

DRAWN BY:
SDB/JGP/
DTM

REV. BY:
KAL/SKR/
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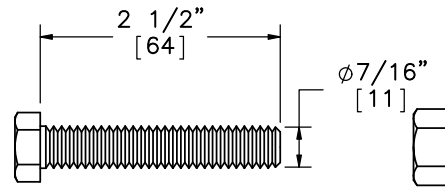


PLAN VIEW



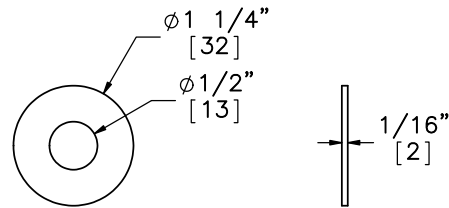
ELEVATION VIEW

Part d1



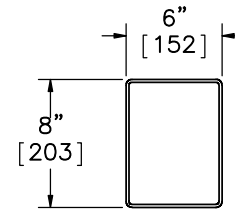
ELEVATION VIEW

Part d5

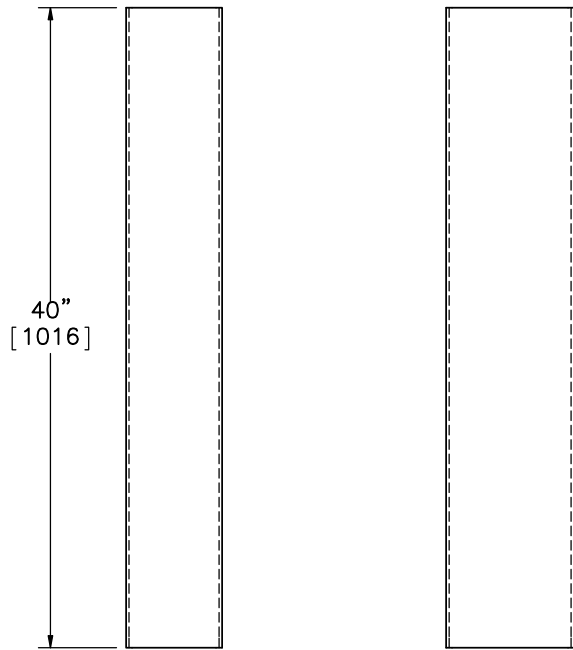


ELEVATION VIEW PROFILE VIEW

Part d6



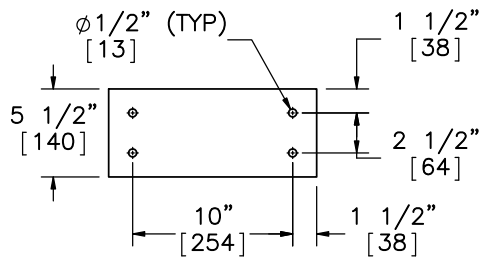
PLAN VIEW



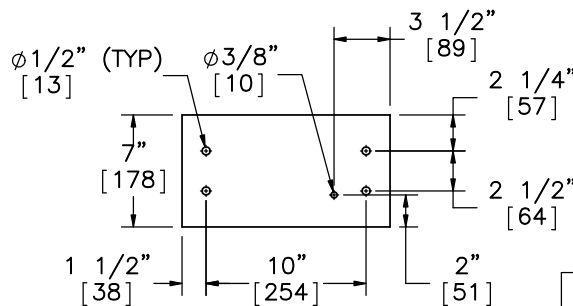
ELEVATION VIEW

PROFILE VIEW

Part d2



Part d3



Part d4

Note: (1) $\phi 3/8$ " [10] Weep Hole is to be drilled in the steel plate (Part d4) to allow for draining of the hot zinc coating during the galvanization process.



Midwest Roadside Safety Facility

31'-3" MGS Long Span with UBSP

UBSP Component Details

DWG. NAME:
MGS_LSW_R10

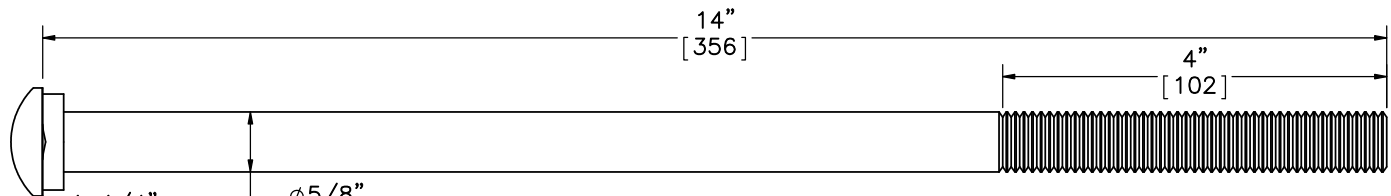
SCALE: 1:12
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SHEET:
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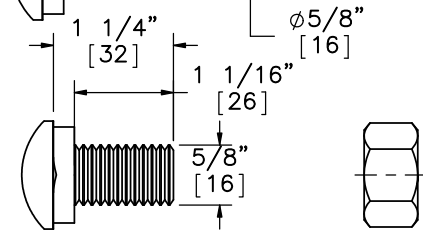
DATE:
10/4/2016

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DTM

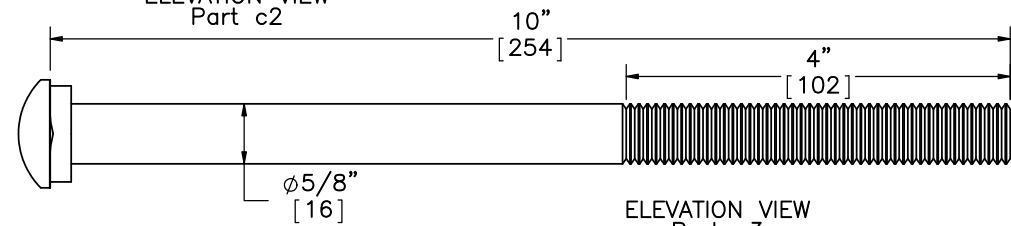
REV. BY:
KAL/SKR/
JCH/RKF



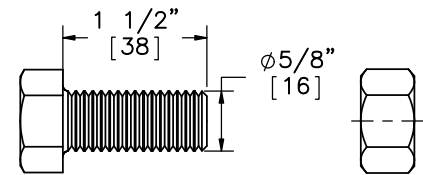
ELEVATION VIEW
Part c1



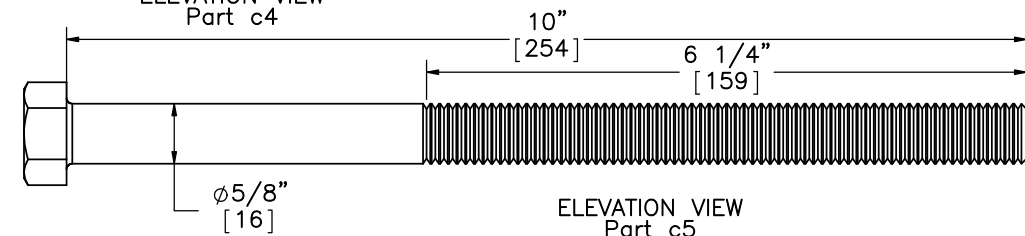
ELEVATION VIEW
Part c2



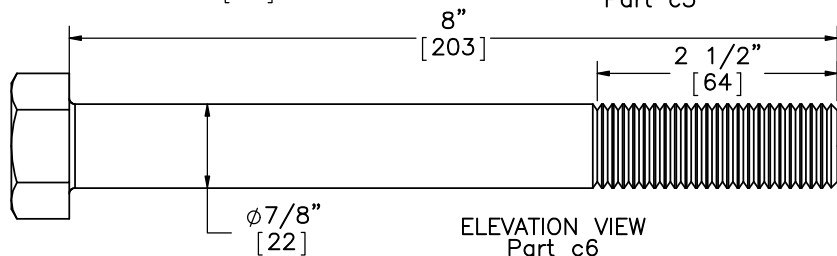
ELEVATION VIEW
Part c3



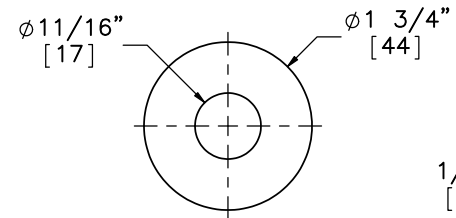
ELEVATION VIEW
Part c4



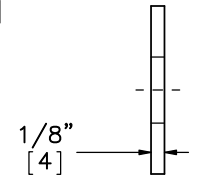
ELEVATION VIEW
Part c5



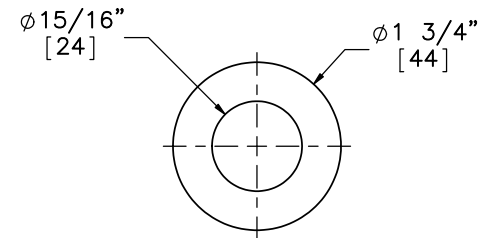
ELEVATION VIEW
Part c6



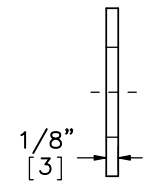
ELEVATION VIEW
Part c7



PROFILE VIEW



ELEVATION VIEW
Part c8



PROFILE VIEW



Midwest Roadside
Safety Facility

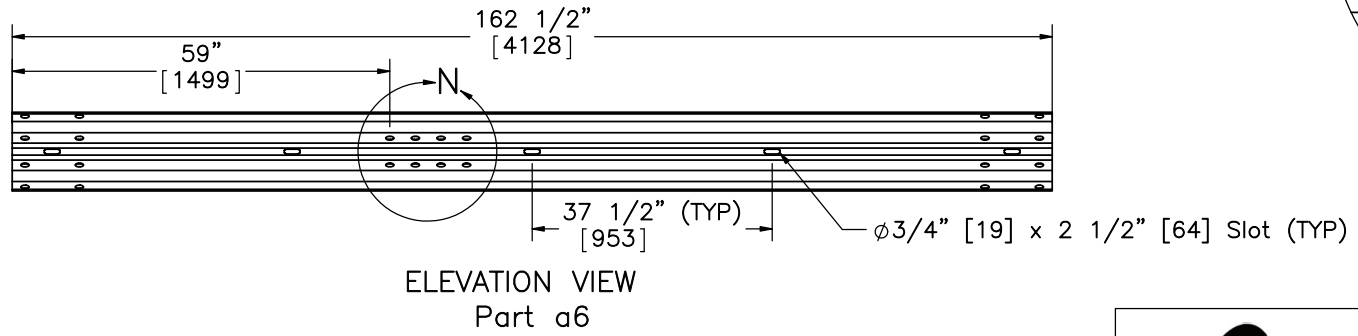
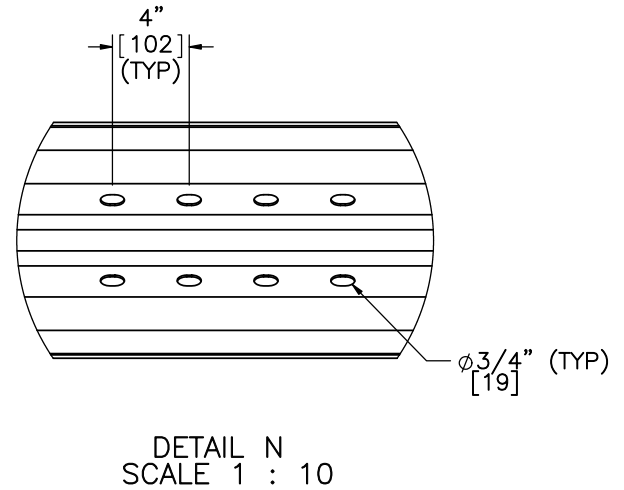
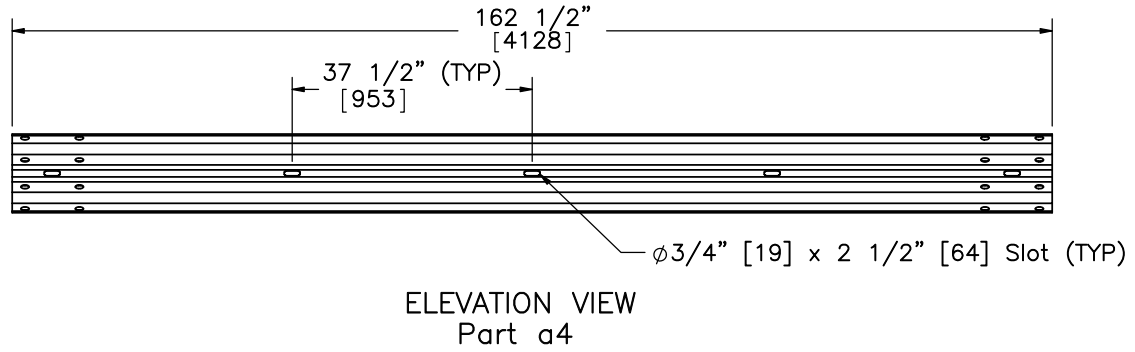
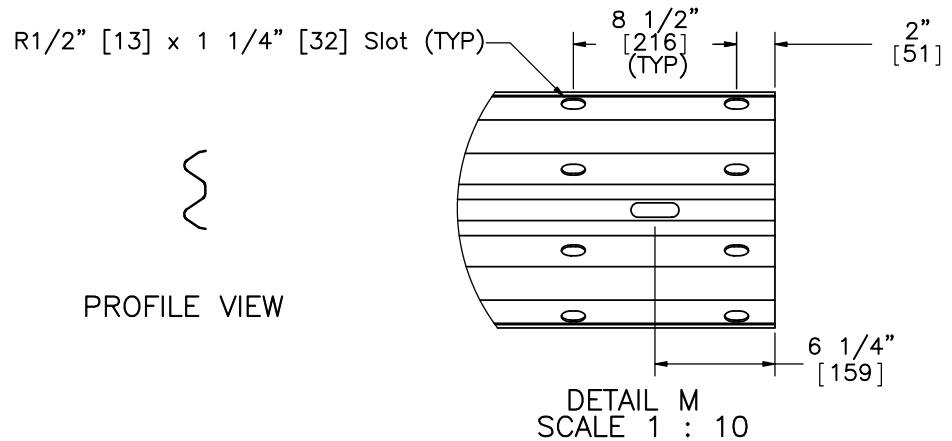
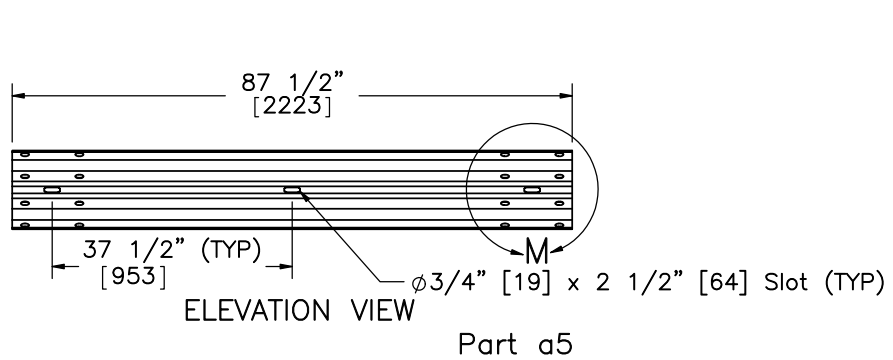
31'-3" MGS Long Span
with UBSP

Fasteners

DWG. NAME:
MGS_LSW_R10

SCALE: 1:8
UNITS: Inches

SHEET:
19 of 22
DATE:
10/4/2016
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Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

Rail Section Details

DWG. NAME:
MGS_LSW_R10

SCALE: 1:30
UNITS: Inches

SHEET:
20 of 22

DATE:
10/4/2016

DRAWN BY:
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JCH/RKF

Item No.	QTY.	Description	Material Specification	Hardware Guide Designation
a1	15	W6x8.5 [W152x12.6] or W6x9 [W152x13.4], 72" Long [1829] Steel Post	ASTM A992 Steel Galv., ASTM A36 Steel Galv.	PWE06
a2	21	6x12x14 1/4" [152x305x368] Timber Blockout for Steel Posts	SYP Grade No.1 or better	PDB10a-b
a3	21	16D Double Head Nail	-	-
a4	12	12'-6" [3810] W-Beam MGS Section	12 gauge [2.7] AASHTO M180 Galv.	RWM04a
a5	1	6'-3" [1905] W-Beam MGS Section	12 gauge [2.7] AASHTO M180 Galv.	-
a6	2	12'-6" [3810] W-Beam MGS End Section	12 gauge [2.7] AASHTO M180 Galv.	-
b1	4	BCT Timber Post - MGS Height	SYP Grade No. 1 or better (No knots, 18" [457] above or below ground tension face)	-
b2	4	72" [1829] Long Foundation Tube	ASTM A500 Grade B Galv.	PTE06
b3	2	Strut and Yoke Assembly	ASTM A36 Steel Galv.	-
b4	2	Anchor Bracket Assembly	ASTM A36 Steel Galv.	FPA01
b5	2	8"x8"x5/8" [203x203x16] Anchor Bearing Plate	ASTM A36 Steel Galv.	FPB01
b6	2	2 3/8" [60] O.D. x 6" Long [152] BCT Post Sleeve	ASTM A53 Grade B Schedule 40 Galv.	FMM02
b7	4	115-HT Mechanical Splice - 3/4" [19] Dia.	As Supplied	-
b8	4	3/4" [190] Dia. 6x19 IWRC IPS Wire Rope	IPS Galvanized	-
b9	4	BCT Anchor Cable End Swage Fitting	Grade 5 - Galvanized	-
b10	4	Crosby Heavy Duty HT-3/4" [19] Dia. Cable Thimble	Stock No. 1037773 - Galvanized	-
b11	4	Crosby G2130 or S2130 Bolt Type Shackle - 1 1/4" [32] Dia. with thin head bolt, nut, and cotter pin, Grade A, Class 3	Stock Nos. 1019597 and 1019604 - As Supplied	-
b12	4	Chicago Hardware Drop Forged Heavy Duty Eye Nut - Drilled and Tapped 1 1/2" [38] Dia. - UNF 12 [M36]	As Supplied, Stock No. 107	-
b13	2	TLL-50K-PTB Load Cell	N/A	-
c1	21	5/8" [16] Dia. UNC, 14" [356] Long Guardrail Bolt and Nut	Bolt ASTM A307 Grade A Galv., Nut ASTM A563 A Galv.	FBB06
c2	112	5/8" [16] Dia. UNC, 1 1/4" [32] Guardrail Bolt and Nut	Bolt ASTM A307 Grade A Galv., Nut ASTM A563 A Galv.	FBB01
c3	4	5/8" [16] Dia. UNC, 10" [254] Long Guardrail Bolt and Nut	Bolt ASTM A307 Grade A Galv., Nut ASTM A563 A Galv.	FBB03
c4	16	5/8" [16] Dia. UNC, 1 1/2" [38] Long Hex Head Bolt and Nut	Bolt ASTM A307 Grade A Galv., Nut ASTM A563 A Galv.	FBX16a
c5	4	5/8" [16] Dia. UNC, 10" [254] Long Hex Head Bolt and Nut	Bolt ASTM A307 Grade A Galv., Nut ASTM A563 A Galv.	FBX16a
c6	4	7/8" [22] Dia. UNC, 8" [203] Long Hex Head Bolt and Nut	Bolt ASTM A307 Grade A Galv., Nut ASTM A563 A Galv.	-
c7	44	5/8" [16] Dia. Plain Round Washer	ASTM F844 Galv.	FWC14a
c8	8	7/8" [22] Dia. Plain Round Washer	ASTM F844 Galv.	-



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

Bill of Materials

DWG. NAME:
MGS_LSW_R10

SCALE: None
UNITS: Inches

SHEET:
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DATE:
10/4/2016

DRAWN BY:
SDB/JGP/
DTM

REV. BY:
KAL/SKR/
JCH/RKF

Item No.	QTY.	Description	Material Specification	Hardware Guide Designation
d1	6	W6x8.5 [W152x12.6] or W6x9 [W152x13.4], 30 5/8" [778] Long Steel Post	ASTM A992 Steel Galv.	PWE11
d2	6	6"x8"x3/16" [152x203x5], 40" [1016] Long Steel Tube	ASTM A500 Steel Grade B Galv.	PTE08
d3	6	13"x5 1/2"x3/4" [330x140x19] Upper Base Plate	ASTM A36 Steel Galv.	PWE11
d4	6	13"x7"x1/2" [330x178x13] Lower Base Plate	ASTM A36 Steel Galv.	PTE08
d5	24	7/16" [11] Dia. UNC, 2 1/2" [64] Long Hex Tap Bolt (Fully Threaded) and Nut	Bolt SAE J449 Grade 5/ASTM A325 Galv., Nut ASTM A563DH Galv.	—
d6	96	7/16" [11] Dia. Plain Round Washer	ASTM F844 Galv., ASTM F436 Type 1 Galv.	—
e1	6	#4 Bar – Longitudinal – 345" [8763] long	Grade 60 Steel	—
e2	8	#4 Bar – Bent Longitudinal – 80" [2032] long	Grade 60 Steel	—
e3	4	#4 Bar – Bent Longitudinal – 50" [1270] long	Grade 60 Steel	—
e4	16	#4 Bar – Stirrup – 93" [2362] long	Grade 60 Steel	—
e5	2	#4 Bar – Stirrup – 75" [1905] long	Grade 60 Steel	—
e6	—	Concrete	Minimum f'c=4000 psi	—
e7	3	36" [914] Dia., 36" Long Unreinforced Concrete Footer	Minimum f'c=4000 psi	—



Midwest Roadside
Safety Facility

31'-3" MGS Long Span
with UBSP

Bill of Materials

DWG. NAME.
MGS_LSW_R10

SCALE: None
UNITS: Inches

SHEET:
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DATE:
10/4/2016

DRAWN BY:
SDB/JGP/
DTM

REV. BY:
KAL/SKR/
JCH/RKF

REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
R0	5/12/2014	-	Derived from MGS_Longspan_LSC-2_R2. Span lengthened by 6'-3". Three UBSP placed upstream and downstream of span.		SDB
R1	6/3/2014	1	Impact location changed to centerline of post no. 11. Entire system shifted so that the back face of the foundation tube is flush with the front face of the concrete headwall. Notes 1-4 changed.		SDB
		3	Note 1 added.		
		5	Shorter top bent and transverse rebar added to maintain the clear cover.		
		6	Shorter top bent and transverse rebar added to maintain the clear cover. Rebar quantities updated.		
		18	General dimension changes. Unnecessary dimensions removed.		
R2	6/4/2014	2	"Culvert Not Shown" note added.		SDB
R3	6/17/2014	1	System name specified. General dimensions added and/or clarified.		SDB
		2	General dimensions added and/or clarified.		
		3	General dimensions added and/or clarified.		
		4	Dimension tolerance changed to reflect realistic capabilities		
		5	Stirrups added in place of vertical rebar. Stirrup spacing corrected. Note 1 added.		
		6	Stirrups added in place of vertical rebar.		
		15	Upper post and base plate alignment fixed. Previous UBSP drawings were incorrectly dimensioned. 3 9/16" is the correct spacing. Weld corrected.		
		19	Part d3 and d4 name changed to base plate instead of shear plate.		
20	Rebar and concrete added				
R4	7/25/2014	19	Part d1 length corrected.		SDB
R5	8/4/2014	1	Note 6 added.		SDB
		7	BCT Load Cells added.		
		9	BCT Load Cells Specifications added.		
		10	BCT Load Cells Specifications added.		

R5	8/4/2014	11	BCT Load Cells Specifications added.		SDB
		22	Parts b7–b13 added (BCT Load Cells)		
R6	12/23/2014	–	Drawing title corrected.	JCH/RKF/ KAL	SDB
		2	Post location dimensions clarified.		
		3	Post location dimensions clarified. Note 1 Modified.		
		11	Part numbers corrected.		
		13	Part numbers corrected.		
		16	Note 1 modified.		
		18	Part d5 thread length corrected.		
		21	Part a1 description changed. Parts a1, c1–c6 material spec changed. Parts a5, a6, and b1 hardware guide designation corrected.		
22	Parts d1 and d2 description corrected. Parts d1–d4 and d6 material spec corrected.				
R7	12/23/2014	20	Slot dimension corrected.	KAL	SDB
R8	2/18/2015	3	Added 3' Dia., 36" long unreinforced concrete footer	KAL	JGP
R9	5/21/2015	7	Added note	KAL	ALL
		17	Added hole to upper post assembly		
R10	10/4/2016	1	Added notes.	KAL	DTM
		21	Deleted unnecessary rows.		
		22	Added hardware guide details. Deleted unnecessary rows.		