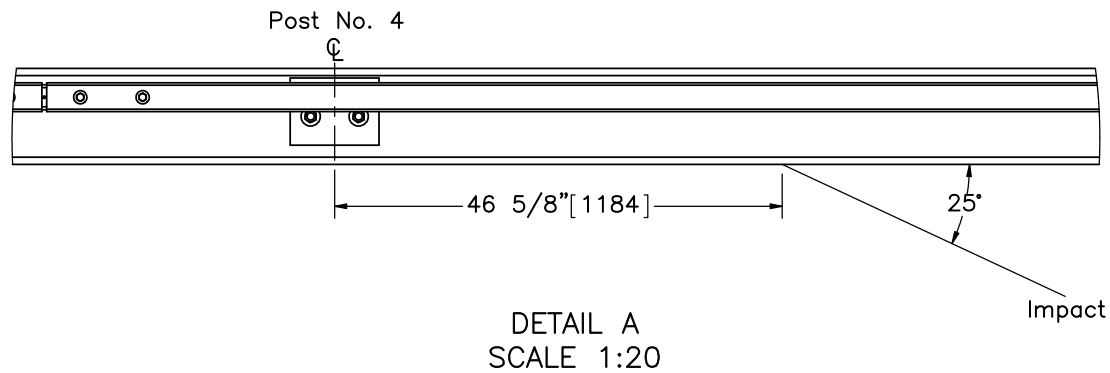
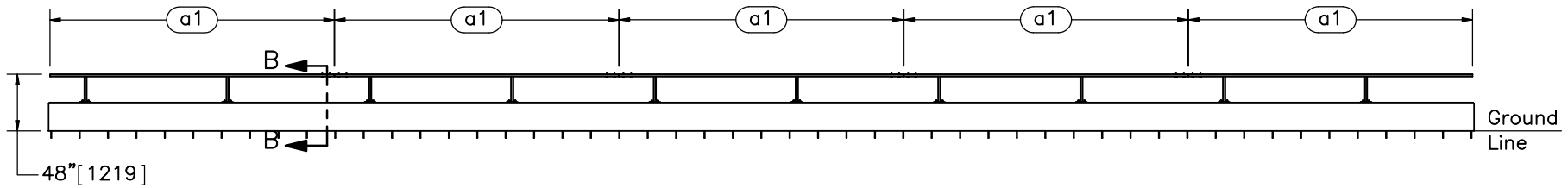
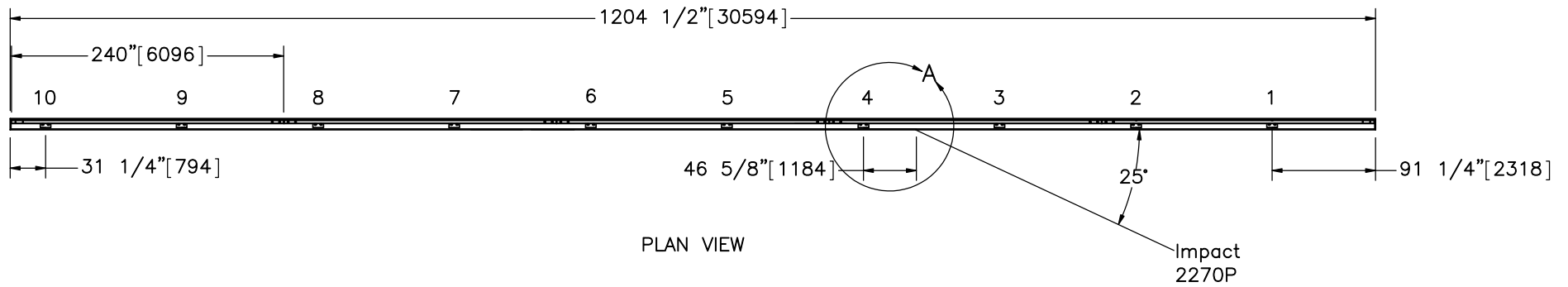
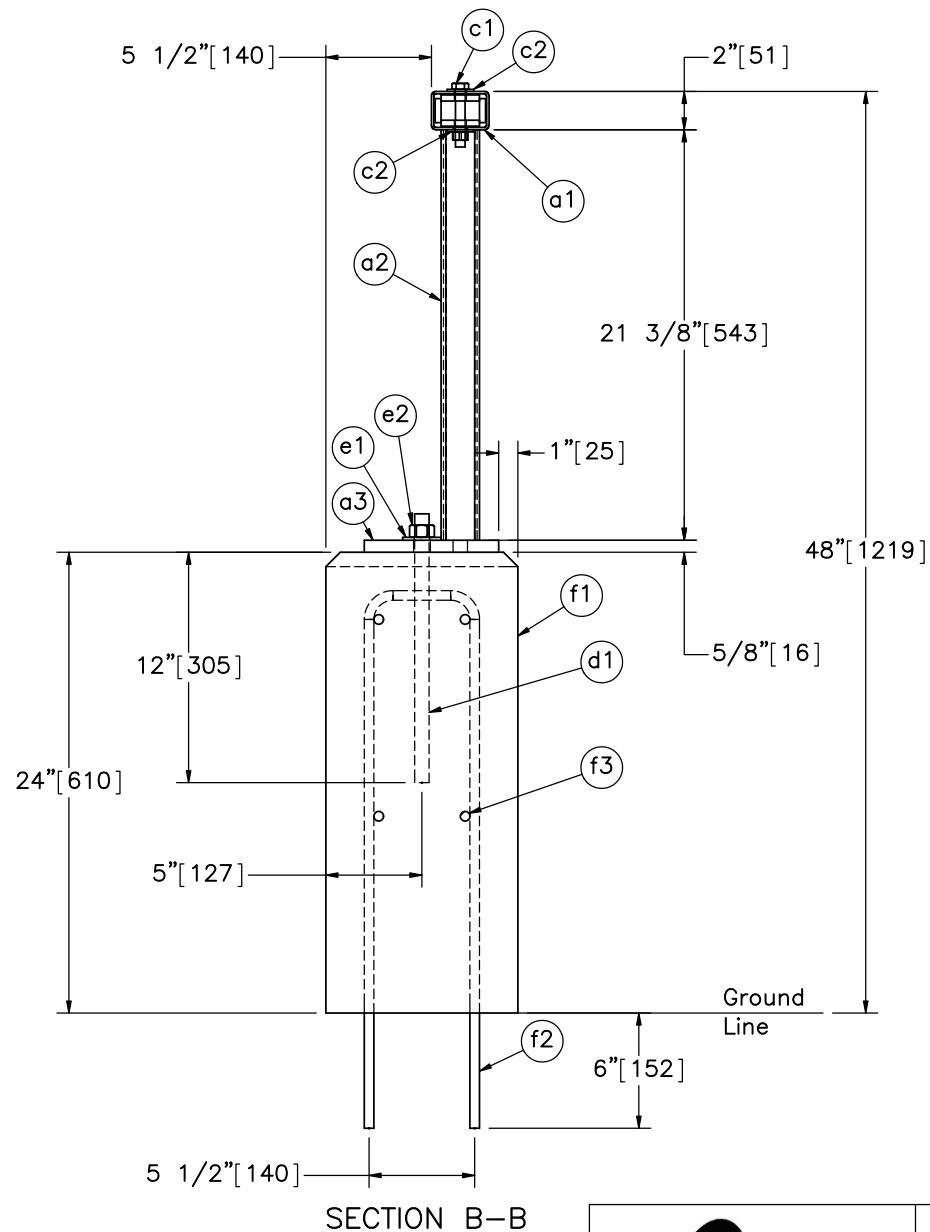




- Notes: (1) Test shall be performed according to test designation no. 2-11 using MASH 2016 criteria.
 (2) The impact location is 46 5/8" [1,184] upstream from centerline of post no. 4.

	Iowa Bicycle Rail Test No. IBBR-1		SHEET: 1 of 14
	System Layout		DATE: 8/23/2018
Midwest Roadside Safety Facility	DWG. NAME: IBBR-1_R14	SCALE: 1:140 UNITS: in.[mm]	DRAWN BY: JDJ/GRL/ JEK/MBD
			REV. BY: JEK/RWB/ CG/RKF



- Notes: (1) Reinforcement bar no. f2 is anchored into the existing tarmac with Hilti HIT-RE 500 V3 epoxy with a minimum bond strength of 1,560 psi [10.8 MPa].
(2) Threaded rod (part d1) is anchored into the concrete barrier with Hilti HIT-RE 500 V3 epoxy with a minimum bond strength of 1,560 psi [10.8 MPa].



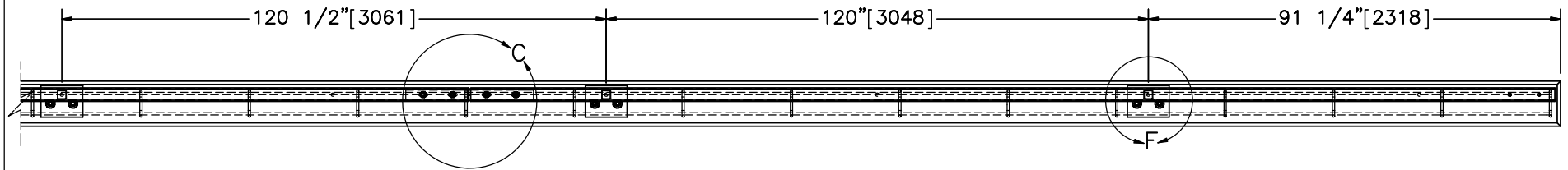
Iowa Bicycle Rail
Test No. IBBR-1

System Cross Section

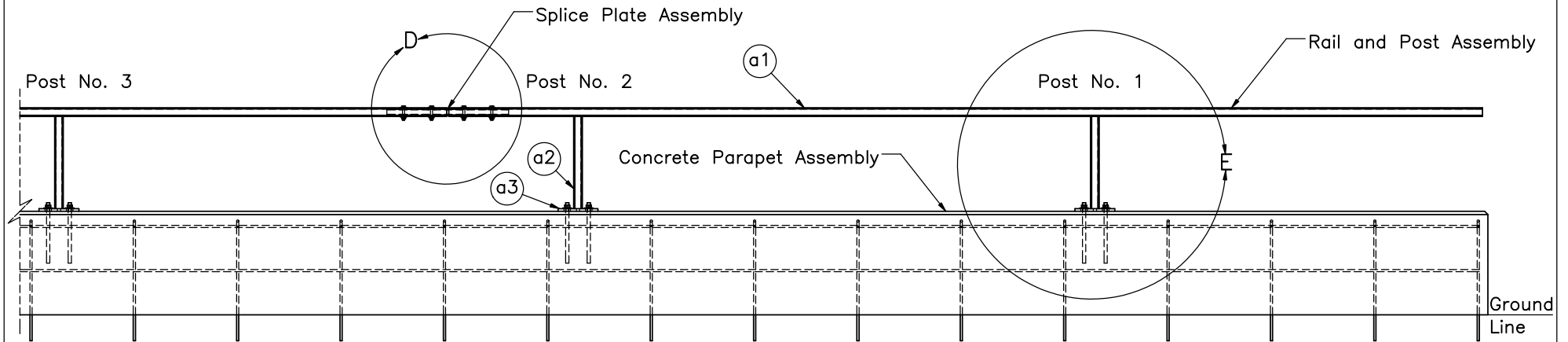
DWG. NAME.	IBBR-1_R14
------------	------------

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

SHEET:	2 of 14
DATE:	8/23/2018
DRAWN BY:	JDJ/GRL/ JEK/MBD
REV. BY:	JEK/RWB/ CG/RKF



PLAN VIEW



ELEVATION VIEW



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Rail and Concrete Parapet
Details

DWG. NAME.
IBBR-1_R14

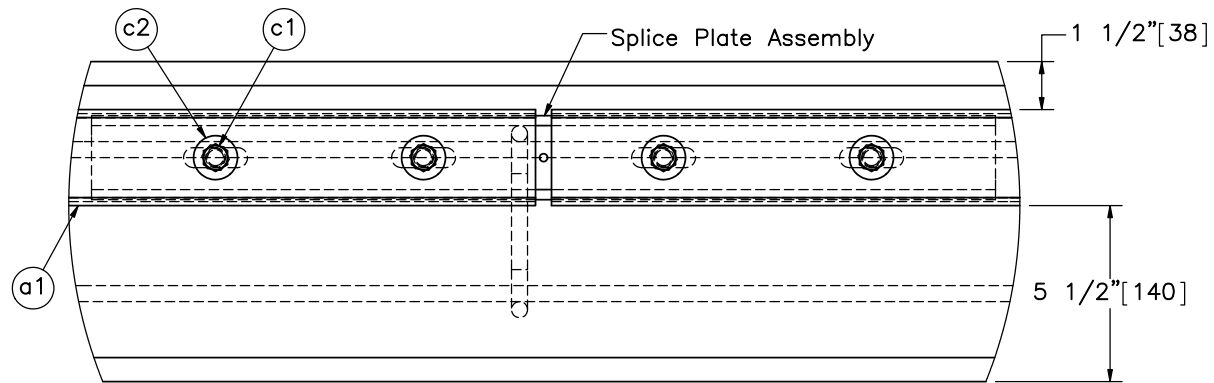
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UNITS: in.[mm]

SHEET:
3 of 14

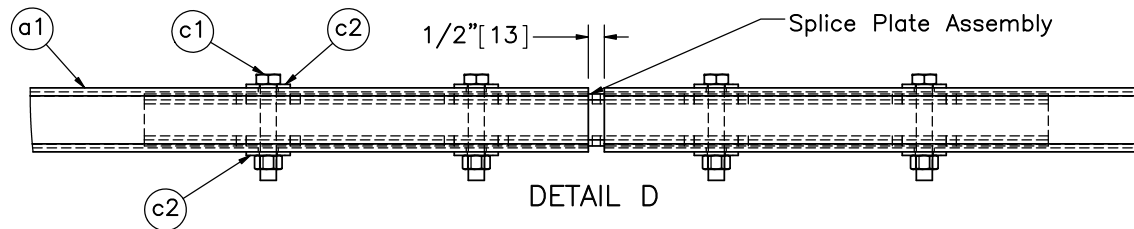
DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

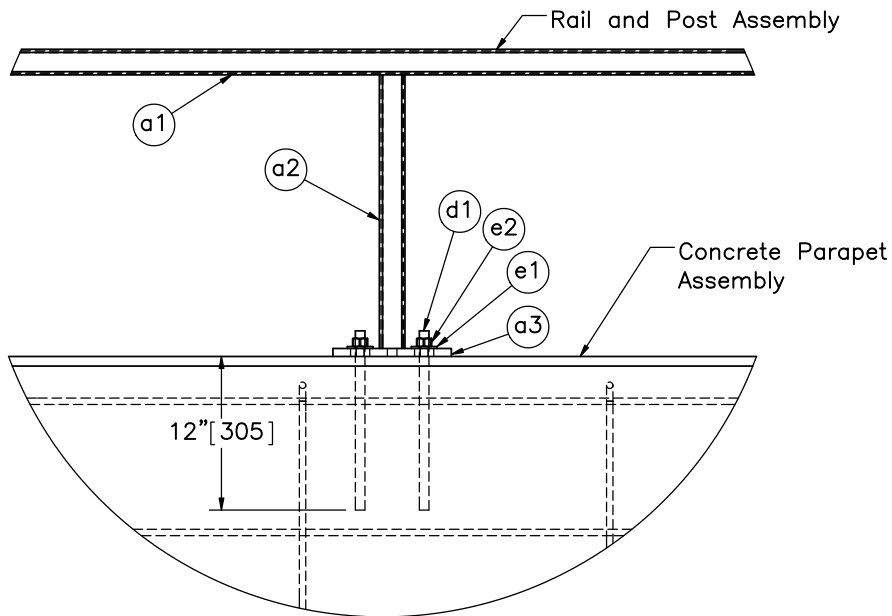
REV. BY:
JEK/RWB/
CG/RKF



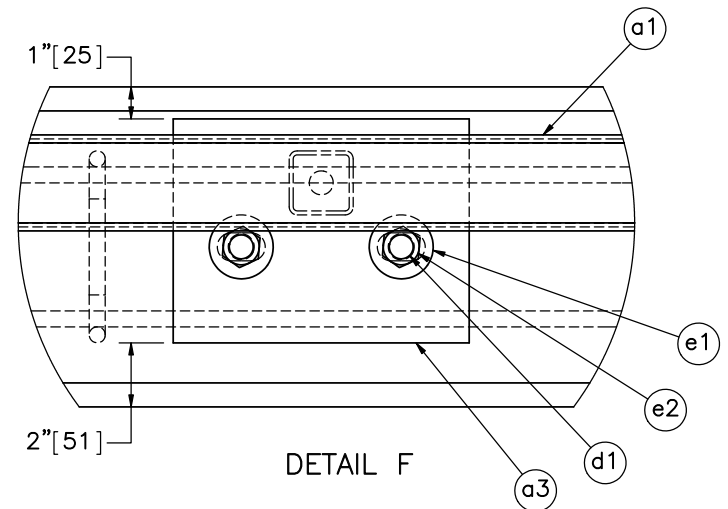
DETAIL C



DETAIL D



DETAIL E
SCALE 1:15



DETAIL F



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Rail and Concrete Parapet
Details

DWG. NAME:
IBBR-1_R14

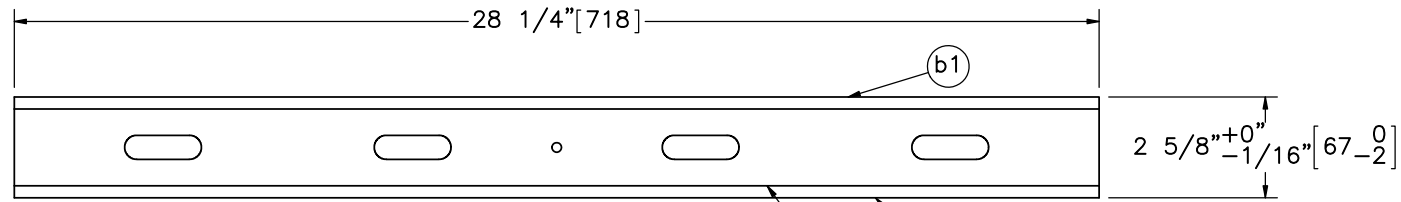
SCALE: 1:6
UNITS: in.[mm]

SHEET:
4 of 14

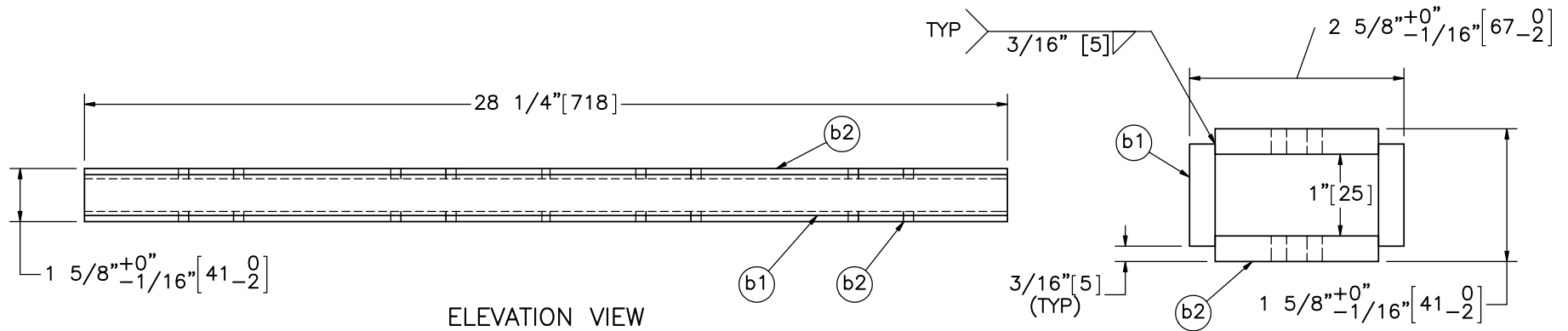
DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

REV. BY:
JEK/RWB/
CG/RKF



PLAN VIEW

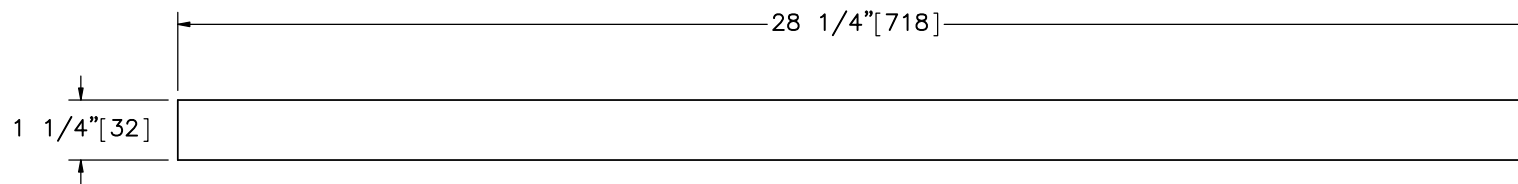


ELEVATION VIEW

Splice Tube

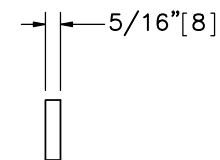
PROFILE VIEW
SCALE 1:2

Item No.	QTY.	Description	Material Specification	Treatment Specification	 Midwest Roadside Safety Facility	Iowa Bicycle Rail Test No. IBBR-1		SHEET: 5 of 14
-	4	Splice Plate Assembly	-	ASTM A123		Splice Plate Assembly		DATE: 8/23/2018
b1	2	28 1/4"x1 1/4"x5/16" [718x32x8] Plate	ASTM A572 Gr. 50	-	Midwest Roadside Safety Facility	DWG. NAME: IBBR-1_R14	SCALE: 1:5 UNITS: in.[mm]	DRAWN BY: JDJ/GRL/ JEK/MBD REV. BY: JEK/RWB/ CG/RKF
b2	2	28 1/4"x2"x5/16" [718x51x8] Plate	ASTM A572 Gr. 50	-				

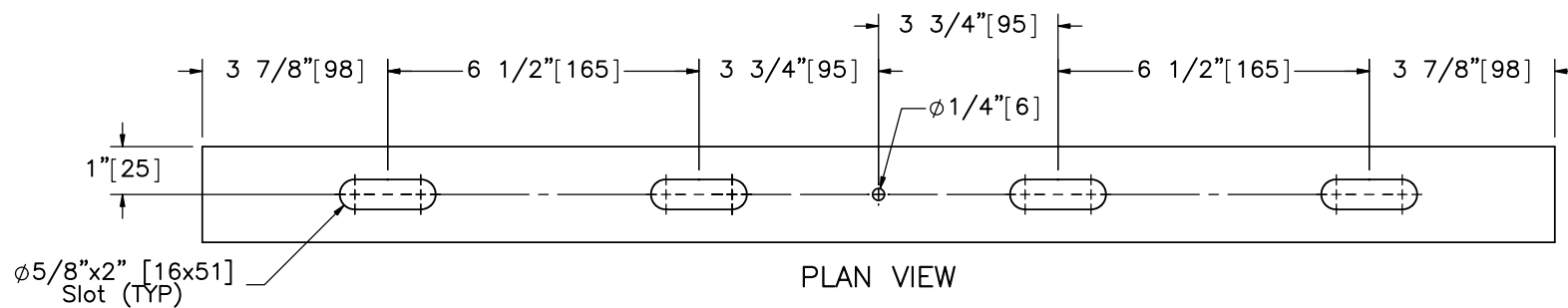


ELEVATION VIEW

Part b1



PROFILE VIEW

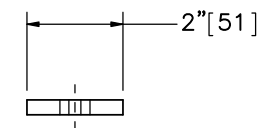


PLAN VIEW



ELEVATION VIEW

Part b2



PROFILE VIEW



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Splice Plate Component Details

DWG. NAME.
IBBR-1_R14

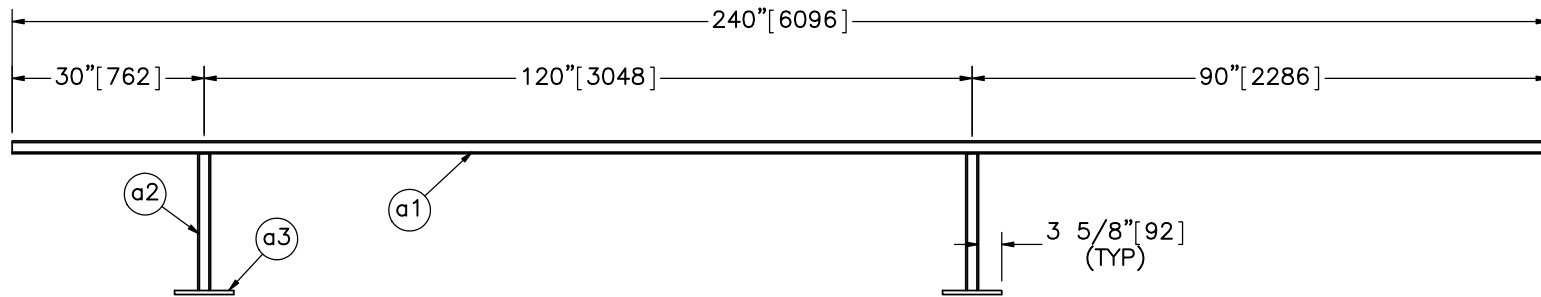
SCALE: 1:4
UNITS: in./mm

SHEET:
6 of 14

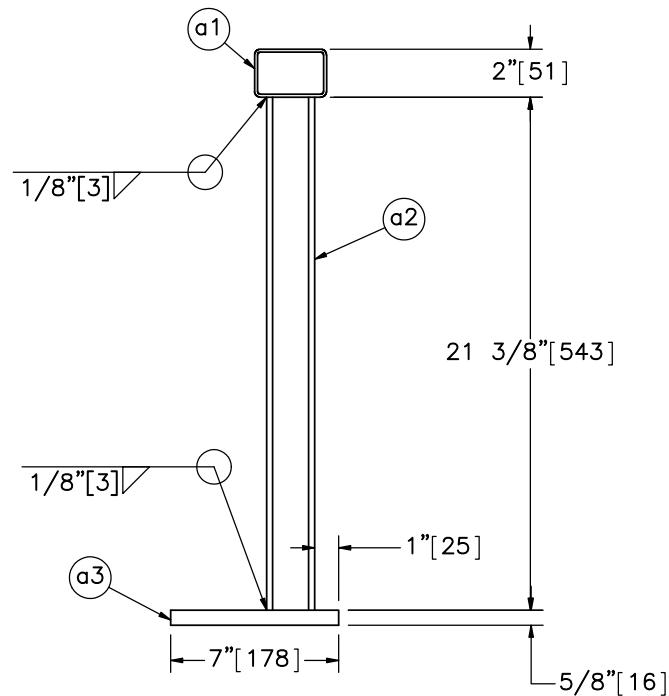
DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

REV. BY:
JEK/RWB/
CG/RKF



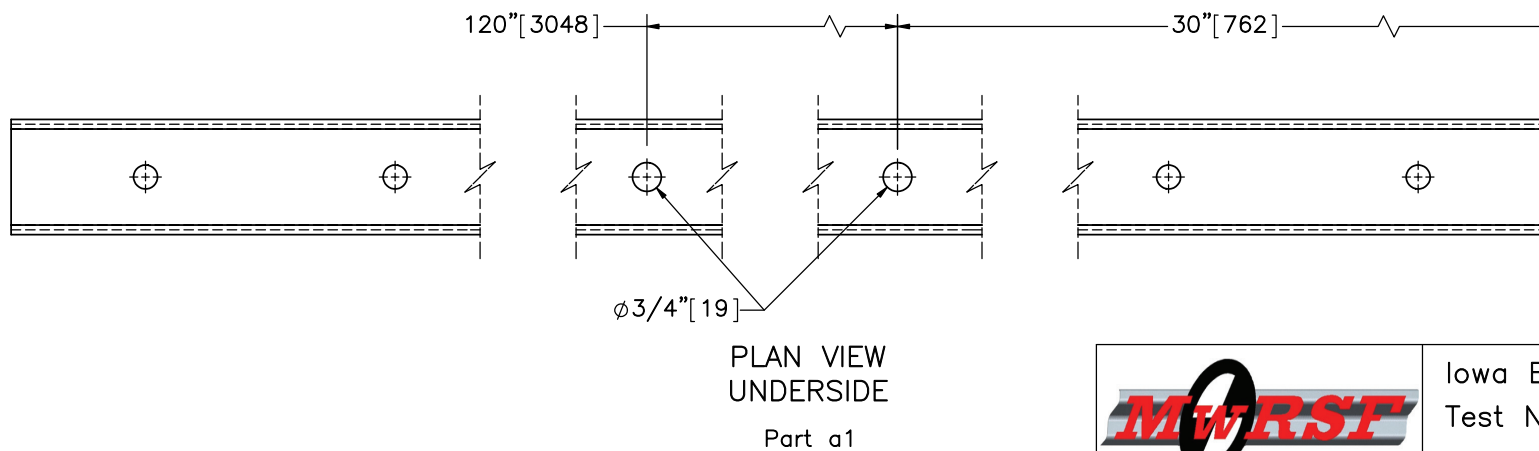
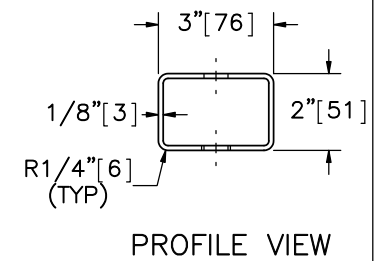
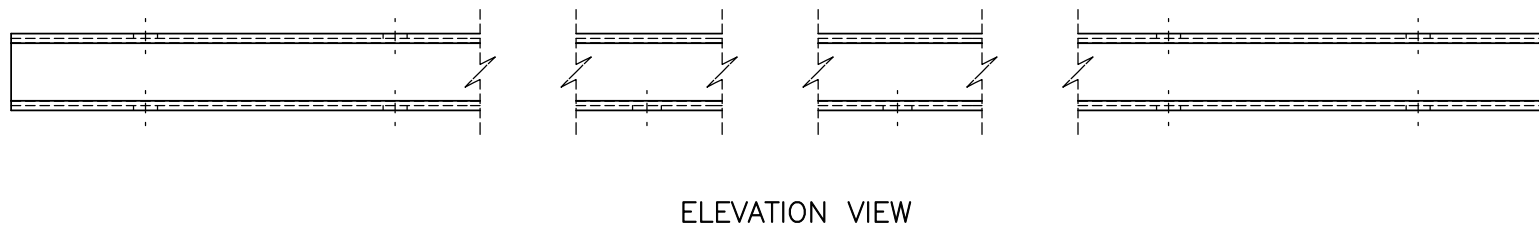
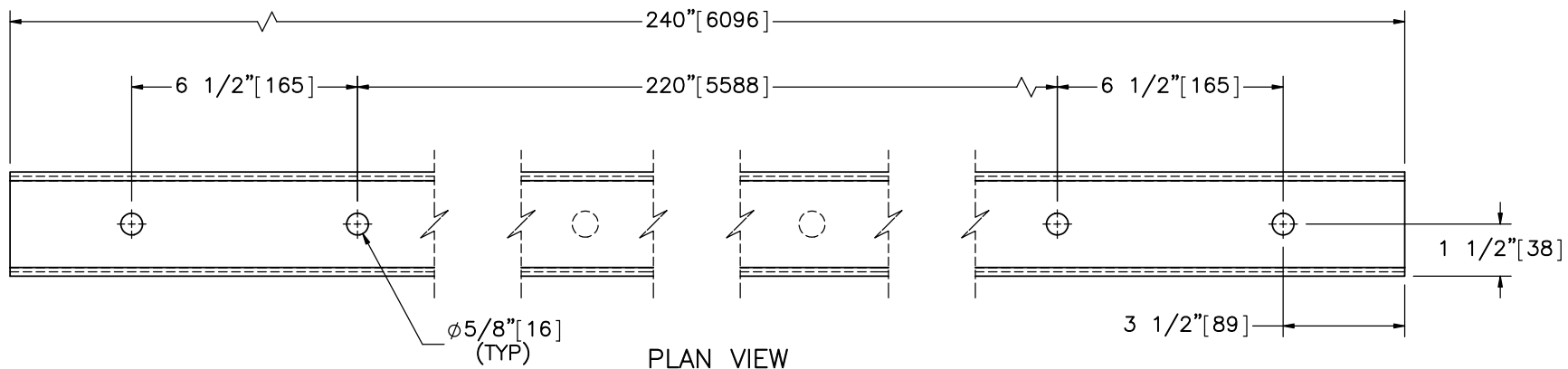
ELEVATION VIEW



PROFILE VIEW
SCALE 1:8

Note: Hidden lines not shown.

Item No.	QTY.	Description	Material Specification	Treatment Specification		Iowa Bicycle Rail Test No. IBBR-1		SHEET: 7 of 14
-	5	Rail and Post Assembly	-	ASTM A123		Rail and Post Assembly		DATE: 8/23/2018
a1	1	HSS 3"x2"x1/8" [76x51x3], 240" [6,096] Long Tube	ASTM A500 Gr. C	-	Midwest Roadside Safety Facility	DRAWN BY: JDJ/GRL/ JEK/MBD		REV. BY: JEK/RWB/ CG/RKF
a2	2	HSS 2"x2"x1/8" [51x51x3], 21 3/8" [543] Long Tube	ASTM A500 Gr. C	-				
a3	2	9 1/4"x7"x5/8" [235x178x16] Plate	ASTM A572 Gr. 50	-				
					DWG. NAME: IBBR-1_R14		SCALE: 1:30 UNITS: in./mm	



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Rail Details

DWG. NAME.
IBBR-1_R14

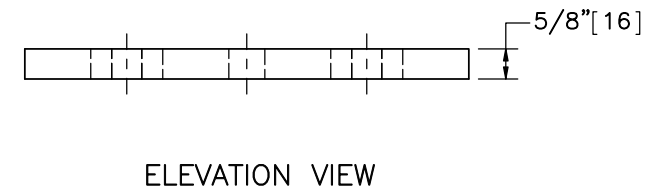
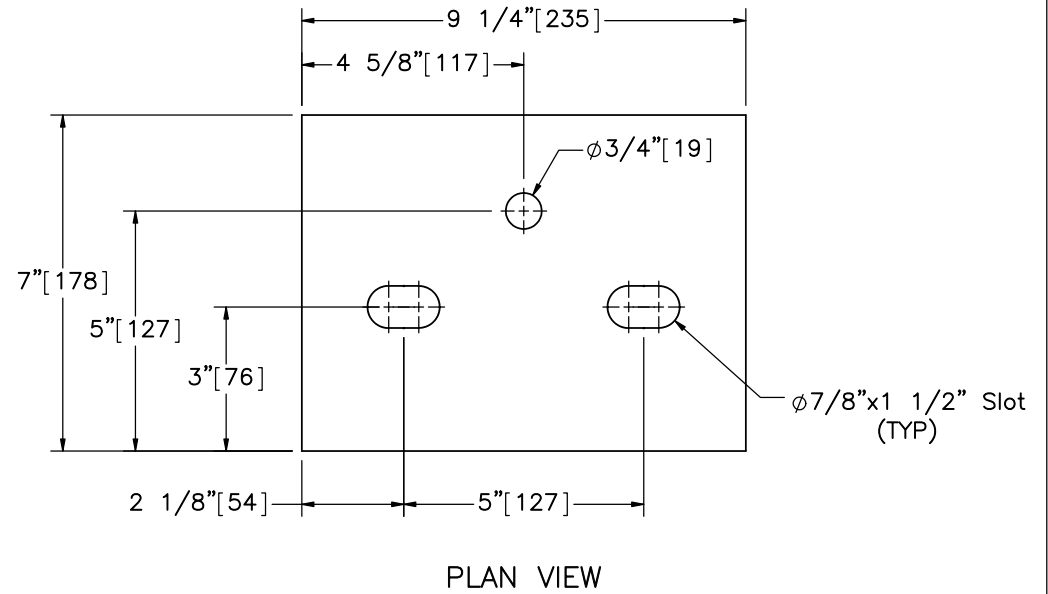
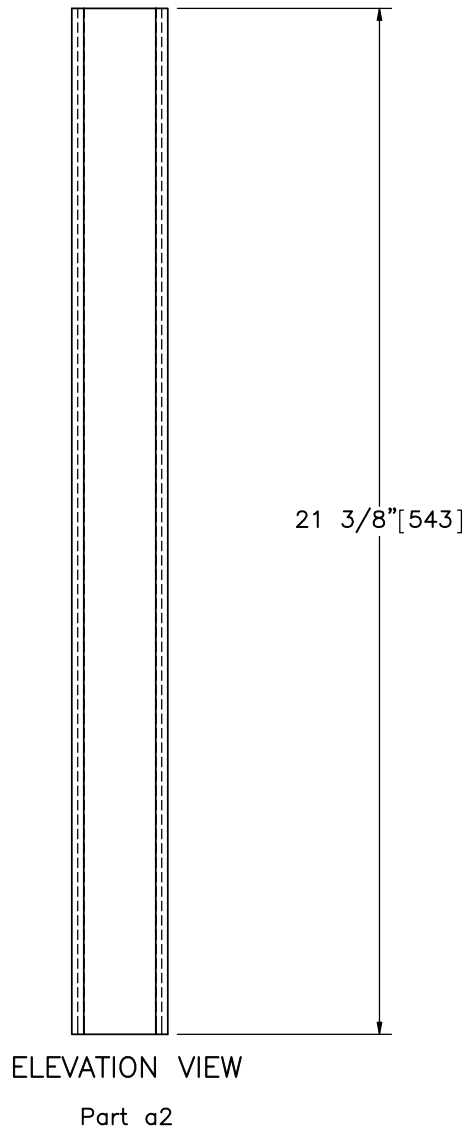
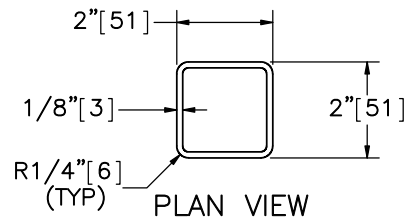
SCALE: 1:5
UNITS: in.[mm]

SHEET:
8 of 14

DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

REV. BY:
JEK/RWB/
CG/RKF



Part a3



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Post and Base Plate Details

DWG. NAME.
IBBR-1_R14

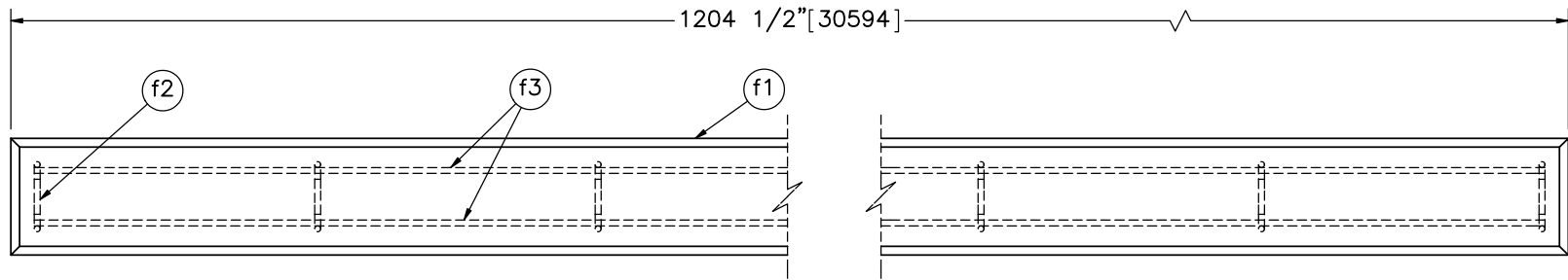
SCALE: 1:4
UNITS: in.[mm]

SHEET:
9 of 14

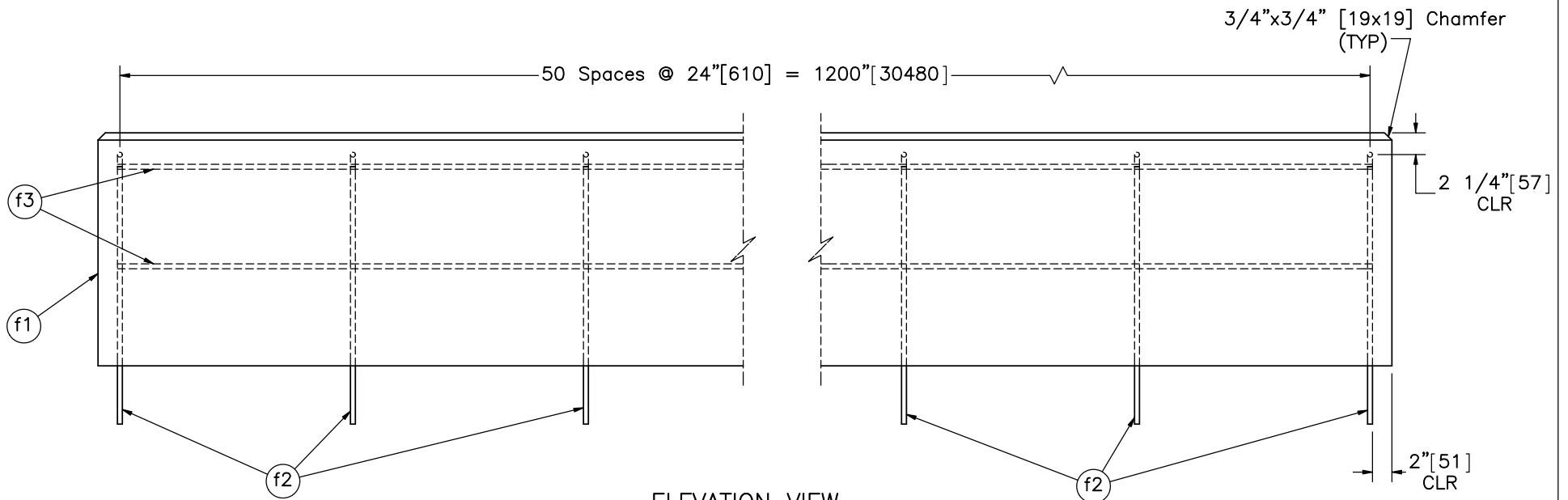
DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

REV. BY:
JEK/RWB/
CG/RKF



PLAN VIEW



ELEVATION VIEW



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Concrete Parapet Assembly
Details

DWG. NAME.
IBBR-1_R14

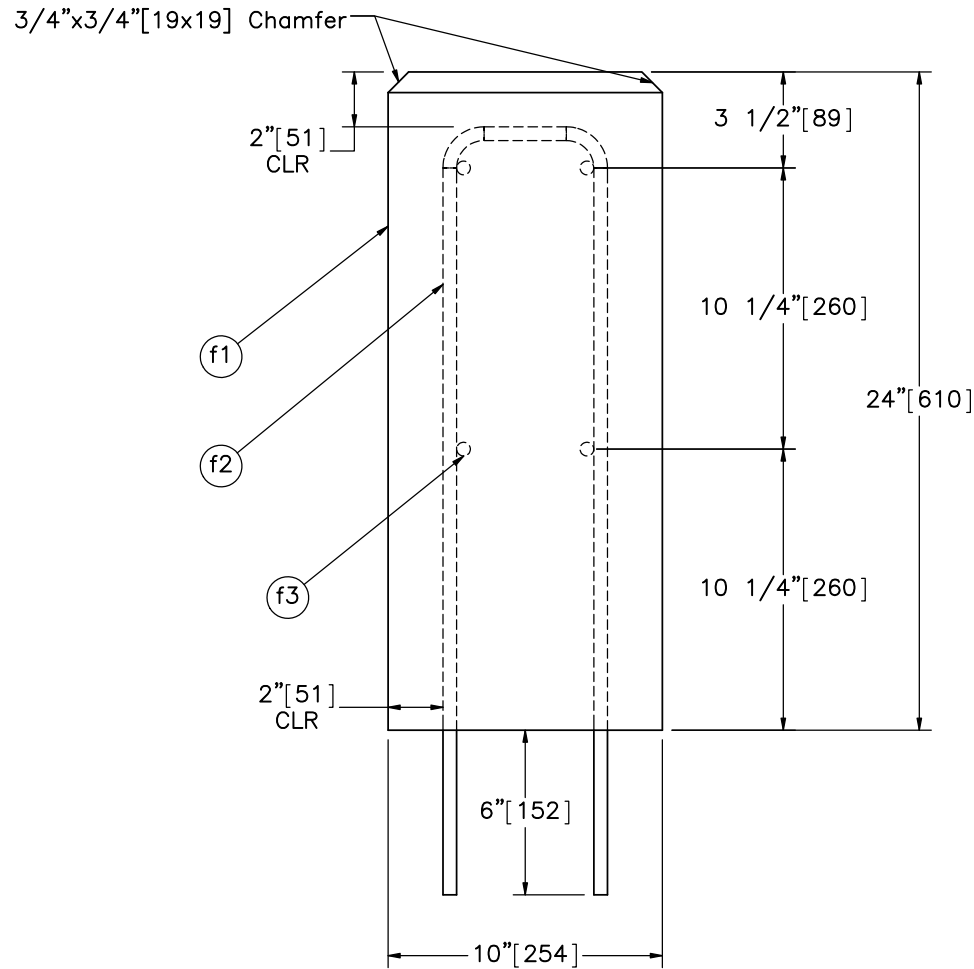
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UNITS: in.[mm]

SHEET:
10 of 14

DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

REV. BY:
JEK/RWB/
CG/RKF



PROFILE VIEW

Item No.	QTY.	Description	Material Specification	Treatment Specification
—	1	Concrete Parapet Assembly	—	—
f1	1	Concrete	Min. f'c = 4,000 psi [27.6 MPa] NE Mix 47BD	—
f2	51	#4 [13] Rebar, 59 15/16" [1,522] Total Unbent Length	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or A934)
f3	4	#4 [13] Rebar, 1,200 1/2" [30,493] Total Length	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or A934)



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Concrete Parapet Assembly
Details

DWG. NAME:
IBBR-1_R14

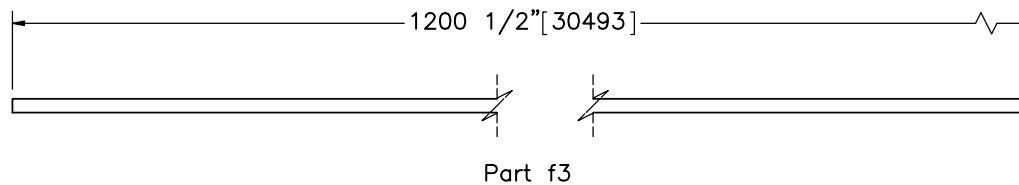
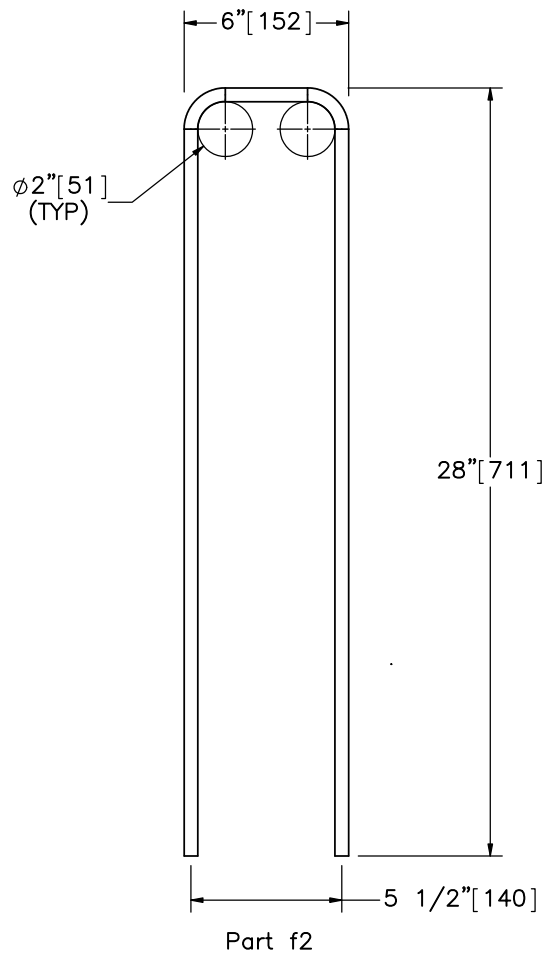
SCALE: 1:7
UNITS: in.[mm]

SHEET:
11 of 14

DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

REV. BY:
JEK/RWB/
CG/RKF



Bill of Bars					
Bar	QTY.	Size	Total Unbent Length	Material Specification	Treatment Specification
f2	51	#4 [13]	59 15/16" [1,522]	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or A934)
f3	4	#4 [13]	1,200 1/2" [30,493]	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or A934)



Iowa Bicycle Rail
Test No. IBBR-1

Concrete Parapet Reinforcement

DWG. NAME.
IBBR-1_R14

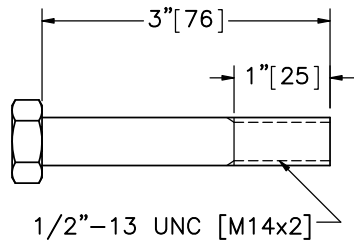
SCALE: 1:7
UNITS: in.[mm]

SHEET:
12 of 14

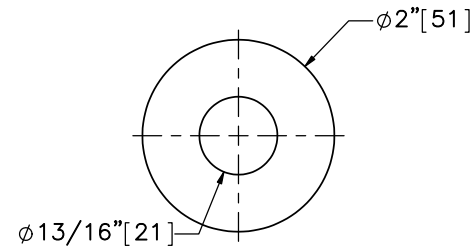
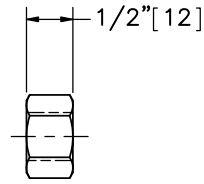
DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

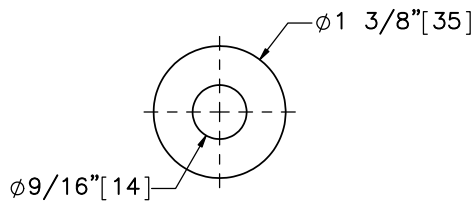
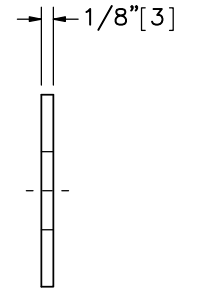
REV. BY:
JEK/RWB/
CG/RKF



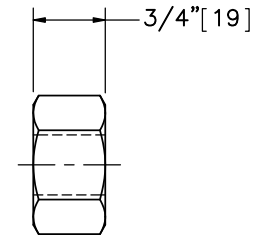
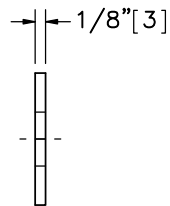
Part c1



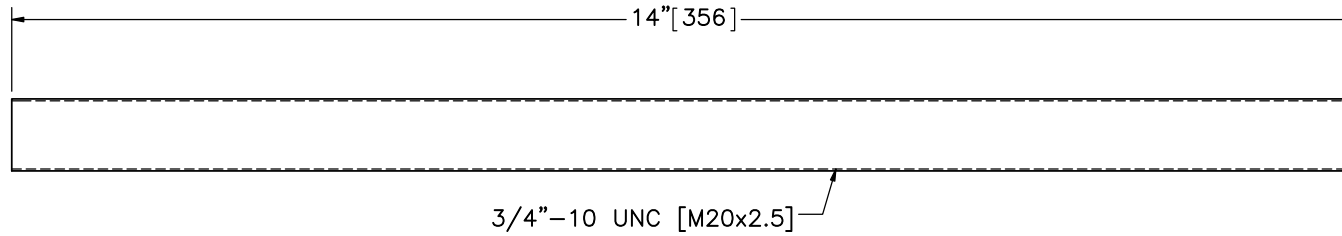
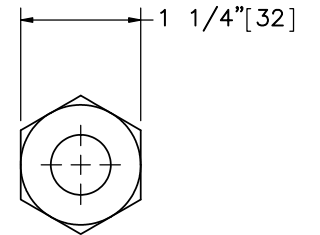
Part e1



Part c2



Part e2



Part d1



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Hardware

DWG. NAME.
IBBR-1_R14

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

SHEET:
13 of 14
DATE:
8/23/2018
DRAWN BY:
JDJ/GRL/
JEK/MBD
REV. BY:
JEK/RWB/
CG/RKF

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
a1	5	HSS 3"x2"x1/8" [76x51x3], 240" [6,096] Long Tube	ASTM A500 Gr. C	—	—
a2	10	HSS 2"x2"x1/8" [51x51x3], 21 3/8" [543] Long Tube	ASTM A500 Gr. C	—	—
a3	10	9 1/4"x7"x5/8" [235x178x16] Plate	ASTM A572 Gr. 50	—	—
b1	8	28 1/4"x1 1/4"x5/16" [718x32x8] Plate	ASTM A572 Gr. 50	—	—
b2	8	28 1/4"x2"x5/16" [718x51x8] Plate	ASTM A572 Gr. 50	—	—
c1	16	1/2"—13 UNC [M14x2], 3" [76] Long Heavy Hex Head Bolt and Nut	Bolt— ASTM F3125 Gr. A325 Type 1 or equivalent Nut — ASTM A563DH or equivalent	ASTM A153 or B695 Class 55 or F1136 Gr.3 or F2329 or F2833 Gr. 1	FBX14b
c2	32	1/2" [13] Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	FWC14a
d1	20	3/4"—10 UNC [M20x2.5], 14" [356] Long Fully Threaded Rod	ASTM F1554 Gr. 105	ASTM A123 or B695 Class 55 or F2329	FRR20b
e1	20	3/4" [19] Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	FWC20a
e2	20	3/4"—10 UNC [M20x2.5] Heavy Hex Nut	ASTM A563DH	ASTM A153 or B695 Class 55 or F2329	FBX20a
f1	1	Concrete	Min. f'c = 4,000 psi [27.6 MPa] NE Mix 47BD	—	—
f2	51	#4 [13] Rebar, 59 15/16" [1,522] Total Unbent Length	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or A934)	—
f3	4	#4 [13] Rebar, 1,200 1/2" [30,493] Total Length	ASTM A615 Gr. 60	Epoxy-Coated (ASTM A775 or A934)	—
—	1	Epoxy	Min. bond strength = 1,560 psi [10.8 MPa] (Hilti HIT-RE 500 V3)	—	—



Midwest Roadside
Safety Facility

Iowa Bicycle Rail
Test No. IBBR-1

Bill of Materials

DWG. NAME.
IBBR-1_R14

SCALE: None
UNITS: in.[mm]

SHEET:
14 of 14

DATE:
8/23/2018

DRAWN BY:
JDJ/GRL/
JEK/MBD

REV. BY:
JEK/RWB/
CG/RKF

REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
0	5/10/2018	–	Original drawing created from assembly made by Chaz	–	JDJ
1	5/11/2018	1	Moved impact location, edited note 2.	JEK	JDJ
		2	Edited part callout. Added dimensions. Edited note 1.		
		3	Changed scale to 1:35. Edited dimensions.		
		4	Added assembly note. Changed scale for detail B and detail D to 1:5. Edited part call out for detail D.		
		5	Added part callout. Edited sheet name.		
		6	Edited dimensions.		
		7	Added part callout. Edited sheet name. Edited annotations.		
		8	Edited dimensions.		
		9	Removed profile view, added elevation view. Edited dimensions.		
		10	Add part callout. Edited dimensions.		
		11	Added dimensions. Edited part callout.		
		12	Edited bill of bars.		
		13	Edited dimensions.		
		BOM	Edited description for part nos. a1, a2, a3, c1, c2, d1, e1, e2, f2, and f3. Edited material specification for part nos. e2, and f1. Edited treatment specification for part no. d1. Edited hardware guide for part nos. c1, and d1.		
2	5/14/2018	1	Edited impact location dimension. Edited note 2.	JEK	JDJ
		7	Added and edited dimensions.		
		11	Added dimensions.		
		12	Edited dimensions.		
		13	Edited dimensions.		
3	5/17/2018	1	Moved impact location to upstream of post no. 4.	JEK/RWB/CG	JDJ
		2	Added dimensions. Added note 2. Moved part no. f2 callout.		
		4	Edited dimensions.		
		5	Added 1/4" diameter hole to part no. b2. Added dimensions.		
		6	Added dimensions.		
		9	Changed holes to slots, increased length to 9.25", and changed thickness to 5/8" on part a3. Added dimensions.		

		13	Increased outside diameter on part no. c2 to 1 3/8", increased outside diameter on part no. e1 to 2".		
		BOM	Edited descriptions for part nos. c2, e1, and f3. Added row for epoxy.		
4	5/18/2018	2	Edited dimensions. Edited notes 1 and 2.	JEK	JDJ
		6	Edited orientation of profile view on part no. b2.		
		8	Decreased height of part no. a2 by 1/4".		
		11	Edited dimensions.		
5	5/22/2018	2	Added dimensions. Edited part callouts. Edited note 1 and 2.	RWB/JEK	JDJ
		13	Edited length of part no. d1.		
		BOM	Edited description for part no. d1. Added epoxy type.		
6	6/4/2018	1	Edited note 1 and 2.	RKF	JDJ
		2	Adjusted dimension alignment.		
		3	Adjusted detail circle B, C, and D.		
		4	Increased rail separation to 1/2". Adjusted part callouts.		
		5	Changed weld to 3/16".		
		6	Moved location of slots. Changed part no. b2 height to 1 7/8", and thickness to 5/16". Changed thickness on part no. b1 to 5/16".		
		9	Added 3/4" diameter drain hole.		
7	6/5/2018	BOM	Edited part descriptions for part nos. b1 and b2.	JEK	JDJ
8	6/7/2018	5	Decreased length of part no. b1 to 1 1/8".	RKF	JDJ
		7	Added note.		
		8	Added drain holes to part a1. Added elevation, and underside plan view. Moved part a2 to nextsheet.		
		9	Added views for part a2. Decreased scale for part a3 to 1:4.		
9	6/13/2018	—	Flipped system.	RWB/JEK	JDJ
		1	Dimension edit.		
		3	Renamed post labels. Adjusted part call outs.		
		7	Shifted location of posts in sub-assembly. Dimension edit.		
		11	Edited distance between part no. f3 in assmebly.		
		12	Decreased bend diameter to 2". Updated total unbent length of part no f2.		

		13	Edited length of part no. c1.		
		BOM	Updated total unbent length for part no. f2. Edited description for part no. c1.		
10	6/27/2018	BOM	Material specification edit for parts a1 and a2.	RWB	GRL
11	7/16/2018	–	Detail/section relettering.	CG/RKF	JEK
		3	Detail circle add. Gen shift.		
		4	Detail add. Scale edit.		
12	7/27/2018	–	Detail/section relettering.	CG/RKF	JEK
		1	Impact location edit. Note 2 edit. 1" added, since initial reference was supposed to be to the upstream face of the post. Drawing reference is still to centerline of post. Detail add. General shift.		
13	8/22/2018	5	Assembly details and BOM replaced with "alternate" splice assembly details and BOM.	RWB	MBD
		6	Plates replaced with "alternate" splice plates.		
		BOM	Item nos. b1 & b2 descriptions updated.		
14	8/23/2018	5	Tolerances added to splice plate assembly width and height.	RWB	JEK