



U.S. Department  
of Transportation  
**Federal Highway  
Administration**

1200 New Jersey Ave., SE  
Washington, D.C. 20590

January 27, 2012

In Reply Refer To:  
HSST/B-231

Scott Rosenbaugh  
Research Associate Engineer  
Midwest Roadside Safety Facility UNL  
2200 Vine Street  
130 Whittier Building  
Lincoln NE, 68583-0853

Dear Mr. Rosenbaugh:

This letter is in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

Name of system:	Transition from steel post MGS to thrie-beam approach
Type of system:	W-beam to thrie-beam stiffness transition
Test Level:	MASH Test Level 3
Testing conducted by:	Midwest Roadside Safety Facility
Task Force 13 Designator:	STG03a
Date of request:	June 28, 2011
Date initially acknowledged:	July 17, 2011
Date of completed package:	June 28, 2011

**Decision:**

The following device is eligible, with details provided in your letter of June 28, 2011, which is enclosed as an integral part of this finding:

- Stiffness Transition from steel post MGS with 12-inch deep blockouts to thrie-beam approach using asymmetrical "Y."

Based on a review of crash test results submitted by the manufacturer certifying the device described herein meets the crashworthiness criteria of the American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware (MASH), the device is eligible for reimbursement under the Federal-aid highway program. Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

FHWA: HSST: Artimovich: sf: x61331:1/25/12  
File: s://directory folder/HSST/Artimovich/ 231\_MGS\_Stiffness  
\_Transition Letter.dotx  
cc: HSST (NArtimovich; JDewar)

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.

### **Requirements**

Roadside safety devices should meet the guidelines contained in the MASH.

### **Description and Crash Testing**

Guardrail to bridgerail transitions are designed to gradually increase the stiffness of the semi-rigid w-beam barrier until connected to the rigid bridge railing. Typically, a single critical impact point (CIP) has been evaluated with full-scale crash testing. That CIP is usually located at the point where we anticipate the greatest likelihood of vehicle snagging or pocketing near the beginning of the rigid bridge railing. Because the stiffness of the barrier transition hardware needed to adequately shield the end of the rigid bridge railing is substantial, there is also reason to determine if the change in stiffness between the w-beam guardrail and the transition design itself is safe. A transition from the MGS with 12-inch deep blockout to a stiffened thrie-beam rail using an asymmetrical “Y” transition piece was evaluated in your crash testing. The enclosed letter describes the transition design and the two crash tests conducted.

Also enclosed are the test data summary sheets and drawings of the transitions.

### **Findings**

Therefore, the system described and detailed in the attached letter, including the various attachment alternatives, is eligible for reimbursement and may be installed under the range of conditions tested.

Please note the following standard provisions that apply to FHWA eligibility letters:

- This letter provides a AASHTO/ARTBA/AGC Task Force 13 designator that should be used for the purpose of the creation of a new and/or the update of existing Task Force 13 drawing for posting on the on-line ‘Guide to Standardized Highway Barrier Hardware’ currently referenced in AASHTO Roadside Design Guide.
- This finding of eligibility is limited to the crashworthiness characteristics of the systems and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may influence the crashworthiness of the system will require a new reimbursement eligibility letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals safety problems, or that the system is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the crashworthiness requirements of the Manual for Assessing Safety Hardware.

- To prevent misunderstanding by others, this letter of eligibility is designated as number B-231 and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The finding of eligibility is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,

Michael S. Griffith  
Director, Office of Safety Technologies  
Office of Safety



U.S. Department  
of Transportation

**Federal Highway  
Administration**

1200 New Jersey Ave., SE  
Washington, D.C. 20590

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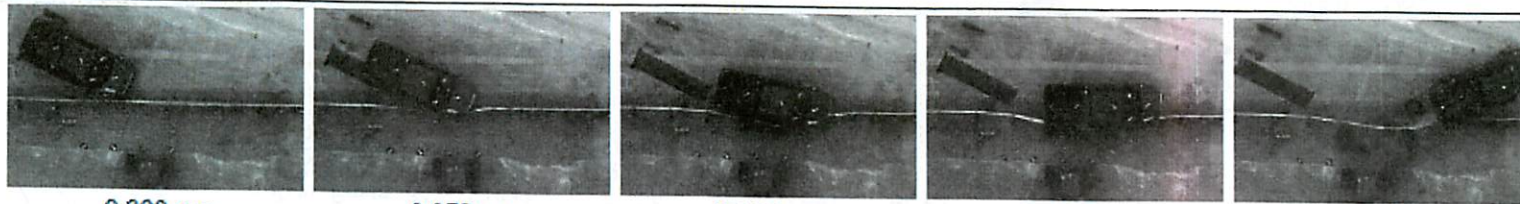
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Sincerely yours,

A handwritten signature in blue ink that reads "Michael S. Griffith". The signature is written in a cursive style with a prominent initial "M".

Michael S. Griffith  
Director, Office of Safety Technologies  
Office of Safety



0.000 sec

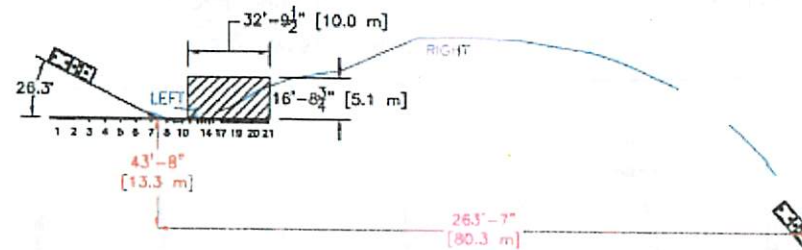
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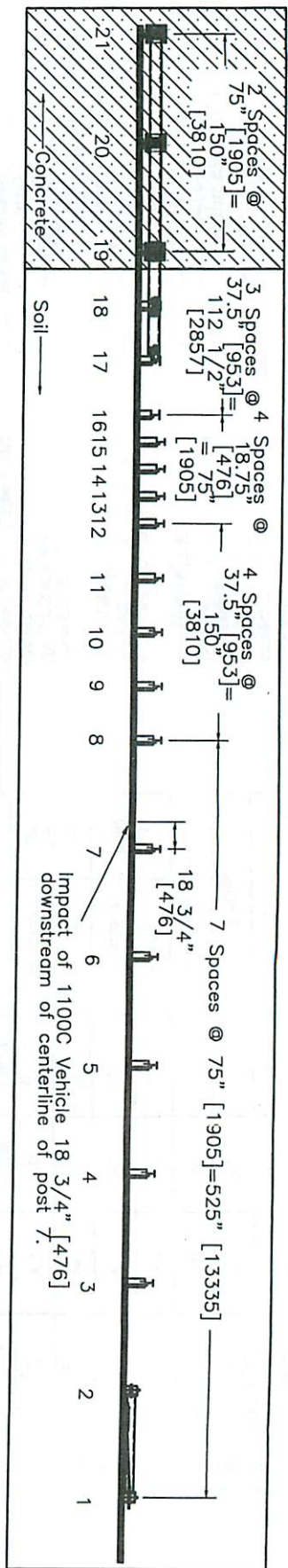
- Test Agency ..... MwRSF
- Test Number ..... MWTSP-2
- Date ..... 7/7/08
- MASH Test Designation ..... 3-21
- Test Article ..... Stiffness Transition between MGS and Thrie Beam Transition
- Total Length ..... 87 ft - 6 in. (26.7 m)
- Height to Top of Rail ..... 31 in. (787 mm)
- Key Components - Steel W-Beam Guardrail
  - Thickness ..... 12 gauge (2.66 mm)
- Key Components - Steel W-Beam to Thrie Beam Transition
  - Thickness ..... 10 gauge (3.42 mm)
  - Segment Length ..... 75 in. (1,905 mm)
- Key Components - Steel Thrie Beam
  - Thickness ..... 12 gauge (2.66 mm)
- Key Components - Steel Posts
  - Post Nos. 3 - 15 ..... 72 in. (1,829 mm) long, W6x9 (W152x13.4)
  - Post Nos. 16 - 18 ..... 84 in. (2,134 mm) long, W6x15 (W152x22.3)
  - Post Nos. 19 - 21 ..... 29 1/2 in. (752 mm) long, W6x20 (W152x29.8)
- Post Spacing
  - Post Nos. 1 - 8, 19 - 21 ..... 75 in. (1,905 mm)
  - Post Nos. 8 - 12, 16 - 19 ..... 37 1/2 in. (953 mm)
  - Post Nos. 12 - 16 ..... 18 3/4 in. (476 mm)
- Type of Soil ..... Grading B - AASHTO M 147-65
- Vehicle
  - Make and Model ..... 2002 Dodge Ram 1500 Quad Cab
  - Curb ..... 5,158 lb (2,331 kg)
  - Test Inertial ..... 4,993 lb (2,265 kg)
  - Gross Static ..... 5,158 lb (2,340 kg)
- Impact Conditions
  - Speed ..... 61.2 mph (98.5 km/h)
  - Angle ..... 26.3 deg
  - Impact Location ..... 75 in. (1,905 mm) US of Post No. 9
- Exit Conditions
  - Speed ..... 37.3 mph (60.0 km/h)
  - Angle ..... 22.0 deg
- Vehicle Stability ..... Satisfactory
- Exit Box Criteria ..... Passed
- Vehicle Damage ..... Moderate
  - VDS<sup>(24)</sup> ..... 1-RFQ-5
  - CDC<sup>(25)</sup> ..... 01-RFEW2



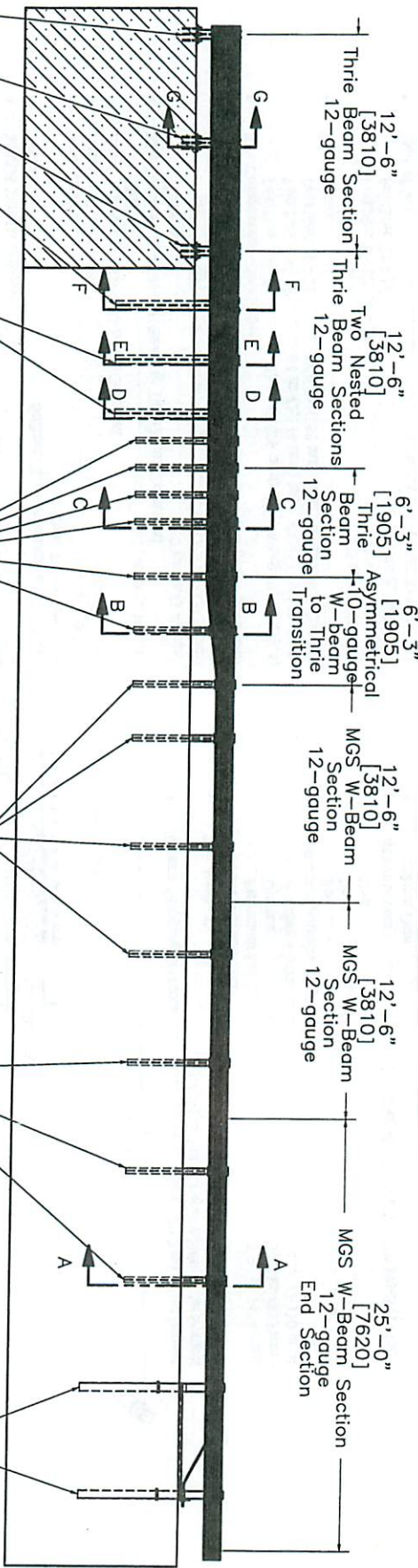
- Vehicle Stopping Distance ..... 263 ft (80.2 m) DS of Impact
- Test Article Damage ..... 43.7 ft (13.3 m) Laterally Behind the System
- Test Article Deflections ..... Moderate
  - Permanent Set ..... 25 3/4 in. (654 mm)
  - Dynamic ..... 32.8 in. (833 mm)
  - Working Width ..... 51.6 in. (1,310 mm)
- Maximum Angular Displacements
  - Roll ..... 13° < 75°
  - Pitch ..... 10° < 75°
  - Yaw ..... 51°
- Impact Severity ..... 126.8 kip-ft (171.9 kJ) > 106 kip-ft (144 kJ)
- Transducer Data

Evaluation Criteria		Transducer			MASH Limit
		EDR-3	EDR-4	DTS	
OIV ft/s (m/s)	Longitudinal	-21.21 (-6.46)	NA	NA	≤ 40 (12.2)
	Lateral	-16.91 (-5.15)	NA	NA	≤ 40 (12.2)
ORA g's	Longitudinal	-12.03	NA	NA	≤ 20.49
	Lateral	-9.87	NA	NA	≤ 20.49
THIV - ft/s (m/s)		-	NA	NA	not required
PHD - g's		-	NA	NA	not required
ASI		0.91	NA	NA	not required

Figure 64. Summary of Test Results and Sequential Photographs, Test No. MWTSP-2



PLAN VIEW

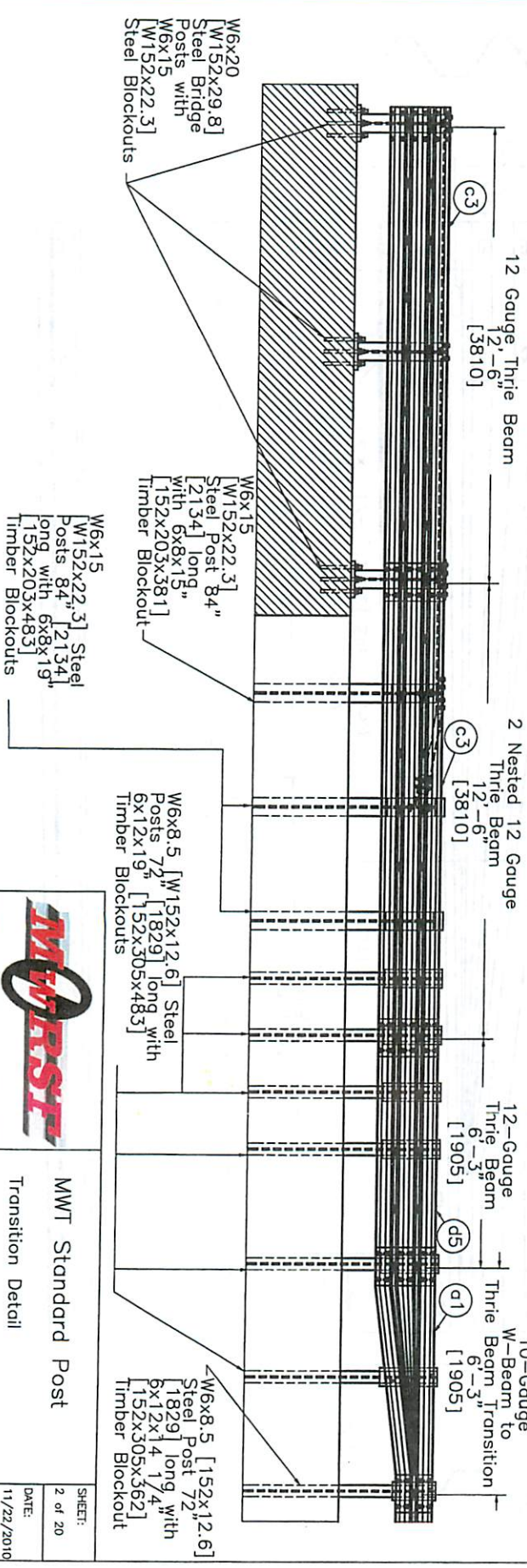
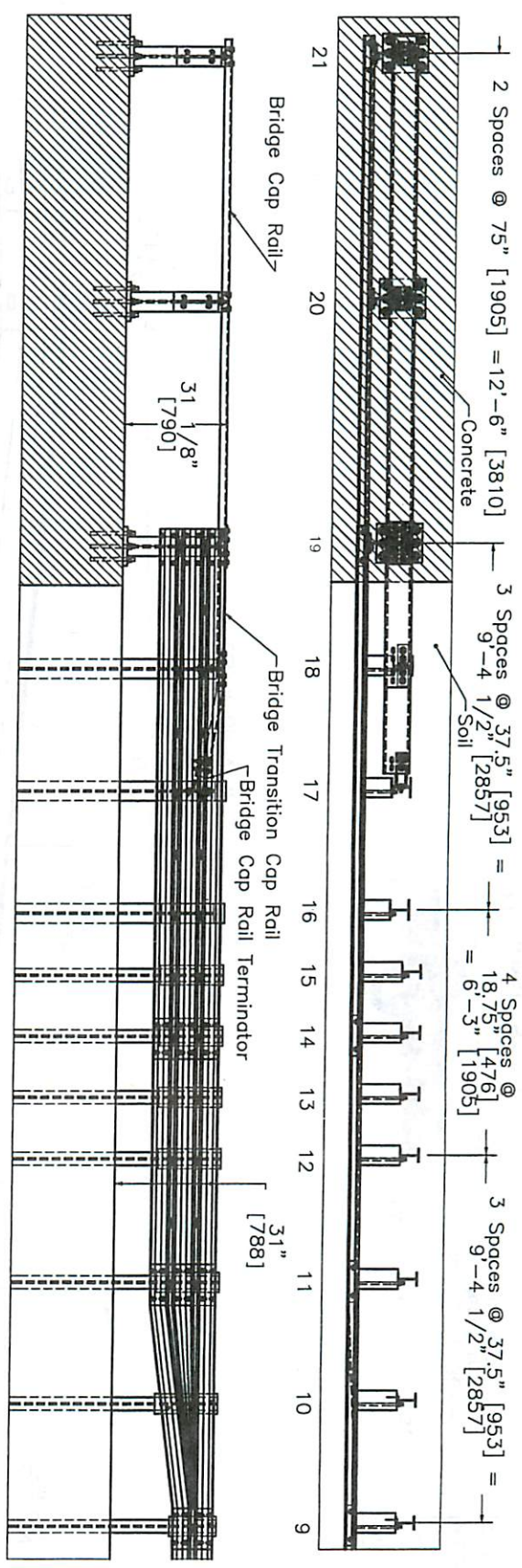


ELEVATION VIEW

- W6x20 [152x29.8] Steel Brdge Posts with W6x15 [152x22.3] Steel Blockouts
- W6x15 [152x22.3] Steel Post 84" long with 6x8x15" [2134] long with 152x203x483] Timber Blockouts
- W6x15 [W152x22.3] Steel Posts 84" [2134] long with 6x8x19" [152x203x483] Timber Blockouts
- W6x8.5 [W152x12.6] Steel Posts 72" [1829] long with 6x12x14" [152x305x362] Timber Blockouts
- W6x8.5 [W152x12.6] Steel Posts 72" [1829] long with 6x12x14" [152x305x362] Timber Blockouts
- BCI posts in 6' [1829] long (galvanized) foundation tubes, ground line strut, and BCI cable anchor

		Midwest Roadside Safety Facility	
		MWT Standard Post System Layout	
DWG. NAME: MWT-SP-3_R3	SCALE: 1:10 UNITS: In./mm	REV. BY: KAP/SKR/RP	SHEET: 1 of 20
DATE: 11/22/2010		DRAWN BY: EMA/RLT	





W6x20 [W152x29.8] Steel Bridge Posts with W6x15 [W152x22.3] Steel Blockouts

W6x15 [W152x22.3] Steel Post 84" [2134] long with 6x8x15" [152x203x381] Timber Blockout

W6x8.5 [W152x12.6] Steel Posts 72" [1829] long with 6x12x19" [152x305x483] Timber Blockouts

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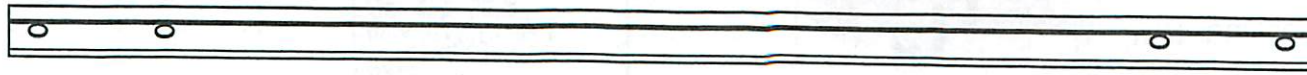
W6x15 [W152x22.3] Steel Posts 84" [2134] long with 6x8x19" [152x203x483] Timber Blockouts



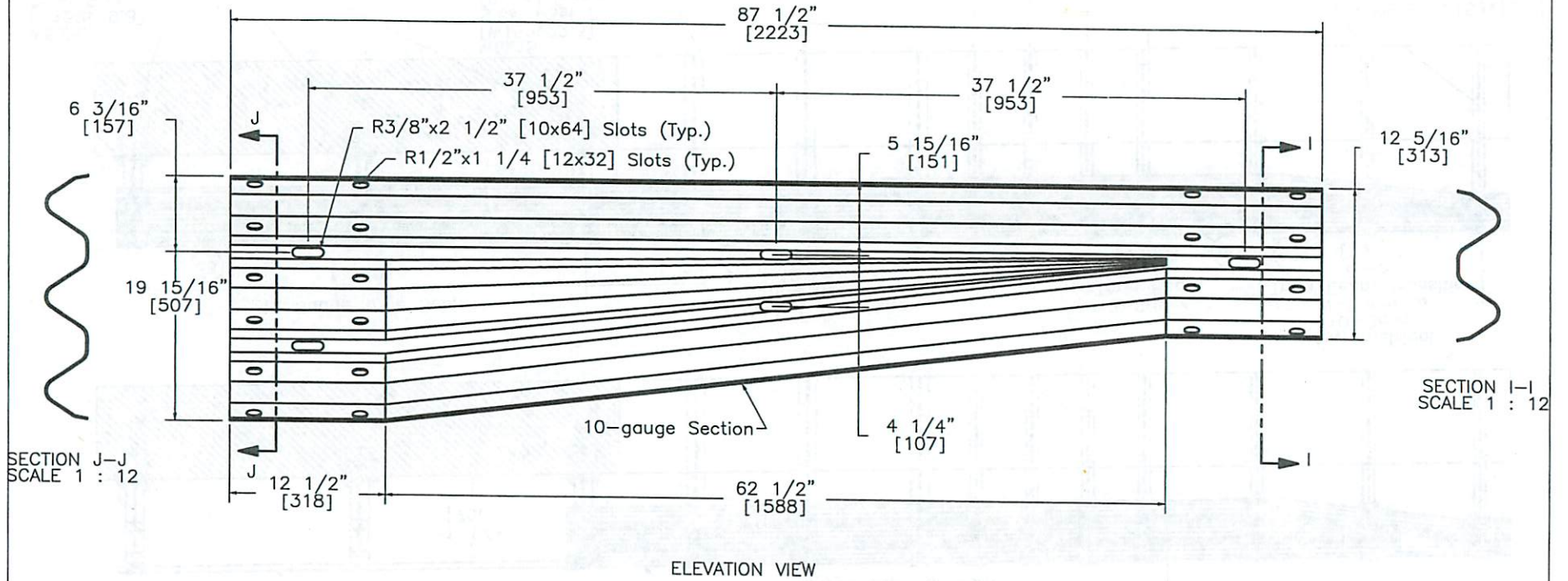
MWT Standard Post  
 Transition Detail

Midwest Roadside Safety Facility

DWG. NAME: MWT-SP-3-R3	SCALE: 1:50 UNITS: In./mm	REV. BY: KAP/SWR/RP
SHEET: 2 of 20		DATE: 11/22/2010
DRAWN BY: EMA/RUF		

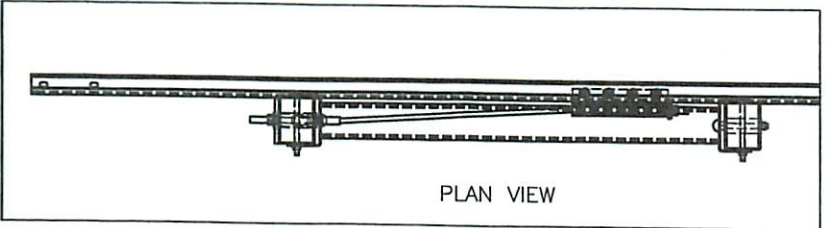


PLAN VIEW

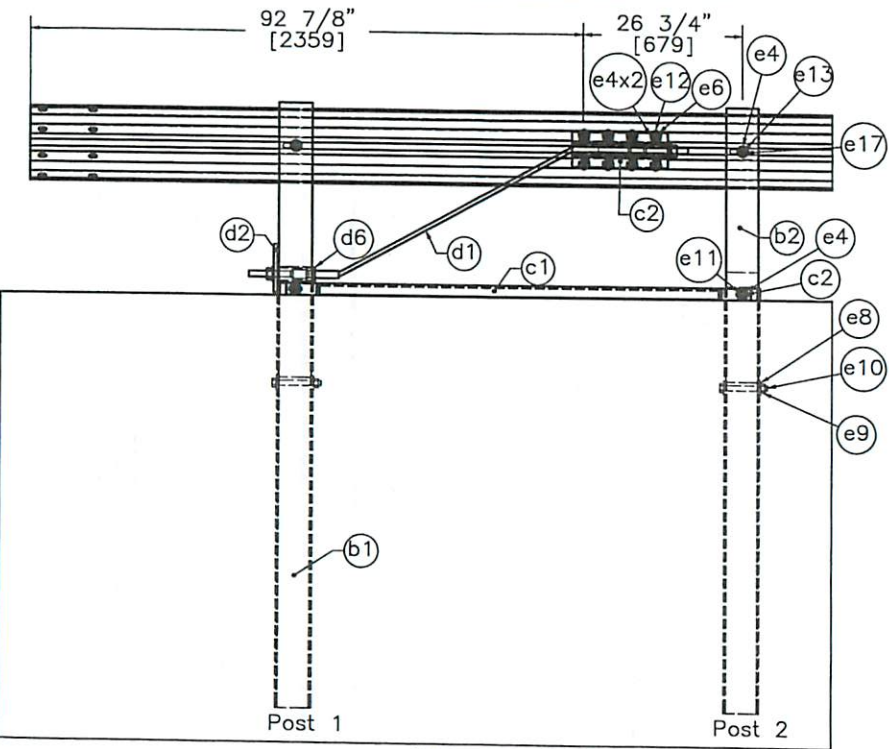


Midwest Roadside Safety Facility

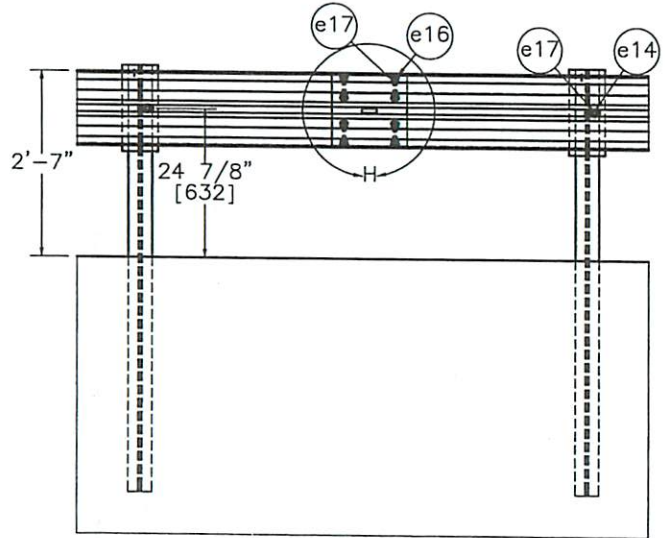
<b>MWT Standard Post</b> Asymmetrical W-Beam to Thrie Beam Transition Rail Section Detail	SHEET: 3 of 20
	DATE: 11/22/2010
DWG. NAME: MWT-SP-3_R3	DRAWN BY: EMA/RJT
	SCALE: 1:10 UNITS: In.[mm]
	REV. BY: KAP/SKR/ RKF



PLAN VIEW



ELEVATION VIEW  
END RAIL DETAIL



ELEVATION VIEW  
SPLICE DETAIL



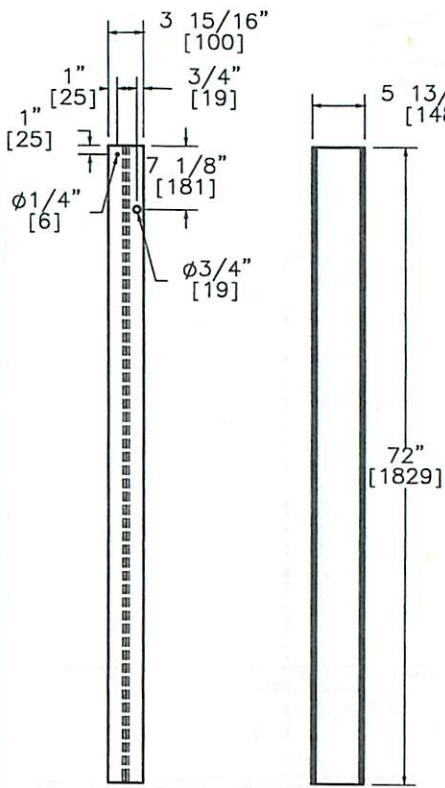
DETAIL H  
SCALE 1 : 15



Midwest Roadside  
Safety Facility

MWT Standard Post Splice Detail End Rail Detail	DWG. NAME: MWT-SP-3_R3	SCALE: None UNITS: In.[mm]	SHEET: 4 of 20
	REV. BY: KAP/SKR/ RKF	DATE: 11/22/2010	DRAWN BY: EMA/RJT

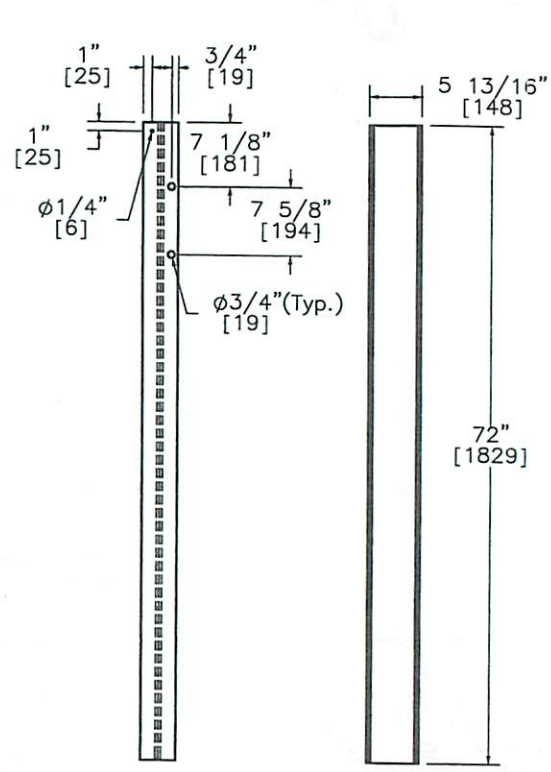
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PLAN VIEW



ELEVATION VIEW PROFILE VIEW

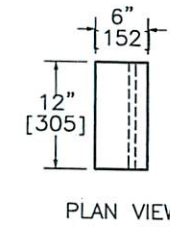
POST 3-9  
W6x8.5  
[W152x12.6]  
Part f1

I  
PLAN VIEW

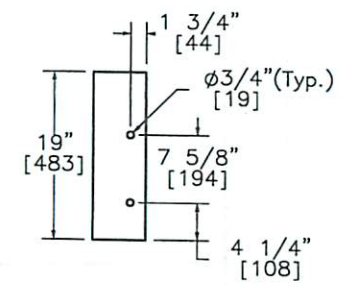


ELEVATION VIEW PROFILE VIEW

POST 10-15  
W6x8.5  
[W152x12.6]  
Part f2



PLAN VIEW



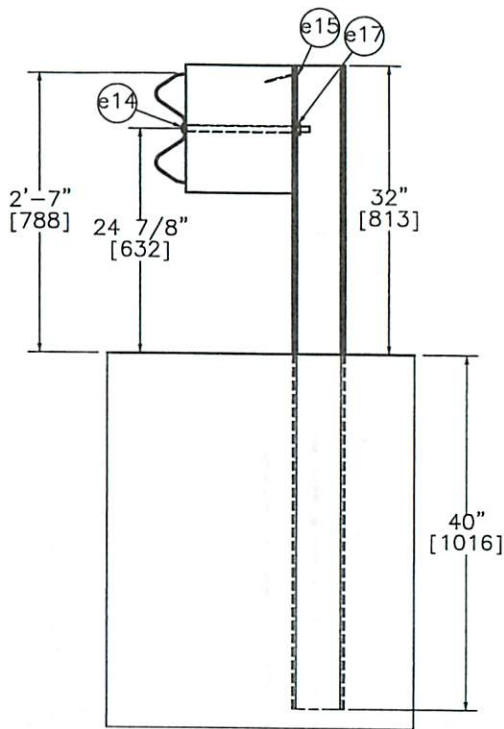
ELEVATION VIEW

BLOCKOUT  
Post 10-15  
Part a3

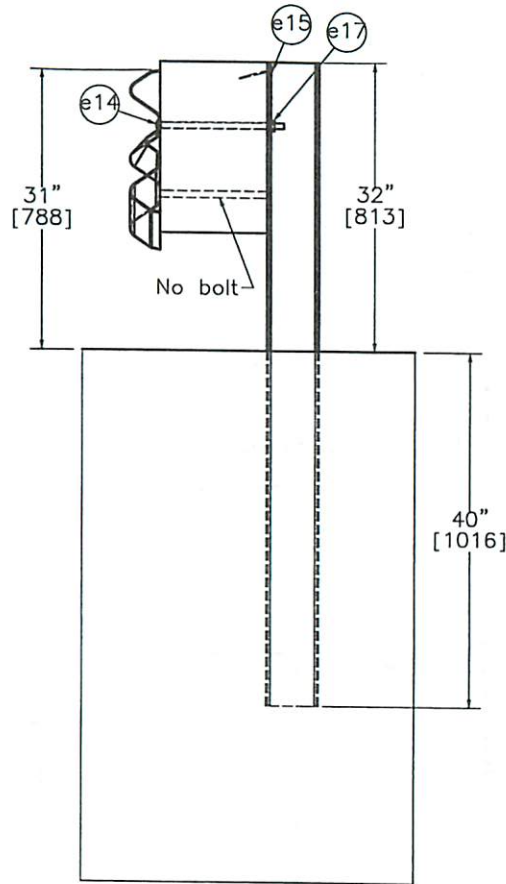


Midwest Roadside  
Safety Facility

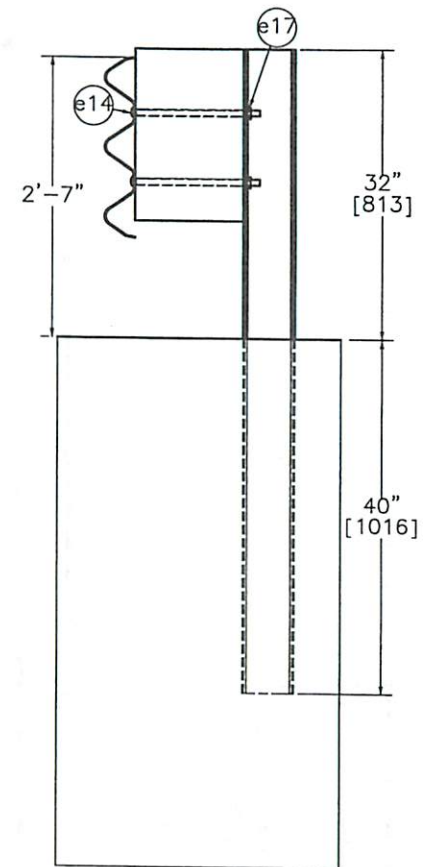
MWT Standard Post		SHEET:
Posts 3-15		5 of 20
Details		DATE:
		11/22/2010
		DRAWN BY:
		EMA/RJT
DWG. NAME:	SCALE: 1:20	REV. BY:
MWT-SP-3_R3	UNITS: In.[mm]	KAP/SKR/ RKF



SECTION A-A  
Post 3-9



SECTION B-B  
Post 10



SECTION C-C  
Post 11-15



Midwest Roadside  
Safety Facility

MWT Standard Post

Posts 3-15 Details  
with Rail

SHEET:  
6 of 20


DATE:  
11/22/2010

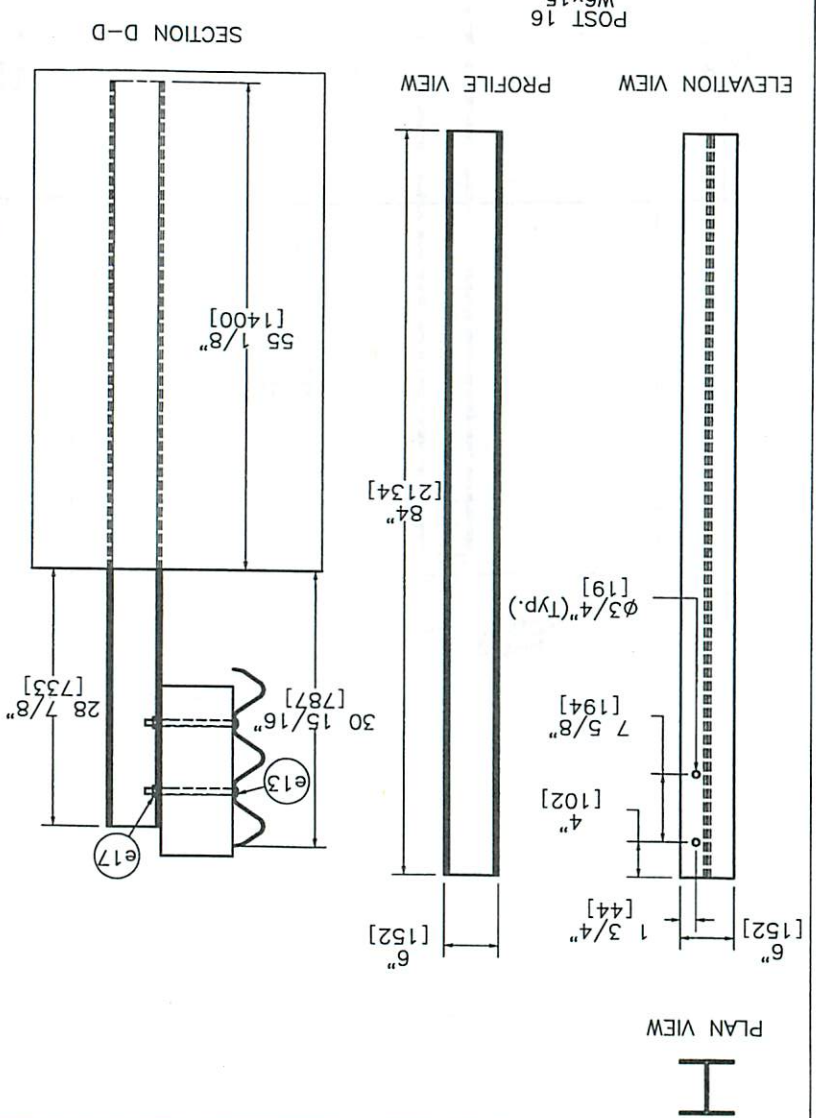
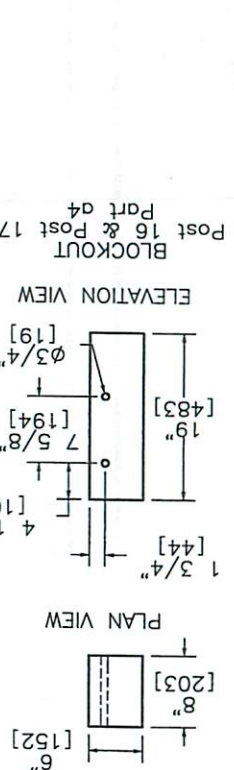
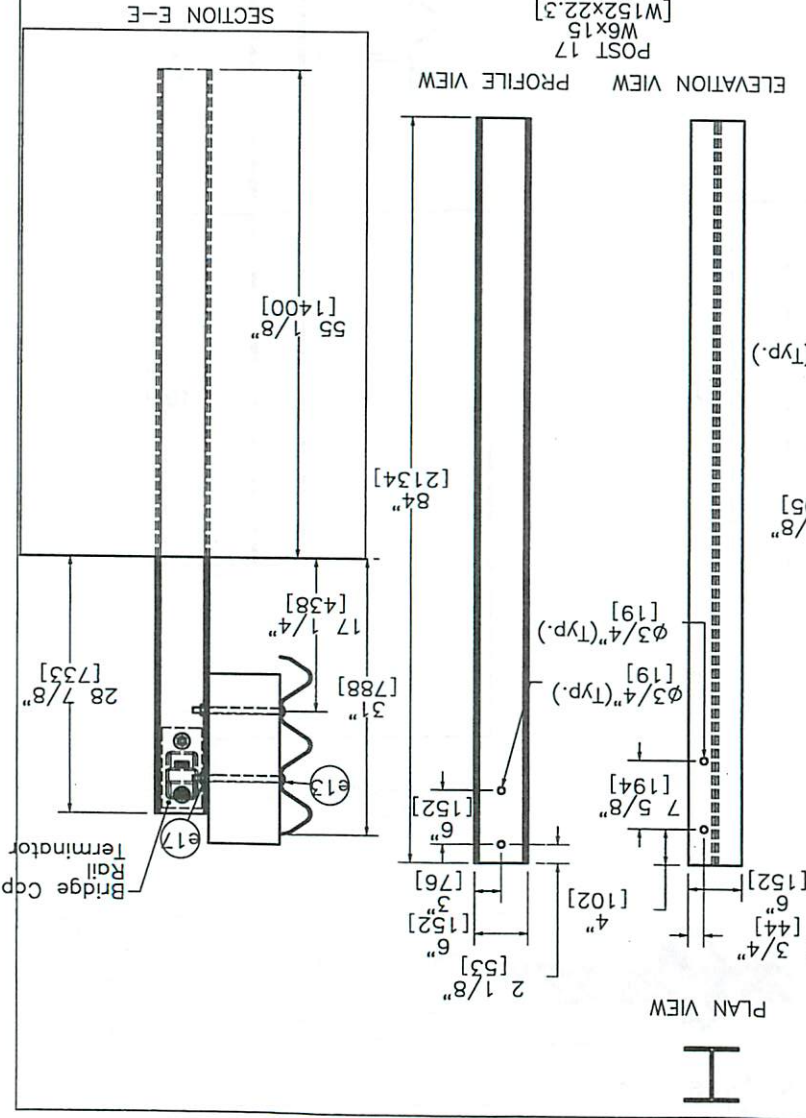
DRAWN BY:  
EMA/RJT

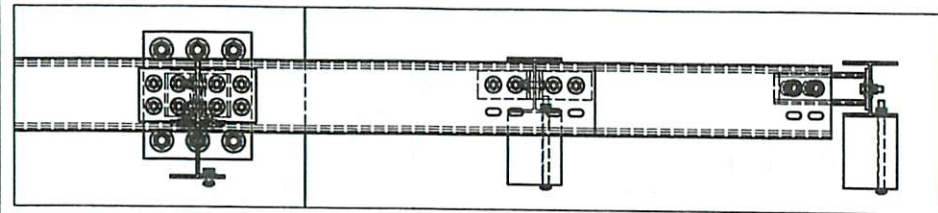
DWG. NAME:  
MWT-SP-3\_R3

SCALE: 1:20  
UNITS: In./mm

REV. BY:  
KAP/SKR/  
RKF

SHEET: 7 of 20	DATE: 11/22/2010	MWT Standard Post Detail Posts 16 & 17		DWG. NAME: Midwest Roadside Safety Facility	DWG. NAME: MWT-SP-3-R3	UNITS: in./mm	SCALE: 1:20	REV. BY:	RIP/KAP/SKR/
	DRAWN BY: EMA/RJT								



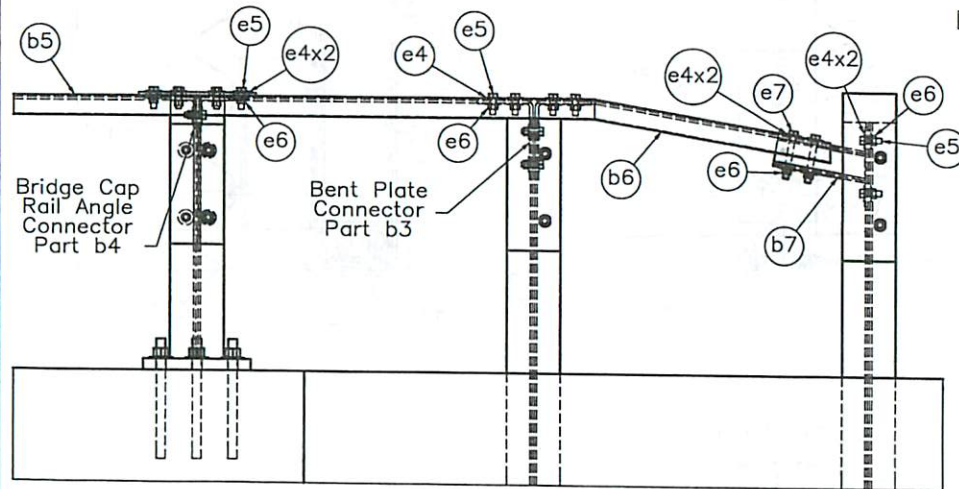


19

18

17

PLAN VIEW

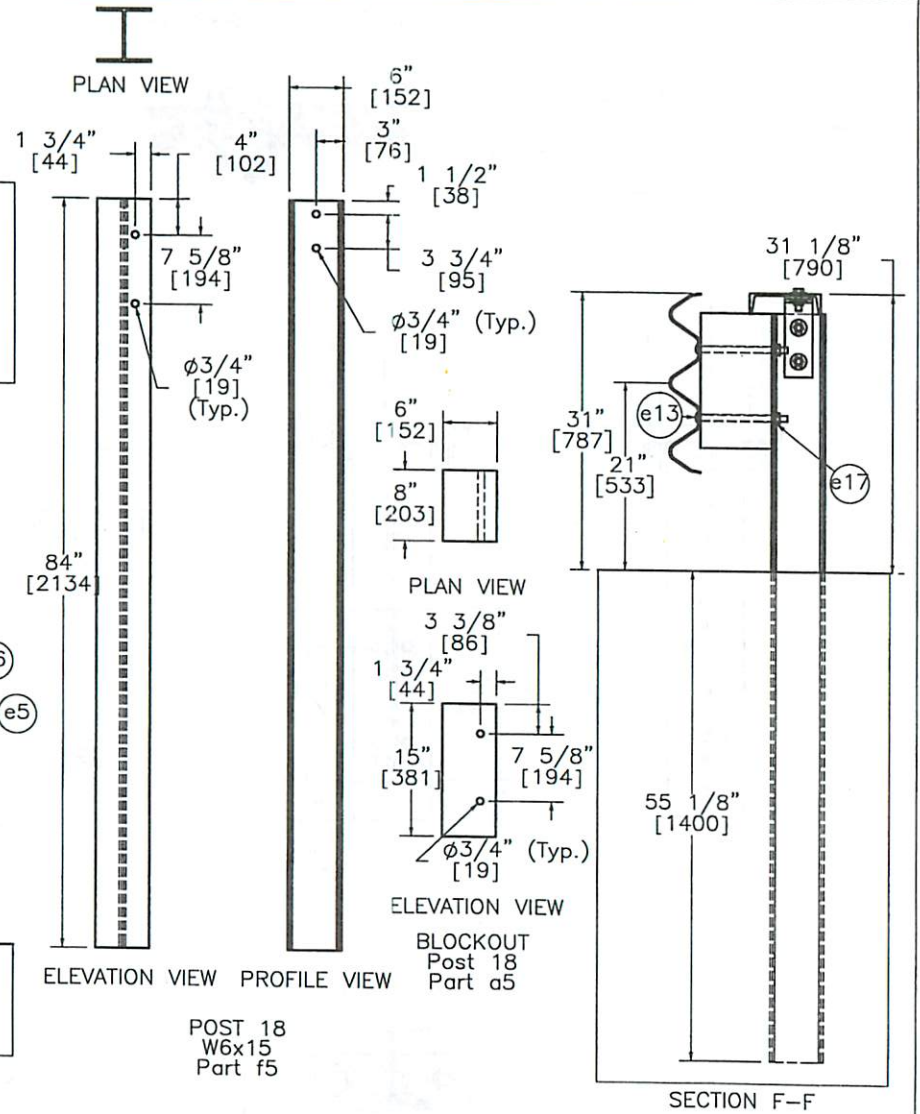


Bridge Cap Rail Angle Connector Part b4

Bent Plate Connector Part b3

ELEVATION VIEW

CAP RAIL DETAILS



PLAN VIEW

1 3/4" [44]

4" [102]

7 5/8" [194]

84" [2134]

ELEVATION VIEW PROFILE VIEW

POST 18  
W6x15  
Part f5

6" [152]  
3" [76]  
1 1/2" [38]  
3 3/4" [95]  
ø3/4" (Typ.) [19]

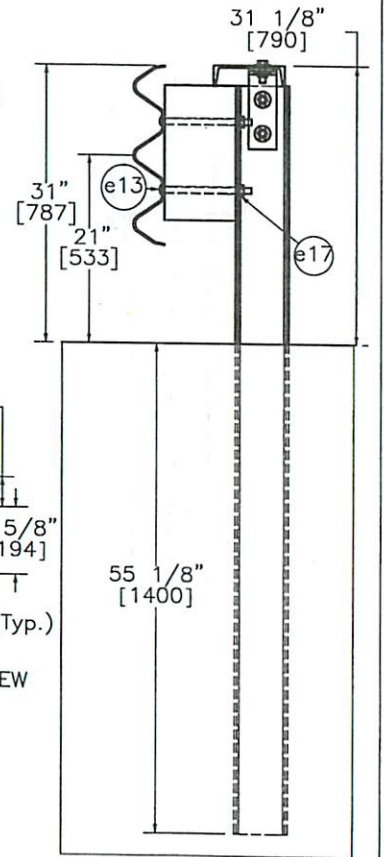
6" [152]  
8" [203]

PLAN VIEW

3 3/8" [86]  
1 3/4" [44]  
15" [381]  
7 5/8" [194]  
ø3/4" (Typ.) [19]

ELEVATION VIEW

BLOCKOUT  
Post 18  
Part a5



SECTION F-F



Midwest Roadside Safety Facility

MWT Standard Post

Cap Rail Hardware Details  
Post 18 Detail

DWG. NAME:  
MWT-SP-3\_R3

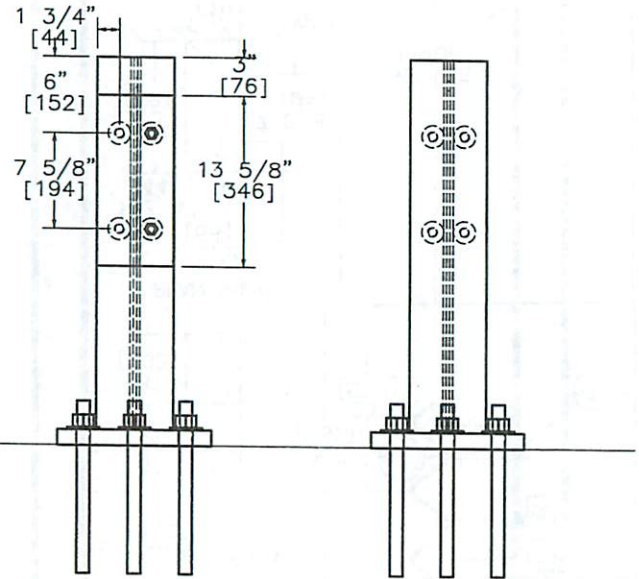
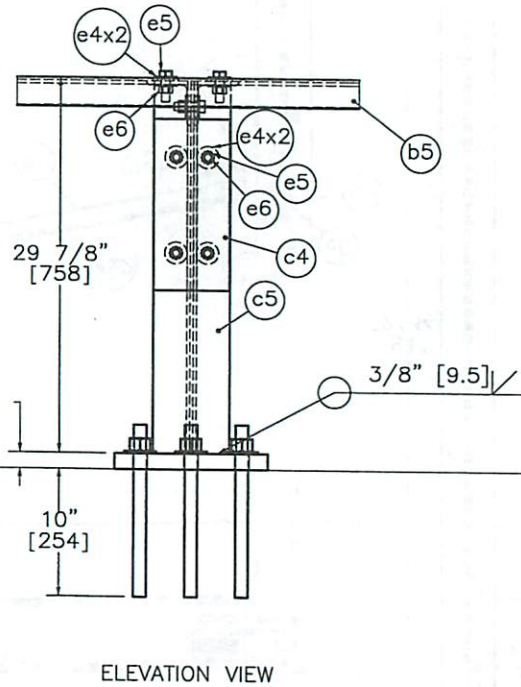
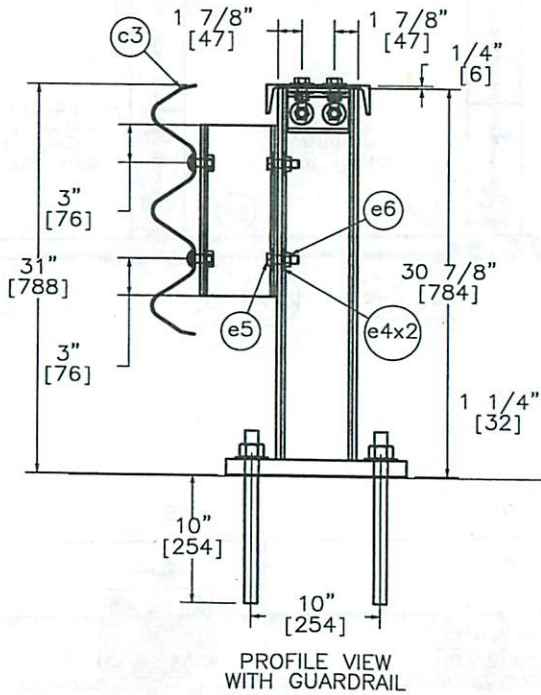
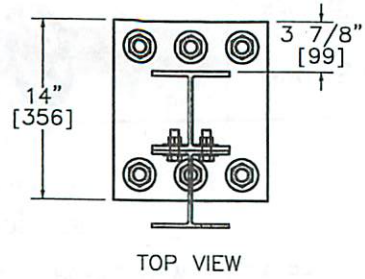
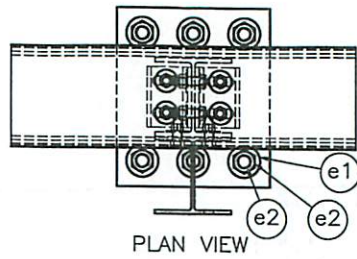
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UNITS: In.[mm]

SHEET:  
8 of 20

DATE:  
11/22/2010

DRAWN BY:  
EMA/RJT

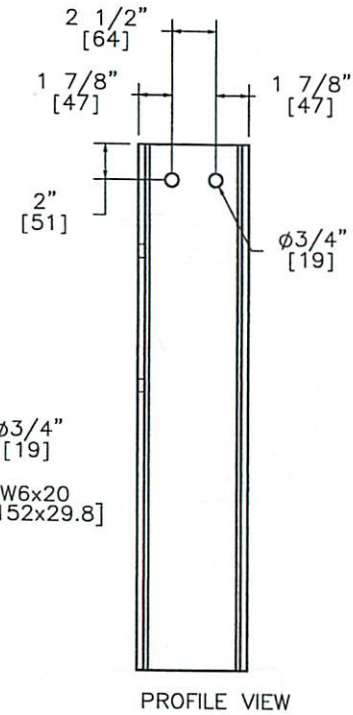
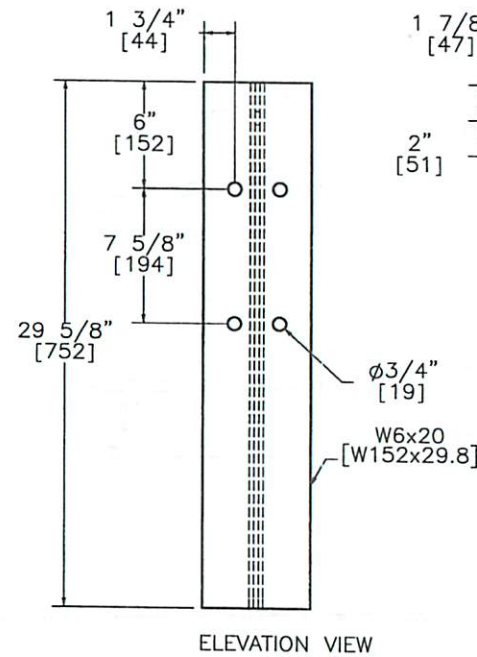
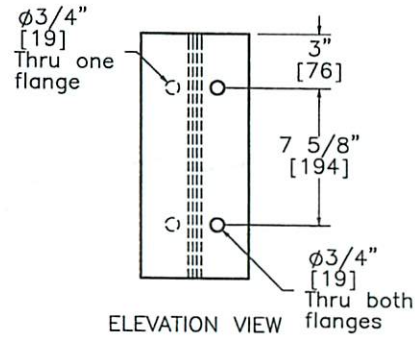
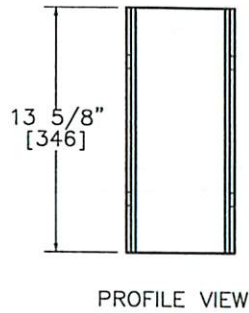
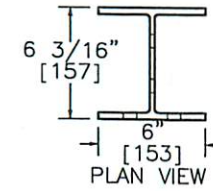
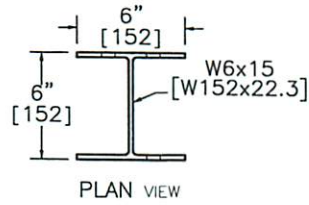
REV. BY:  
KAP/SKR/  
RKF



Midwest Roadside  
Safety Facility

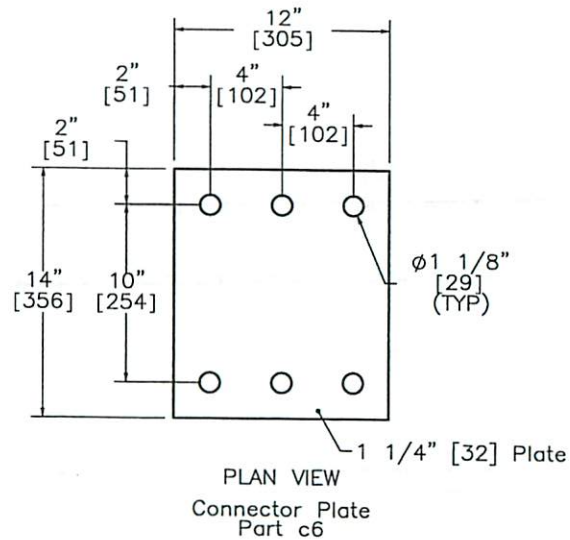
MWT Standard Post Bridge Rail Details		SHEET: 9 of 20
		DATE: 11/22/2010
DWG. NAME: MWT-SP-3_R3		DRAWN BY: EMA/RJT
		REV. BY: KAP/SKR/ RKF
SCALE: 1:14 UNITS: In.[mm]		





Steel Blockout Part c4

Steel Post Part c5



Midwest Roadside Safety Facility

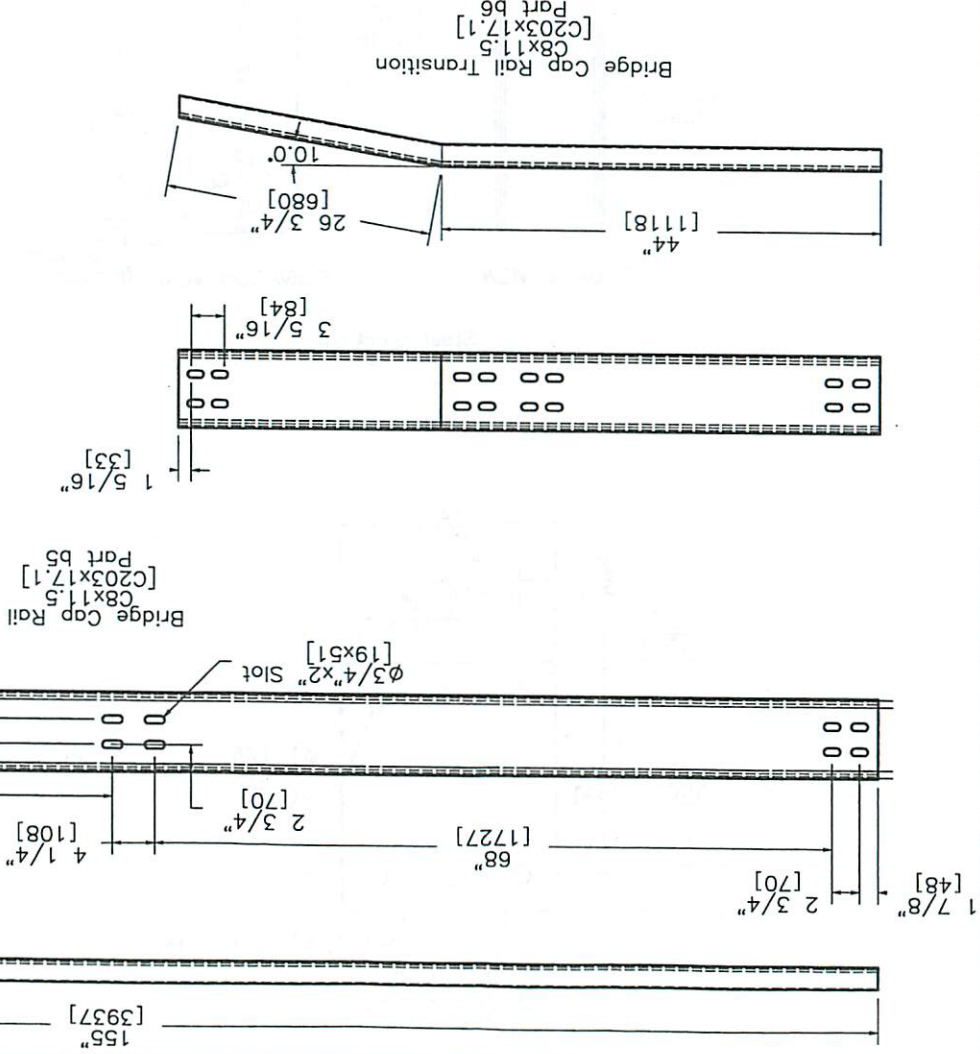
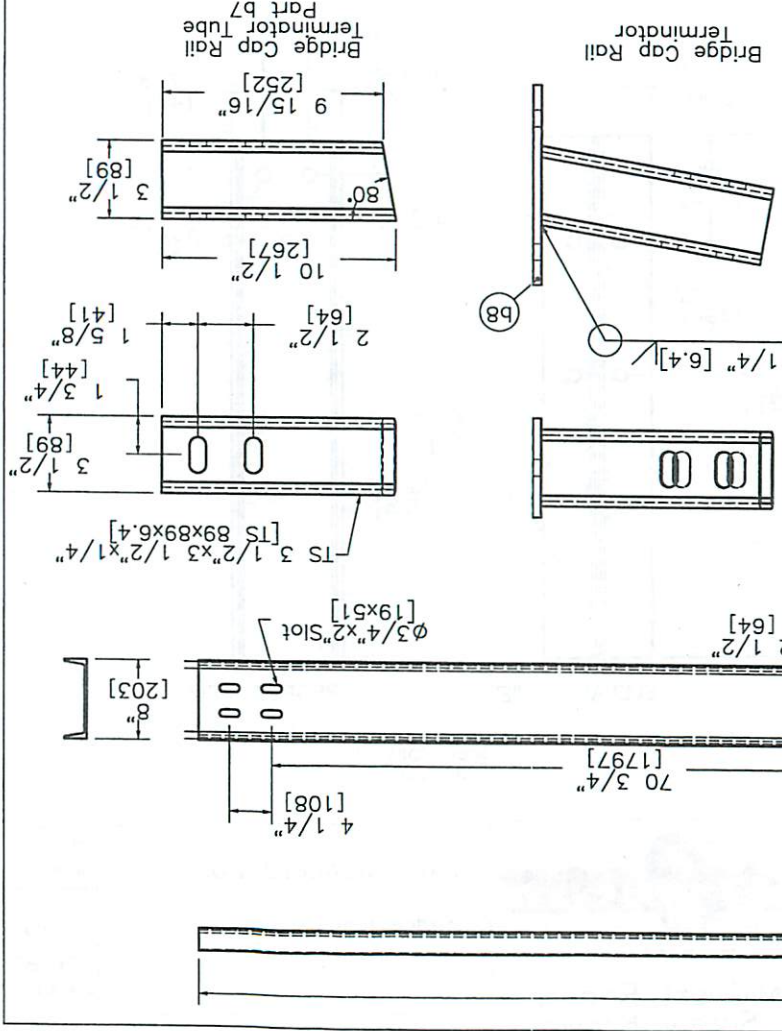
MWT Standard Post  
Bridge Rail Details

DWG. NAME:  
MWT-SP-3\_R3

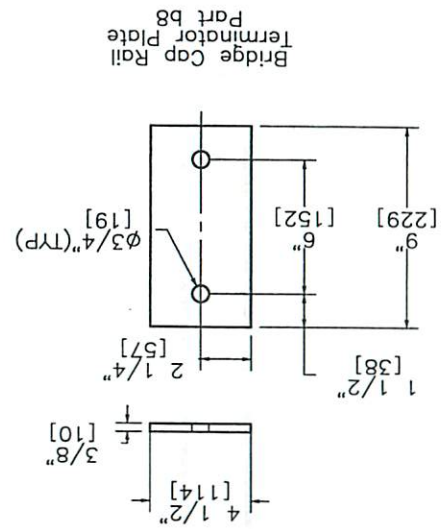
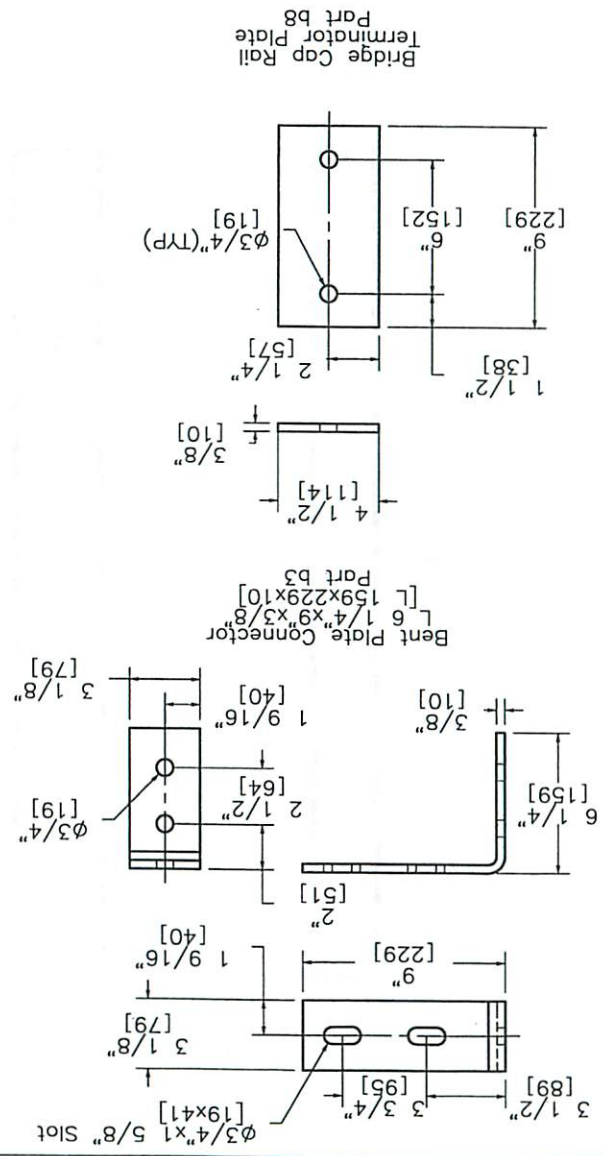
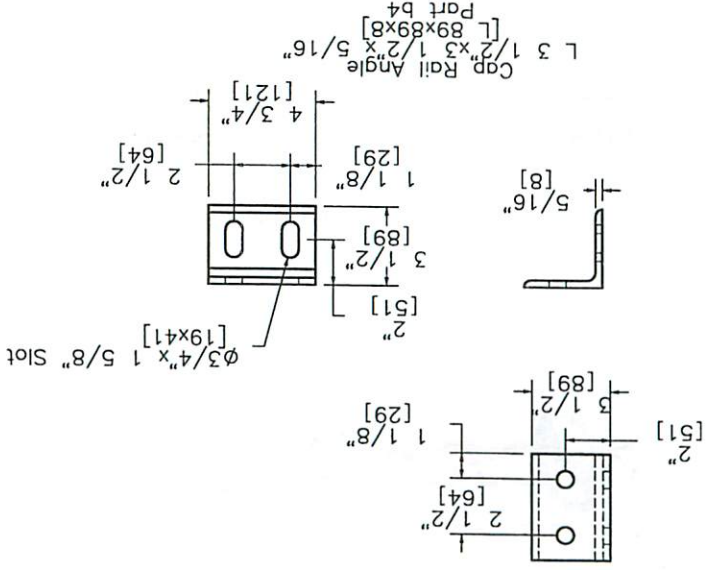
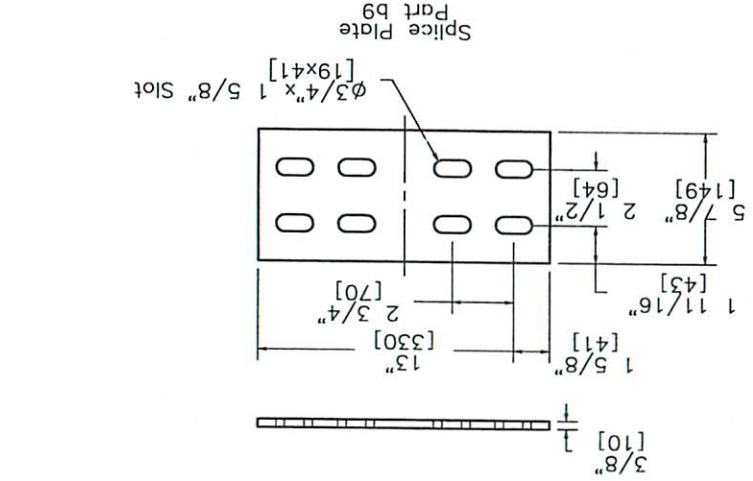
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UNITS: In./mm

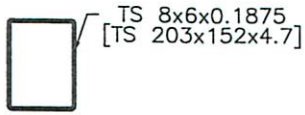
SHEET:  
10 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT  
REV. BY:  
KAP/SKR/  
RKF

SHEET: 11 of 20	DATE: 11/22/2010	DRAWN BY: EMA/RLT	REV. BY: None	DWG. NAME: MWT-SP-3-R3	UNITS: In. [mm]	KAP/SKR/ RKT
				MWT Standard Post		
			Midwest Roadside Safety Facility			
			SCALE: None			

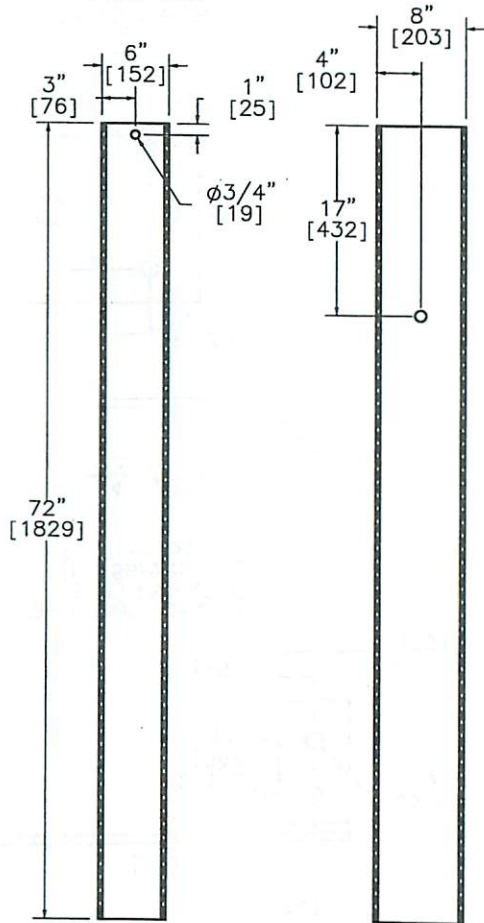


SHEET:	12 of 20	MWT Standard Post Bridge Rail Details		DWG. NAME:	Midwest Roadside Safety Facility
	DATE:			11/22/2010	
DRAWN BY:	EMA/RTJ	SCALE:	1:8	REV. BY:	
RIP/KAP/SKR/		UNITS:	In./[mm]	DWG. NAME:	MWT-SP-3-R3





PLAN VIEW



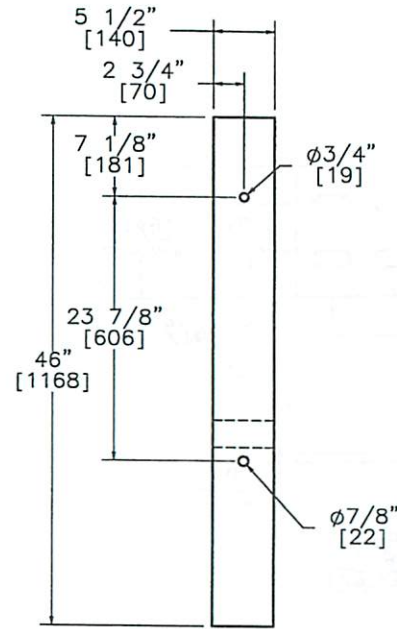
ELEVATION VIEW

PROFILE VIEW

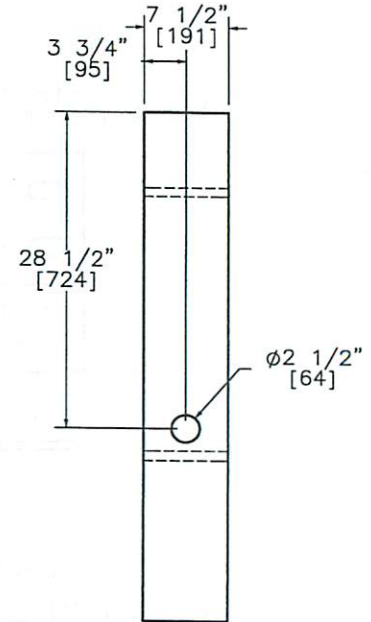
Foundation Tube  
Part b1



PLAN VIEW



ELEVATION VIEW



PROFILE VIEW

BCT (MGS) Timber Post  
Part b2



Midwest Roadside  
Safety Facility

MWT Standard Post  
BCT Timber Posts &  
Foundation Tube Detail

DWG. NAME.  
MWT-SP-3\_R3

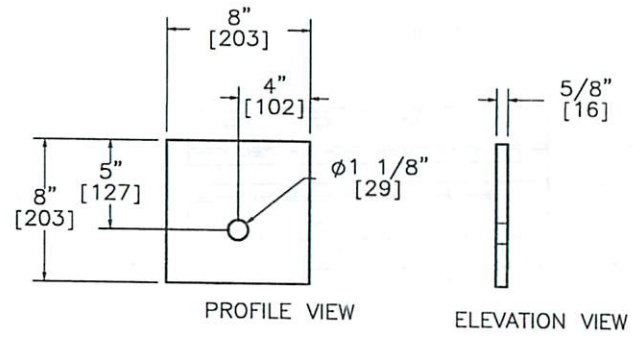
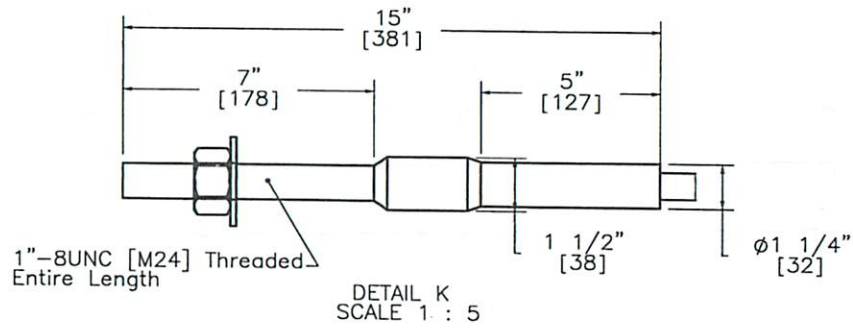
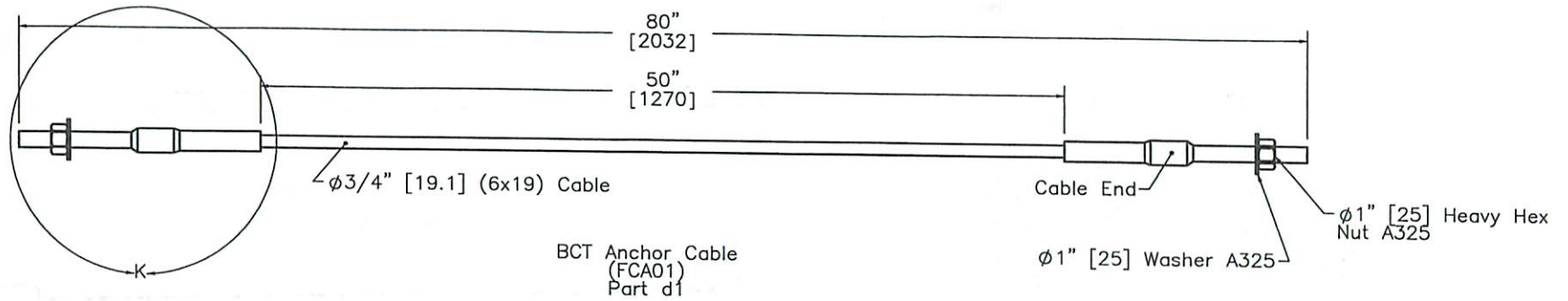
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UNITS: In,[mm]

SHEET:  
13 of 20

DATE:  
11/22/2010

DRAWN BY:  
EMA/RJT

REV. BY:  
KAP/SKR/  
RKF



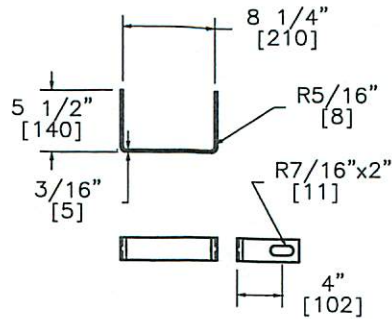
Midwest Roadside Safety Facility

MWT Standard Post  
BCT Anchor Cable Detail

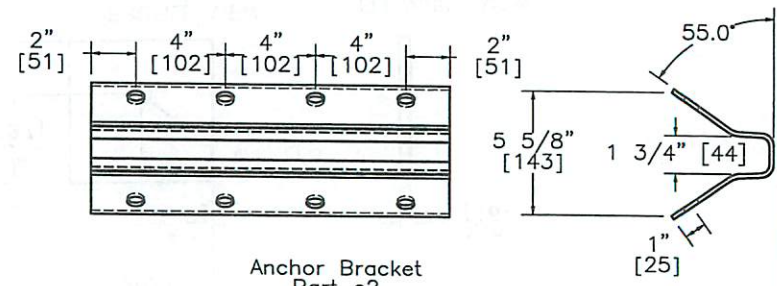
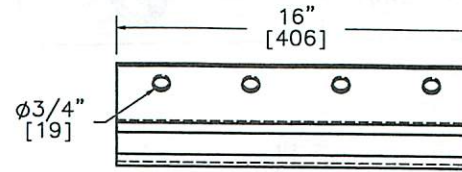
DWG. NAME.  
MWT-SP-3\_R3

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

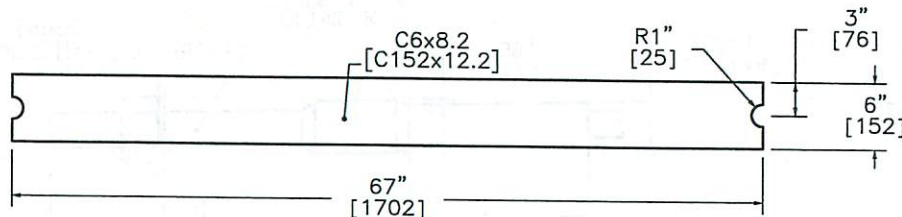
SHEET:  
14 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT  
REV. BY:  
KAP/SKR/  
RKF



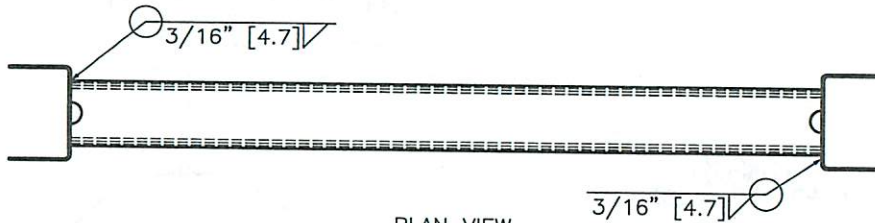
Yoke Detail



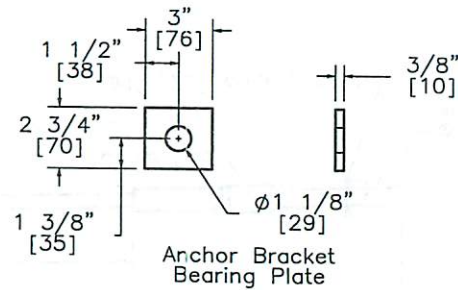
Anchor Bracket Part c2



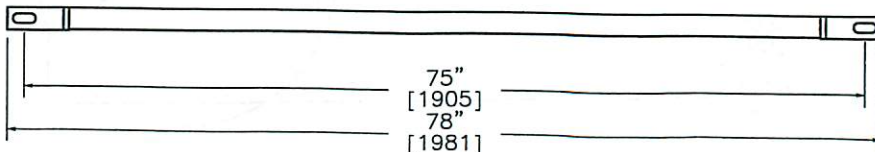
Strut Detail



PLAN VIEW



Anchor Bracket Bearing Plate



ELEVATION VIEW

Ground Strut Part c1



Midwest Roadside Safety Facility

MWT Standard Post

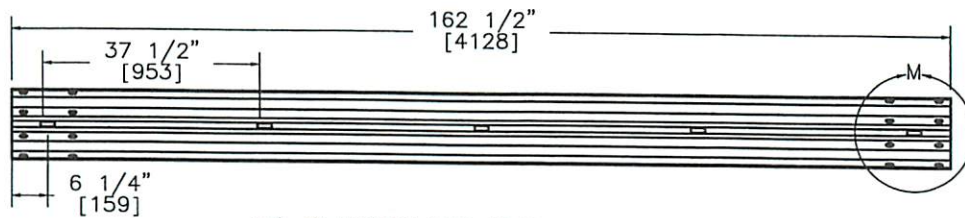
Ground Strut & Anchor Bracket Details

SHEET: 15 of 20  
DATE: 11/22/2010  
DRAWN BY: EMA/RJT

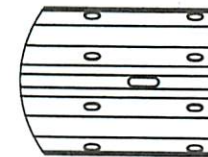
DWG. NAME: MWT-SP-3\_R3

SCALE: None  
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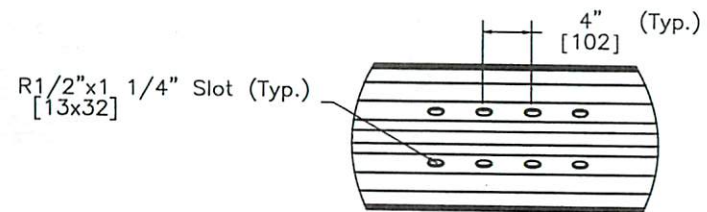
REV. BY: KAP/SKR/RKF



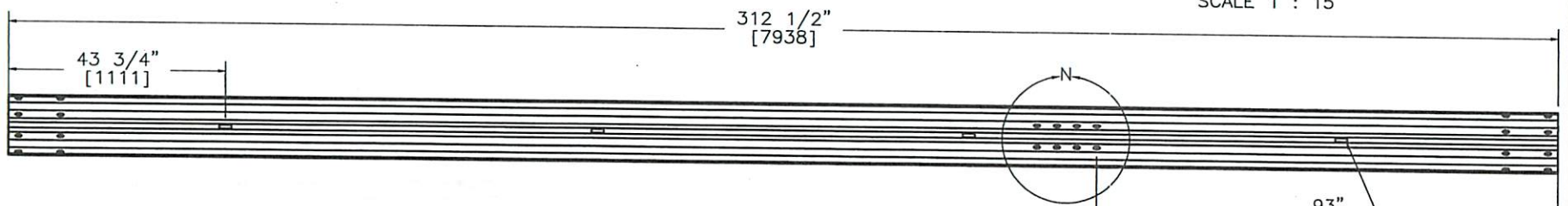
12'-6" [3810] MGS W-Beam, 12 gauge  
Part d4



DETAIL M  
SCALE 1 : 15



DETAIL N  
SCALE 1 : 15



25' [7620] MGS W-Beam End Section, 12 gauge  
Part d3

ø 3/4" x 2 1/2"  
Slots (Typ.)



Midwest Roadside  
Safety Facility

MWT Standard Post  
Rail Section Details

SHEET:  
16 of 20

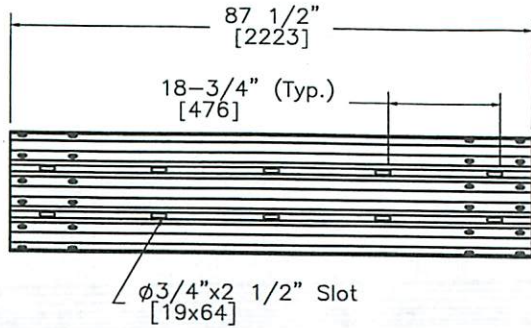
DATE:  
11/22/2010

DRAWN BY:  
EMA/RJT

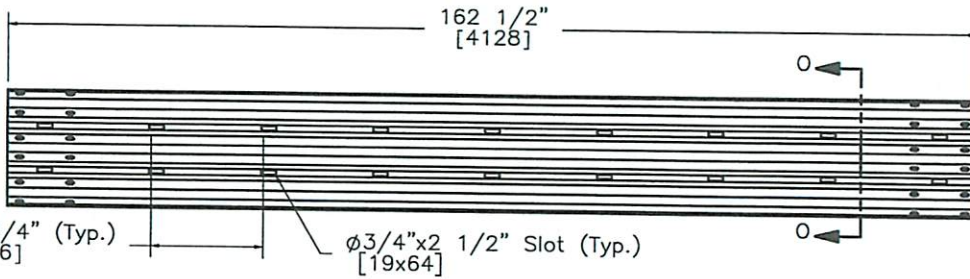
DWG. NAME:  
MWT-SP-3\_R3

SCALE: 1:31  
UNITS: In,[mm]

REV. BY:  
KAP/SKR/  
RKF



6'-3" [1905] Thrie Beam Section, 12 gauge,  
1/4 Post Spacing  
Part d5



12'-6" [3810] Thrie Beam Section, 12 gauge,  
1/4 Post Spacing  
Part c3

SECTION 0-0

 <b>Midwest Roadside Safety Facility</b>	<b>MWT Standard Post</b> Rail Section Details	SHEET: 17 of 20
		DATE: 11/22/2010
		DRAWN BY: EMA/RJT
DWG. NAME: MWT-SP-3_R3	SCALE: 1:30 UNITS: In./mm	REV. BY: KAP/SKR/ RKF



Midwest Guardrail System with Standard Post Spacing

Item No.	QTY.	Description	Material Spec	Hardware Guide
a1	1	6'-3" [1905] W-Beam to Thrie-Beam Transition Section	10 gauge AASHTO M180	-
a2	7	6x12x14 1/4" [152x305x362] Blockout	SYP Grade No.1 or better	-
a3	6	6x12x19" [152x305x483] Blockout - Post 10-15	SYP Grade No.1 or better	-
a4	2	6x8x19" [152x305x483] Blockout - Post 16-17	SYP Grade No.1 or better	-
a5	1	6x8x15" [152x305x381] Blockout - Post 18	SYP Grade No.1 or better	-
b1	2	72" [1829] Foundation Tube	A500 Grade B	PTE05
b2	2	BCT Timber Post -MGS Height	SYP Grade No. 1 or better	PDF01
b3	2	Bridge Cap Rail Bent Plate Connector 6 1/4x9x3/8" [159x229x9.5]	A36 Steel	-
b4	6	Bridge Cap Rail Angle 3 1/2x3 1/2x5/16" [89x89x7.9]	A36 Steel	-
b5	1	Bridge Cap Rail C8x11.5 [C203x17.1]	A36 Steel	-
b6	1	Bridge Cap Rail C8x11.5 [C203x17.1]	A36 Steel	-
b7	1	Bridge Cap Rail Terminator Tube 3 1/2x3 1/2x1/4" [89x89x6.4]	A36 Steel	-
b8	1	Terminator Plate 9x4 1/2x3/8" [229x114x9.5]	A36 Steel	-
b9	1	Bridge Cap Rail Splice Plate 5 7/8x13x3/8" [149x330x9.5]	A36 Steel	-
c1	1	Strut and Yoke Assembly	A36 Steel	PFP01
c2	1	Anchor Bracket	A36 Steel	FPA01
c3	3	12'-6" [3810] Thrie Beam Section - 1/2 Post Spacing	12 gauge AASHTO M180	-
c4	3	W6x15 [W152x22.3] Steel Bridge Blockout	A36 Steel	-
c5	3	W6x20 [W152x29.8] Steel Bridge Post	A36 Steel	-
c6	3	12x14x1 1/4" [305x356x32] Bridge Cap Connector Plate	A36 Steel	-
d1	1	BCT Anchor Cable 6' [1829] Long	6x19 Cable	FCA01
d2	1	8x8x5/8" [203x203x15.9] Anchor Bearing Plate	A36 Steel	FPB01
d3	1	25' [7620] W-Beam MGS End Section	12 gauge AASHTO M180	-
d4	2	12'-6" [3810] W-Beam MGS Section	12 gauge AASHTO M180	-
d5	1	6'-3" [1905] Thrie Beam Section - 1/2 Post Spacing	12 gauge AASHTO M180	-
d6	1	2 3/8" [60] O.D.x 6" [152] long BCT Hole insert	ASTM A53 Grade B Schedule 40	FMM02



Midwest Roadside Safety Facility

MWT Standard Post  
Bill of Materials

SHEET:  
18 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT

DWG. NAME:  
MWT-SP-3\_R3

SCALE: None  
UNITS: In./mm  
REV. BY:  
KAP/SKR/  
RKF

Midwest Guardrail System with Standard Post Spacing

Item No.	QTY.	Description	Material Spec	Hardware Guide
e1	20	1"Dia. [25] Flat Washer	Grade 5	FWC24a
e2	20	1"Dia. [25] Heavy Hex Nut	Grade 5	A325 or A449 Substitute
e3	18	1"Dia. [25] Threaded Rod	Grade A307	-
e4	116	5/8"Dia. [15.9] Flat Washer	Grade 5	-
e5	42	5/8"Dia. x 2" [M16x51] long Hex Head Bolt	Grade 5	FBX16a
e6	54	5/8"Dia. [15.9] Hex Nut	Grade 5	A325 or A449 Substitute
e7	2	5/8"Dia. x 5" [M16x127] long Hex Head Bolt	Grade 5	FBX16a
e8	4	7/8"Dia. [22.2] Flat Washer	Grade 5	FWC22a
e9	2	7/8"Dia. [22.2] Hex Nut	Grade 5	FBX22a
e10	2	7/8"Dia. x 7 1/2" [M22x191] long Hex Head Bolt	Grade 5	FBX22a
e11	2	5/8"Dia. x 10" [M16x254] long Hex Head Bolt	Grade 5	FBX16a
e12	8	5/8"Dia. x 1 1/2" [M16x38.1] long Hex Head Bolt	Grade 5	FBX16a
e13	8	5/8"Dia. x 10" [M16x254] long Guardrail Bolt	Grade A307	FBB03
e14	18	5/8"Dia. x 14" [M16x356] long Guardrail Bolt	Grade A307	FBB06
e15	8	16D Double Head Nail	-	-
e16	66	5/8"Dia. x 1 1/2" [M16x38] Guardrail Bolt	Grade A307	FBB01
e17	92	5/8"Dia. [15.9] Guardrail Nut	Grade 5	-
f1	7	W6x8.5 [W152x12.6] 72" [1829] long - Post Nos. 3-9	A36 Steel	-
f2	6	W6x8.5 [W152x12.6] 72" [1829] long - Post Nos. 10-15	A36 Steel	-
f3	1	W6x15 [W152x22.3] 84" [2134] long - Post No. 16	A36 Steel	-
f4	1	W6x15 [W152x22.3] 84" [2134] long - Post No. 17	A36 Steel	-
f5	1	W6x15 [W152x22.3] 84" [2134] long - Post No. 18	A36 Steel	-



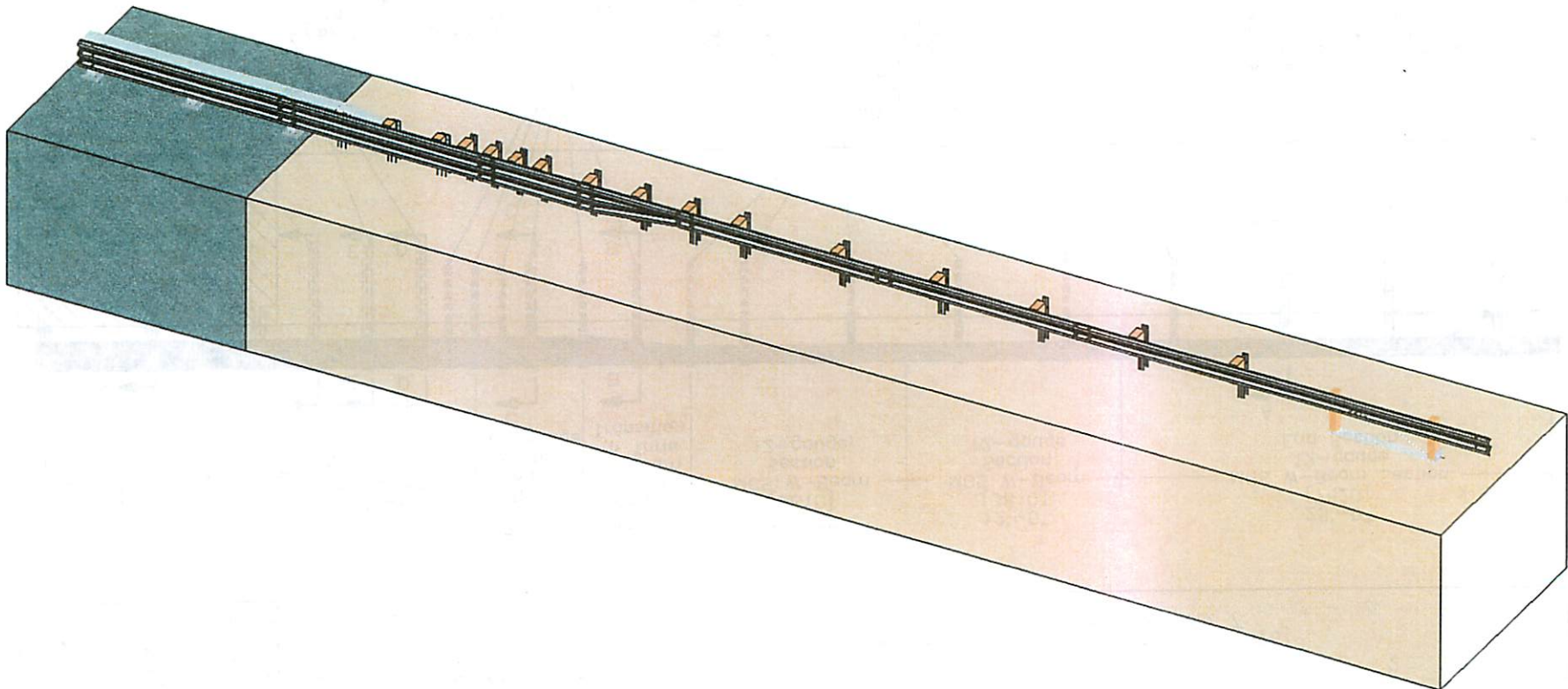
Midwest Roadside  
Safety Facility

MWT Standard Post  
Bill of Materials

DWG. NAME:  
MWT-SP-3\_R3

SCALE: None  
UNITS: In./mm

SHEET:  
19 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT  
REV. BY:  
KAP/SKR/  
RKF




Midwest Roadside  
Safety Facility

MWT Standard Post  
Isometric System View

DWG. NAME:  
MWT-SP-3\_R3

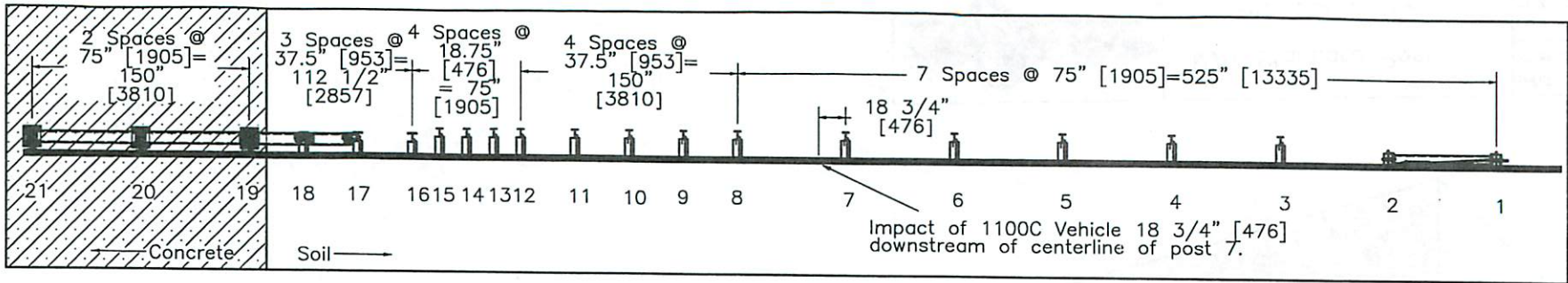
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SHEET:  
20 of 20

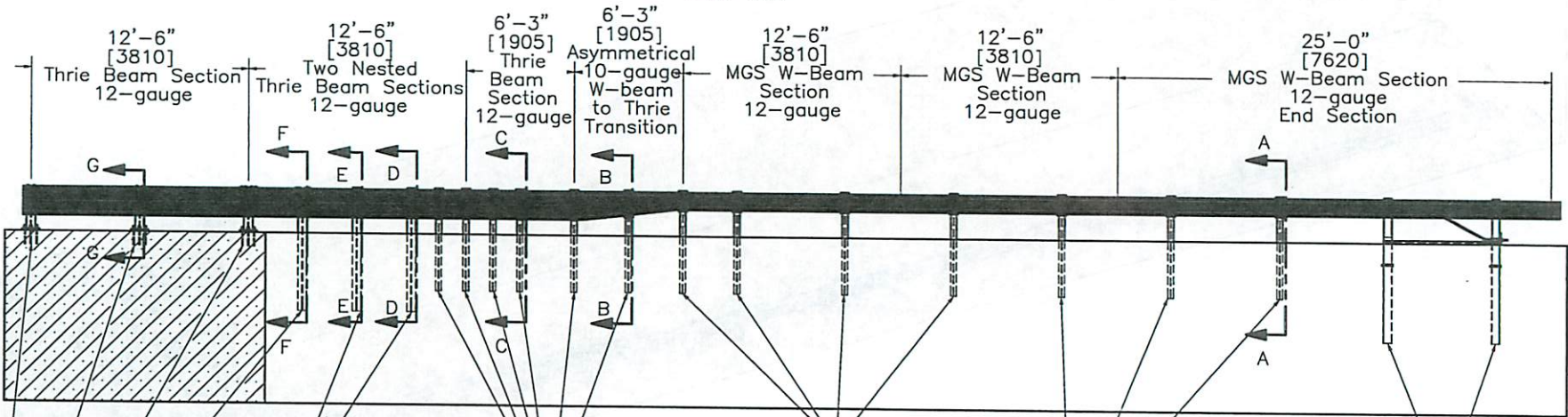
DATE:  
11/22/2010

DRAWN BY:  
EMA/RJT

REV. BY:  
KAP/SKR/  
RKF



PLAN VIEW



ELEVATION VIEW

W6x15 [W152x22.3] Steel Posts 84" [2134] long with 6x8x19" [152x203x483] Timber Blockouts  
 W6x15 [W152x22.3] Steel Posts 84" [2134] long with 6x8x15" [152x203x381] Timber Blockout  
 W6x20 [W152x29.8] Steel Bridge Posts with W6x15 [152x22.3] Steel Blockouts  
 W6x8.5 [W152x12.6] Steel Posts 72" [1829] long with 6x12x14 1/4" [152x305x362] Blockouts  
 W6x8.5 [W152x12.6] Steel Posts 72" [1829] long with 6x12x19" [152x305x483] Timber Blockouts  
 BCT posts in 6' [1829] long (galvanized) foundation tubes, ground line strut, and BCT cable anchor



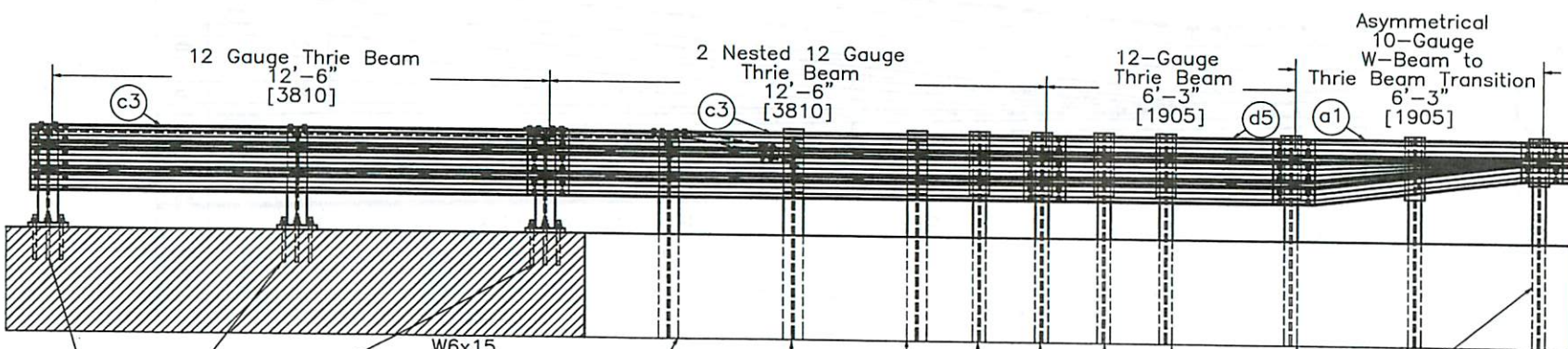
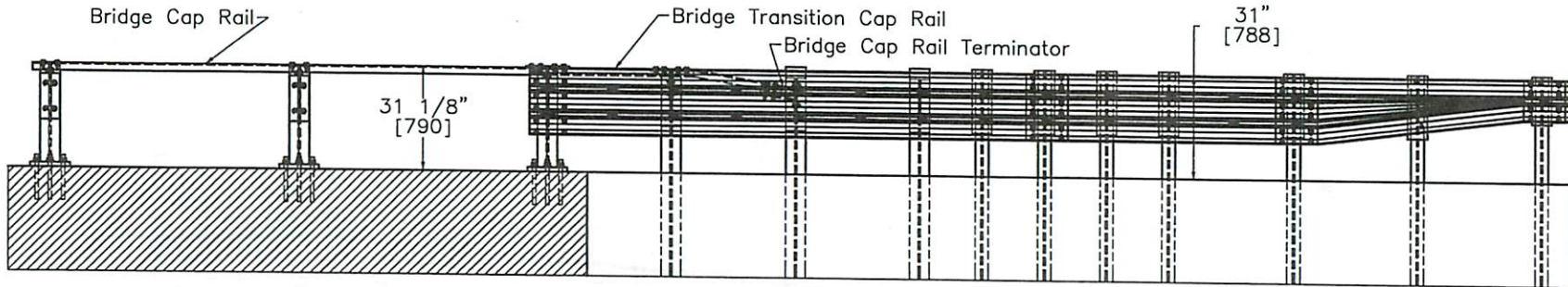
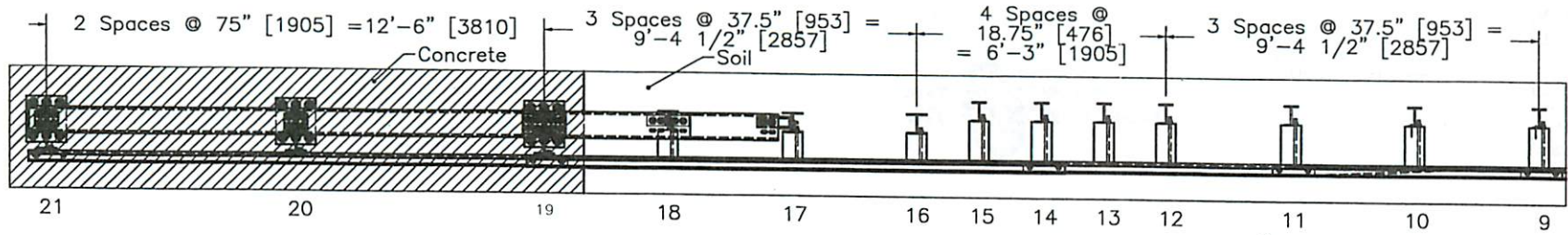
Midwest Roadside Safety Facility

MWT Standard Post System Layout

DWG. NAME.  
MWT-SP-3\_R3

SCALE: 1:110  
UNITS: In.,[mm]

SHEET:  
1 of 20  
 DATE:  
11/22/2010  
 DRAWN BY:  
EMA/RJT  
 REV. BY:  
KAP/SKR/  
RKF



W6x20  
[W152x29.8]  
Steel Bridge  
Posts with  
W6x15  
[W152x22.3]  
Steel Blockouts

W6x15  
[W152x22.3]  
Steel Post 84"  
[2134] long  
with 6x8x15"  
[152x203x381]  
Timber Blockout

W6x15  
[W152x22.3] Steel  
Posts 84" [2134]  
long with 6x8x19"  
[152x203x483]  
Timber Blockouts

W6x8.5 [W152x12.6] Steel  
Posts 72" [1829] long with  
6x12x19" [152x305x483]  
Timber Blockouts

W6x8.5 [152x12.6]  
Steel Post 72"  
[1829] long with  
6x12x14 1/4"  
[152x305x362]  
Timber Blockout

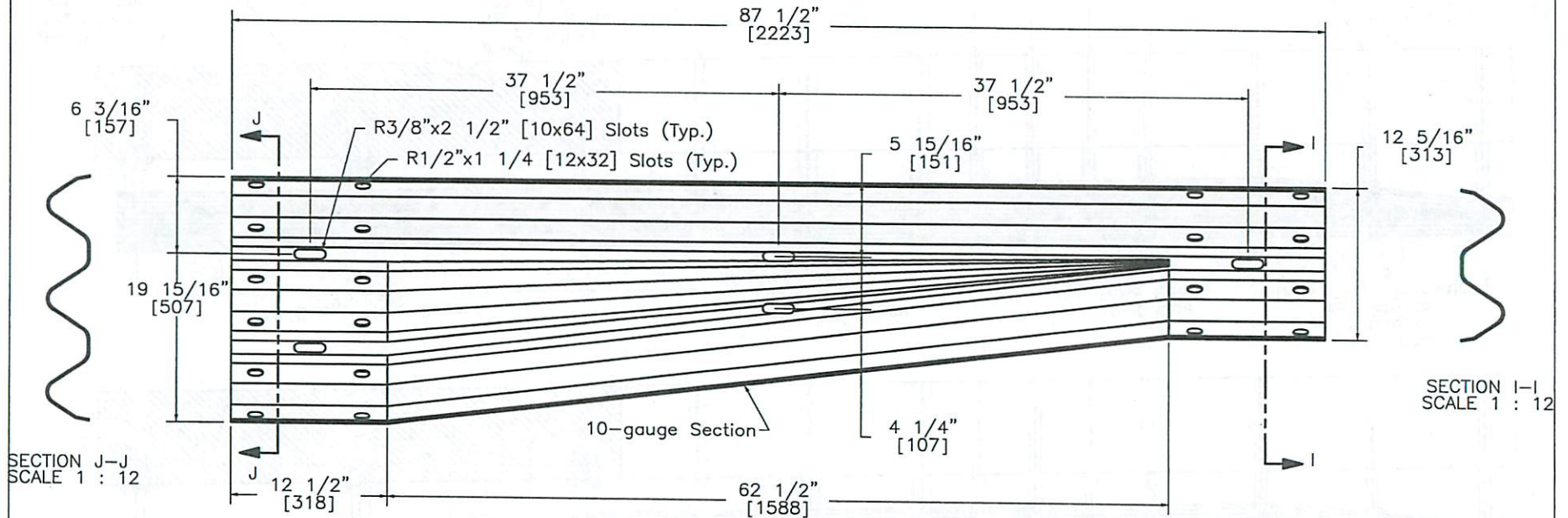


Midwest Roadside  
Safety Facility

<p>MWT Standard Post Transition Detail</p>		SHEET: 2 of 20
		DATE: 11/22/2010
<p>DWG. NAME: MWT-SP-3_R3</p>		DRAWN BY: EMA/RJT
		REV. BY: KAP/SKR/ RKF
		SCALE: 1:50 UNITS: In.,[mm]



PLAN VIEW



ELEVATION VIEW



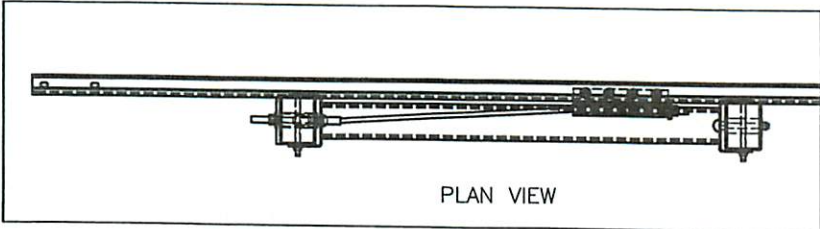
Midwest Roadside  
Safety Facility

MWT Standard Post  
  
Asymmetrical W-Beam  
to Thrie Beam Transition  
Rail Section Detail

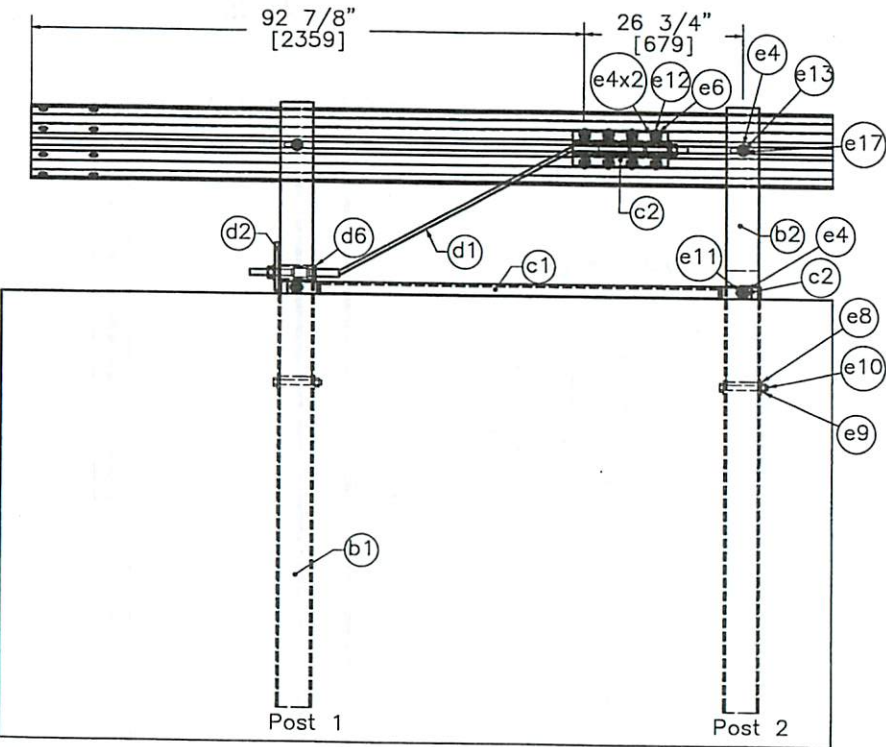
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MWT-SP-3\_R3

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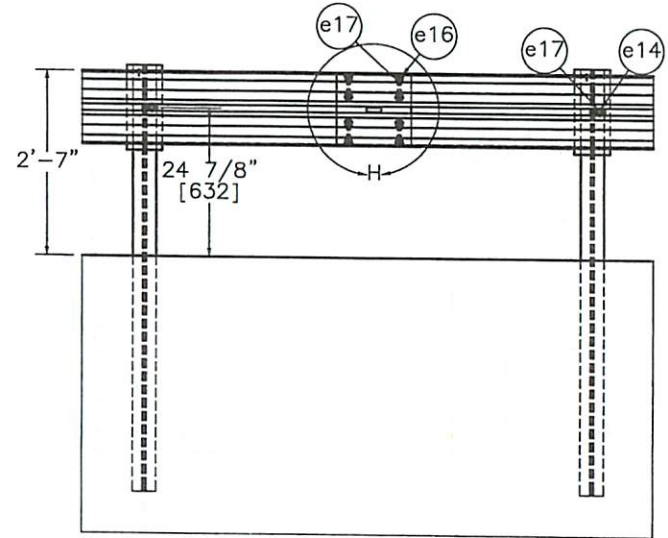
SHEET:  
3 of 20  
  
DATE:  
11/22/2010  
  
DRAWN BY:  
EMA/RJT  
  
REV. BY:  
KAP/SKR/  
RKF



PLAN VIEW



ELEVATION VIEW  
END RAIL DETAIL



ELEVATION VIEW  
SPLICE DETAIL

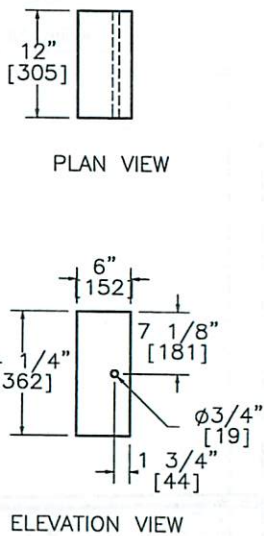
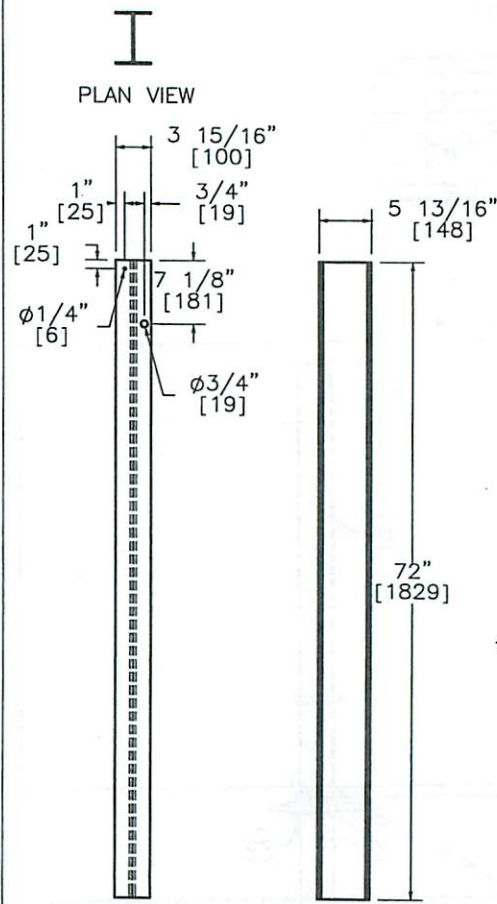


DETAIL H  
SCALE 1 : 15



Midwest Roadside  
Safety Facility

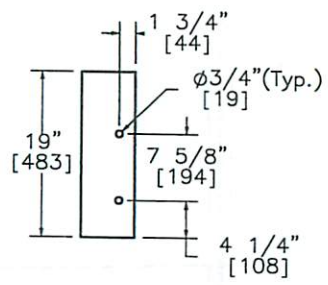
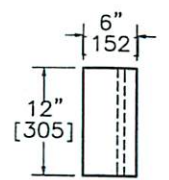
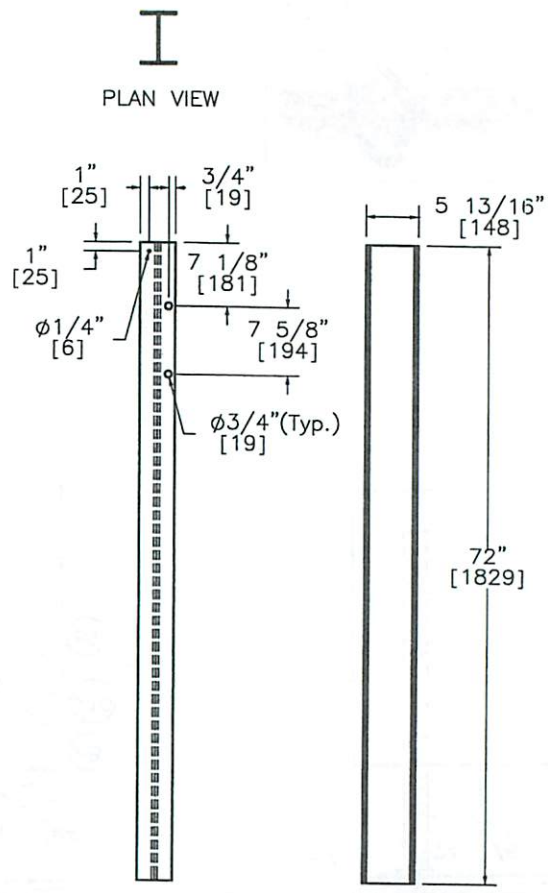
MWT Standard Post		SHEET:
		4 of 20
Splice Detail End Rail Detail		DATE:
		11/22/2010
Midwest Roadside Safety Facility		DRAWN BY:
		EMA/RJT
DWG. NAME:	SCALE: None	REV. BY:
MWT-SP-3_R3	UNITS: In.[mm]	KAP/SKR/ RKF



BLOCKOUT  
Post 3-9  
Part a2

ELEVATION VIEW PROFILE VIEW

POST 3-9  
W6x8.5  
[W152x12.6]  
Part f1



BLOCKOUT  
Post 10-15  
Part a3

ELEVATION VIEW PROFILE VIEW

POST 10-15  
W6x8.5  
[W152x12.6]  
Part f2



Midwest Roadside  
Safety Facility

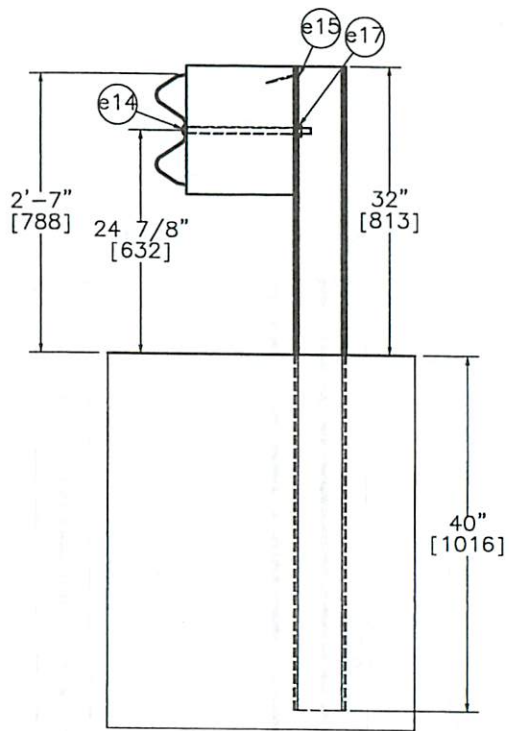
MWT Standard Post  
Posts 3-15  
Details

DWG. NAME.  
MWT-SP-3\_R3

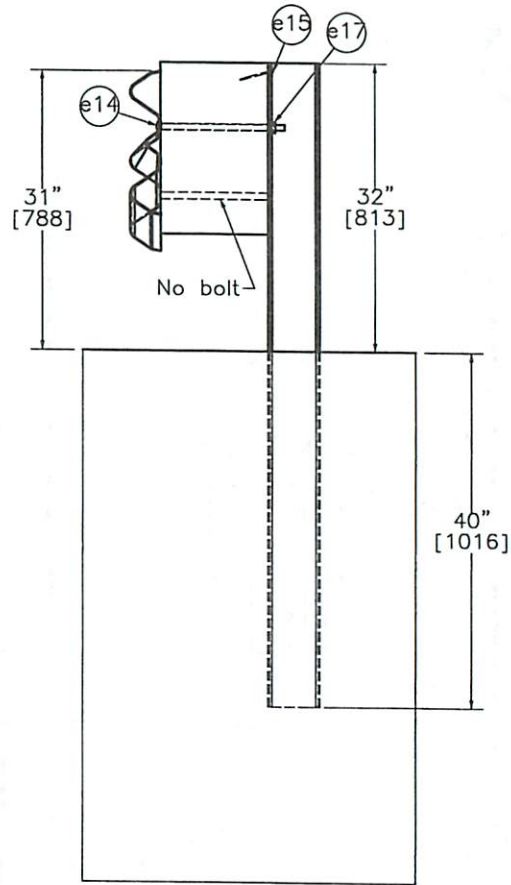
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UNITS: In.[mm]

SHEET:  
5 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT  
REV. BY:  
KAP/SKR/  
RKF

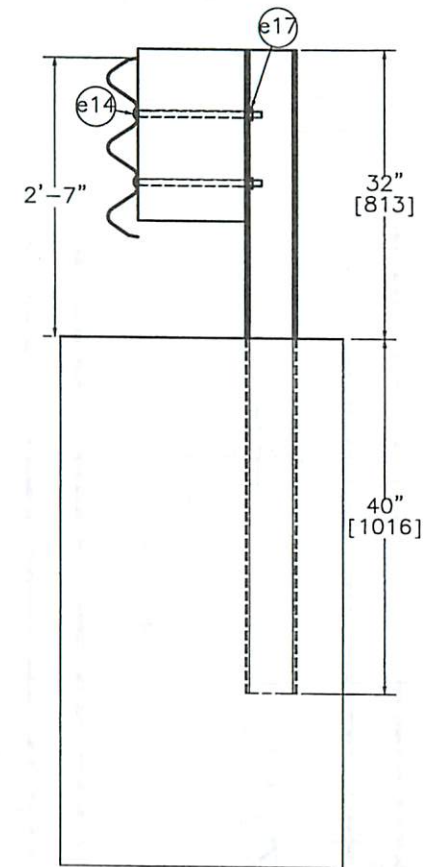




SECTION A-A  
Post 3-9



SECTION B-B  
Post 10



SECTION C-C  
Post 11-15



Midwest Roadside  
Safety Facility

MWT Standard Post  
Posts 3-15 Details  
with Rail

DWG. NAME.  
MWT-SP-3\_R3

SCALE: 1:20  
UNITS: In.,[mm]

SHEET:  
6 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT  
REV. BY:  
KAP/SKR/  
RKF



Midwest Roadside Safety Facility

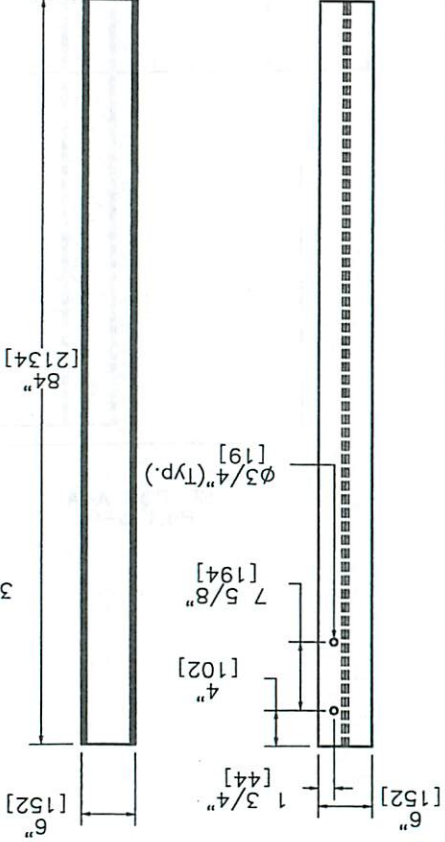
Posts 16 & 17  
Detail

MWT Standard Post

SHEET: 7 of 20	DATE: 11/22/2010	DRAWN BY: EMA/RTJ	REV. BY: KAP/SKR/
SCALE: 1:20		UNITS: In./mm	DWG. NAME: MWT-SP-3-R3

POST 16  
W6x15  
[W152x22.3]  
Part 13

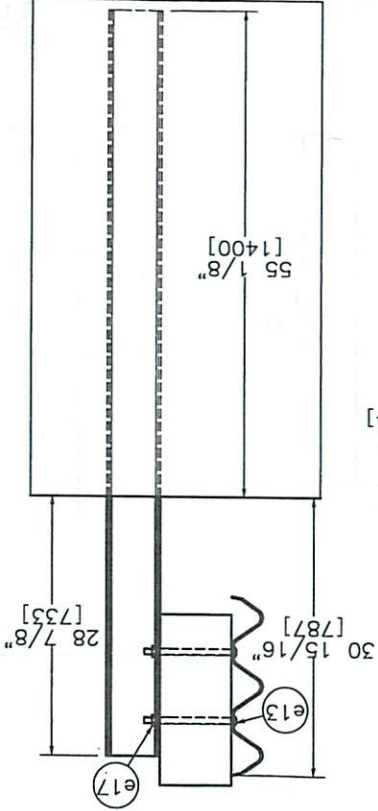
ELEVATION VIEW PROFILE VIEW



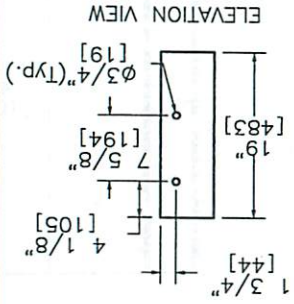
PLAN VIEW



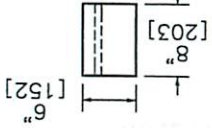
SECTION D-D



BLOCKOUT  
Post 16 & Post 17  
Part 14



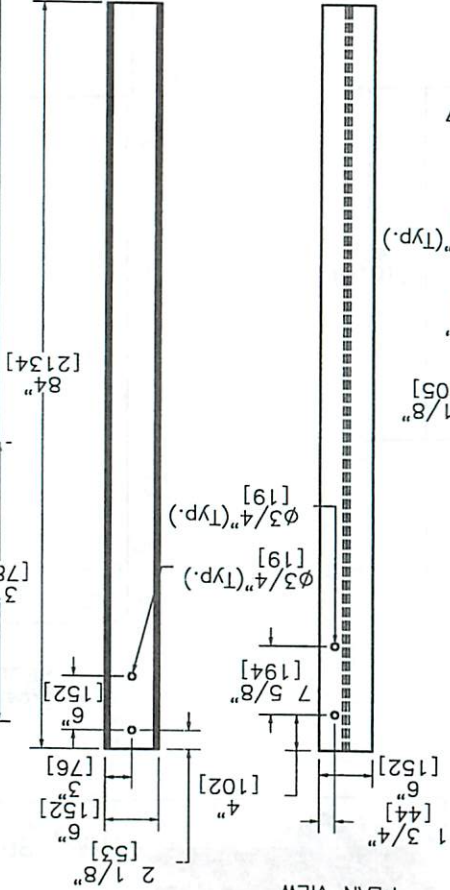
PLAN VIEW



PLAN VIEW



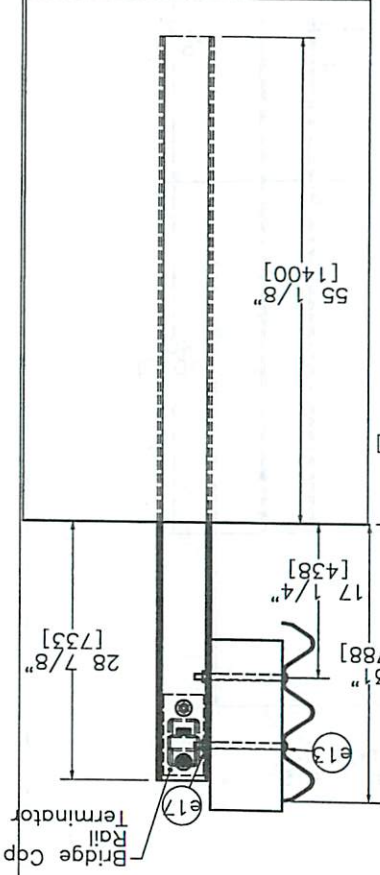
ELEVATION VIEW PROFILE VIEW



PLAN VIEW



SECTION E-E

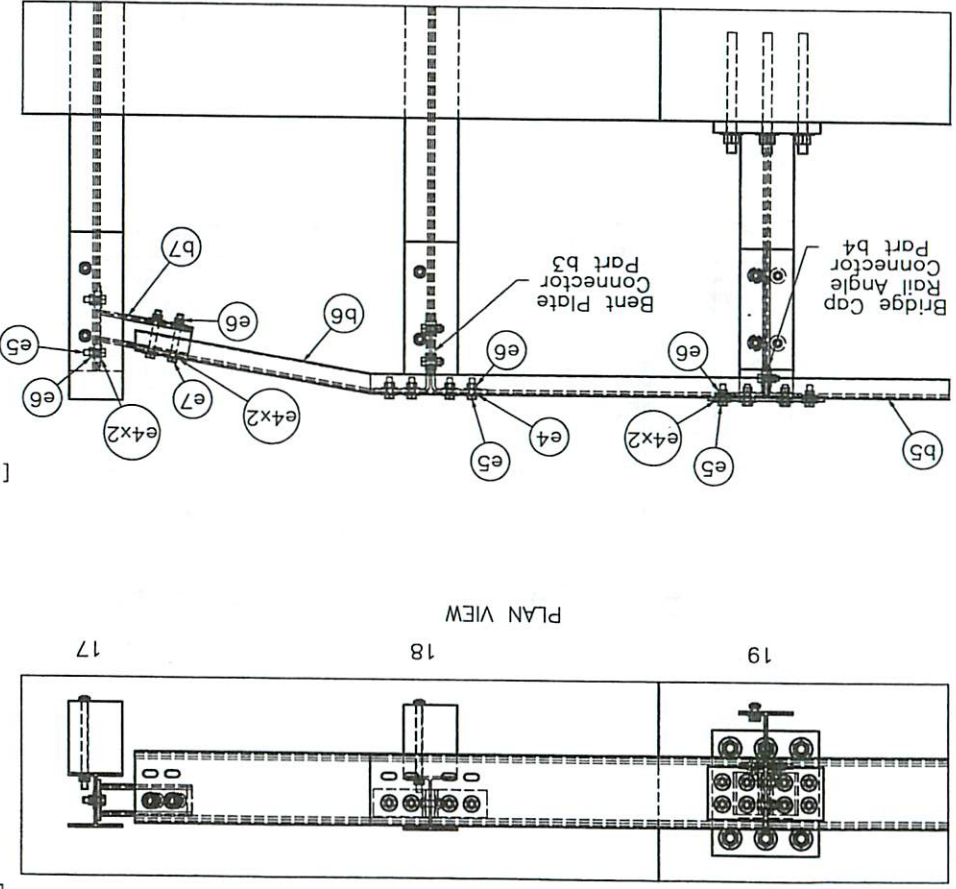


Bridge Ccp  
Rail  
Terminator

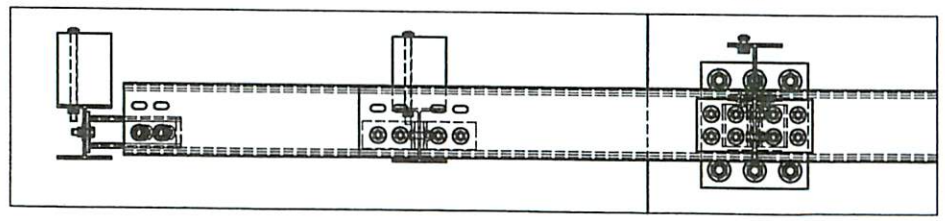
SHEET: 8 of 20	DATE: 11/22/2010	DRAWN BY: EMA/RJT	DWG. NAME: Midwest Roadside Safety Facility	UNITS: in./mm	KAP/SKR/ RJK
				SCALE: 1:20	REV. BY:
MWT Standard Post			MWT-SP-3-R3		
Cap Rail Hardware Details			Post 18 Detail		



CAP RAIL DETAILS  
ELEVATION VIEW

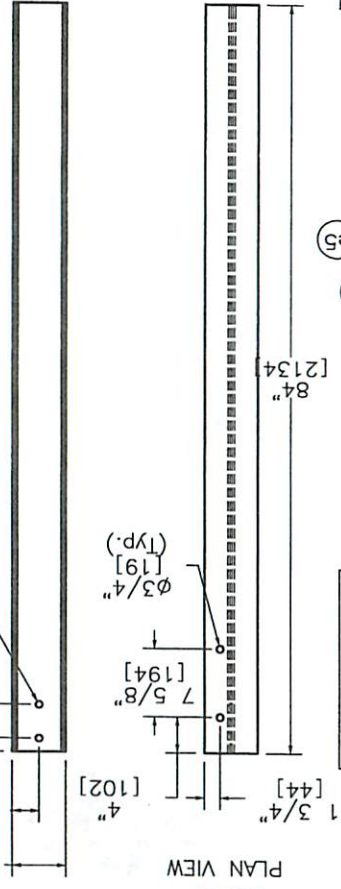


PLAN VIEW

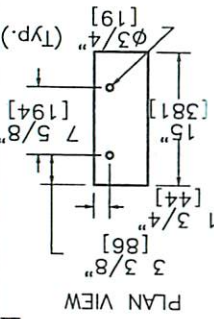


POST 18  
W6x15  
Part 15

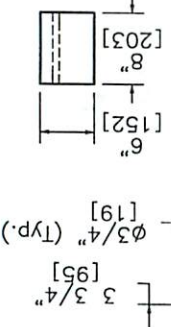
ELEVATION VIEW PROFILE VIEW



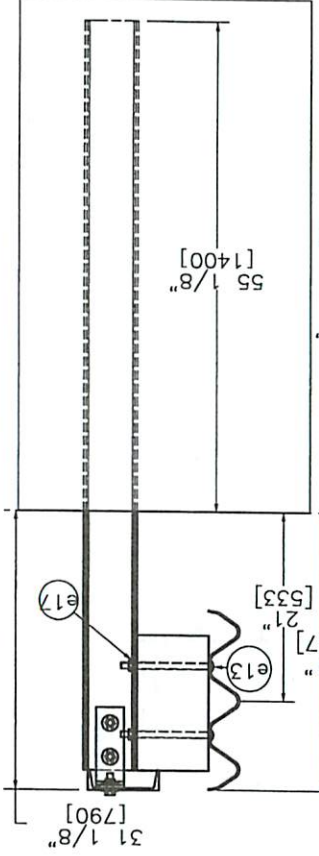
BLOCKOUT  
Post 18  
Part 05

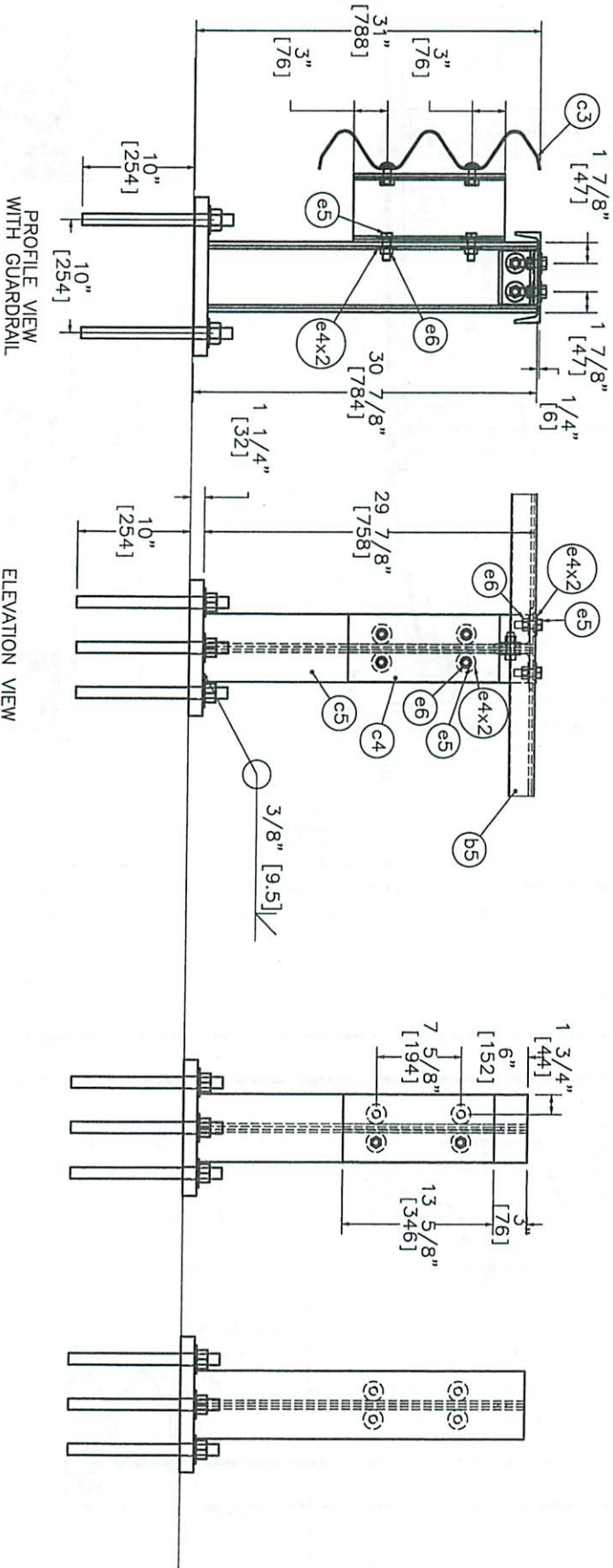
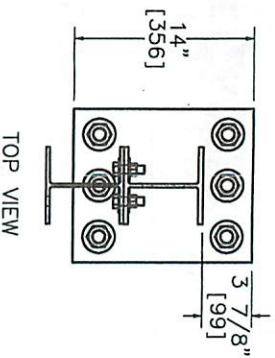
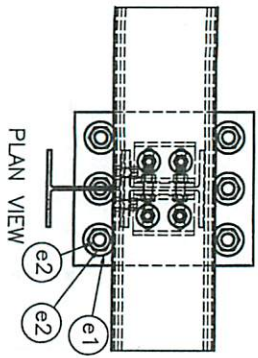


PLAN VIEW



SECTION F-F





PROFILE VIEW  
WITH GUARDRAIL

ELEVATION VIEW



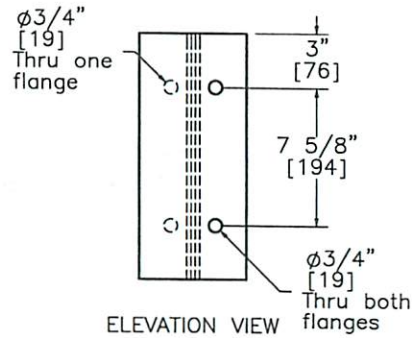
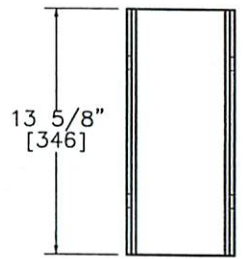
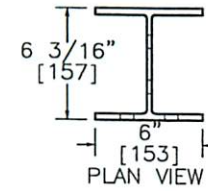
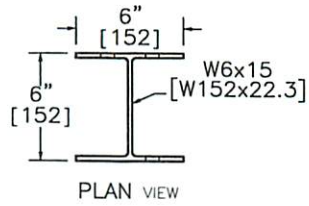
Midwest Roadside  
Safety Facility

MWT Standard Post  
Bridge Rail Details

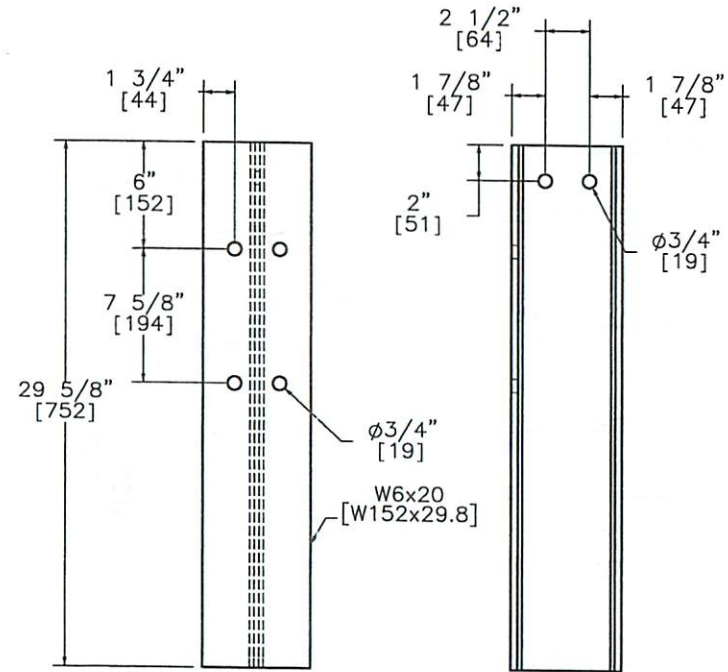
DMG. NAME:  
MWT-sp-3\_r3

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

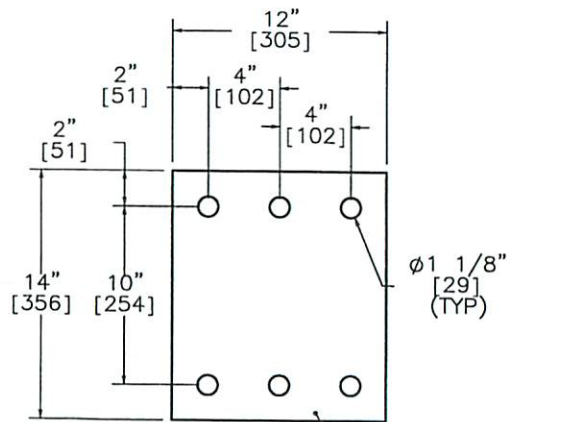
SHEET:  
9 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EAA/RJT  
REV. BY:  
KJP/SKR/  
RJK



Steel Blockout  
Part c4



Steel Post  
Part c5



Connector Plate  
Part c6



Midwest Roadside  
Safety Facility

MWT Standard Post  
Bridge Rail Details

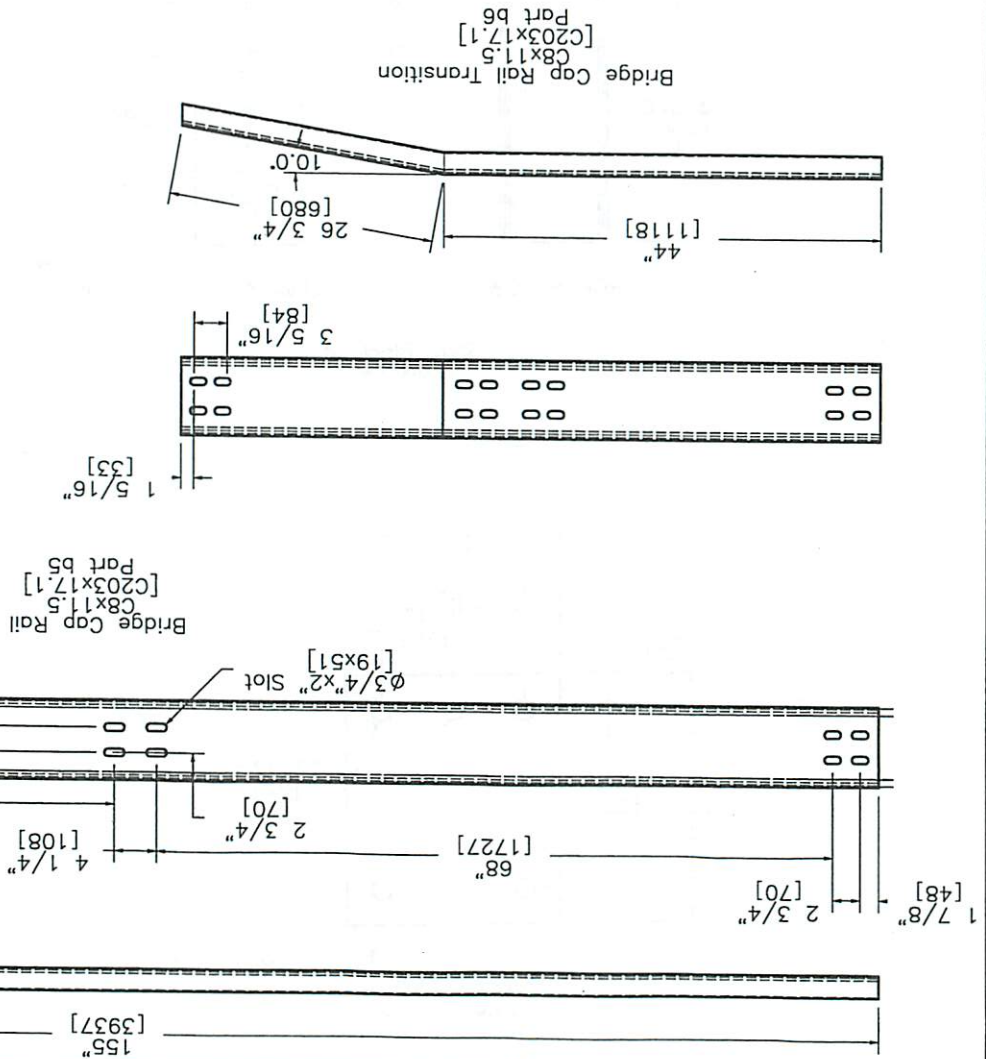
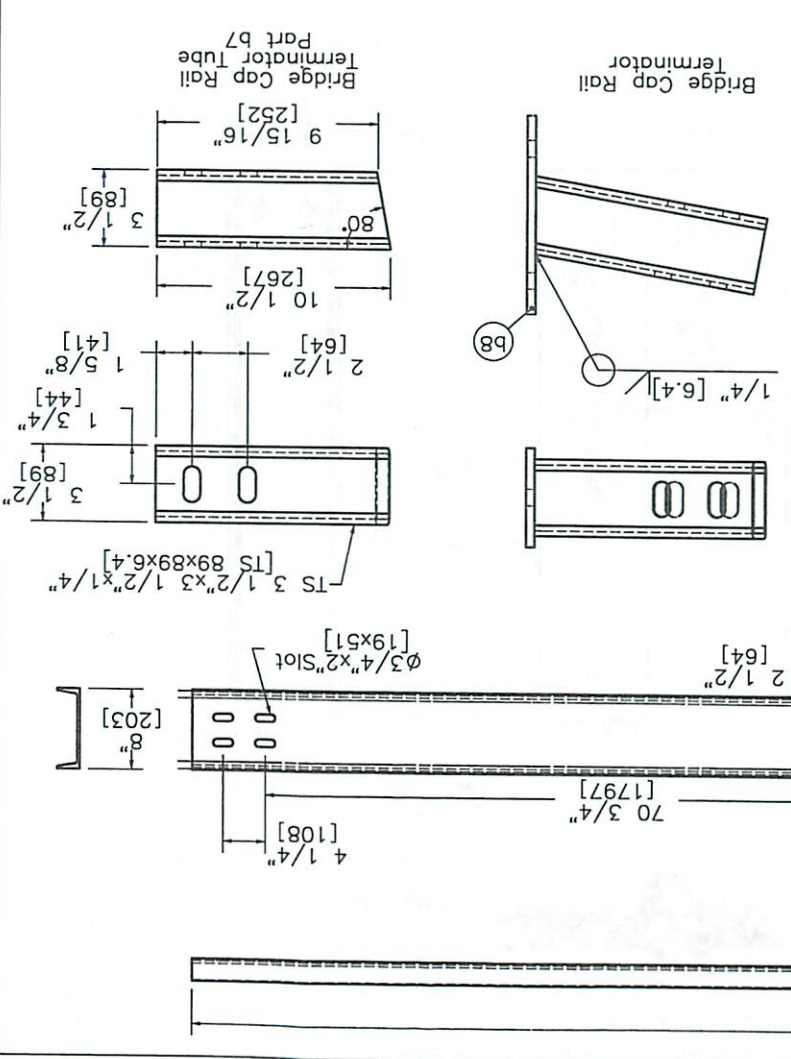
SHEET:  
10 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT

DWG. NAME:  
MWT-SP-3\_R3

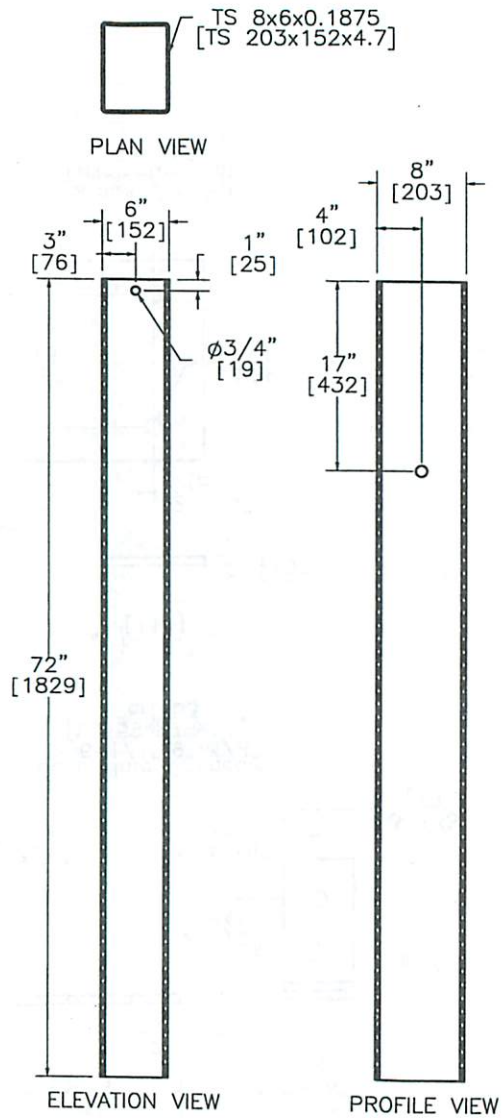
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REV. BY:  
KAP/SKR/  
RKF

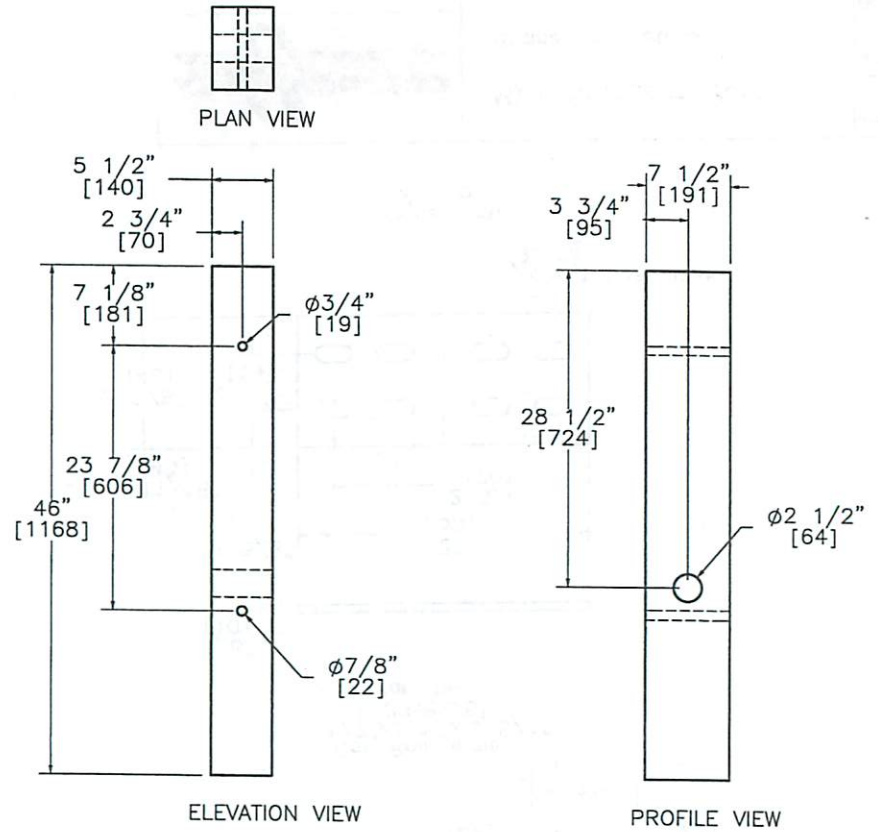
SHEET: 11 of 20	DATE: 11/22/2010	DRAWN BY: EMA/RT	REV. BY: None	DWG. NAME: Midwest Roadside Safety Facility
				MWT-SP-3-R3
MWT Standard Post			Bridge Rail Details	
SCALE: None			UNITS: In./mm	RK/SKR/








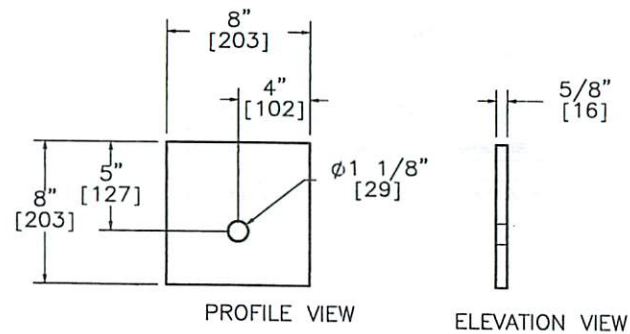
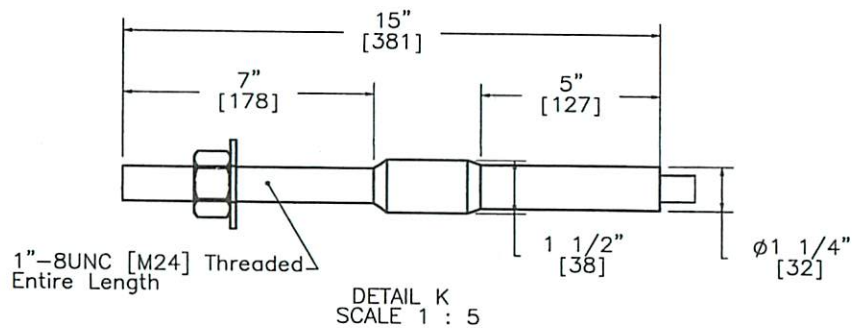
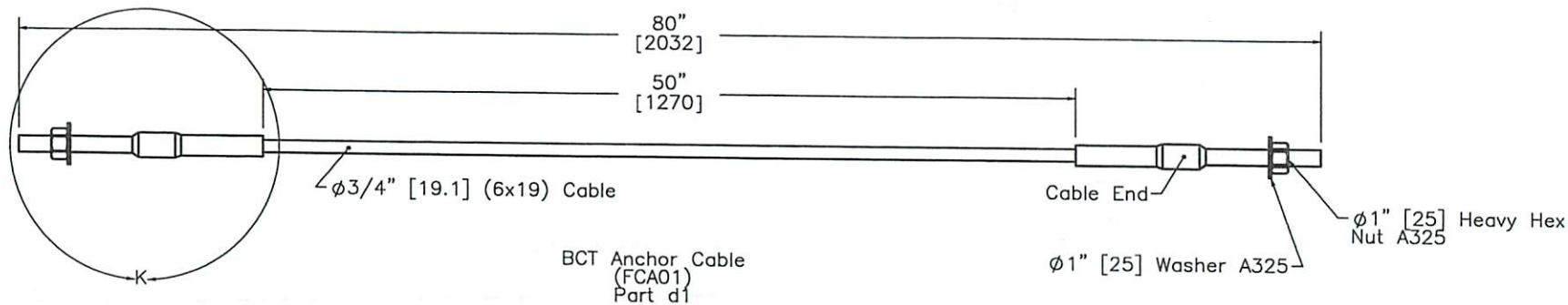
Foundation Tube  
Part b1




BCT (MGS) Timber Post  
Part b2

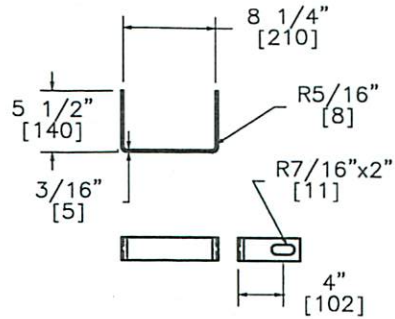
	<b>MWT Standard Post</b> BCT Timber Posts & Foundation Tube Detail		SHEET: 13 of 20
	Midwest Roadside Safety Facility		DATE: 11/22/2010
DWG. NAME: MWT-SP-3_R3			SCALE: 1:16 UNITS: In.[mm]
			REV. BY: KAP/SKR/ RKF



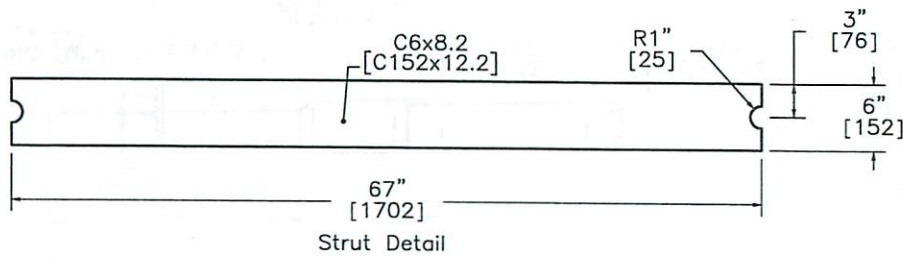
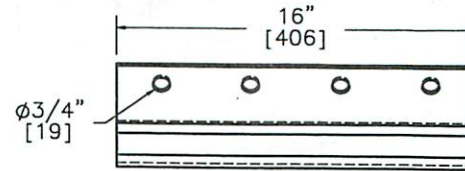


Anchor Cable Bearing Plate (FPB01) Part d2

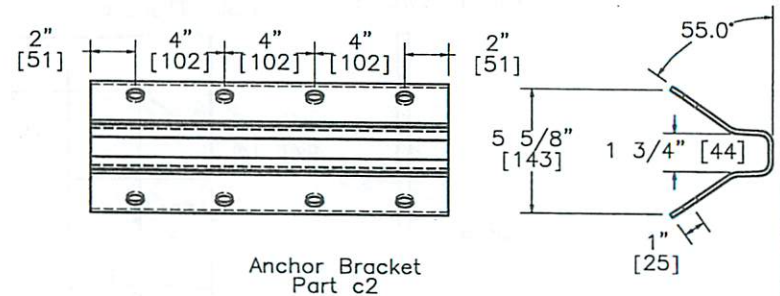
 <b>Midwest Roadside Safety Facility</b>	<b>MWT Standard Post</b> BCT Anchor Cable Detail	SHEET: 14 of 20
		DATE: 11/22/2010
		DRAWN BY: EMA/RJT
	DWG. NAME: MWT-SP-3_R3	SCALE: 1:10 UNITS: In.[mm]
		REV. BY: KAP/SKR/RKF



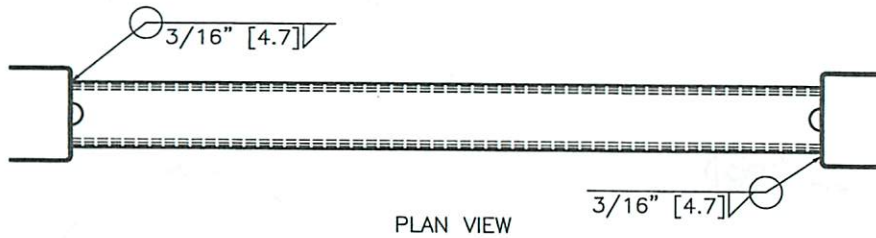
Yoke Detail



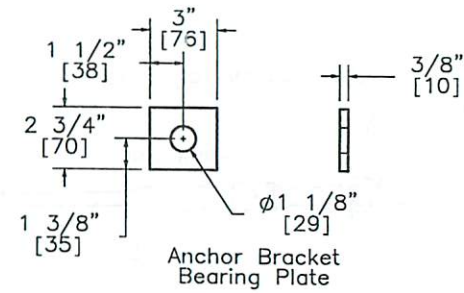
Strut Detail



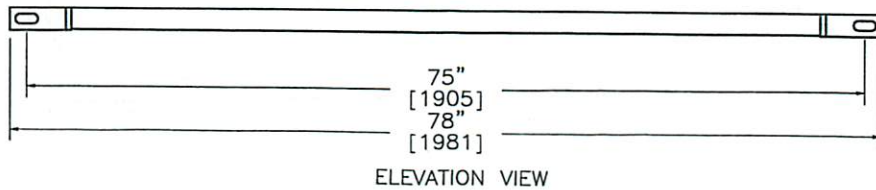
Anchor Bracket Part c2



PLAN VIEW



Anchor Bracket Bearing Plate



ELEVATION VIEW

Ground Strut Part c1



Midwest Roadside Safety Facility

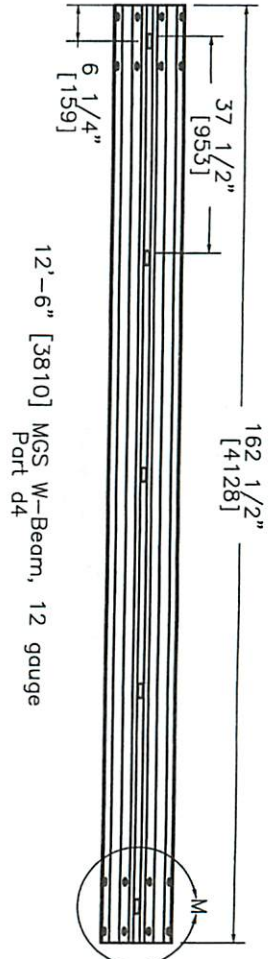
MWT Standard Post

Ground Strut & Anchor Bracket Details

DWG. NAME:  
MWT-SP-3\_R3

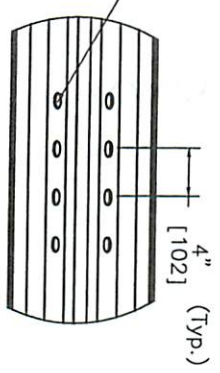
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SHEET:  
15 of 20  
DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT  
REV. BY:  
KAP/SKR/  
RKF

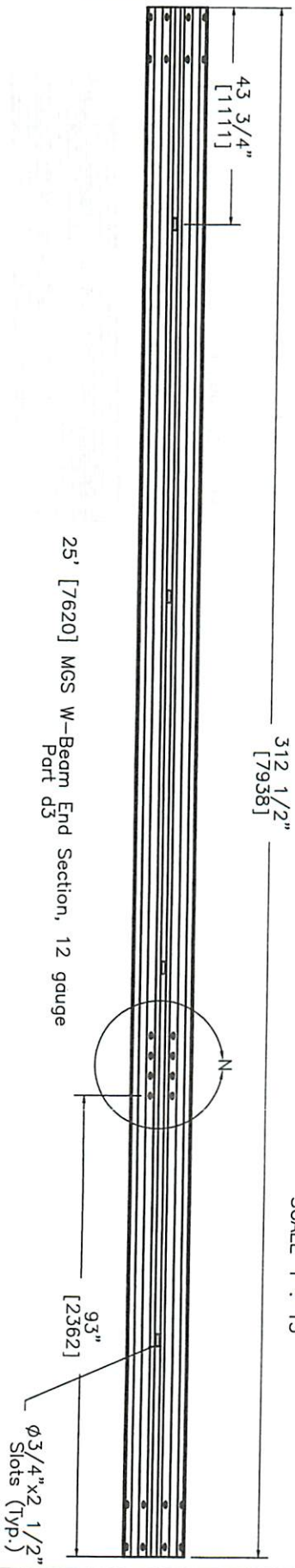


DETAIL M  
SCALE 1 : 15

R1/2" x 1 1/4" Slot (Typ.)  
[13x32]



DETAIL N  
SCALE 1 : 15



Midwest Roadside Safety Facility

MWT Standard Post  
Rail Section Details

DWG. NAME:  
MWT-SP-3\_R3

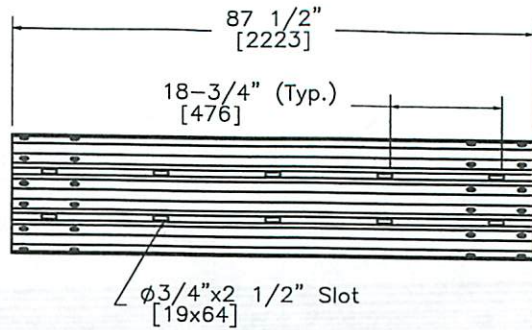
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SHEET:  
16 of 20

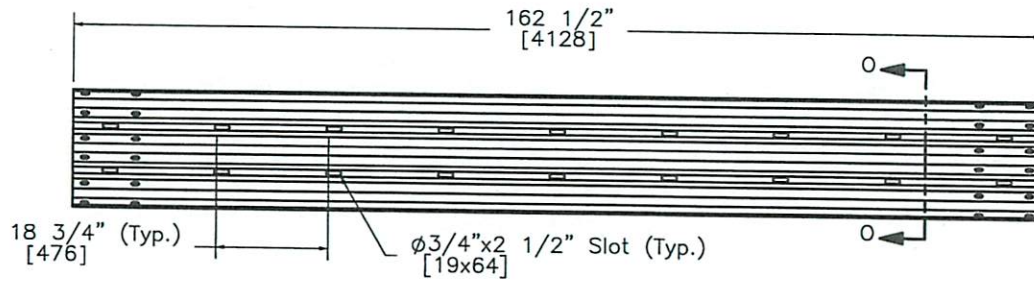
DATE:  
11/22/2010

DRAWN BY:  
EAM/rajt

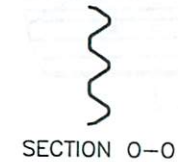
REV. BY:  
KAP/SKR/  
RKF



6'-3" [1905] Thrie Beam Section, 12 gauge,  
1/4 Post Spacing  
Part d5



12'-6" [3810] Thrie Beam Section, 12 gauge,  
1/4 Post Spacing  
Part c3



 Midwest Roadside Safety Facility	MWT Standard Post Rail Section Details		SHEET: 17 of 20
			DATE: 11/22/2010
		DWG. NAME: MWT-SP-3_R3	DRAWN BY: EMA/RJT
		SCALE: 1:30 UNITS: In.[mm]	REV. BY: KAP/SKR/ RKF

Midwest Guardrail System with Standard Post Spacing

Item No.	QTY.	Description	Material Spec	Hardware Guide
a1	1	6'-3" [1905] W-Beam to Thrie-Beam Transition Section	10 gauge AASHTO M180	-
a2	7	6x12x14 1/4" [152x305x362] Blockout	SYP Grade No.1 or better	-
a3	6	6x12x19" [152x305x483] Blockout - Post 10-15	SYP Grade No.1 or better	-
a4	2	6x8x19" [152x305x483] Blockout - Post 16-17	SYP Grade No.1 or better	-
a5	1	6x8x15" [152x305x381] Blockout - Post 18	SYP Grade No.1 or better	-
b1	2	72" [1829] Foundation Tube	A500 Grade B	PTE05
b2	2	BCT Timber Post -MGS Height	SYP Grade No. 1 or better	PDF01
b3	2	Bridge Cap Rail Bent Plate Connector 6 1/4x9x3/8" [159x229x9.5]	A36 Steel	-
b4	6	Bridge Cap Rail Angle 3 1/2x3 1/2x5/16" [89x89x7.9]	A36 Steel	-
b5	1	Bridge Cap Rail C8x11.5 [C203x17.1]	A36 Steel	-
b6	1	Bridge Cap Rail C8x11.5 [C203x17.1]	A36 Steel	-
b7	1	Bridge Cap Rail Terminator Tube 3 1/2x3 1/2x1/4" [89x89x6.4]	A36 Steel	-
b8	1	Terminator Plate 9x4 1/2x3/8" [229x114x9.5]	A36 Steel	-
b9	1	Bridge Cap Rail Splice Plate 5 7/8x13x3/8" [149x330x9.5]	A36 Steel	-
c1	1	Strut and Yoke Assembly	A36 Steel	PFP01
c2	1	Anchor Bracket	A36 Steel	FPA01
c3	3	12'-6" [3810] Thrie Beam Section - 1/2 Post Spacing	12 gauge AASHTO M180	-
c4	3	W6x15 [W152x22.3] Steel Bridge Blockout	A36 Steel	-
c5	3	W6x20 [W152x29.8] Steel Bridge Post	A36 Steel	-
c6	3	12x14x1 1/4" [305x356x32] Bridge Cap Connector Plate	A36 Steel	-
d1	1	BCT Anchor Cable 6' [1829] Long	6x19 Cable	FCA01
d2	1	8x8x5/8" [203x203x15.9] Anchor Bearing Plate	A36 Steel	FPB01
d3	1	25' [7620] W-Beam MGS End Section	12 gauge AASHTO M180	-
d4	2	12'-6" [3810] W-Beam MGS Section	12 gauge AASHTO M180	-
d5	1	6'-3" [1905] Thrie Beam Section - 1/2 Post Spacing	12 gauge AASHTO M180	-
d6	1	2 3/8" [60] O.D.x 6" [152] long BCT Hole insert	ASTM A53 Grade B Schedule 40	FMM02



Midwest Roadside Safety Facility

MWT Standard Post  
Bill of Materials

DWG. NAME:  
MWT-SP-3\_R3

SCALE: None  
UNITS: in.[mm]

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DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT  
REV. BY:  
KAP/SKR/  
RKF

Midwest Guardrail System with Standard Post Spacing

Item No.	QTY.	Description	Material Spec	Hardware Guide
e1	20	1"Dia. [25] Flat Washer	Grade 5	FWC24a
e2	20	1"Dia. [25] Heavy Hex Nut	Grade 5	A325 or A449 Substitute
e3	18	1"Dia. [25] Threaded Rod	Grade A307	-
e4	116	5/8"Dia. [15.9] Flat Washer	Grade 5	-
e5	42	5/8"Dia. x 2" [M16x51] long Hex Head Bolt	Grade 5	FBX16a
e6	54	5/8"Dia. [15.9] Hex Nut	Grade 5	A325 or A449 Substitute
e7	2	5/8"Dia. x 5" [M16x127] long Hex Head Bolt	Grade 5	FBX16a
e8	4	7/8"Dia. [22.2] Flat Washer	Grade 5	FWC22a
e9	2	7/8"Dia. [22.2] Hex Nut	Grade 5	FBX22a
e10	2	7/8"Dia. x 7 1/2" [M22x191] long Hex Head Bolt	Grade 5	FBX22a
e11	2	5/8"Dia. x 10" [M16x254] long Hex Head Bolt	Grade 5	FBX16a
e12	8	5/8"Dia. x 1 1/2" [M16x38.1] long Hex Head Bolt	Grade 5	FBX16a
e13	8	5/8"Dia. x 10" [M16x254] long Guardrail Bolt	Grade A307	FBB03
e14	18	5/8"Dia. x 14" [M16x356] long Guardrail Bolt	Grade A307	FBB06
e15	8	16D Double Head Nail	-	-
e16	66	5/8"Dia. x 1 1/2" [M16x38] Guardrail Bolt	Grade A307	FBB01
e17	92	5/8"Dia. [15.9] Guardrail Nut	Grade 5	-
f1	7	W6x8.5 [W152x12.6] 72" [1829] long - Post Nos. 3-9	A36 Steel	-
f2	6	W6x8.5 [W152x12.6] 72" [1829] long - Post Nos. 10-15	A36 Steel	-
f3	1	W6x15 [W152x22.3] 84" [2134] long - Post No. 16	A36 Steel	-
f4	1	W6x15 [W152x22.3] 84" [2134] long - Post No. 17	A36 Steel	-
f5	1	W6x15 [W152x22.3] 84" [2134] long - Post No. 18	A36 Steel	-



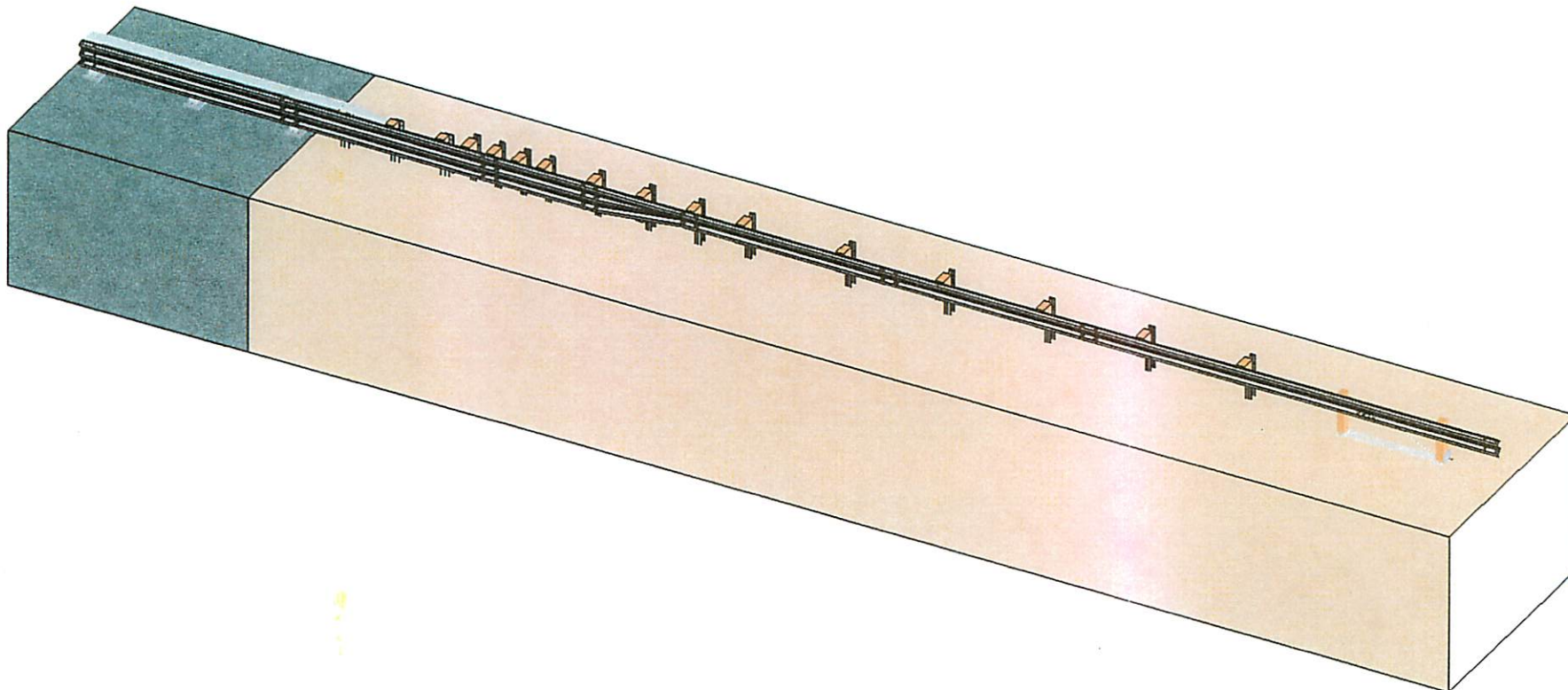
Midwest Roadside Safety Facility

MWT Standard Post  
Bill of Materials

SHEET:  
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DATE:  
11/22/2010  
DRAWN BY:  
EMA/RJT

DWG. NAME:  
MWT-SP-3\_R3

SCALE: None  
UNITS: In.[mm]  
REV. BY:  
KAP/SKR/  
RKF



Midwest Roadside  
Safety Facility

MWT Standard Post  
Isometric System View

SHEET:  
20 of 20

DATE:  
11/22/2010

DRAWN BY:  
EMA/RJT

DWG. NAME:  
MWT-SP-3\_R3

SCALE: 1:105  
UNITS: in,[mm]

REV. BY:  
KAP/SKR/  
RKF