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A GUIDE TO STANDARDIZED HIGHWAY BARRIER RAIL HARDWARE

A REPORT PREPARED AND APPROVED
BY THE
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ACKNOWLEDGEMENTS

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The Bridge Division of the Federal Highway Administration provided the drafting and editing services required for the preparation of this guide, thanks to Lester A. Herr, Chief of the Division, and Stanley Gordon, Chief of the Design and Inspection Branch. Frederick J. Herbold's handling of many of the details of the preparation of the guide, in the Design and Inspection Branch, is greatly appreciated.

CONTENTS

INTRODUCTION

This guide supersedes "A Guide to Standarized Highway Barrier Rail Hardware," dated May 1971, and its supplement, dated July 1973, Technical Bulletins No. 268 and No. 268-A, respectively, published by the American Road and Transportation Builders' Association.

The barrier hardware details shown in this guide have been compiled and reviewed by the American Association of State Highway and Transportation Officials—the Associated General Contractors of America—American Road and Transportation Builders' Association Joint Cooperative Committee's Task Force No. 13. This was done in response to a long recogized need for standard hardware for highway barriers.

Some of the benefits that can be realized from the use of the standard parts detailed in this guide are as follows:

(1) *For the Administrator*—Economy in both new construction and maintenance operations. Improved availability of parts permitting faster opening or returning of roads to full operation.

(2) *For the Designer*—Readily available details and specifications for parts for many of the barrier systems shown in the American Association of State Highway and Transportation Officials', "Guide for Selecting, Locating, and Designing Traffic Barriers," 1977, and for parts that can be used in the design of barrier terminals, transitions, and anchorages.

(3) *For the Maintenance Division*—Reduced repair time and reduced inventory of replacement parts because of interchangeability of parts and their greater availability from suppliers.

The bridge railing parts shown in this guide are for railings similar to those widely used in the United States. In most cases the designs are not exactly the same as those used by any particular state. The task force has attempted to substitute standard components that can be used interchangeably in several states' designs.

Because the geometry of the railing posts affects the appearance of a bridge, this guide contains several post designs. It is the belief of the task force that, with a few possible exceptions, within the range of post silhouettes presented one can be found that will approximate in appearance and strength each of the many unique designs now being used. Thus, a Designer will be able to obtain the appearance and performance he is seeking and enjoy the advantages of using standard parts in his barrier designs.

As already stated, the task force revised some of the details from the original designs upon which the designs in this guide are based. These revisions were made in the belief that they produced better balanced or more versatile designs. The task force believes the barrier designs shown in this guide are in conformance with recognized design and performance criteria. However, A DESIGNER WISHING TO USE A BARRIER DESIGN SUGGESTED IN THIS GUIDE SHOULD ASSURE HIMSELF OF THE GEOMETRIC AND STRUCTURAL ADEQUACY OF THE DESIGN.

The Appendix shows some barrier details that may further contribute to barrier standardization. A.1 shows a terminal layout, joint connection, and post location for barrier MB7. A.2 shows a terminal layout for G8 and MB8. A.3 shows cross-section details for concrete barriers. A.4 and A.5 show layouts for standard breakaway cable terminal designs utilizing, respectively, wood and steel posts. A.6 is a discussion of the need for a toughness requirement for tubular steel rails and a suggested specification to ensure adequate toughness. And A.7.1 through A.7.4 show a special heavy duty aluminum rail element and accessories for use in special service conditions.

It is recognized that these standards must be continually updated to remain of value. It is therefore suggested that information on any new designs developed be forwarded to the AASHTO-AGC-ARTBA Joint Committee's Task Force No. 13 through AASHTO, AGC, or ARTBA for further evaluation and proposal of standards.

This guide will be revised and updated as the need arises.

Many traffic barriers were built before extensive testing and observation of barrier performance was undertaken. A large percentage of those barriers along with barriers rendered obsolete or ineffective through changed conditions need upgrading. Frequently the best method of upgrading will be total replacement with a barrier suitable for new construction. However, at other times retrofit hardware that accommodates and utilizes existing construction may produce a better solution. Task Force 13 expects to make recommendations on the standardization of such hardware but decided not to include them in this publication because of the limited experience that has been gained with this type hardware.

STANDARD BARRIER TYPES

Task Force No. 13 received plans from the state highway departments for guardrails, median barriers, and bridge railings used in the states. A review of those plans did not reveal any widely accepted bridge railing designs. However, on the basis of the states' designs and the designs shown in the AASHTO "Guide for Selecting, Locating, and Designing Traffic Barriers," the task force has selected several barrier designs that the task force believes to be representative of the current practice and trends in barrier design to serve as standards. The following sheets, titled Standard Barrier Types, show the silhouettes of the barrier designs selected.

Standard ground-mounted barrier type designations used in this publication are patterned after the designations used in the AASHTO "Guide for Selecting, Locating, and Designing Traffic Barriers."

The standard structure-mounted median barrier types carry the same designations as their ground-mounted counterparts, except for the addition of a suffix "B". Thus, standard median barrier MB8B will be recognized as the structure-mounted equivalent of standard median barrier MB8.

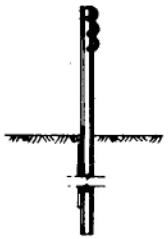
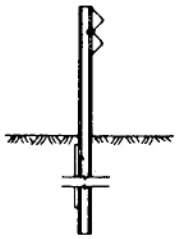
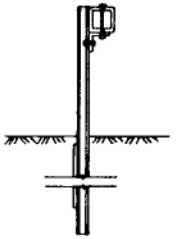
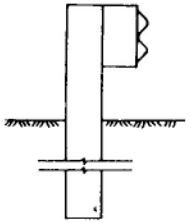
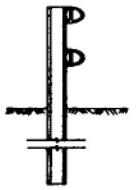
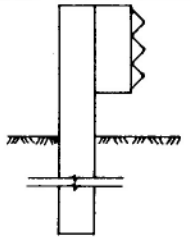
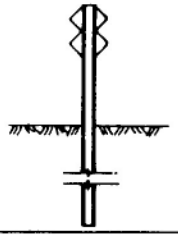
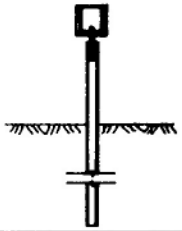
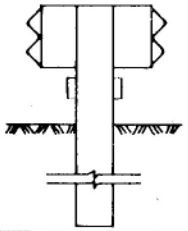
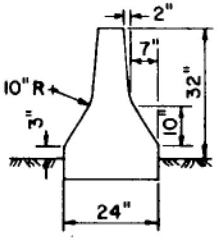
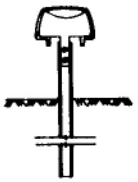
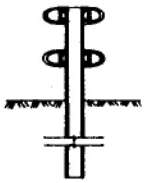
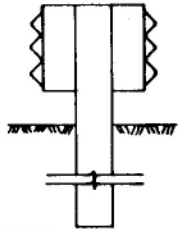
The barrier silhouettes for bridge railings are grouped first by barrier construction materials, steel or aluminum, and then by similarity of details. For example, there are two designs listed under Steel Type A: BR1 (Steel) Type A and BR2 (Steel) Type A. Each of these designs uses the same TS 5 x 3 x .25 rail, rail splice, and rail clamp details.

It should be noted that the bridge railing silhouettes are ordered horizontally by their basic design configurations. For example, the BR2 designation applies to two steel designs and three aluminum designs, all similar in design loading application.

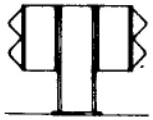
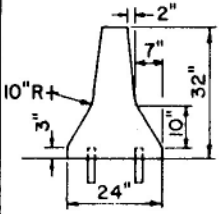
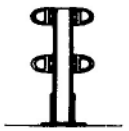
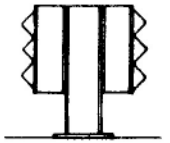
The "BR" in the barrier designations stands for bridge railing and the number in the designation indicates the number of rails in the barrier design. A letter "A" following the numeral indicates that the barrier is a combination railing and that the top rail is designed only for a pedestrian loading.

STANDARD BARRIER TYPES

GROUND-MOUNTED

G1	G2	G3	G4			G8	G9
				open	open		
	MB2	MB3	MB4	MB5	MB7	MB8	MB9
open							

STRUCTURE-MOUNTED

		MB3B	MB4B	MB5B	MB7B	MB8B	MB9B
open	open						

STANDARD BARRIER TYPES
(CONTINUED)

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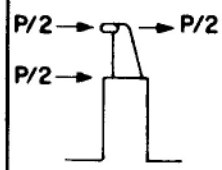
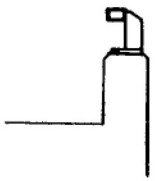
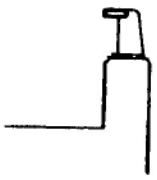
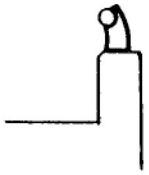
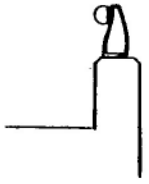
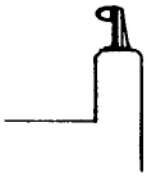
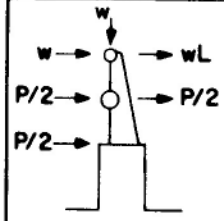
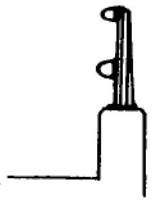
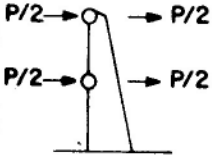
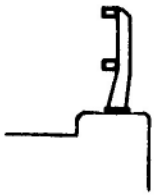
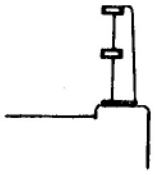
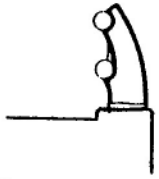
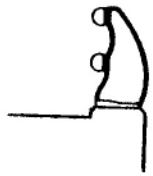
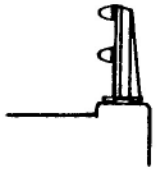
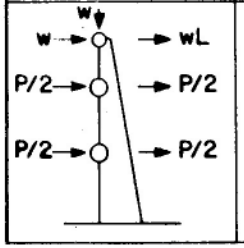
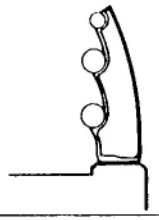
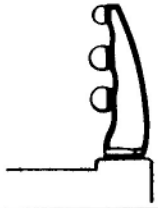
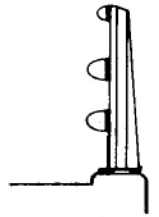
BR1	TYPE A	TYPE B		TYPE A	TYPE B	TYPE C	
			open				open
BR2A				TYPE A		TYPE C	
	open	open	open		open		open
BR2	TYPE A	TYPE B		TYPE A	TYPE B		TYPE D
			open			open	

STANDARD BARRIER TYPES
(CONTINUED)

AASHTO DESIGN LOADING	BRIDGE RAIL (Steel) (Cont.)			BRIDGE RAIL (Aluminum) (Cont.)			
BR3A				TYPE A	TYPE B		TYPE D
	open	open	open			open	

STANDARDS DRAWINGS—DISCUSSION

The standard parts drawings that follow are assembled into three basic functional categories, Fasteners, Posts, and Rail Elements.

Fasteners include bolts, nuts, and washers. Some of the nut and bolt drawings include a washer detail; others do not. The significance of this is that a particular washer may be used with more than one bolt or that a particular bolt may be used with more than one washer. Therefore, to avoid exclusion and explanatory notes on the drawings, the parts have been segregated.

Posts include posts, blocks, support angles, and supports plates.

Rail Elements include the basic rail elements, splices, and special rail sections such as terminals.

Two indexes are included. The first index shows each of the standard barrier types and the parts required for their construction. The second index lists in alphabetical and numerical order all the parts shown in this guide.

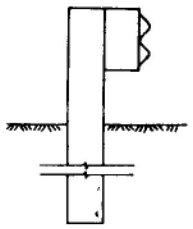
The standards drawings numbering system uses letters to indicate a functional category (F = Fasteners, P = Posts, and RE = Rail Element), an arbitrary sequence number followed by a hyphen, and two numerals indicating the year the standard was developed. Some drawing numbers include instructions in brackets calling for the designation of features of the part shown in the drawing. This allows a single drawing to serve for several parts that are similar in details.

INDEX TO STANDARD DRAWINGS (By Barrier Types)

INDEX TO STANDARD DRAWINGS (By Barrier Types)

BARRIER TYPES

G4



STANDARD	TITLE	PAGE
F-3 [Length Designation] - 76	5/8" Button Head Bolt and Recess Nut	48
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F-9 [Length Designation] - 73	5/8" Carriage Bolt and Nut	54
F-12-73	Rectangular Plate Washer	57
F-13-73	Washer for 5/8" Bolt	58
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P-10-79	G4 and MB4 Structural Shape Post and Block	96
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RE-3 [Designate Post Slot Centers & Sum of Centers] - 73	W Beam	150
RE-4-76	W Beam Back-up Plate	151
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RE-9 [Length Designation] - 73	C6x8.2 Rub Rail and Splice Plate*	156
RE-69-76	W-Thrie Beam Transition Section	208
RE-72-76	Bent Plate Rub Rail*	210

(See page 19 for Breakaway Cable Terminal Index.)

*For rub rail not shown in barrier cross section

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INDEX TO STANDARD DRAWINGS (By Barrier Types)

INDEX TO STANDARD DRAWINGS (By Barrier Types)

(For approach rail support posts see P-6-73, P-41-73, and P-50-76.)

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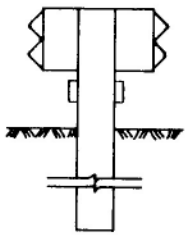
BARRIER TYPES

MB4



*For rub rail not shown in barrier cross section.

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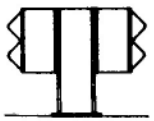
BARRIER TYPES	STANDARD	TITLE	PAGE
MB4B 	F-3 [Length Designation] - 73	5/8" Button Head Bolt and Recess Nut	48
	F-8-76	5/8" Hex Bolt and Nut	53
	F-9 [Length Designation] - 73	5/8" Carriage Bolt and Nut[1]	54
	F-12-73	Rectangular Plate Washer	57
	F-13-73	Washer for 5/8" Bolt	58
	F-31-73	3/4" Anchor Stud and Nuts and Washer	72
	F-33-73	Concrete Insert Anchor Assembly	74
	P-42 [Length Designation] - 79	MB4B Structural Shape Post[2]	121
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	RE-38-76	W Beam Expansion Section	178
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	RE-72-76	Bent Plate Rub Rail[1]	210

[1] For rub rail not shown in barrier cross section

[2] For post blocks and for approach rail support posts, see P-10-79.

[3] For post blocks and for approach rail support posts, see P-52-76.

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(For approach rail support posts see P-6-79, P-41-73, and P-50-76.)

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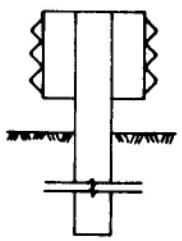
BARRIER TYPES

MB9



STANDARD	TITLE	PAGE
F-3 [Length / Designation] - 76	5/8" Button Head Bolt and Recess Nut	48
F-8-76	5/8" Hex Bolt and Nut	53
F-12-73	Rectangular Plate Washer	57
F-13-73	Washer for 5/8" Bolt	58
P-54-79	G9 and MB9 Structural Shape Post and Block	133
P-55-79	G9 and MB9 6x8 Timber Post and Block	134
P-56-76	G9 and MB9 Bent Plate Post and Block (Steel)	135
P-66-79	G9 and MB9 Structural Shape Post and Block (Aluminum)	145
RE-63 [Designate Post / Slot Centers & / Sum of Centers] - 76	Thrie Beam	202
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RE-66[Diameter] - 79	Thrie Beam End Section (Buffer)	205
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RE-68-76	Thrie Beam Expansion Section	207
RE-69-76	W-Thrie Beam Transition Section	208

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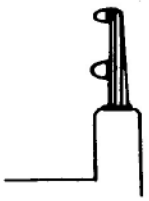
BARRIER TYPES	STANDARD	TITLE	PAGE
BR2A (Aluminum) Type C 	F-20-73	4-3/4" x 3-3/4" and 4-3/4" x 4" Semi-Ellipse Rail Clamp Bar (5-3/4" long)	62
	F-22-73	4" x 3-1/8" Semi-Ellipse Rail Clamp Bar (5-3/4" long)	64
	F-30-73	5/8" Anchor Stud and Nuts and Washer	71
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	RE-51-73	4-3/4" x 3-3/4" Semi-Ellipse Rail	191
	RE-52 [Designate Splice Type] -73	4-3/4" x 3-3/4" Semi-Ellipse Rail Splice	192
	RE-53-73	4-3/4" x 3-3/4" Semi-Ellipse Rail End Cap	193
	RE-55-73	4" x 3-18" Semi-Ellipse Rail	195
	RE-56-73	4" x 3-1/8" Semi-Ellipse Rail Splice	196
	RE-57-73	4" x 3-1/8" Semi-Ellipse Rail End Cap	197
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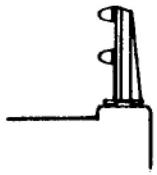
BARRIER TYPES	STANDARD	TITLE	PAGE
BR2 (Aluminum) Type D 	F-21-76	4-3/4" x 3-3/4", 4-3/4" x 4" and 6-7/8" x 4-1/2" Semi-Ellipse Rail Clamp Bar (7-1/8" long)	63
	F-30-73	5/8" Anchor Stud and Nuts and Washer	71
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	P-44-73	G8 and MB8 Structural Shape Post (Transition Section)	123
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	RE-52 [Designate Splice Type] - 73	4-3/4" x 3-3/4" Semi-Ellipse Rail Splice	192
	RE-53-73	4-3/4" X 3-3/4" Semi-Ellipse Rail End Cap	193
	RE-61-73	4-3/4" x 3-3/4" Semi-Ellipse Rail Terminal Cap	201
	Alternate Rail		
	RE-58-73	4-3/4" x 4" Semi-Ellipse Rail	198
	RE-59 [Designate Splice Type] - 73	4-3/4" x 4" Semi-Ellipse Rail Splice	199
	RE-60-73	4-3/4" x 4" Semi-Ellipse Rail End Cap	200

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F-2-70	DELETED		
F-3 [Length Designation] -76	5/8" Button Head Bolt and Recess Nut	G2, G4, G9, MB2, MB4, MB4B, MB9, MB9B, BCT	48
F-4-76	5/16" Hex Bolt and Nut and Square Washer	G2, MB2	49
F-5-76	3/8" Hex Bolt and Nut and Washer	G3	50
F-6-76	1/2" Hex Bolt and Nut and Washer	G3	51
F-7-73	1/2" High Strength Hex Bolt and Nut and Washer	MB7, MB7B	52
F-8-76	5/8" Hex Bolt and Nut	G4, G9, MB4, MB4B, MB9, MB9B, BCT	53
F-9 [Length Designation] -73	5/8" Carriage Bolt and Nut	G4, MB4, MB4B	54
F-10 [Length Designation] -79	3/4" Hex Bolt and Nut and Washer	G1, MB3, MB3B, MB7, MB7B, BR2(Steel) Type A	55
F-11-73	3/4" High Strength Hex Bolt and Washer	G3, MB3, MB3B	56
F-12-73	Rectangular Plate Washer	G4, G9, MB4, MB4B, MB9, MB9B, BCT	57
F-13-73	Washer for 5/8" Bolt	G4, G9, MB4, MB4B, MB9, MB9B, BCT	58

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STANDARD	TITLE	USED IN BARRIER TYPE	PAGE
F-25-73	1/2" Toggle Bolt	BR1(Aluminum) Type A BR2(Aluminum) Type A BR2A(Aluminum) Type A BR3A(Aluminum) Type A	67
F-26 [Length Designation] -73	1" High Strength Anchor Bolt and Nut and Washer	BR1(Steel) Type B BR2(Steel) Type B	68
F-27-73	DELETED		
F-28 [Length Designation] - 79	1" High Strength Anchor Stud and Nuts and Washers	BR2(Steel) Type A	69
F-29-73	7/8" Anchor U-Bolt and Nuts and Washers	BR1(Steel) Type A	70
F-30-73	5/8" Anchor Stud and Nuts and Washer	BR1(Aluminum) Type B BR1(Aluminum) Type C BR2A(Aluminum) Type C BR2(Aluminum) Type D BR3A(Aluminum) Type D	71
F-31-73	3/4" Anchor Stud and Nuts and Washer	MB3B, MB4B, MB7B, MB8B, MB9B BR1(Aluminum) Type A BR2A(Aluminum) Type A BR1(Aluminum) Type B BR2(Aluminum) Type B BR3A(Aluminum) Type B BR2(Aluminum) Type D BR3A(Aluminum) Type D	72

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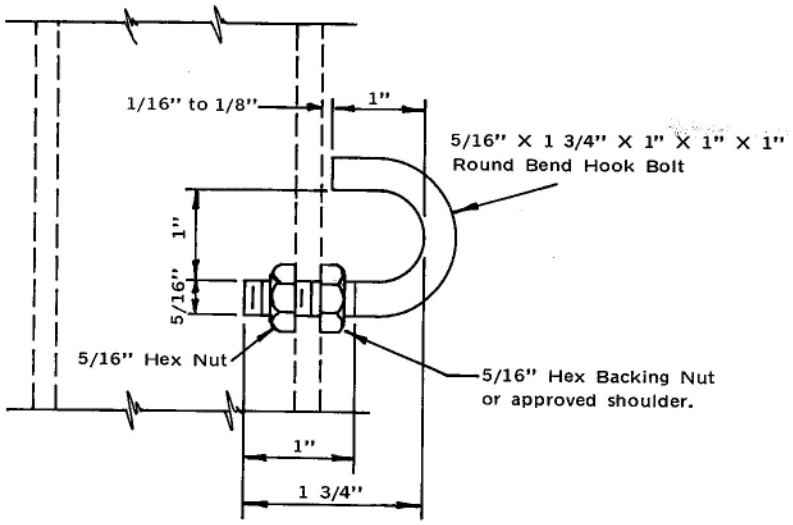
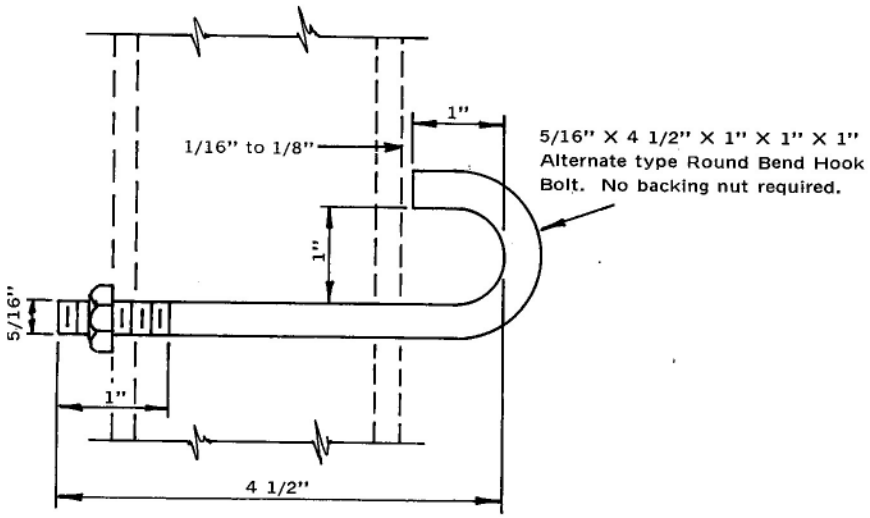
INDEX TO STANDARD DRAWINGS (SEQUENTIAL)

RAIL ELEMENTS (Cont'd)

FASTENERS



5/16" ϕ HOOK BOLT



ALTERNATE 5/16" ϕ HOOK BOLT

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307 and nuts to the requirements of A.S.T.M. A563, Grade A or better, and shall be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel bolts are requested in which case bolts and nuts shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively.

Nuts shall be of the hex or heavy hex types.

Bolts, as installed, shall develop an ultimate pull open strength of from 500 pounds to 1000 pounds applied in a direction normal to the longitudinal axis of the post.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

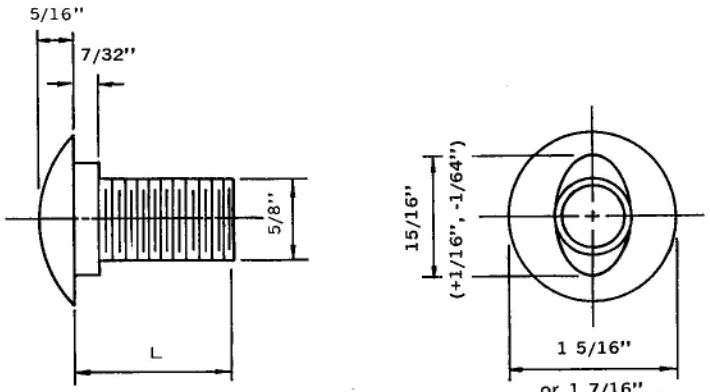
This bolt is for fastening wire ropes to posts in the standard guardrail design G1.

5/16" HOOK BOLT

HM- TF-13

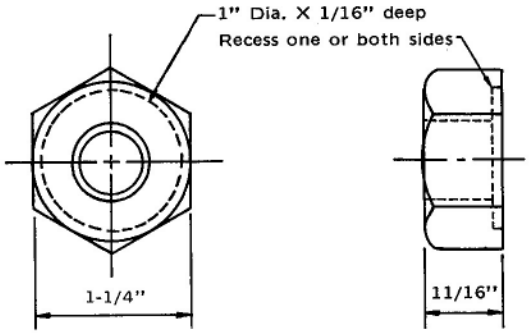
STANDARD

F-1 -76



5/8" ϕ BUTTON HEAD BOLT

L	Thread Length
1-1/4"	Full length thread
2"	1-1/2" min. thread length
9-1/2"	1-3/4" min. thread length
18"	2-1/2" min. thread length
25"	2" min. thread length



5/8" ϕ RECESS NUT

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307 and nuts to the requirements of A.S.T.M. A563, Grade A or better, and be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel is requested in which case bolts and nuts shall be made of material having an atmospheric corrosion resistance, approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively.

INTENDED USE

1. (1-1/4 inch length). This bolt is used to splice rail elements used in the standard corrugated sheet steel beam guardrail designs G2, G4, and G9 and in median barrier designs MB2, MB4,MB4B, MB9, MB9B, and BCT.

2. (2 inch length). This bolt is for fastening rails to steel posts when used in the standard corrugated sheet steel beam guardrail designs G4 and G9 and median barrier designs MB4, MB4B, MB9, MB9B, and BCT.

3. (9-1/2 inch length). This bolt is for fastening rails, when used as rub rails, to wood or concrete posts in the standard corrugated sheet steel beam guardrail design G4 and median barrier design MB4.

4. (18 inch length). This bolt is for fastening rails to wood or concrete posts in the standard corrugated sheet steel beam guardrail designs G4 and G9.

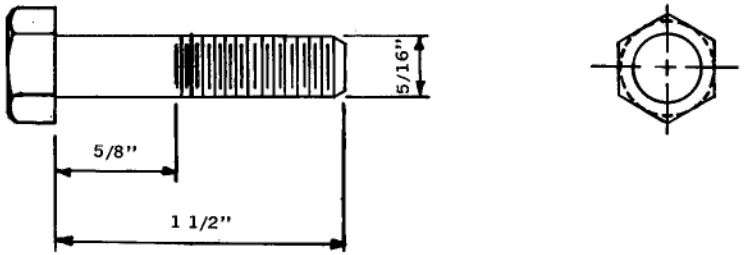
5. (25 inch length). This bolt is for fastening rails to wood or concrete posts in the standard corrugated sheet steel beam median barrier designs MB4 and MB9.

Note: See Standards F-12-73 and F-13-73 for washers that may be used with these bolts.

5/8" BUTTON HEAD BOLT AND RECESS NUT

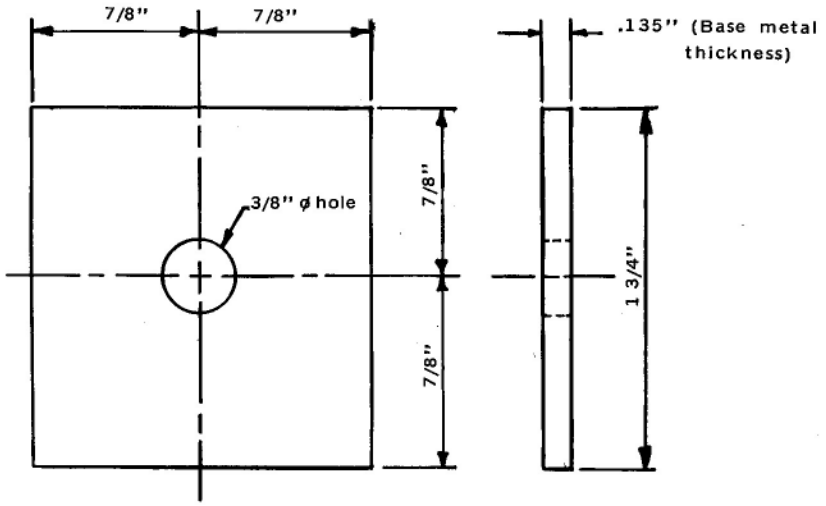
HM-TF-13 STANDARD

F-3 [LENGTH DESIGNATION] -76



5/16" ϕ HEX BOLT

5/16" ϕ HEX NUT



SQUARE WASHER

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307 and nuts to the requirements of A.S.T.M. A563, Grade A or better, and be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel bolts are requested in which case bolts and nuts shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively.

All bolts, galvanized or corrosion resistant, shall develop 4000 pounds minimum tensile strength.

Bolts and nuts shall be of the hex or heavy hex types.

Washers shall be made of steel meeting the requirements of A.S.T.M. A36 and shall be galvanized in accordance with the requirements of A.S.T.M. A123 except when corrosion resistant steel is requested in which case the washers shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. No punching, drilling or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

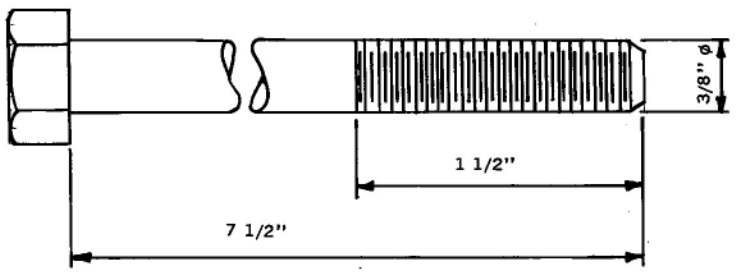
This bolt and square washer are used to fasten "W" beam rail elements to posts in the standard "weak post" "W" beam guardrail and median barrier systems G2 and MB2 .

5/16" HEX BOLT AND NUT AND SQUARE WASHER

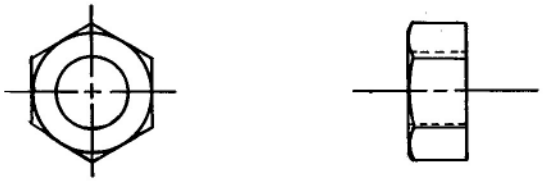
HM-TF-13

STANDARD

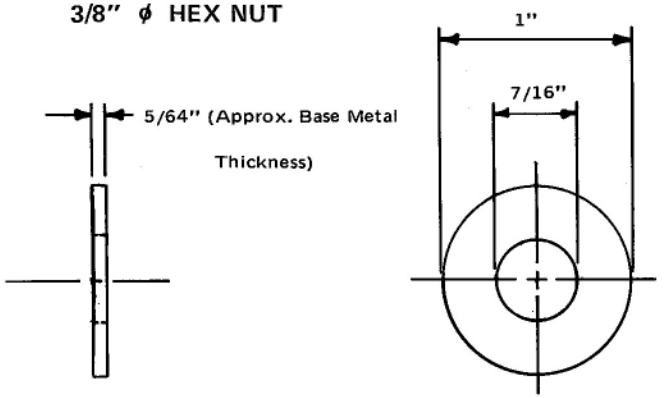
F-4-76



3/8" ϕ HEX BOLT



3/8" ϕ HEX NUT



STEEL WASHER

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307 and nuts to the requirements of A.S.T.M. A563, Grade A or better, and be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel bolts are requested in which case bolts and nuts shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively.

Bolts and nuts shall be of the hex or heavy hex types.

Washers shall be made of steel and shall be galvanized in accordance with the requirements of A.S.T.M. A153 except when corrosion resistant steel is required in which case the washers shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. They shall meet the dimensional requirements of A.N.S.I. B27.2, Type A Plain Washer. No punching, drilling, or cutting will be permitted after galvanizing.

INTENDED USE

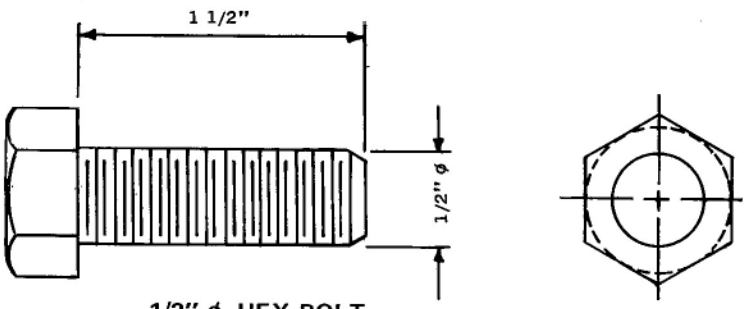
This bolt is for fastening rails to rail support angles in standard Box Beam Guardrail system G3 .

3/8" HEX BOLT AND NUT AND WASHER

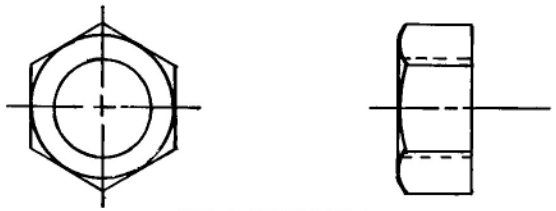
HM-TF-13

STANDARD

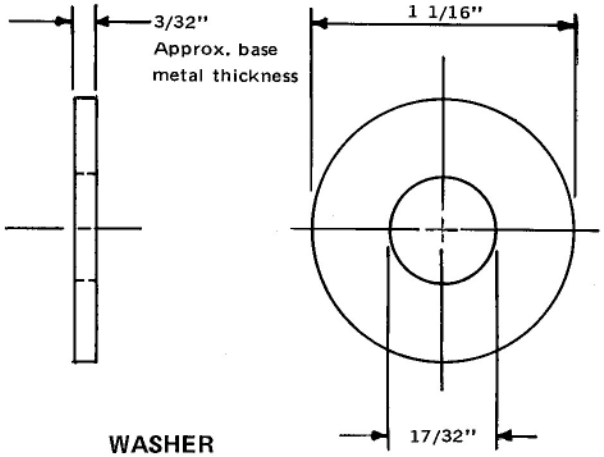
F-5 -76



1/2" ø HEX BOLT



1/2" ø HEX NUT



WASHER

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307 and nuts to the requirements of A.S.T.M. A563, Grade A or better, and be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel bolts are requested in which case bolts and nuts shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively.

Bolts and nuts shall be of the hex or heavy hex types.

Washers shall be made of steel and shall be galvanized in accordance with the requirements of A.S.T.M. A153 except when corrosion resistant steel is required in which case the washers shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. They shall meet the dimensional requirements of A.N.S.I. B27.2, Type A Plain Washer. No punching, drilling, or cutting will be permitted after galvanizing.

INTENDED USE

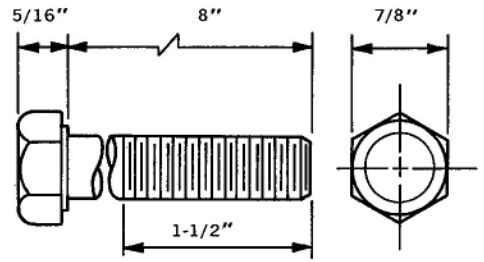
This bolt is for fastening rail support angles to posts in the standard Box Beam Guardrail system G3 .

1/2" HEX BOLT AND NUT AND WASHER

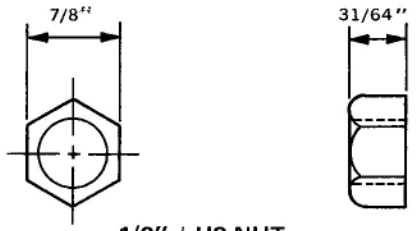
HM-TF-13

STANDARD

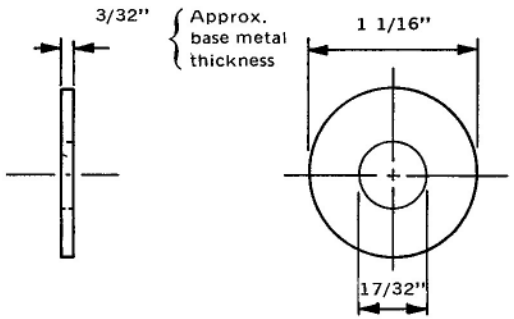
F- 6 -76



1/2" ϕ HS BOLT



1/2" ϕ HS NUT



STEEL WASHER

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A325 or A449 and nuts to the requirements of A.S.T.M. A563, Grade C or better, and shall be galvanized in accordance with the requirements of A.S.T.M. A153. Washers shall be made of steel, shall be galvanized in accordance with the requirements of A.S.T.M. A153, and shall meet the dimensional requirements of A.N.S.I. B27.2, Type A Plain Washers.

No punching, drilling, or cutting will be permitted after galvanizing.

INTENDED USE

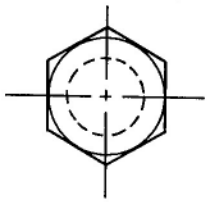
This bolt is used for fastening splice extrusions and pipe sleeve spreaders to rail elements in the standard Box Beam Median Barrier (Aluminum) designs MB7 and MB7B.

1/2" HIGH STRENGTH HEX BOLT AND NUT AND WASHER

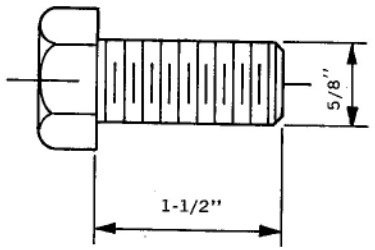
HM-TF-13

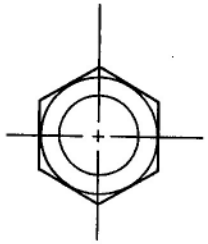
STANDARD

F-7-73

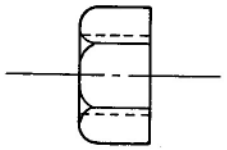


5/8"–11 HEX BOLT





5/8"–11 HEX NUT



SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307 and nuts to the requirements of A.S.T.M. A563, Grade A or better, and shall be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel is requested in which case bolts and nuts shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively.

Bolts and nuts shall be of the hex or heavy hex types.

INTENDED USE

This bolt is for fastening steel blocks to steel posts in the corrugated sheet steel beam guardrail designs G4 and G9, and the median barrier designs MB4, MB9, MB4B, and MB9B; and for fastening the anchor plate (RE-71-76) to rail elements in the standard breakaway cable terminal designs as shown in Appendixes A.4 and A.5.

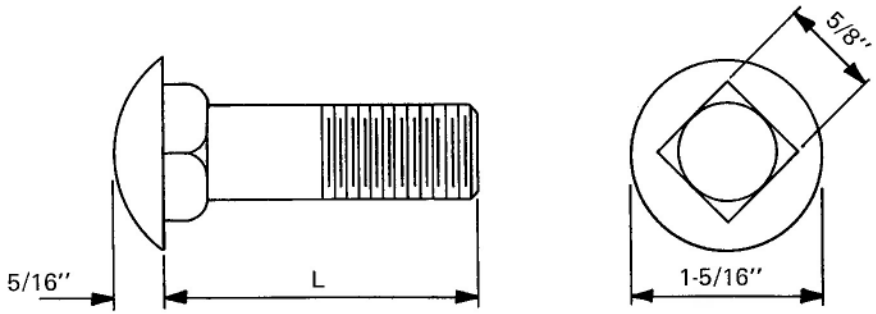
Note: For required washer see F-13-73.

5/8" HEX BOLT AND NUT

HM-TF-13

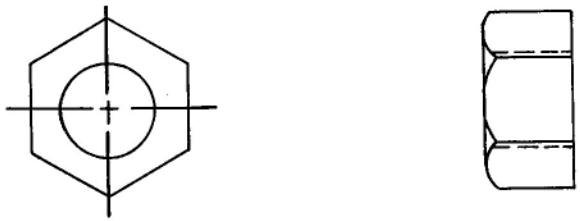
STANDARD

F-8 -76



5/8" ϕ CARRIAGE BOLT

L	Thread length
1-1/2"	Full length thread
3"	1-1/2" min. thread length
11"	1-3/4" min. thread length
13"	1-3/4" min. thread length



5/8" ϕ HEX NUT

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307 and nuts to the requirements of A.S.T.M. A563, Grade A or better, and be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel bolts are requested in which case bolts and nuts shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively.

Bolts shall be round head square neck or short square neck (carriage) bolts conforming to A.N.S.I. B18.5. Nuts shall be of the hex or heavy hex types.

INTENDED USE

1. (1-1/2 inch length). This bolt is a splice bolt for the channel rub rail elements used in the standard "W" Beam Guardrail and "W" Beam Median Barrier systems (G4, MB4, and MB4B).

2. (3-inch length). This bolt is for fastening channel rub rail elements to steel posts in the standard "W" Beam Guardrail and "W" Beam Median Barrier systems (G4,MB4, and MB4B).

3. (11-inch length). This bolt is for fastening channel rub rail elements to wood or concrete posts in the standard "W" Beam Guardrail system (G4).

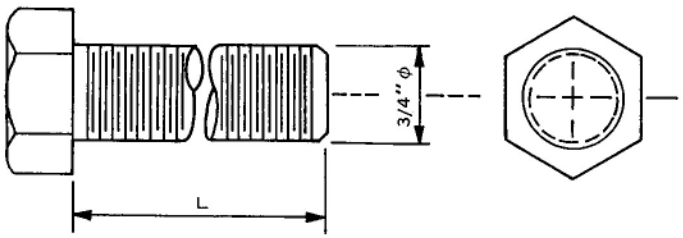
4. (13-inch length). This bolt is for fastening channel rub rail elements to wood or concrete posts in the standard "W" Beam Median Barrier system (MB4).

Note: For required washers see F-13-73.

5/8" CARRIAGE BOLT AND NUT

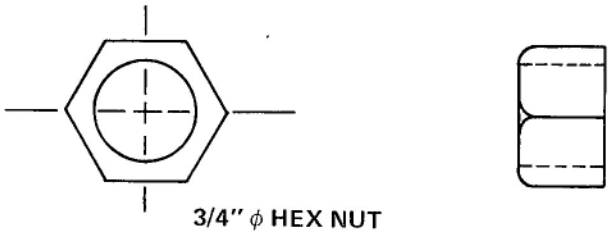
HM-TF-13 STANDARD

F-9 [LENGTH DESIGNATION] -73

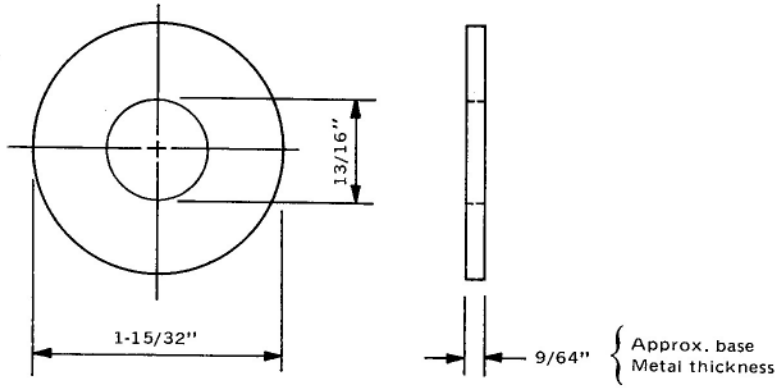


3/4" ϕ HEX BOLT

L	Thread Length
1-1/2"	Full
4-1/2"	2"
7-1/2"	2"



3/4" ϕ HEX NUT



STEEL WASHER

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307 and nuts to the requirements of A.S.T.M. A563, Grade A or better, and shall be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel is requested in which case bolts and nuts shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively. Bolts and nuts shall be of the hex or heavy hex types.

Washers shall be made of steel and shall be galvanized in accordance with the requirements of A.S.T.M. A153 except when corrosion resistant steel is required in which case the washers shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. They shall meet the dimensional requirements of A.N.S.I. B27.2, Type A Plain Washer. No punching, drilling, or cutting will be permitted after galvanizing.

INTENDED USE

1. (1-1/2 inch length). This bolt is for fastening rail support plates (or post blades) to posts in the standard Box Beam Median Barrier designs (steel and aluminum) MB3, MB3B, MB7, and MB7B.

2. (4-1/2 inch length). This bolt is for fastening end post ground line base plates in the standard Cable Guardrail design G1.

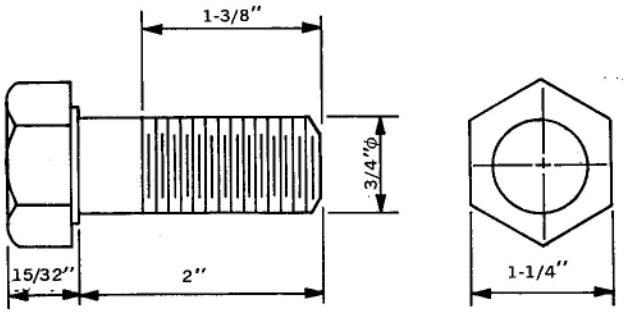
3. (7-1/2 inch length). This bolt is for fastening the rail of guardrail design G3 to the bridge rail end assemblies of Br2 (Steel) Type A (RE–23[ ]–79). This bolt also requires a steel lock washer meeting the requirements of A.N.S.I. B27.1 Regular Spring Lock Washers. The hex nut and lock washer are placed on the bottom of the rail.

3/4" HEX BOLT AND NUT AND WASHER

HM-TF-13

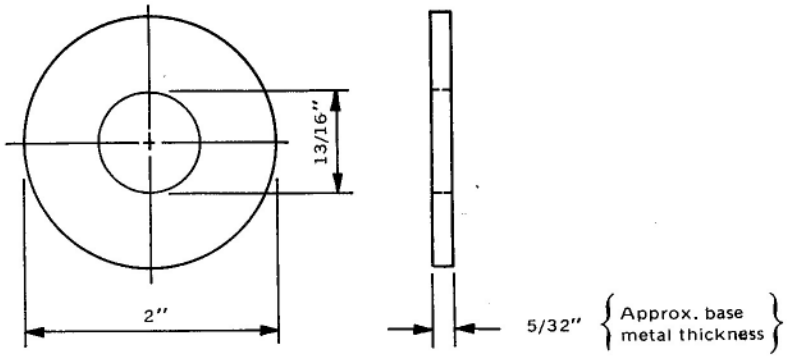
STANDARD

F-10 [LENGTH DESIGNATION] -79



Nut shown on Standards RE-11-73, RE-13-73, and RE-19-73.

3/4" ϕ HS BOLT



STEEL WASHER

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A325 or A449 and shall be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel bolts are requested in which case bolts shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts shall conform to or exceed the mechanical requirements of A.S.T.M. A325.

Washers shall be made of steel and shall be galvanized in accordance with the requirements of A.S.T.M. A153 except when corrosion resistant steel is required in which case the washers shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with cooper and shall not be galvanized. They shall meet the dimensional requirements of A.N.S.I. B27.2 Type A plain washers. No punching, drilling or cutting will be permitted after galvanizing.

INTENDED USE

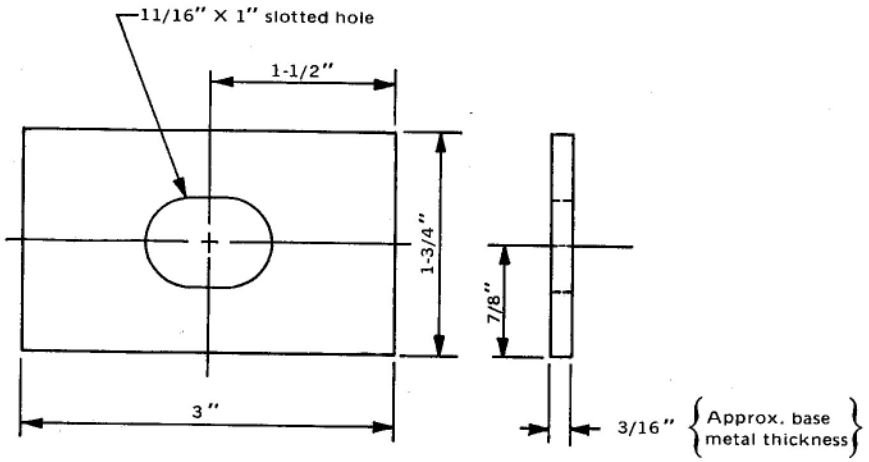
This bolt is for fastening internal splices in the standard guardrail design G3 and median barrier designs MB3 and MB3B.

3/4" HIGH STRENGTH HEX BOLT AND WASHER

HM-TF-13

STANDARD

F-11-73



WASHER

SPECIFICATIONS

Washers shall conform to the current requirements of A.A.S.H.T.O. M180.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

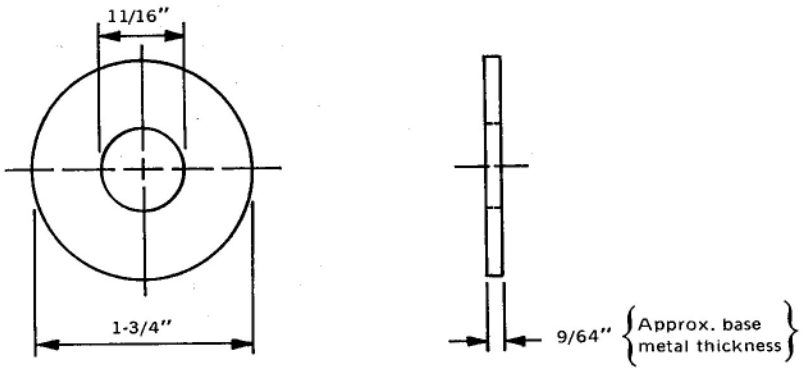
This washer is used with 5/8-inch diameter post rail bolts in the corrugated sheet steel beam guardrail designs G4 and G9, and median barrier designs MB4, MB9, MB4B, MB9B, and BCT.

RECTANGULAR PLATE WASHER

HM-TF-13

STANDARD

F-12.73



STEEL WASHER

SPECIFICATIONS

Washers shall be made of steel and shall be galvanized in accordance with the requirements of A.S.T.M. A153 except when corrosion resistant steel is requested in which case the washers shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. They shall meet the dimensional requirements of ANSI B27.2 Type A Plain Washers. No punching, drilling, or cutting will be permitted after galvanizing.

INTENDED USE

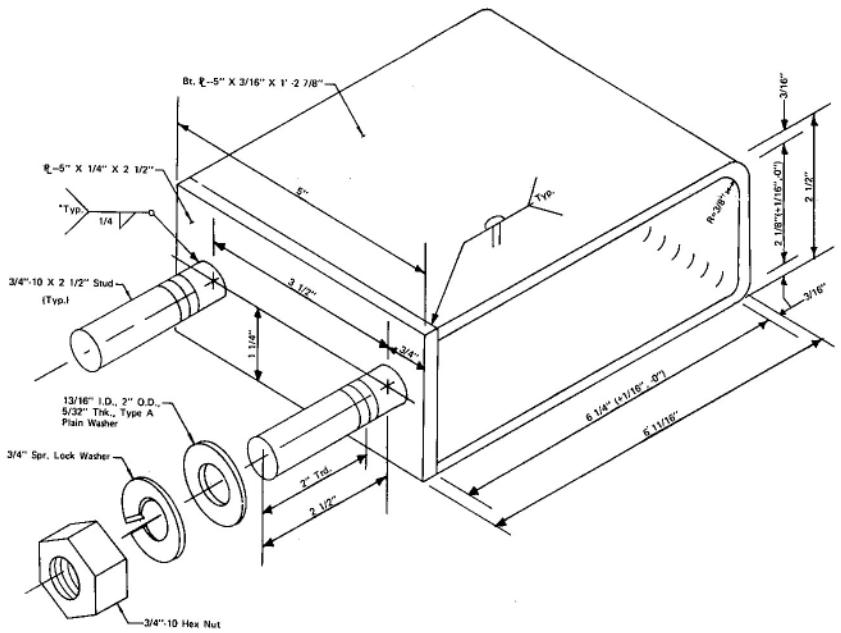
This washer is for use where round washers are required with 5/8-inch diameter bolts in the corrugated sheet steel beam guardrail and median barrier designes G4, G9, MB4, MB4B, MB9, MB9B, and BCT.

WASHER FOR 5/8" BOLT

HM-TF-13

STANDARD

F-13-73



RAIL CLAMP

*Stud welding may be used as alternative to fillet welds. See specifications.

SPECIFICATIONS

Nuts shall conform to the requirements of ASTM A563, Grade A, or better. Plain washers shall be made of steel and shall meet the dimensional requirements of ANSI B27.2 Type A Plain Washers. Spring lock washers shall meet the requirements of ANSI B27.1 Regular Spring Lock Washers. Nuts and washers shall be galvanized in accordance with the requirements of ASTM A153.

Plates for the rail clamp shall conform to the requirements of ASTM A36. Studs shall meet the requirements of ASTM A307 unless stud welding is used in which case studs shall meet the requirements of the American Welding Society Structural Welding Code, AWS D1.1. Studs shall be threaded (UNC, Class 2A Tolerance) to meet the dimensional requirements of ANSI B1.1. The unit shall be galvanized in accordance with the requirements of ASTM A123. No punching, drilling, cutting or welding will be permitted after galvanizing.

All welding shall conform to the current American Welding Society Structural Welding Code, AWS D1.1.

INTENDED USE

This clamp is used for fastening 6" X 2" rail elements to posts in bridge railing designs BR1 (Steel) Type B and BR2 (Steel) Type B.

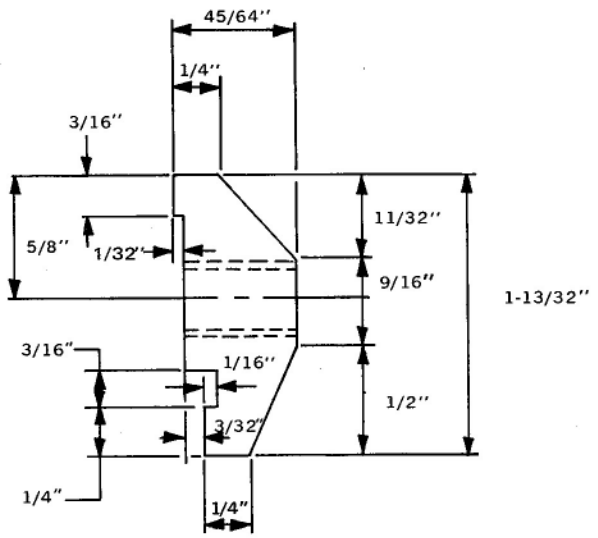
Note: This clamp is an alternate to welding studs directly to the rails. If studs are welded to the rail, see Standards RE-31-76, RE-34-76 and RE-35-76 for the rail specifications.

TS 6 X 2 X .25 RAIL CLAMP

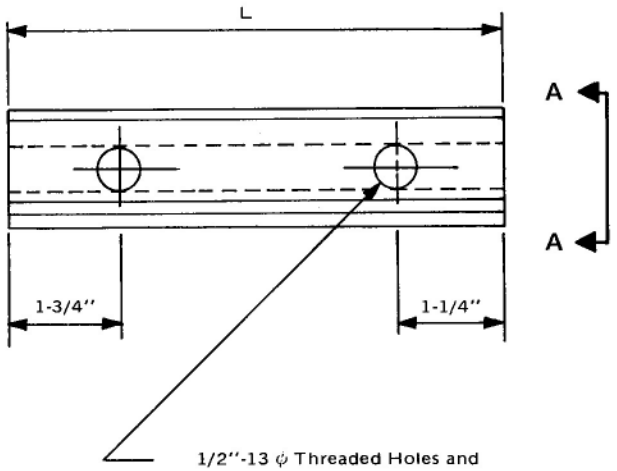
HM-TF-13

STANDARD

F-17-73



A-A



1/2"-13 ϕ Threaded Holes and 1/2" -13 X 1" Cap Screws with 9/16" I.D., 1-3/8" O.D., 7/64" Thk. Type A Plain Washers

SPECIFICATIONS

Aluminum clamp bars shall meet the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5.

Cap screws shall meet the mechanical requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.2.1. Both clamp bar and cap screw shall be threaded to A.N.S.I. B1.1, UNC, Class 2 tolerance.

Washers shall meet the mechanical requirements of A.S.T.M. B209, alloy 2024-T3 alclad and the dimensional requirements of A.N.S.I. B27.2 for Type A Plain Washers.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practice.

INTENDED USE

1. (L = 5-1/2"). This clamp bar connects 5-1/4" tubular rails to posts in bridge railing design BR1 (Aluminum) Type B.

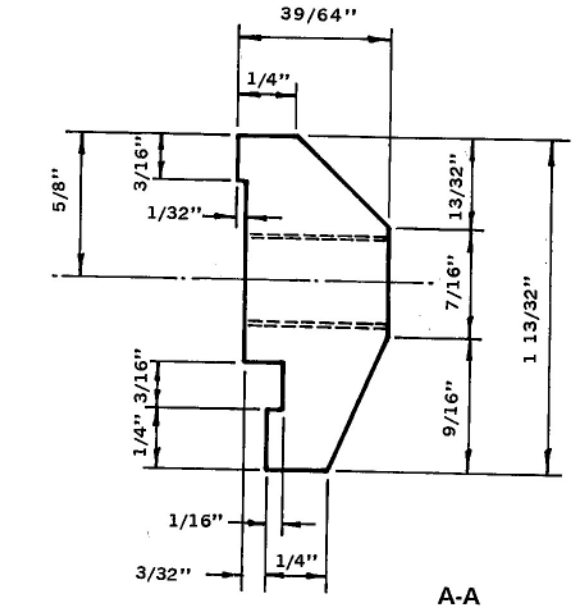
2. (L = 6-1/2"). This clamp bar connects 5-1/4" tubular rails to posts in bridge railing designs BR2 (Aluminum) Type B and BR3A (Aluminum) Type B.

5-1/4" TUBULAR RAIL CLAMP BAR

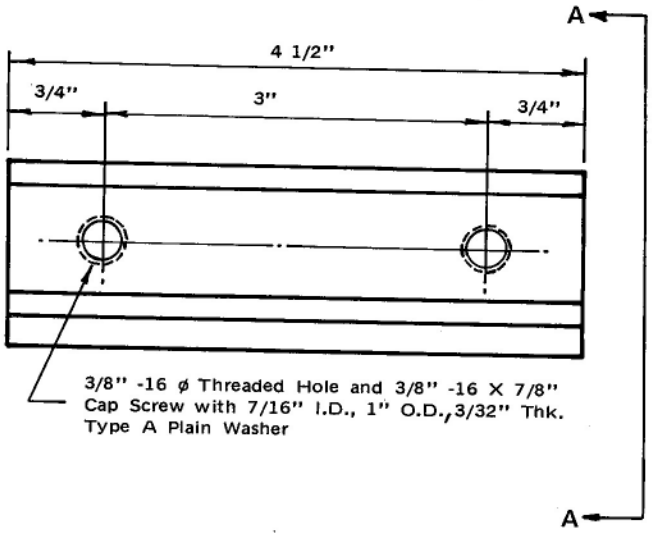
HM-TF-13

STANDARD

F-18 [LENGTH DESIGNATION] -73



A-A



HAND RAIL CLAMP BAR

SPECIFICATIONS

Aluminum clamp bars shall meet the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5.

Cap screws shall meet the mechanical requirements of ASTM A276, Type 430 and the dimensional requirements of ANSI B18.2.1. Both clamp bar and cap screw shall be threaded to ANSI B1.1, UNC, Class 2 tolerance.

Washers shall meet the mechanical requirements of ASTM B209, alloy 2024-T3 alclad and the dimensional requirements of ANSI B27.2 for Type A Plain Washers.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practice.

INTENDED USE

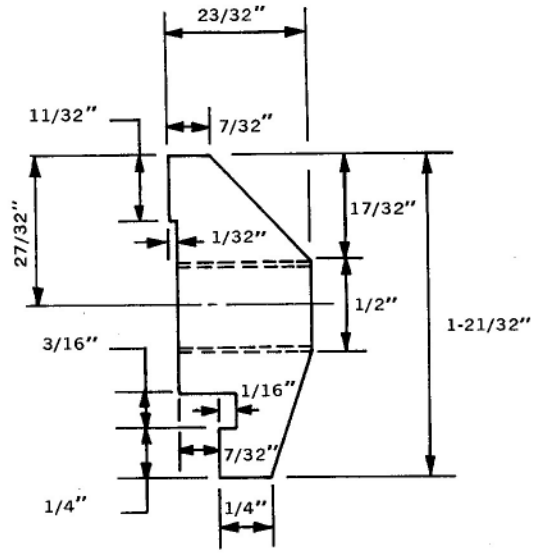
This clamp bar connects 4-5/8" tubular rails to posts in bridge railing design BR3A (Aluminum) Type B.

4-5/8" TUBULAR RAIL CLAMP BAR

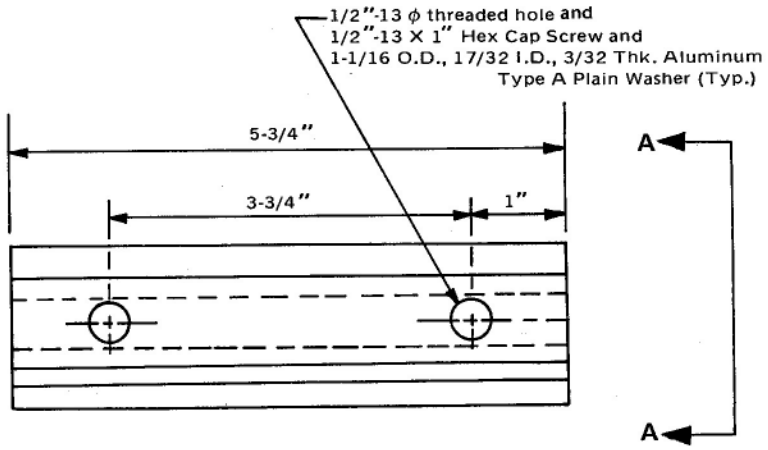
HM-TF-13

STANDARD

F-19-73



A-A



CLAMP BAR DETAILS

SPECIFICATIONS

Aluminum clamp bars shall meet the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5.

Cap screws shall meet the mechanical requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.2.1. Both clamp bar and cap screw shall be threaded to A.N.S.I. B1.1, UNC, Class 2 tolerance.

Washers shall meet the mechanical requirements of A.S.T.M. B209, alloy 2024-T3 alclad and the dimensional requirements of A.N.S.I. B27.2 for Type A Plain Washers.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practice.

INTENDED USE

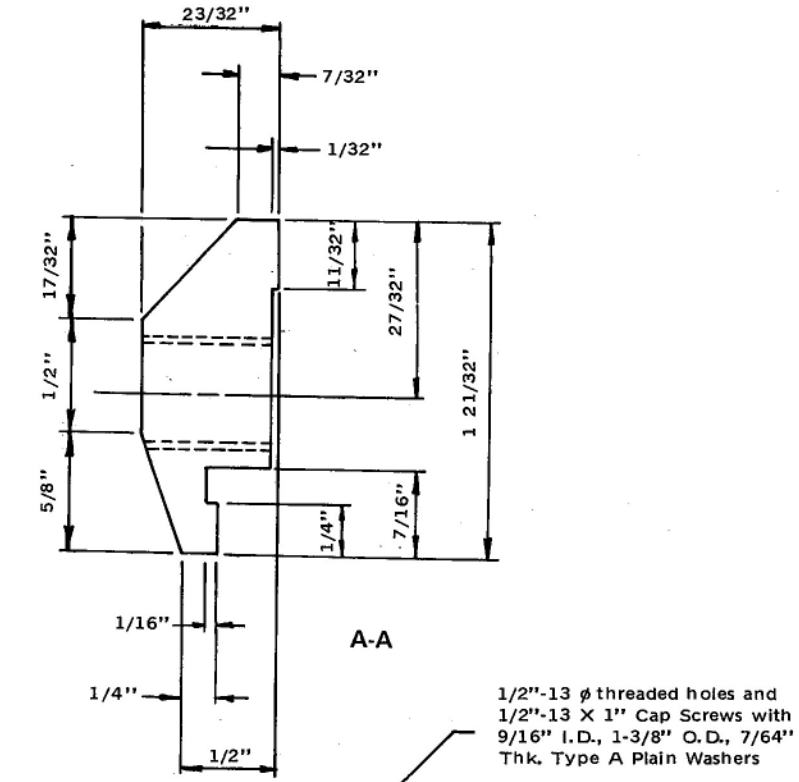
This clamp bar connects 4-3/4" X 3-3/4" and 4-3/4" X 4" semi-ellipse rails to posts in bridge railing designs BR1 (Aluminum) Type C and BR2A (Aluminum) Type C.

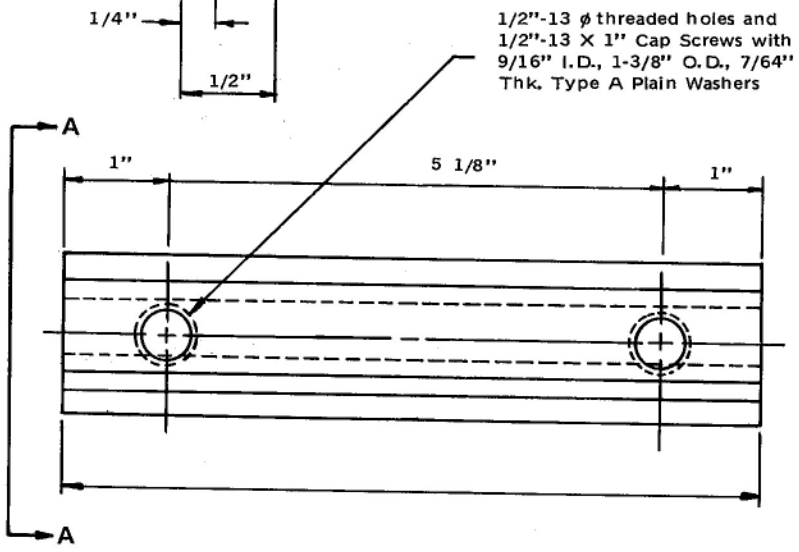
4-3/4" X 3-3/4" AND 4-3/4" X 4"
SEMI-ELLIPSE RAIL CLAMP BAR
(5-3/4" LONG)

HM-TF-13

STANDARD

F-20-73





SPECIFICATIONS

Aluminum clamp bars shall meet the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5.

Cap screws shall meet the mechanical requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.2.1. Both clamp bar and cap screw shall be threaded to A.N.S.I. B1.1, UNC, Class 2 Tolerance.

Washers shall meet the mechanical requirements of A.S.T.M. B209, alloy 2024-T3 alclad and the dimensional requirements of A.N.S.I. B27.2, Type A Plain Washers.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

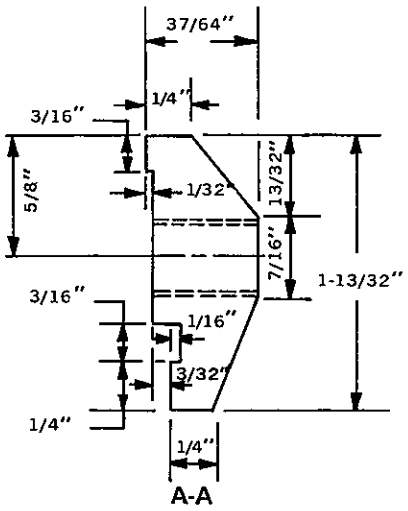
This clamp bar connects 4-3/4"X 3-3/4" and 4-3/4"X 4" semi-ellipse rails to posts in bridge railing designs BR2 (Aluminum) Type D and BR3A (Aluminum) Type D, in guardrail design G8, and in median barrier designs MB8 and MB8B. The clamp bar also connects 6-7/8"X 4-1/2" semi-ellipse rail shown in Appendix A.7.1. to posts.

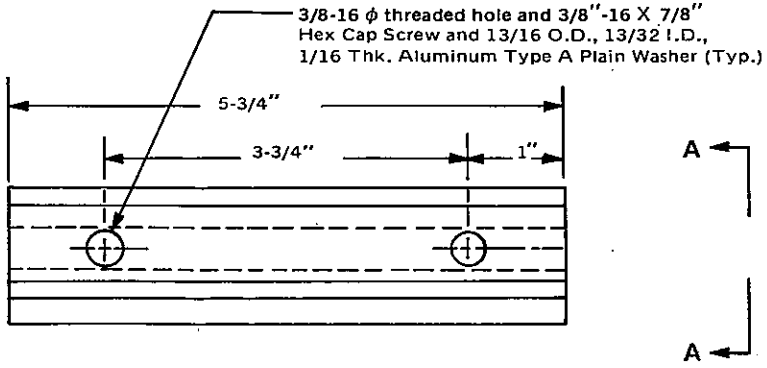
4-3/4" X 3-3/4", 4-3/4" X 4" AND 6-7/8" X 4-1/2" SEMI-ELLIPSE RAIL CLAMP BAR (7-1/8" LONG)

HM-TF-13

STANDARD

F-21.76





SPECIFICATIONS

Aluminum clamp bars shall meet the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5.

Cap screws shall meet the mechanical requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.2.1. Both clamp bar and cap screw shall be threaded to A.N.S.I. B1.1, UNC, Class 2 Tolerance.

Washers shall meet the mechanical requirements of A.S.T.M. B209, alloy 2024-T3 alclad and the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

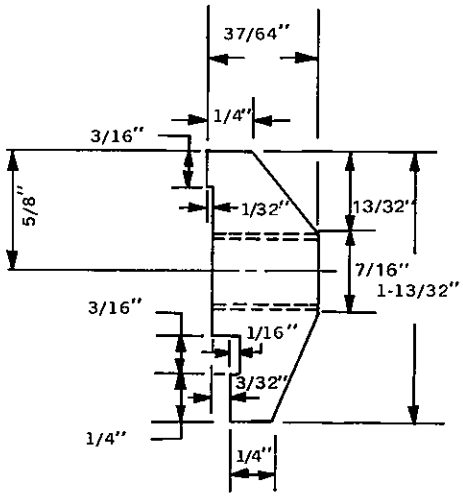
This clamp bar connects 4" X 3-1/8" semi-ellipse rails to posts in bridge railing design BR2A (Aluminum) Type C.

4" X 3-1/8"
SEMI-ELLIPSE RAIL CLAMP BAR
(5-3/4" LONG)

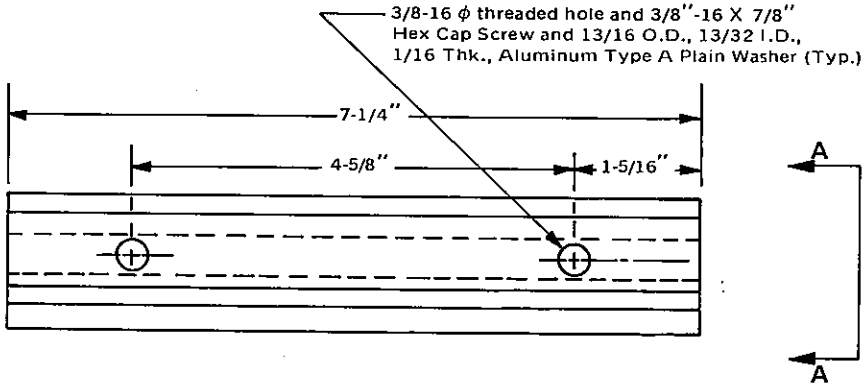
HM-TF-13

STANDARD

F-22-73



A-A



SPECIFICATIONS

Aluminum clamp bars shall meet the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5.

Cap screws shall meet the mechanical requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.2.1. Both clamp bar and cap screw shall be threaded to A.N.S.I. B1.1, UNC, Class 2 tolerance.

Washers shall meet the mechanical requirements of A.S.T.M. B209, alloy 2024-T3 alclad and the dimensional requirements of A.N.S.I. B27.2 for Type A Plain Washers.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practice.

INTENDED USE

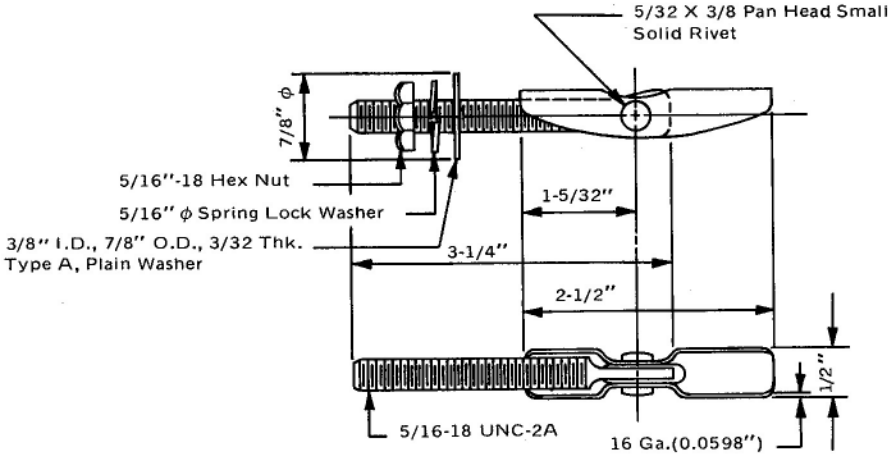
This clamp bar connects 4" x 3-1/8" semi-ellipse rails to posts in bridge railing design BR3A (Aluminum) Type D.

4" X 3-1/8"
SEMI-ELLIPSE RAIL CLAMP BAR
(7-1/4" LONG)

HM-TF-13

STANDARD

F-23 -73



TOGGLE BOLT ASSEMBLY

SPECIFICATIONS

Toggles shall conform to A.S.T.M. A570, Grade C or better; toggle bolt to A.S.T.M. A108, Grade 1020, with threads meeting the requirements of A.N.S.I. B1.1, UNC, Class 2A tolerance. Nuts shall meet the requirements of A.S.T.M. A563, Grade C or better. Plain washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers. Spring lock washers shall meet the requirements of A.N.S.I. B27.1.

Rivets shall meet the requirements of A.S.T.M. A276 Type 304 Condition B and the dimensional requirements of A.N.S.I. B18.1.

Steel components shall be cadmium plated to A.S.T.M. A165, Type OS, or better.

Required minimum tensile load shall equal 1000 pounds when in open position and tested through a 5/8" ϕ hole.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

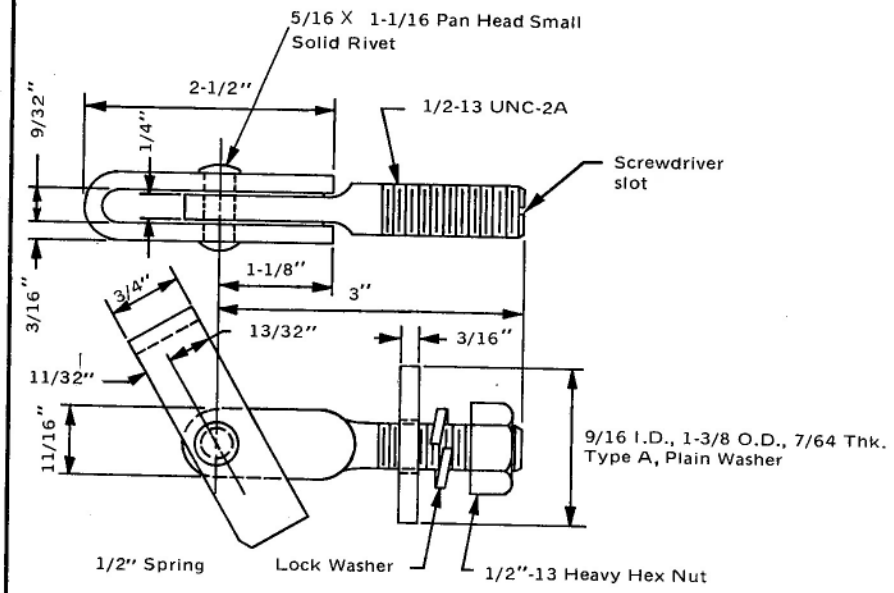
This toggle bolt is used to connect 3" OD tubular handrails to posts in bridge railing designs BR2A (Aluminum) Type A and BR3A (Aluminum) Type A.

5/16" TOGGLE BOLT

HM-TF-13

STANDARD

F-24-73



TOGGLE BOLT ASSEMBLY

SPECIFICATIONS

Toggles shall conform to A.S.T.M., A570, Grade D or better; toggle bolt to A.S.T.M. A354, Grade BD; hex nut to A.S.T.M. A563, Grade D; rivet to A.S.T.M. A276, Type 304 Condition B.

Plain washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers. Spring lock washers shall meet the requirements of A.N.S.I. B27.1.

Steel components shall be cadmium plated to A.S.T.M. A165, Type OS, or better.

Required minimum tensile load shall equal 9000 pounds when in open position and tested through a 1" ϕ hole.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

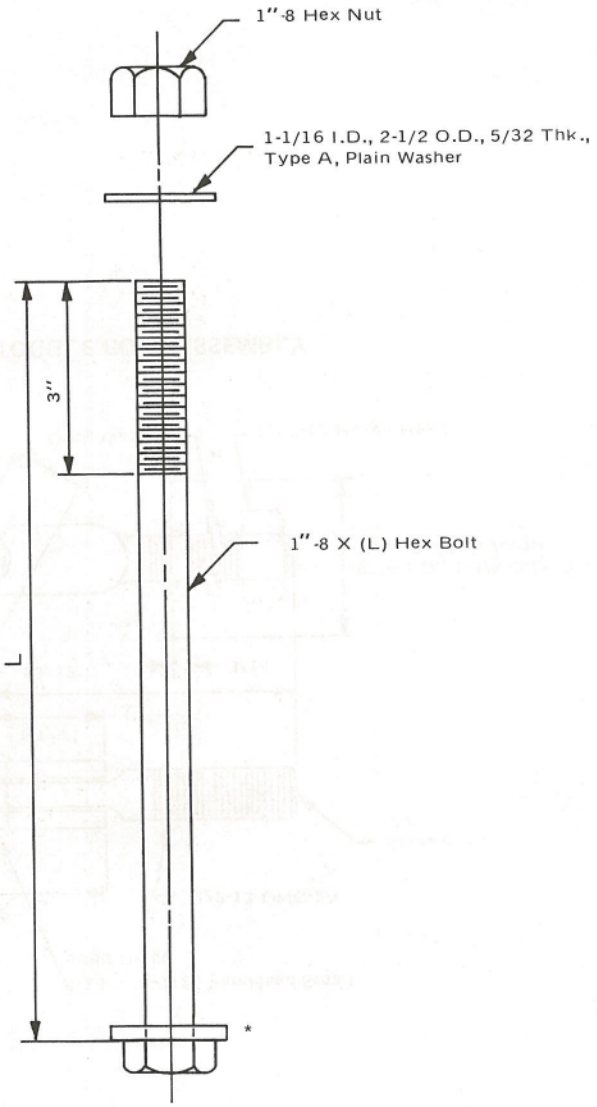
This toggle bolt is used to connect 5" OD tubular rails to posts in bridge railing designs BR1 (Aluminum) Type A, BR2A (Aluminum) Type A, BR2 (Aluminum) Type A, and BR3A (Aluminum) Type A.

1/2" TOGGLE BOLT

HM-TF-13

STANDARD

F-25-73



H.S. ANCHOR BOLT

* Washer required only when bolt head is embedded and no anchor plate provided.

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A325 or A449; nuts to the requirements of A.S.T.M. A563, Grade B or better. Washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers.

Bolts, nuts, and washers shall be galvanized in accordance with A.S.T.M. A153.

INTENDED USE

1. (L=8") This bolt is used as an outer anchor bolt for posts in bridge railing design BR1 (Steel) Type B.

2. (L=12") This bolt is used as an inner anchor bolt for posts in bridge railing design BR1 (Steel) Type B and for rail end assembly anchor bolts in bridge railing designs BR1 (Steel) Type B and BR2 (Steel) Type B.

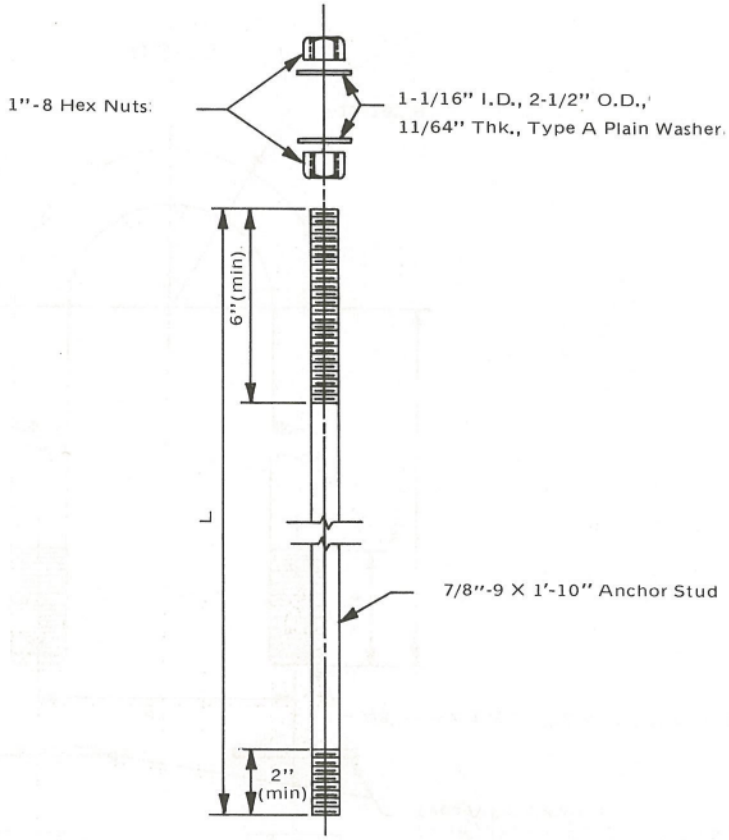
3. (L=Variable) The length varies between 3" plus the slab thickness up to a maximum 9" slab thickness. This bolt is used as an anchor bolt in bridge railing design BR2 (Steel) Type B. (For deck slabs up to 9 inches in thickness Post Anchor Plate P-21-73 should be placed on the underside of the slab. For deck slabs greater than 9 inches Post Anchor Plate P-21-73 should be embedded in the slab and a maximum bolt length of 12 inches used.)

1" HIGH STRENGTH ANCHOR BOLT AND NUT AND WASHER

HM-TF-13

STANDARD

F-26 [LENGTH DESIGNATION] -73



ANCHOR STUD

SPECIFICATIONS

Studs shall meet the requirements of A.S.T.M. A449; nuts to the requirements of A.S.T.M. A563, Grade B or better. Washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2 for Type A Plain Washers. Studs, nuts, and washers shall be galvanized in accordance with A.S.T.M. A153.

INTENDED USE

This stud is for anchoring posts to structures in bridge railing designs BR2 (Steel) Type A.

Note: For embedded anchor plate see P-18-79.

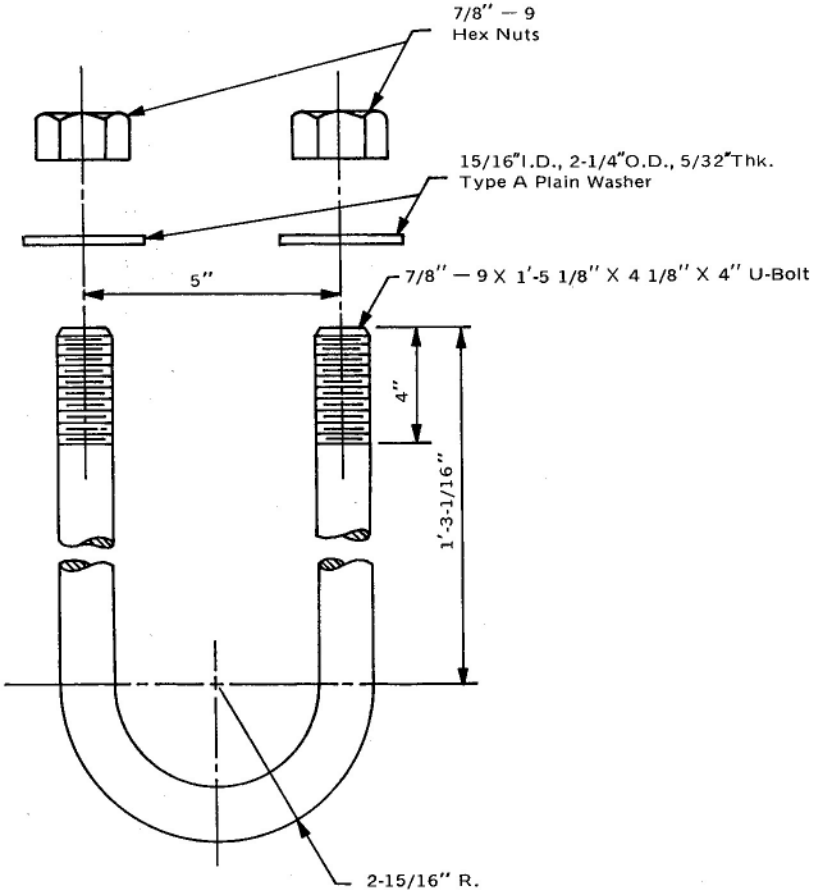
L = Curb height plus 11" unless available clearances dictate otherwise.

1" HIGH STRENGTH ANCHOR STUD AND NUTS AND WASHERS

HM-TF-13

STANDARD

F-28 [LENGTH DESIGNATION] -79



U-BOLT

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A307, nuts to the requirements of A.S.T.M. A563, Grade A or better; and they shall be galvanized in accordance with A.S.T.M. A153.

Washers shall be made of steel and shall be galvanized in accordance with A.S.T.M. A153. They shall meet the dimensional requirements of A.N.S.I. B27.2 for Type A Plain Washers.

INTENDED USE

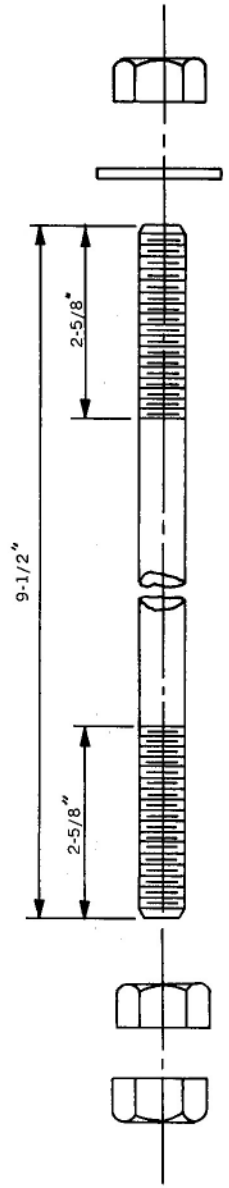
This fastener is used as an anchor bolt for posts in bridge railing design BR1 (Steel) Type A.

7/8" ANCHOR U-BOLT AND NUTS AND WASHERS

HM-TF-13

STANDARD

F-29-73



Alt. 1 5/8"-11 Stainless Steel Hex Nut
or 5/8"-11 Aluminum Heavy Hex Nut
Alt. 2 5/8"-11 Gal. Steel Hex Nut

Alt. 1 Aluminum
Alt. 2 Gal. Steel
1-5/16" O.D., 21/32" I.D., 3/32" Thk. Type A Plain Washer

Alt. 1 5/8"-11 Stainless Steel Anchor Stud
Alt. 2 5/8"-11 Gal. H.S. Steel Anchor Stud

Alt. 1
Alt. 2
5/8"-11 Steel Jam Nut

Alt. 1
Alt. 2
5/8"-11 Steel Hex Nut

SPECIFICATIONS

Alternate 1: Stainless steel studs shall meet the requirements of A.S.T.M. A276, Type 430 modified (100,000 psi with 15% elongation). Top hex nuts shall meet the requirements of stainless steel A.S.T.M. A276, Type 302 or, if specified, heavy hex nuts to meet the requirements of aluminum A.S.T.M. B221, alloy 6061-T6. Studs shall meet the dimensional requirements of A.N.S.I. B18. 2.1; nuts shall meet the dimensional requirements of A.N.S.I. B18. 2.2.

Aluminum washers shall meet the requirements of A.S.T.M. B209, alloy 2024-T3 alclad and shall meet the dimensional requirements of A.N.S.I. B27.2 for Type A Narrow Washers.

Embedded jam and hex nuts shall meet the requirements of A.S.T.M. A563 Grade A, or better.

Alternate 2: Studs shall meet the requirements of A.S.T.M. A449; hex nuts shall meet the requirements of A.S.T.M. A563 Grade B, or better. Washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2. Studs, nuts, and washers shall be galvanized in accordance with A.S.T.M. A153.

Embedded jam and hex nuts shall meet the requirements of A.S.T.M. A563 Grade A, or better.

INTENDED USE

This stud is intended as an anchorage for posts in the following barrier designs:

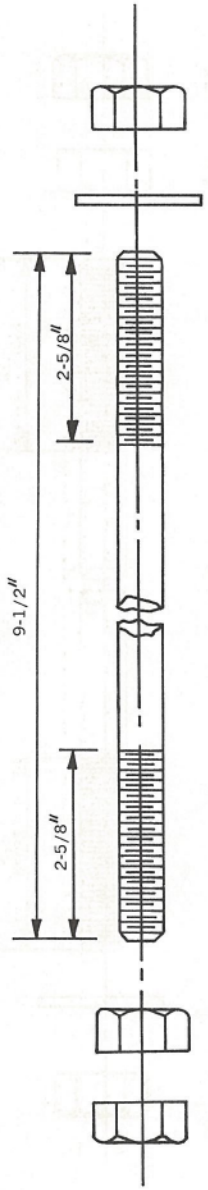
Barrier Designs	Front Anchors	Rear Anchors
BR1 (Aluminum) Type B		✔
BR1 (Aluminum) Type C	✔	✔
BR2A (Aluminum) Type C	✔	✔
BR2 (Aluminum) Type D		✔
BR 3A (Aluminum) Type D		✔

5/8" ANCHOR STUD AND NUTS AND WASHER

HM-TF-13

STANDARD

F-30-73



Alt. 1 3/4"-10 Stainless Steel Hex Nut
or 3/4"-10 Aluminum Heavy Hex Nut
Alt. 2 3/4"-10 Gal. Steel Hex Nut

Alt. 1 Aluminum 1-15/32" O.D., 13/16" I.D.,
Alt. 2 Gal. Steel 1/8" Thk. Type A Plain Washer

Alt. 1 3/4"-10 Stainless Steel Anchor Stud
Alt. 2 3/4"-10 Gal. H.S. Steel Anchor Stud

Alt. 1
Alt. 2 3/4"-10 Steel Jam Nut

Alt. 1
Alt. 2 3/4"-10 Steel Hex Nut

SPECIFICATIONS

Alternate 1: Stainless steel studs shall meet the requirements of A.S.T.M. A276, Type 430 modified (100,000 psi with 15% elongation). Top hex nuts shall meet the requirements of A.S.T.M. A276, Type 302; or, if specified heavy hex nuts to meet the requirements of A.S.T.M. B221, alloy 6061-T6. Studs and nuts shall meet the dimensional requirements of A.N.S.I. B18.2.1 and B18.2.2, respectively.

Aluminum washers shall meet the requirements of A.S.T.M. B209, alloy 2024-T3 alclad and the dimensional requirements of A.N.S.I. B27.2 for Type A Narrow Washers. Embedded jam and hex nuts shall meet the requirements of A.S.T.M. A563, Grade A or better.

Alternate 2: Studs shall meet the requirements of A.S.T.M. A449; hex nuts shall meet the requirements of A.S.T.M. A563, Grade B or better. Washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2. Studs, nuts, and washers shall be galvanized in accordance with A.S.T.M. A153.

Embedded jam and hex nuts shall meet the requirements of A.S.T.M. A563, Grade A or better.

INTENDED USE

This stud is intended as an anchorage for posts in the following barrier designs:

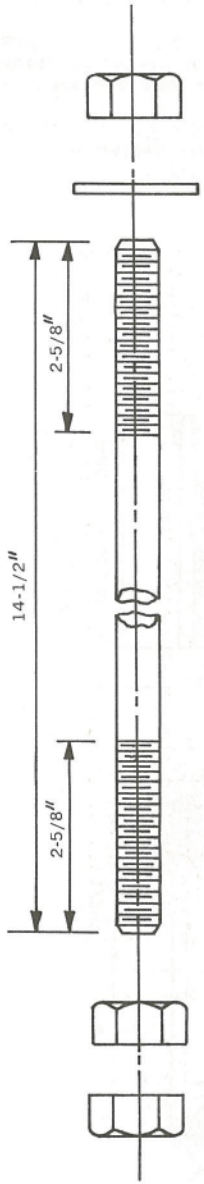
Barrier Designs	Front Anchors	Rear Anchors
BR1 (Aluminum) Type A	✓	✓
BR2A (Aluminum) Type A	✓	✓
BR1 (Aluminum) Type B	✓	
BR2 (Aluminum) Type B		✓
BR3A (Aluminum) Type B		✓
BR2 (Aluminum) Type D	✓	
BR3A (Aluminum) Type D	✓	
MB3B,MB4B,MB7B,MB8B,MB9B	✓	✓

3/4" ANCHOR STUD AND NUTS AND WASHER

HM-TF-13

STANDARD

F-31-73



Alt. 1 1-1/8"-7 Stainless Steel Hex Nut
or 1-1/8"-7 Aluminum Heavy Hex Nut
Alt. 2. 1-1/8"-7 Gal. Steel Hex Nut

Alt. 1. Aluminum
Alt. 2. Gal. Steel
2-1/4" O.D., 1-1/4" I.D., 9/64 Thk. Type A Plain Washer

Alt. 1 1-1/8"-7 Stainless Steel Anchor Stud
Alt. 2 1-1/8"-7 Gal. H.S. Steel Anchor Stud

Alt. 1
Alt. 2
1-1/8"-7 Steel Jam Nut

Alt. 1
Alt. 2
1-1/8"-7 Steel Hex Nut

SPECIFICATIONS

Alternate 1: Stainless steel studs shall meet the requirements of A.S.T.M. A276, Type 430 modified (100,000 psi with 15% elongation). Top hex nuts shall meet the requirements of stainless steel A.S.T.M. A276, Type 302; or, if specified, heavy hex nuts to meet the requirements of aluminum A.S.T.M. B221, alloy 6061-T6. Studs shall meet the dimensional requirements of A.N.S.I. B18.2.1; nuts shall meet the dimensional requirements of A.N.S.I. B18.2.2.

Aluminum washers shall meet the requirements of A.S.T.M. B209, alloy 2024-T3 alclad and shall meet the dimensional requirements of A.N.S.I. B27.2 for Type A Narrow Washers.

Embedded jam and hex nuts shall meet the requirements of A.S.T.M. A563 Grade A, or better.

Alternate 2: Studs shall meet the requirements of A.S.T.M. A449; hex nuts shall meet the requirements of A.S.T.M. A563 Grade B, or better. Washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2. Studs, nuts and washers shall be galvanized in accordance with A.S.T.M. A153.

Embedded jam and hex nuts shall meet the requirements of A.S.T.M. A563 Grade A, or better.

INTENDED USE

This stud is intended as an anchorage for posts in the following barrier designs:

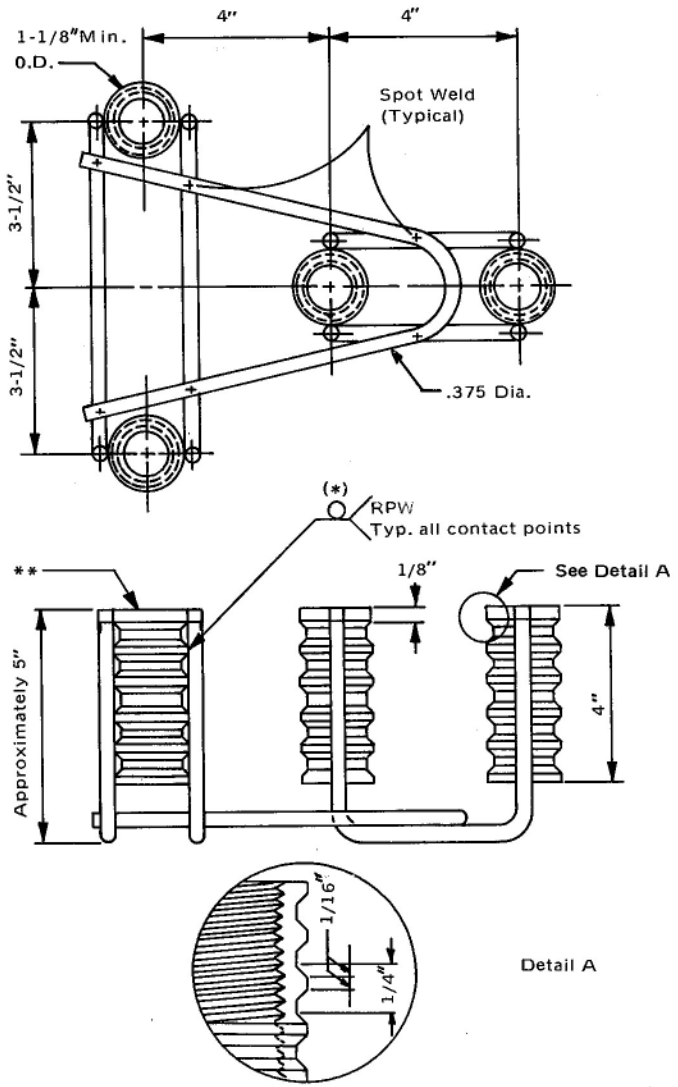
Barrier Design	Front Anchors	Rear Anchors
BR2 (Aluminum) Type A	✓	✓
BR3A (Aluminum) Type A	✓	✓
BR2 (Aluminum) Type B	✓	
BR3A (Aluminum) Type B	✓	

1-1/8" ANCHOR STUD AND NUTS AND WASHER

HM-TF-13

STANDARD

F-32-73



* Each welded attachment of wire to ferrule shall develop the tensile strength of the wire.

** Threaded steel insert with solid bottom tapped to a minimum threaded depth of 2-1/2" for use with 7/8" -9 X 2-1/2" galvanized H. S. Hex Bolt and a 15/16" I.D., 2-1/4" O.D., 5/32" Thk., Type A Plain Washer.

Four bolts and four washers to be provided with each assembly.

SPECIFICATIONS

Wires shown are minimum allowable size and shall conform to the requirements of A.S.T.M. A510, Grade 1030 and have a minimum tensile strength of 100,000 psi.

Ferrules shall be made from steel meeting the requirements of A.S.T.M. A108, Grade 12L14. Inserts shall be tapped to the dimensional requirements specified in A.S.T.M. A563 for nuts receiving galvanized bolts.

Bolts shall conform to the requirements of A.S.T.M. A325 or A449 and shall be threaded full length. Washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers. Both shall be galvanized in accordance with A.S.T.M. A153.

Wire diameters and materials requirements and ferrule material requirements and external diameters may be altered provided manufacturer demonstrates revised design is equivalent to design shown in this standard.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

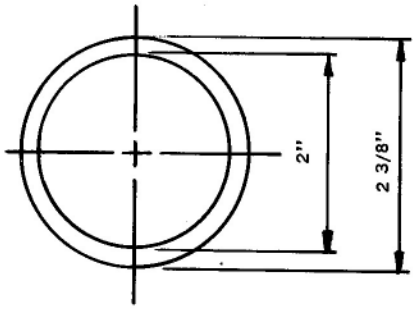
This Insert Anchor Assembly is used to anchor the terminal connector, RE-8-73, for corrugated sheet steel beam barrier designs to concrete. It is used in guardrail designs G2 and G4 and in median barrier designs MB2, MB4, and MB4B.

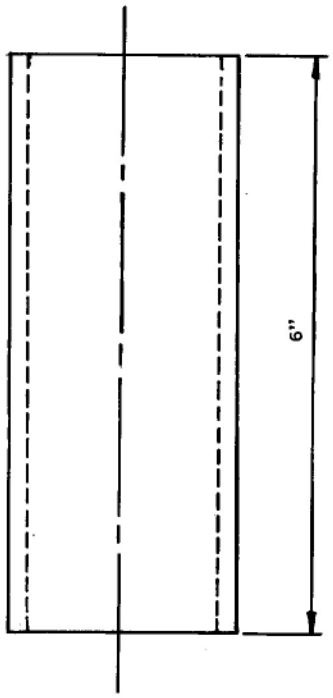
CONCRETE INSERT ANCHOR ASSEMBLY

HM-TF-13

STANDARD

F-33-73





BCT SLEEVE

SPECIFICATIONS

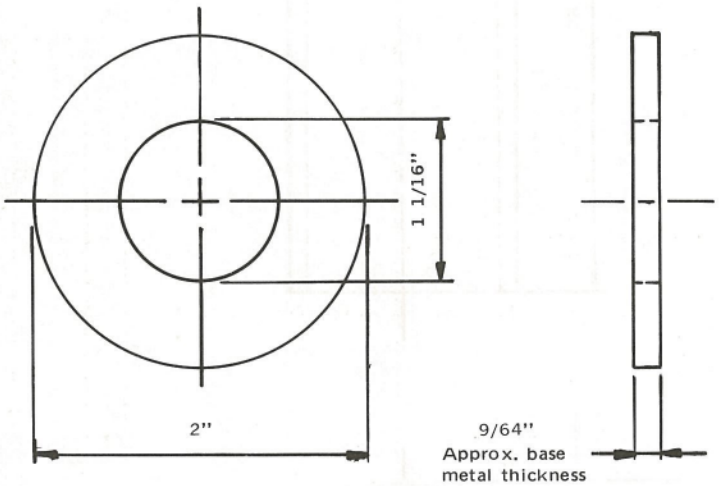
Sleeves shall conform to the requirements of A.S.T.M. A120 and shall be of 2-inch galvanized standard pipe.

INTENDED USE

This sleeve is used in anchoring the cable assembly in the standard breakaway cable terminal design as shown in Appendix A.4.

BCT SLEEVE	
HM-TF-13 STANDARD	F-34 -76

1" Ø HEX NUT



STEEL WASHER

SPECIFICATIONS

Nuts shall conform to the requirements of A.S.T.M. A325 and washers shall be made of steel; both shall be galvanized in accordance with A.S.T.M. A153. After galvanizing the pitch diameter of the nut may be tapped 0.023 inch over the A.N.S.I. Class 2B Tolerance.

Washers shall meet the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers. No punching, drilling or cutting will be permitted after galvanizing.

INTENDED USE

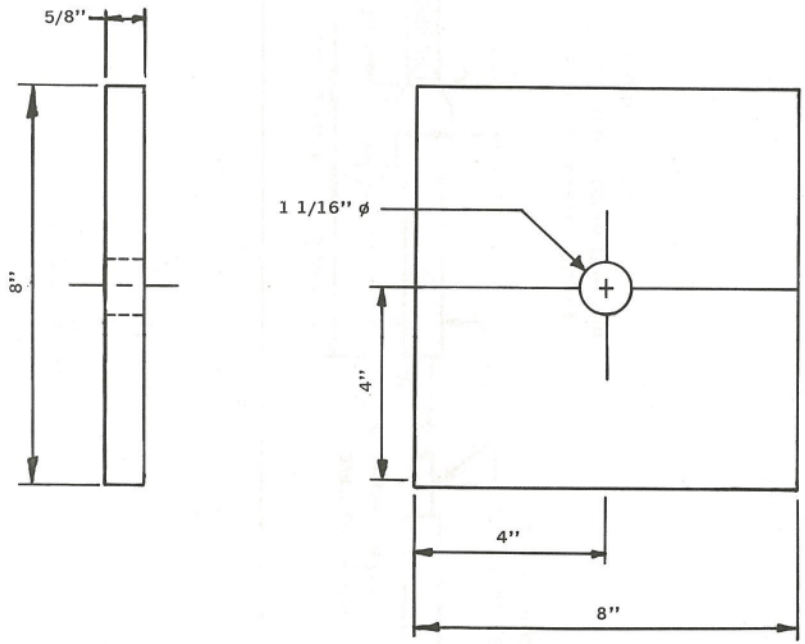
This nut and washer are used in anchoring the cable assembly in the standard breakaway cable terminal designs as shown in Appendixes A.4 and A.5. (See F-37-76)

1" NUT AND WASHER

HM-TF-13

STANDARD

F-35 -76



BEARING PLATE

SPECIFICATIONS

Bearing plates shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123, except when corrosion resistant steel is requested, in which case plates shall conform to A.S.T.M. A588 and shall not be painted nor galvanized.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

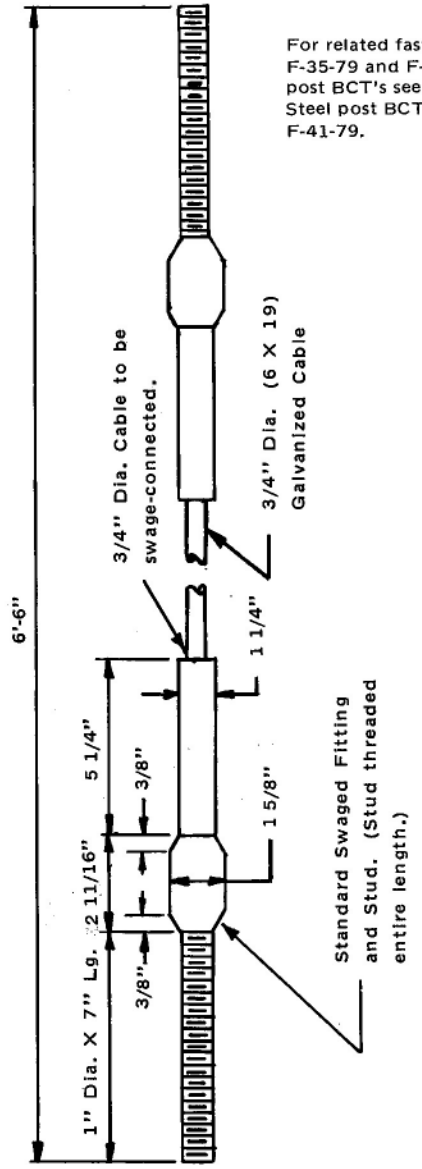
This bearing plate is used in anchoring the cable assembly to the post in the standard breakaway cable terminal design as shown in Appendix A.4.

BCT (TIMBER) BEARING PLATE

HM-TF-13

STANDARD

F-36-79



CABLE ASSEMBLY

For related fastener hardware see F-35-79 and F-38-79 and for Wood post BCT's see F-36-79 and for Steel post BCT's see F-40-79 and F-41-79.

SPECIFICATIONS

The swaged fitting shall be machined from hot-rolled carbon steel conforming to the requirements of A.S.T.M. A576, Grade 1035, and shall be annealed suitable for cold swaging. The swaged fitting shall be galvanized in accordance with A.S.T.M. A123 before swaging. A lock pin hole to accomodate a 1/4-inch, plated, spring steel pin shall be drilled through the head of the swage fitting to retain the stud in the proper position. After galvanizing the head may be tapped 0.023-inch over the A.N.S.I. Class 2B tolerance.

The stud shall conform to the requirements of A.S.T.M. A449 and shall be galvanized in accordance with A.S.T.M. A153. The threads shall have a Class 2A fit before galvanizing. Prior to galvanizing a 3/8-inch slot for the locking pin shall be milled into the stud end.

Wire rope shall conform to the requirements of A.A.S.H.T.O. M-30 and shall be 3/4-inch preformed, 6 X 19, wire strand core or independent wire rope core (IWRC), galvanized, right regular lay, manufactured of improved plow steel with a minimum breaking strength of 42,800 pounds.

The swaged fitting, stud, and nut (F-35-76) shall develop the breaking strength of the wire rope.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

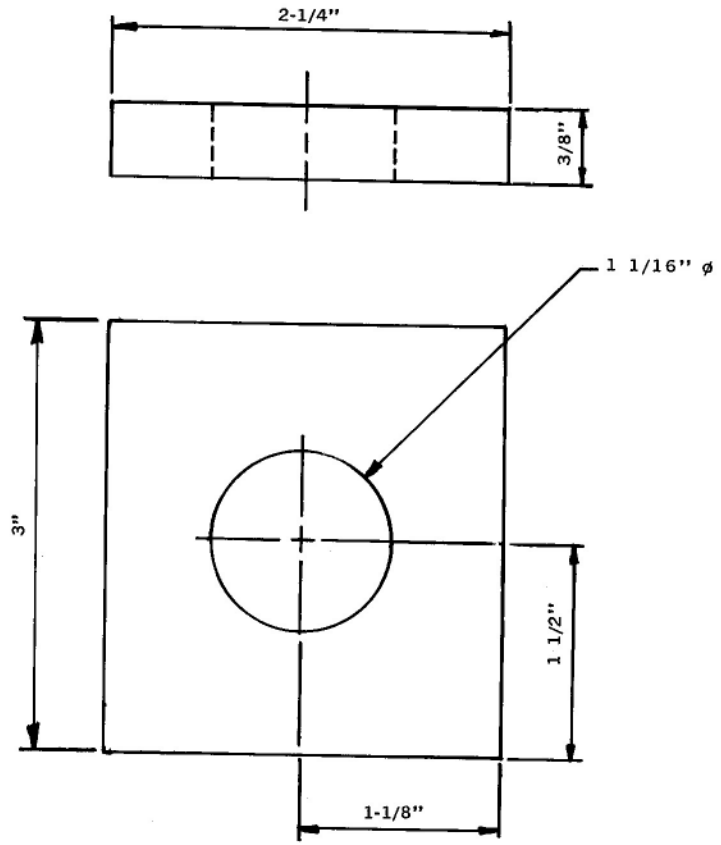
This cable assembly is used in the standard breakaway cable terminal designs as shown in Appendixes A.4 and A.5.

BCT CABLE ASSEMBLY

HM-TF-13

STANDARD

F-37-76



END PLATE

SPECIFICATIONS

End plates shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel is requested in which case the plates shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized.

No punching, drilling or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

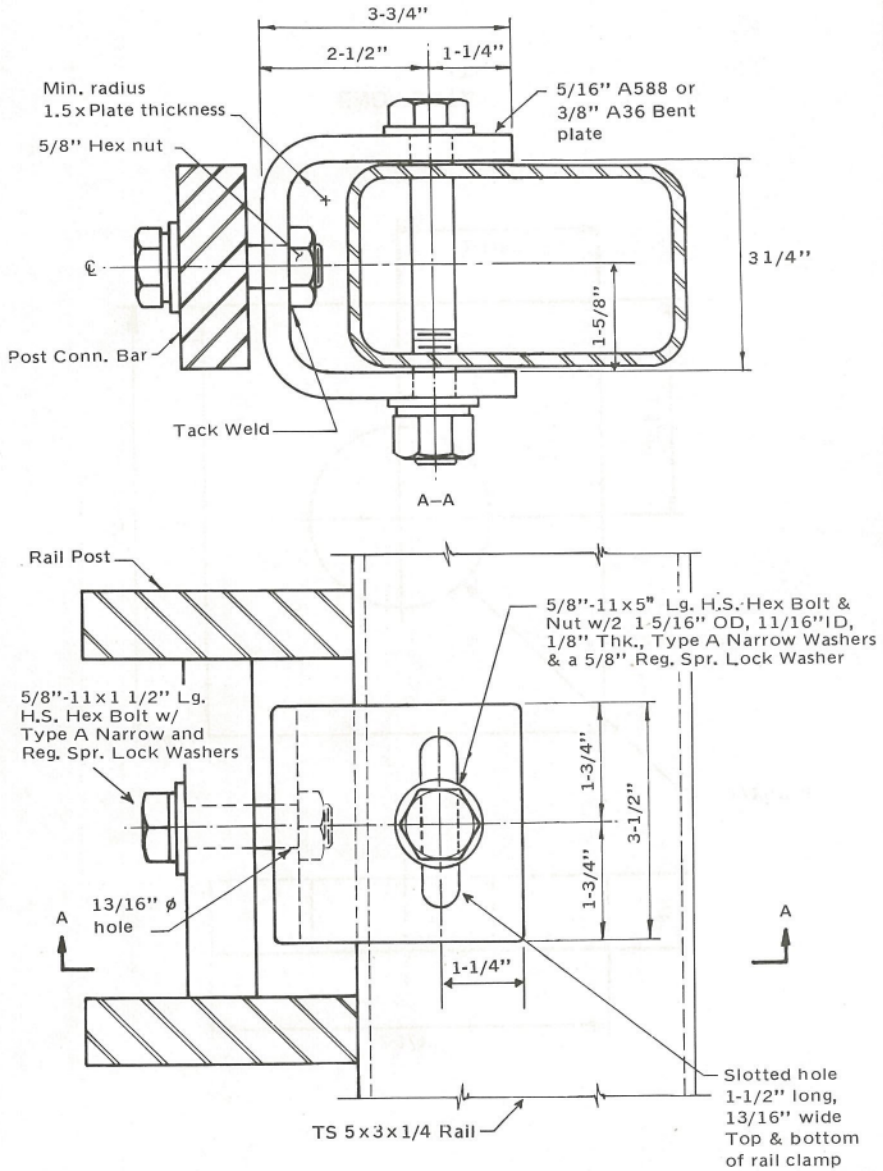
This end plate is used in fastening the cable assembly (F-37-76) to anchor plate RE-71-79 in the standard breakaway cable terminal designs as shown in Appendixes A.4 and A.5.

BCT CABLE END PLATE

HM-TF-13

STANDARD

F-38-79



SPECIFICATIONS

Bolts, nuts, and washers shall conform to the requirements of A.S.T.M. A325 or A449. Lock washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.1 Regular Spring Lock Washers. The bolts shall have an A.N.S.I. Class 2A thread before galvanizing; and all bolts, nuts and washers shall be galvanized in accordance with A.S.T.M. A153.

The rail clamp shall meet the requirements of A.S.T.M. A36 or A588. After welding the nut to the rail clamp and galvanizing, the nut shall be tapped to the dimensional requirements specified in A.S.T.M. A563 for nuts receiving galvanized bolts. The fabricated rail clamp shall have all exposed edges and corners ground to approximately a 1/16" radius before being galvanized in accordance with A.S.T.M. A123. No punching, drilling, cutting or welding will be permitted after galvanizing.

Welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

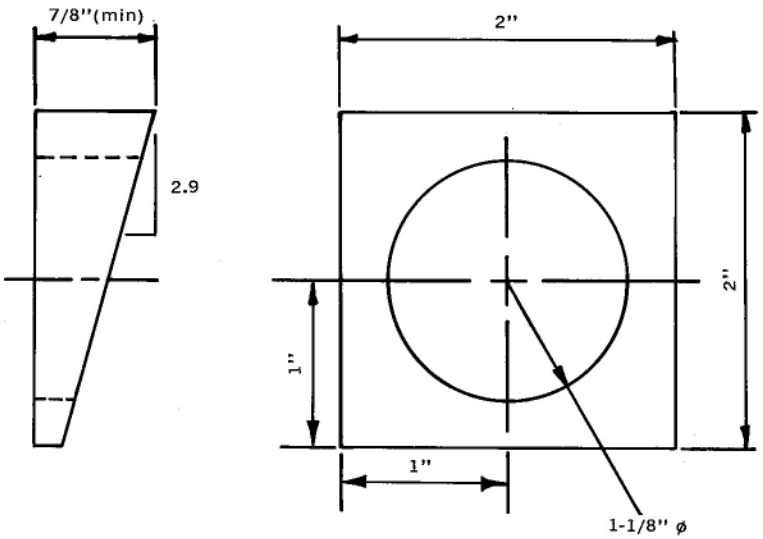
This clamp is used for fastening 5" X 3" rail elements to posts in bridge railing designs BR1 (Steel) Type A and BR2 (Steel) Type A.

TS 5 X 3 X .25
RAIL CLAMP

HM-TF-13

STANDARD

F-39 -79



TAPERED WASHER

SPECIFICATIONS

Washers shall be made of steel or malleable iron and shall be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel is requested in which case the washers shall be made of steel having an atmospheric corrosion resistance approximately two times that to carbon structural steel with copper and shall not be galvanized.

No punching, drilling, or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This washer is used in anchoring the cable assembly in the standard breakaway cable terminal design as shown in Appendix A.5

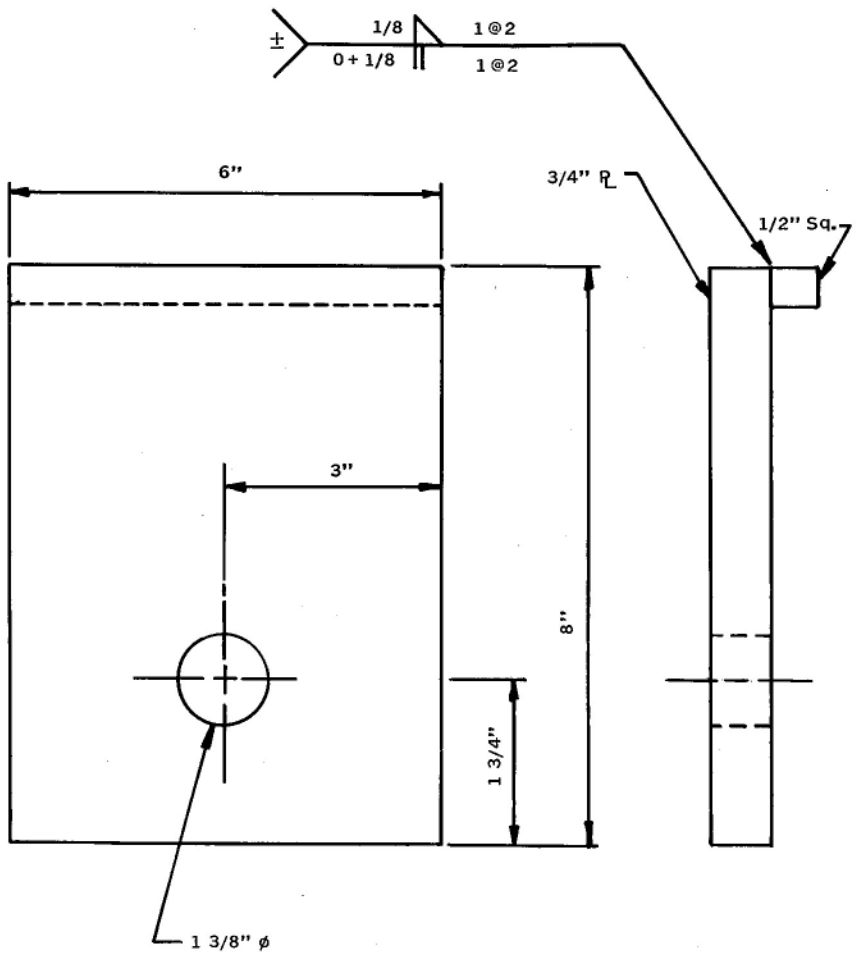
Note: An acceptable alternate to the tapered washer in this standard would be TWO A.N.S.I. B27.4 Type A or Type B beveled washers for 1-1/8" diameter bolts. When this alternate is used the beveled washers must be rotated relative to themselves and the bearing plate to produce uniform bearing.

BCT (STEEL) TAPERED WASHER

HM-TF-13

STANDARD

F - 40 - 79



BEARING PLATE

SPECIFICATIONS

Bearing plates shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123, except when corrosion resistant steel posts are requested, in which case bearing plates shall conform to A.S.T.M. A588 and shall not be painted nor galvanized.

Welding shall conform to the requirements contained in the current American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This bearing plate is used in fastening the cable assembly to the post in the standard breakaway cable terminal design as shown in Appendix A.5.

BCT (STEEL) BEARING PLATE

HM-TF-13

STANDARD

F - 41 - 79

82a

AASHTO-AGC-ARTBA JOINT COMMITTEE

A cooperative activity of

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
444 N. CAPITOL ST., N.W., SUITE 225
WASHINGTON, D. C. 20001

ASSOCIATED GENERAL CONTRACTORS OF AMERICA
1957 E STREET, N.W.
WASHINGTON, D. C. 20006

AMERICAN ROAD AND TRANSPORTATION BUILDERS' ASSOCIATION
ARBA BUILDING
525 SCHOOL STREET, S.W.
WASHINGTON, D. C. 20024

Address Reply to:

James H. Hatton, Jr.
Federal Highway Administration,
Office of Engineering, HNG-14
Washington, D.C. 20590

Subcommittee on New Materials
Task Force No. 13
Standardization of Details for
Bridge and Road Hardware
202/366-1329

June 23, 1987

TO: Task Force No. 13 Members and Sponsoring Organization Secretaries

It was recently brought to the attention of the Federal Highway Administration (FHWA) that a change is necessary in the dimensioning shown on Drawing F-41-79, BCT (Steel) Bearing Plate, from the 1979 AASHTO-AGC-ARTBA publication "A Guide to Standardized Highway Barrier Rail Hardware."

By a June 15, 1987, memorandum the FHWA informed its Regional Offices of the need for this change. A copy of this memorandum is enclosed for your information.

Sincerely yours,

James H. Hatton, Jr.
Secretary, Task Force No. 13

Enclosure

cc: Maurice E. Bronstad
Robert E. Spicher
G.R. Van Schooneveld
John J. Panak
Barry T. Shapiro
Ronnell M. Sprenkle
Kenneth A. Gregory
John G. Kunna
Micheal Cox

RECEIVED
JUN 26 1987
SYRO STEEL COMPANY

826

Memorandum

U.S. Department of Transportation
Federal Highway Administration

Washington, D.C. 20590

Subject: Breakaway Cable Terminal (BCT) Date: JUN 15 1987

From: Chief, Federal-Aid and Design Division Reply to Attn. of: HNG-14

To: Regional Federal Highway Administrators
Direct Federal Program Administrator

Attached is a revision to Drawing F-41-79, BCT (Steel) Bearing Plate, from the 1979 AASHTO-AGC-ARTBA publication "A Guide to Standardized Highway Barrier Rail Hardware." This revision is to change the dimension from the bottom of the plate to the center of the 1 3/8-inch diameter hole from 1 3/4 inches to 2 1/4 inches. The 2 1/4-inch dimension is necessary if the bearing plate is to properly engage the bottom foundation plate as shown in Drawing A.5 from the cited barrier hardware guide.

Since few States have used a steel slip base terminal post in the BCT layout, the impact of this dimensioning oversight will be limited. However, we are requesting that the revised drawing be provided to the division offices and State highway agencies so they will be aware of this change should a steel slip base terminal post be used and that, in those States where the steel slip base terminal post has been used, a check be made to ensure that installed bearing plates properly engage the bottom foundation plate.

Based on our recent field reviews and inquiries we have received concerning installation practices for BCTs, the following construction and maintenance details for this terminal continue to need attention.

1. The 4-foot parabolic flare in the BCT layout must be provided. This flare is essential in reducing the buckling strength of the BCT.

2. A nearly level approach to the BCT is necessary. A 10:1 or less steep foreslope should be provided between the edge of pavement and the BCT railing. Additionally, this nearly level area should be continued on to a hinge or breakpoint at least 5 feet outside the end of the BCT and be gradually tapered back into the cross section on the approach to the terminal. This relatively level grading is necessary since adequate BCT performance is dependent on maintaining generally level vehicle approaches to the terminal system.

3. The area outside and down stream of the 12 1/2-foot breakaway nose section of the BCT (the 37 1/2-foot BCT is composed of two sections - the 12 1/2-foot breakaway nose and the remaining 25-foot containment section) should be free of obstacles and graded in such a way as to allow a vehicle to pass through the breakaway nose section and come to a safe stop. A clear zone consistent with guidance provided in the AASHTO "A Policy on Geometric Design of Highways and Streets" (1984) is recommended.

4. The commonly used wood terminal posts should be 6 x 8 inches in cross section. The size of the wood terminal post was reduced from 8 x 8 inches to 6 x 8 inches to improve BCT performance during low-speed, end-on impacts by small vehicles.

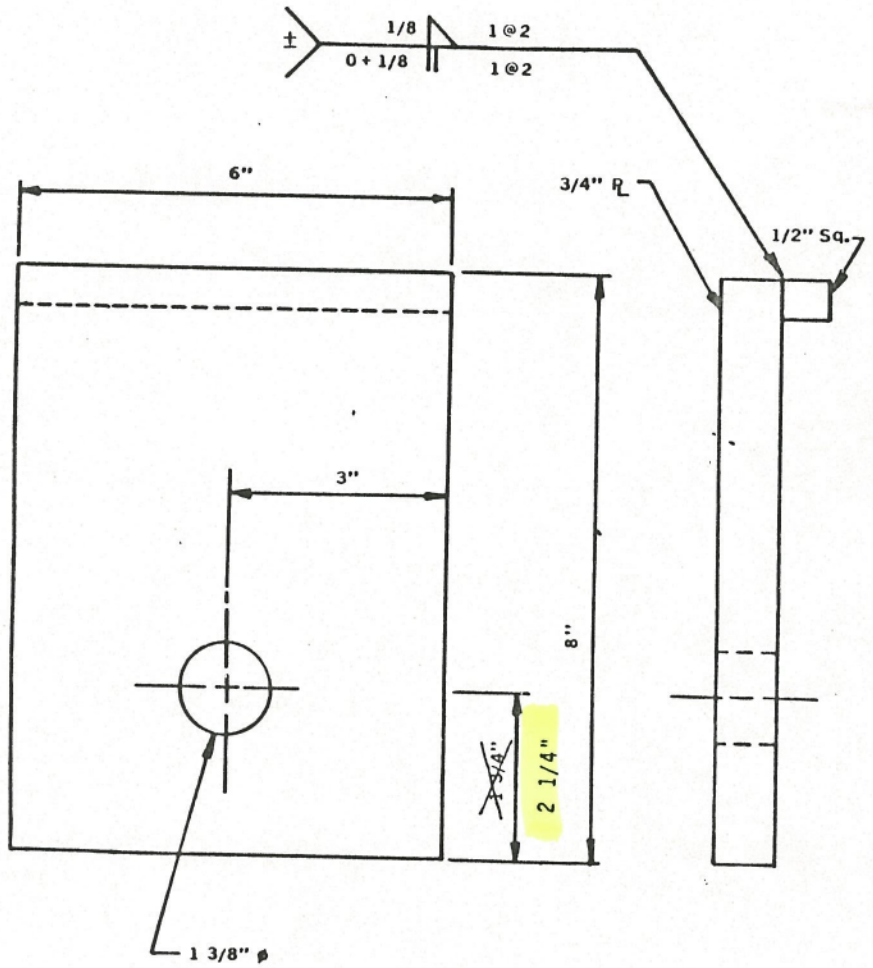
5. Steel and wood posts should not be intermixed within the 25-foot containment section of the BCT beyond the initial breakaway section. Although FHWA Technical Advisory T 5040.23, Corrugated Sheet Steel (W-Beam) Guardrail, dated March 13, 1984, discussed interchanging steel and wood posts, that advice was intended to allow limited substitution within standard guardrail sections to expedite post replacement. This advice was not intended to cover the BCT layout, as the characteristics of steel versus wood posts are of sufficient difference to influence the behavior of the 25-foot containment section of the BCT. Therefore, only one post type should be used within that section. Technical Advisory T 5040.23 provides details for laying out both post systems (note the steel version has one additional post).

FHWA Technical Advisory T 5040.25, W-Beam Guardrail End Treatments, dated January 7, 1986, provided information on the Eccentric Loader BCT. We believe the Eccentric Loader BCT could provide improved performance over the conventional BCT. We continue to encourage installation of the Eccentric Loader BCT as an experimental feature. Similar to the conventional BCT, vehicles are expected to pass behind the Eccentric Loader BCT installation during some impacts and items 2 and 3 above are also appropriate recommendations for the construction of an Eccentric Loader BCT.

L. A. Staron

L. A. Staron

Attachment



BEARING PLATE

SPECIFICATIONS

Bearing plates shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123, except when corrosion resistant steel posts are requested, in which case bearing plates shall conform to A.S.T.M. A588 and shall not be painted nor galvanized.

Welding shall conform to the requirements contained in the current American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This bearing plate is used in fastening the cable assembly to the post in the standard breakaway cable terminal design as shown in Appendix A.5.

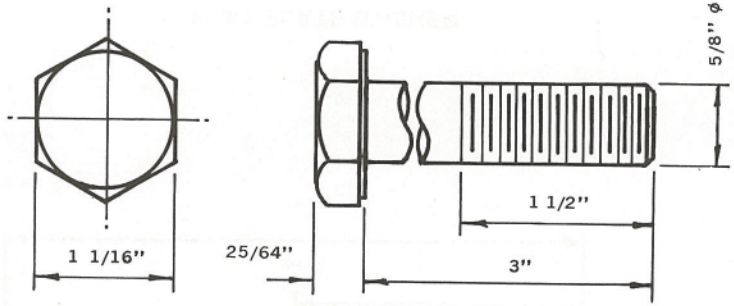
BCT (STEEL) BEARING PLATE

HM-TF-13

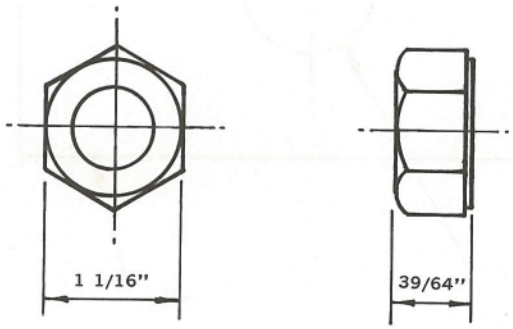
STANDARD

F-41 - 87

FHWA
Recommended Revision
June 1987



5/8" Ø HS BOLT



5/8" Ø HS NUT

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A325 or A449 and nuts to the requirements of A.S.T.M. A563, Grade C or better, and shall be galvanized in accordance with the requirements of A.S.T.M. A153. No punching, drilling or cutting will be permitted after galvanizing.

INTENDED USE

This bolt is used for fastening terminal posts to foundation plates in the standard breakaway cable terminal design as shown in Appendix A.5.

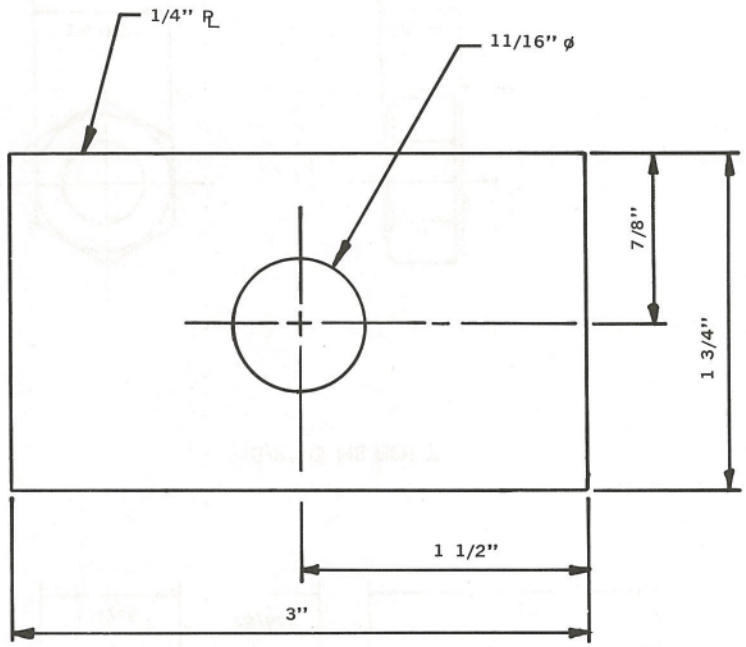
Note: Requires one F-13-73 washer and two F-43-79 washers when used in BCT steel post slip base.

5/8" HIGH STRENGTH HEX BOLT AND NUT

HM-TF-13

STANDARD

F-42 -79



FLAT PLATE WASHER

SPECIFICATIONS

Washers shall be made of steel and shall be galvanized in accordance with A.S.T.M. A153, except when corrosion resistant steel is requested in which case the washers shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized.

No punching, drilling, or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practice.

INTENDED USE

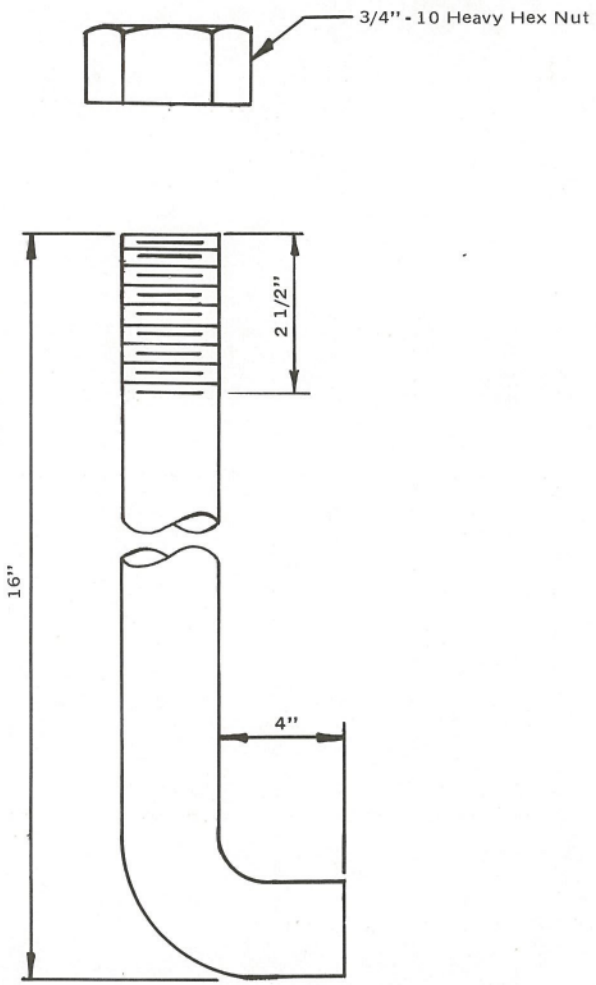
This washer is used in fastening terminal posts to foundation posts in the standard breakaway cable terminal design as shown in Appendix A.5.

FLAT PLATE WASHER

HM-TF-13

STANDARD

F - 43 - 79



3/4" ϕ ANCHOR BOLT X 16" LONG

SPECIFICATIONS

Bolts shall conform to the requirements of A.S.T.M. A325 or A449; nuts shall conform to the requirements of A.S.T.M. A563, Grade B or better.

Bolts and nuts shall be galvanized in accordance with the requirements of A.S.T.M. A153.

INTENDED USE

This anchor bolt is used ot anchor foundation posts to concrete footings in the standard breakaway cable terminal design as shown in appendix A.5.

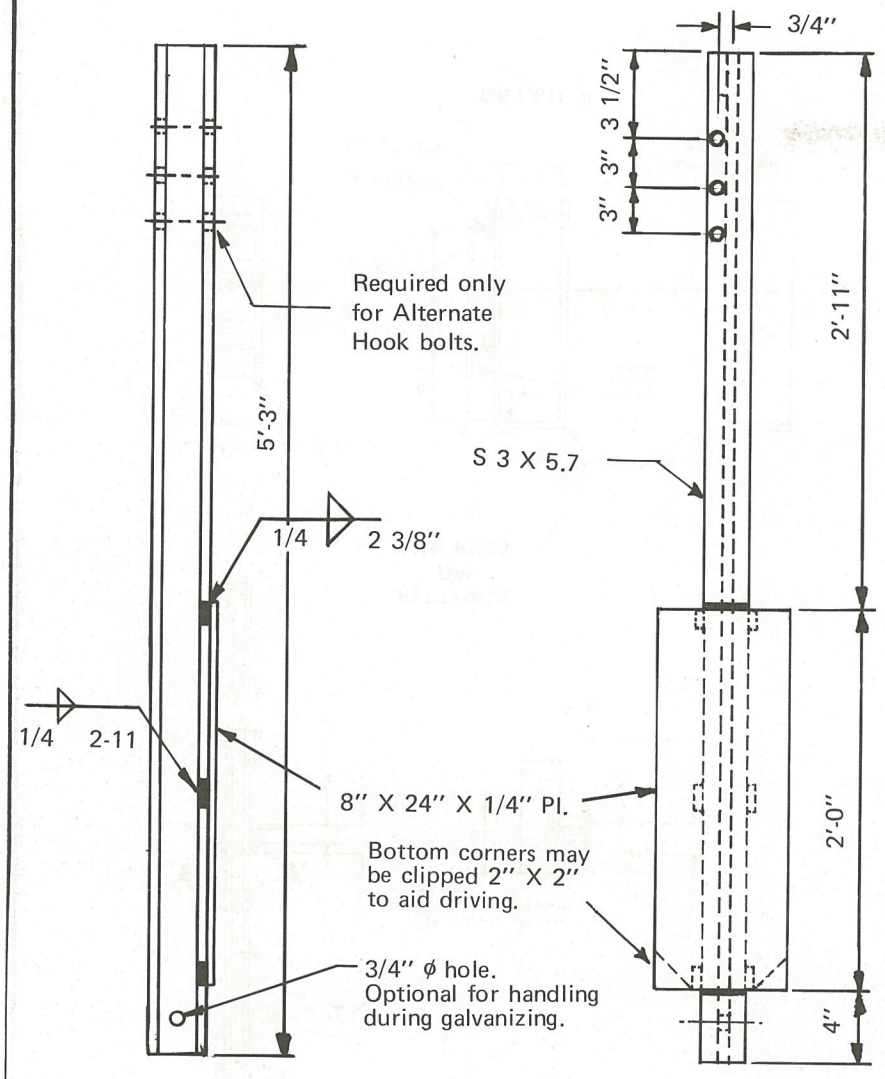
3/4" HIGH STRENGTH ANCHOR BOLT

HM-TF-13

STANDARD

F - 44 - 79

POSTS
BLOCKS AND POST ACCESSORIES



Note:
All holes 3/8" except as noted.

SPECIFICATIONS

Posts and post plates shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel posts are requested, in which case posts and post plates shall conform to A.S.T.M. A588 and shall not be galvanized or painted.

Welding shall conform to the requirements of the current American Welding Society Structural Welding Code, A.W.S. D1.1.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used for intermediate cable support in the standard Cable Guardrail system G1 .

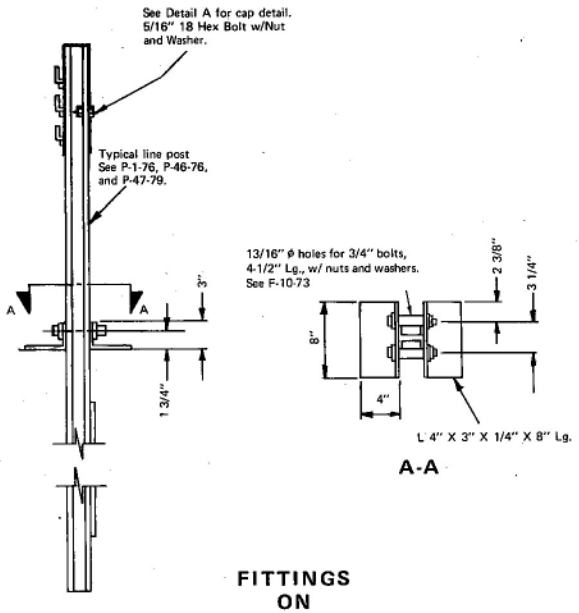
Note: This post may be used as an alternate to P-46-76 and P-47-79.

G1 STRUCTURAL SHAPE LINE POST (STEEL)

HM-TF-13

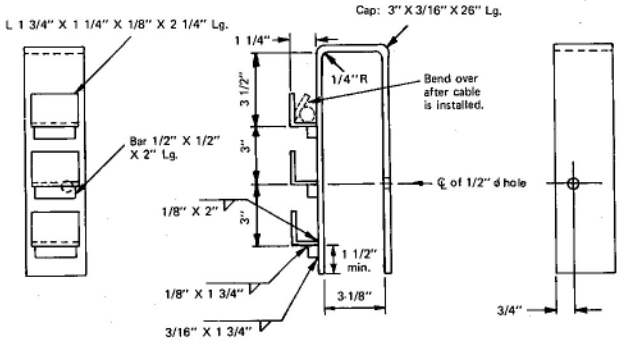
STANDARD

P-1-76



A-A

FITTINGS ON END POST



DETAIL A

SPECIFICATIONS

Angles and plates shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel is requested, in which case angles and plates shall conform to A.S.T.M. A588 and shall not be painted nor galvanized.

Bolts and nuts shall conform to the requirements of A.S.T.M. A307 and A563, Grade A or better, respectively; and washers shall be made of steel. Bolts, nuts and washers shall be galvanized in accordance with A.S.T.M. A153 except when corrosion resistant steel is requested, in which case they shall be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be galvanized. Corrosion resistant bolts and nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A307 and A563, Grade A, respectively. Washers shall meet the dimensional requirements of A.N.S.I. B27.2 Type A Narrow Washer.

Welding shall conform to the current requirements of the American Welding Society Structural Welding Code, A.W.S. D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practice.

INTENDED USE

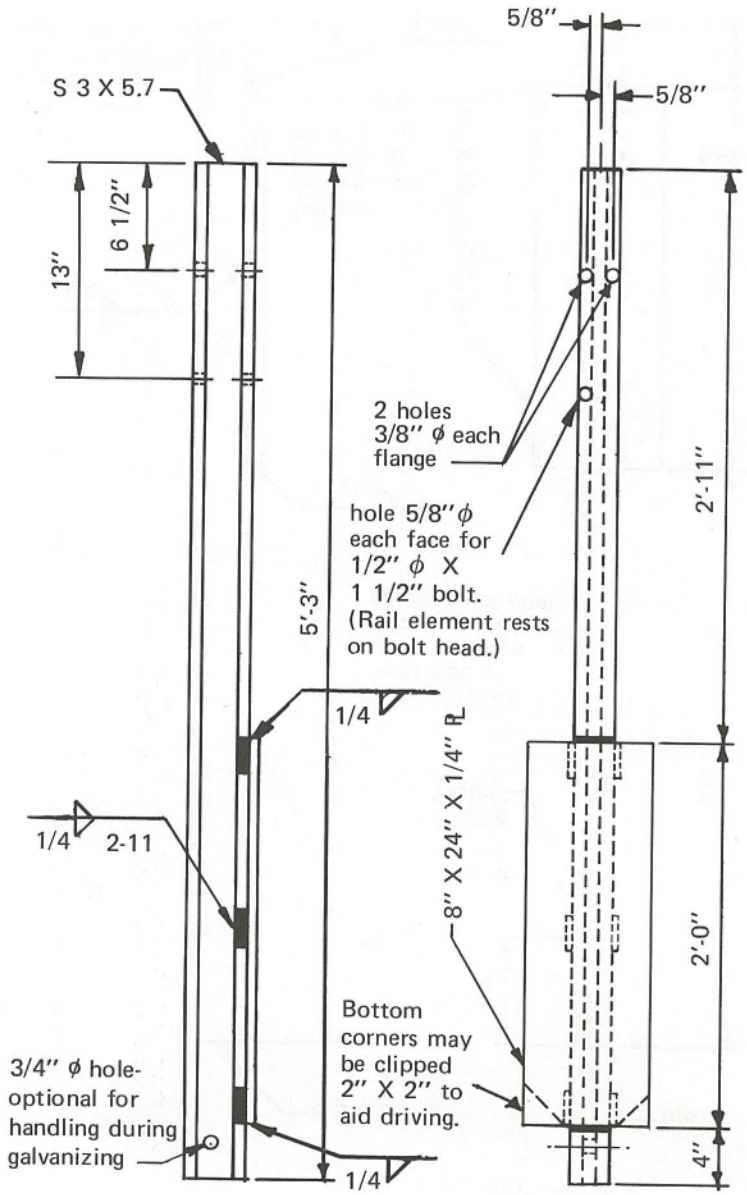
These fittings are used to modify P-1-76, P-46-76, or P-47-79 to make end posts for cable guardrail design G1.

G1 END POST FITTINGS

HM-TF-13

STANDARD

P-2-79



SPECIFICATIONS

Posts and post plates shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel posts are requested, in which case posts and post plates shall conform to A.S.T.M. A588 and shall not be painted nor galvanized.

Welding shall conform to the requirements of the current American Welding Society Structural Welding Code, A.W.S. D1.1.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in the standard guardrail and median barrier designs G2 and MB2.

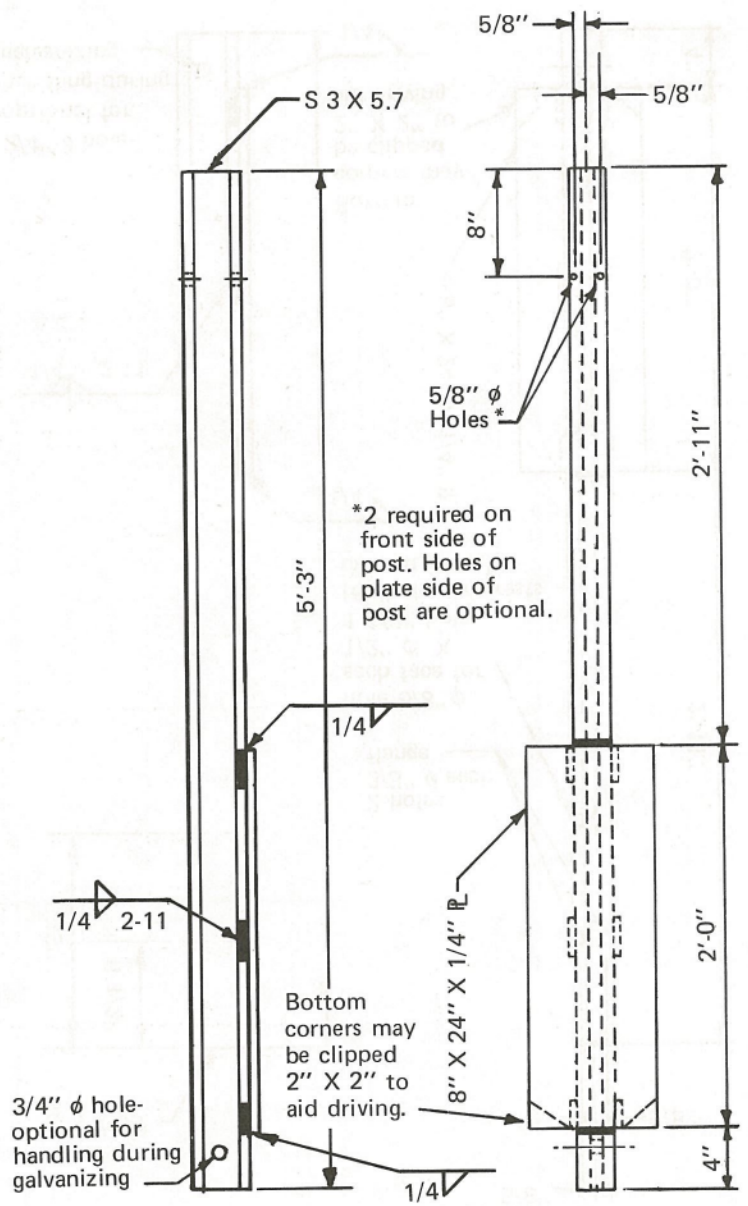
Note: This post may be used as an alternate to P-48-76 and P-63-79.

G2 AND MB2 STRUCTURAL SHAPE POST (STEEL)

HM-TF-13

STANDARD

P-3-76



SPECIFICATIONS

Posts and post plates shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel posts are requested, in which case posts and post plates shall conform to A.S.T.M. A588 and shall not be painted or galvanized.

Welding shall conform to the requirements of the current American Welding Society Structural Welding Code, A.W.S. D1.1.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in the standard Box Beam Guardrail system G3 .

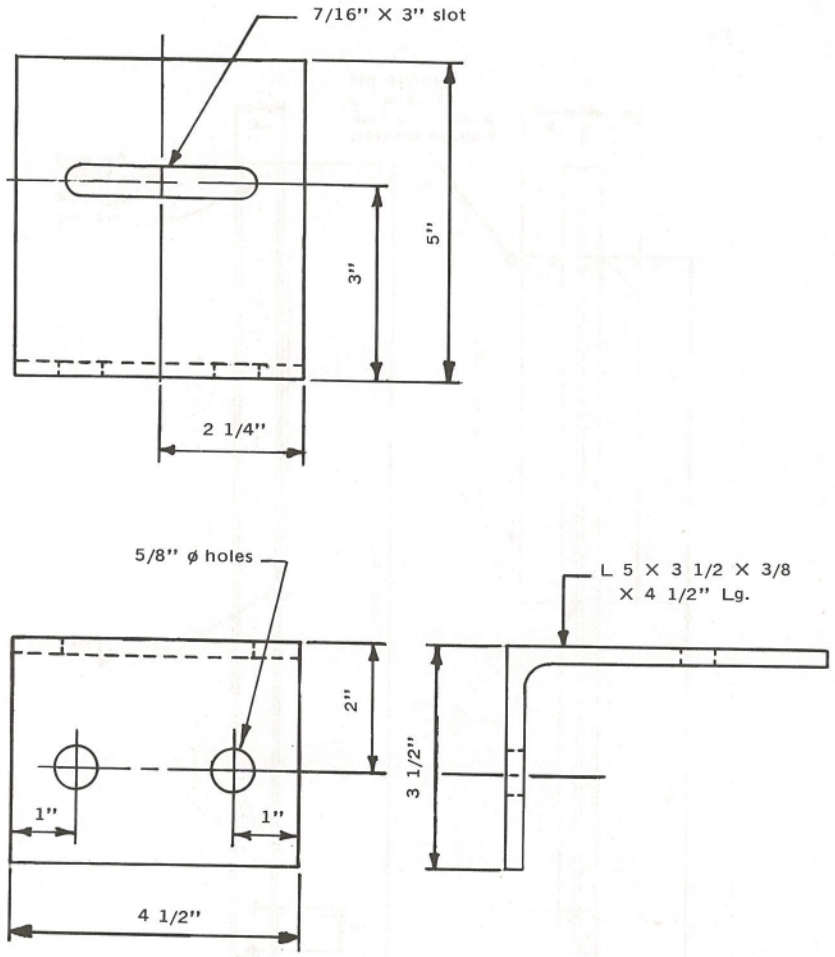
Note: See P-5-76 for Rail Support Angle details. This post may be used as an alternate to p-49-76 and P-64-79.

G3 STRUCTURAL SHAPE POST (STEEL)

HM-TF-13

STANDARD

P-4-76



SPECIFICATIONS

Rail support angles shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant posts are requested, in which case support angles shall conform to A.S.T.M. A588 and shall not be painted or galvanized.

No punching, drilling or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

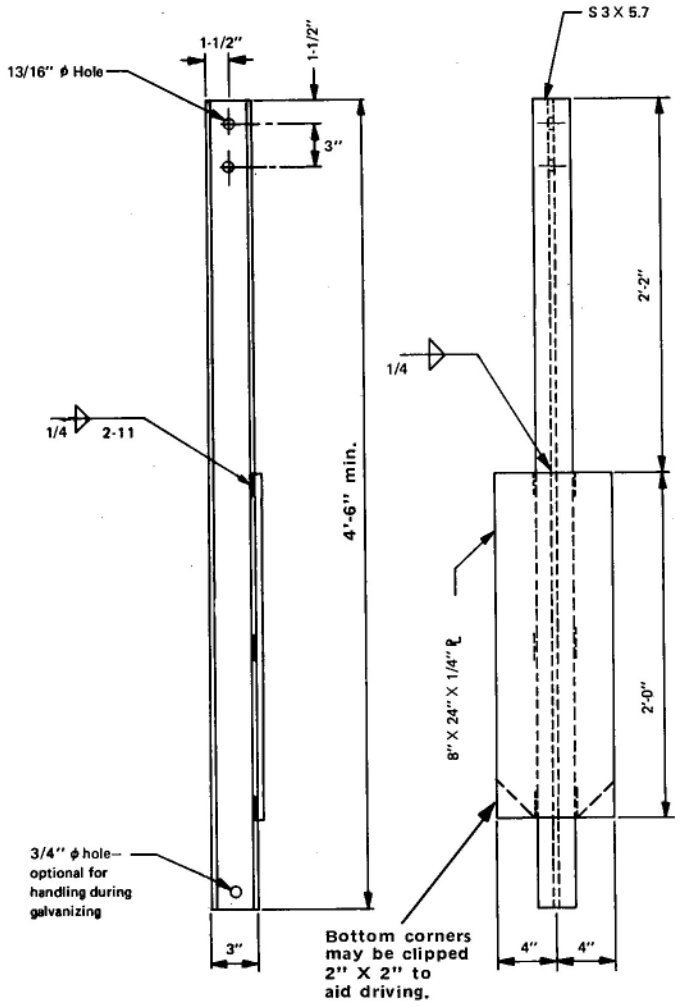
This angle is used in connecting rail elements to posts in the standard Box Beam Guardrail system G3 .

G3 RAIL SUPPORT ANGLE (STEEL)

HM-TF-13

STANDARD

P-5 -76



SPECIFICATIONS

Posts and post plates shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel posts are requested, in which case posts and post plates shall conform to A.S.T.M. A588 and shall not be painted or galvanized.

Welding shall conform to the requirements of the current American Welding Society Structural Welding Code, A.W.S. D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in the standard box beam median barrier designs MB3 and MB7.

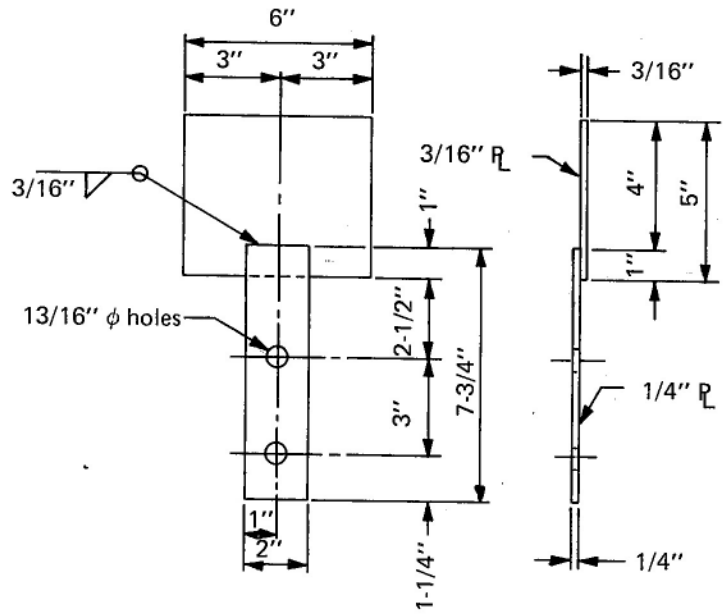
Note: This post may be used as an alternate to p-41-79 and P-50-76.

MB3 AND MB7
STRUCTURAL SHAPE POST
(STEEL)

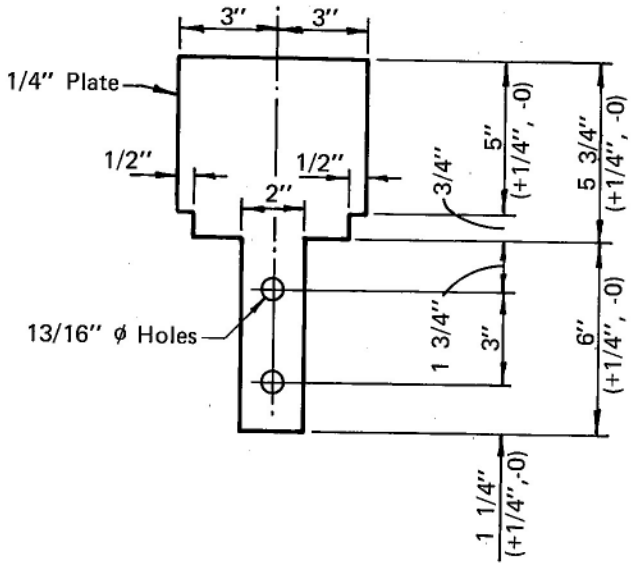
HM-TF-13

STANDARD

P - 6 - 79



RAIL SUPPORT PLATE



RAIL SUPPORT PLATE (ALTERNATE)

SPECIFICATIONS

Rail support plates shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel plates are requested, in which case plates shall conform to A.S.T.M. A588 and shall not be painted or galvanized.

Welding shall conform to the current requirements of the American Welding Society Structural Welding Code, A.W.S. D1.1.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

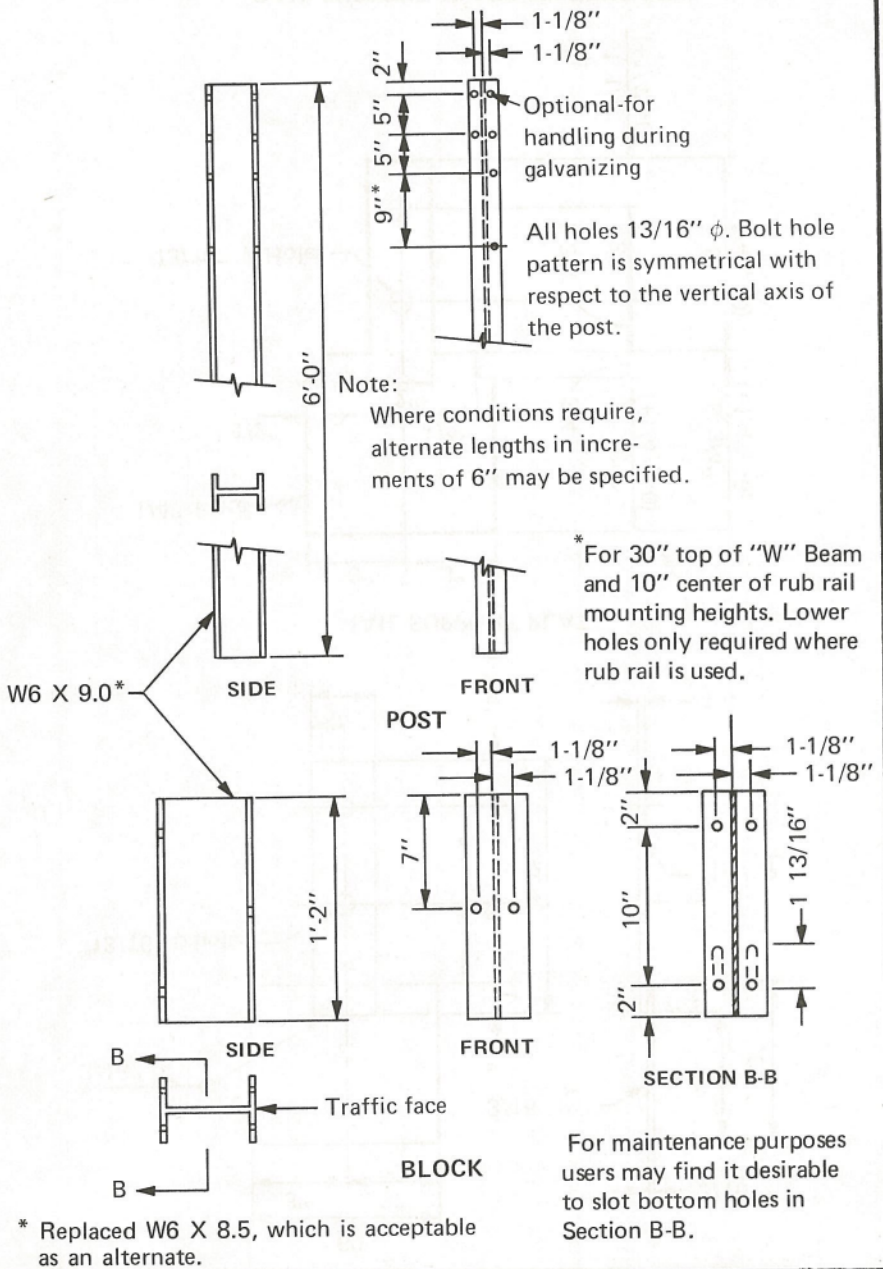
This plate holds rail elements on top of the posts in the standard box beam median barrier steel designs MB3 and MB3B.

MB3 AND MB3B
STEEL RAIL SUPPORT PLATE

HM-TF-13

STANDARD

P - 7 - 76



SPECIFICATIONS

Posts and blocks shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel posts are requested, in which case posts and blocks shall conform to A.S.T.M. A588 and shall not be painted or galvanized.

No punching, drilling or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

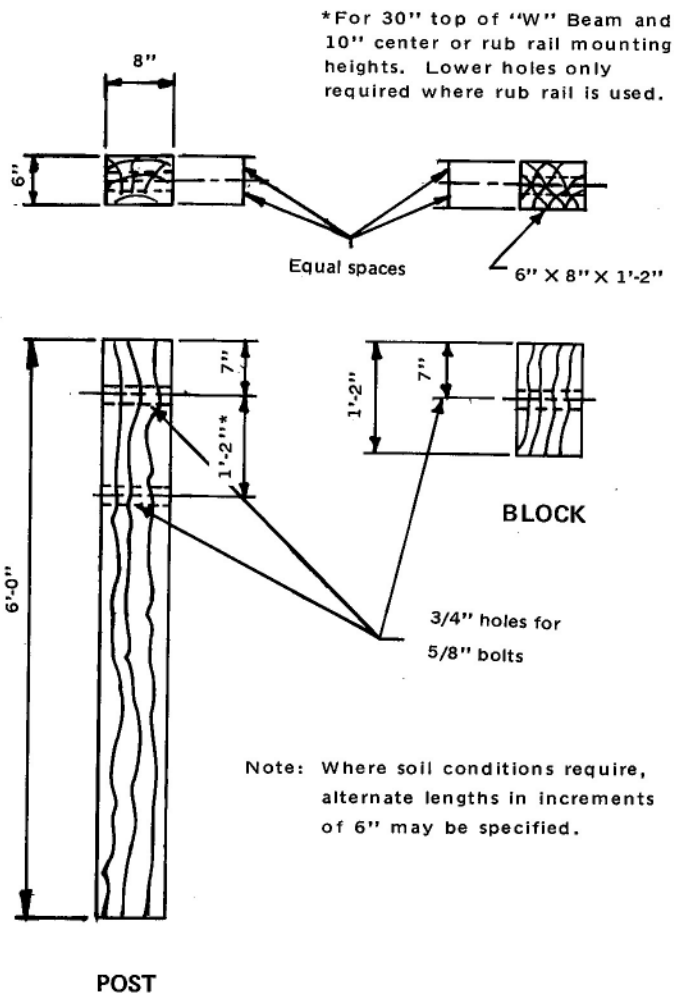
INTENDED USE

This post and block are used in the standard "W" Beam Guardrail and "W" Beam Median Barrier designs G4 and MB4.

Notes: This post may be used as an alternate to P-52-76 and P-65-79.

Some barrier stiffness transition designs call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

G4 AND MB4
STRUCTURAL SHAPE POST AND BLOCK



SPECIFICATIONS

Posts and blocks shall be made of timber with a stress grade of 1200psi or more. Testing shall be in accordance with West Coast Lumber Inspection Bureau, Southern Pine Inspection Bureau or other appropriate timber association. Timber for posts and blocks shall be either rough sawn (unplaned) or S4S with nominal dimensions indicated. The size tolerance of rough sawn blocks in the direction of the bolt holes shall be not more than ± 1/4 inch. Only one combination of post and block finish shall be used for any one continuous length of guardrail.

All timber shall receive a preservation treatment in accordance with AASHTO Designation M-133.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post and block are used in the standard "W" Beam Guardrail and "W" Beam Median Barrier systems G4 and MB4.

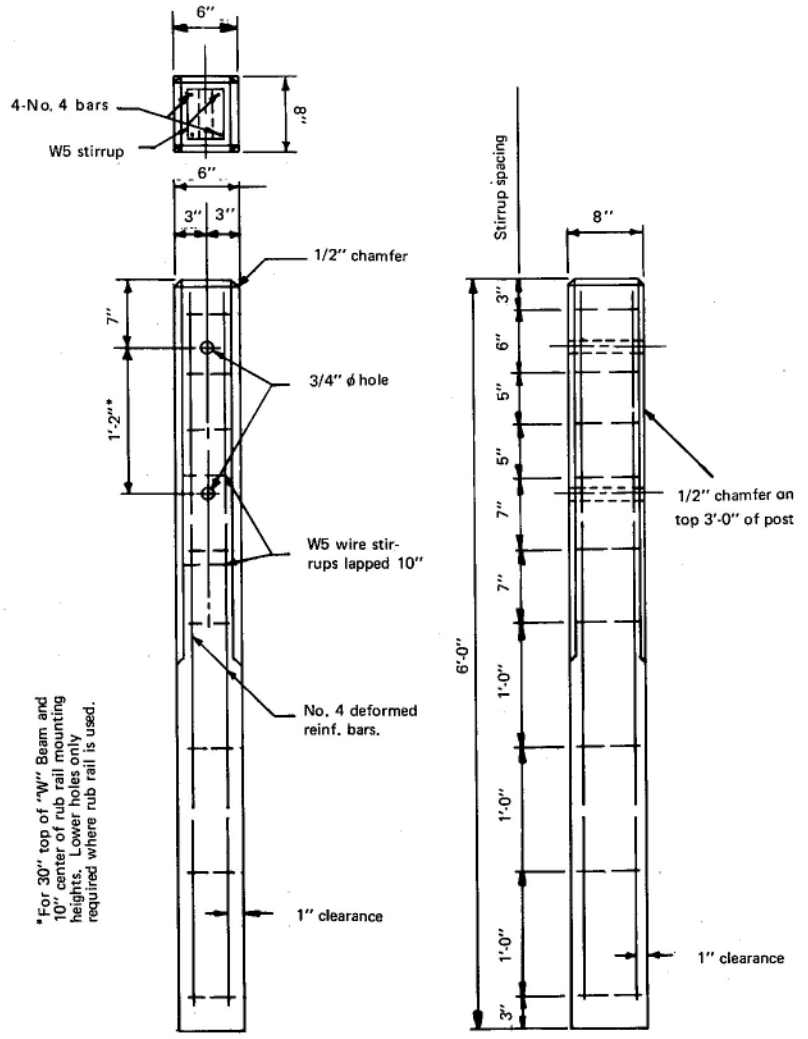
Note: Some barrier stiffness transition designs call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

G4 AND MB4
6 X 8 TIMBER POST AND BLOCK

HM-TF-13

STANDARD

P - 11 - 79



FRONT (TRAFFIC FACE)

SIDE

SPECIFICATIONS

Concrete: Minimum Cement Factor of 1.50 Bbls. per yard (6.00 sacks per yard).

Maximum Gallons Water per sack of cement - 6.0 gal.

Maximum Size Coarse Aggregate - 3/4" (100% passing 1" sieve).

Percent Entrained Air - 6% ± 2%

9 - W5 (.252" Dia.) Wire Stirrups, ASTM A82.

4-No. 4 Deformed Reinforcing Bars, 5'-8" in length, A.S.T.M. A615 or A616.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post, along with the block shown in Standard P-11-79, is used in the standard "W" Beam Guardrail and "W" Beam Median Barrier systems G4 and MB4.

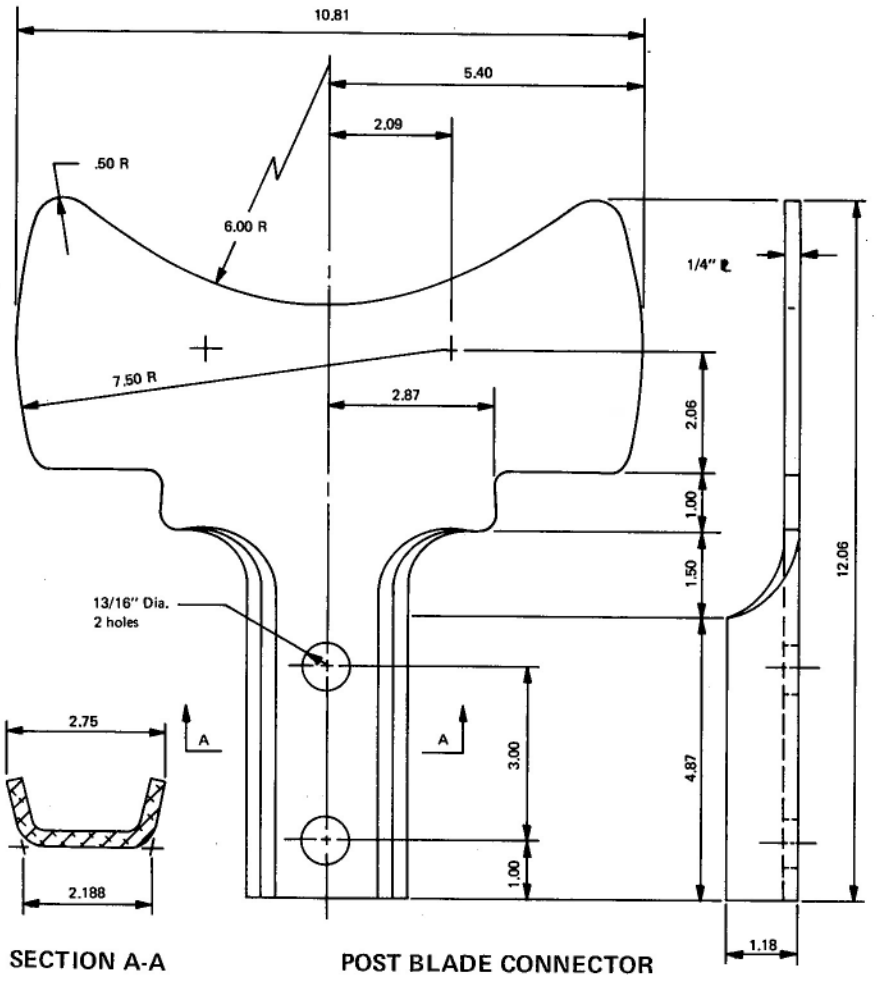
Note: Some barrier stiffness transition designs call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

G4 AND MB4
6 X 8 CONCRETE POST

HM-TF-13

STANDARD

P-12 -76



SECTION A-A

POST BLADE CONNECTOR

SPECIFICATIONS

Post blades shall conform to A.S.T.M. B209, alloy 6061-T6.

No welds are permitted.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

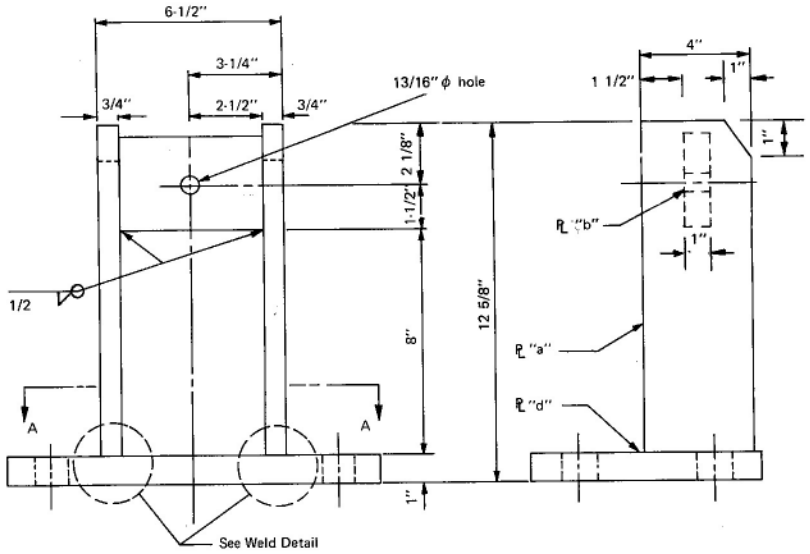
This plate holds rail elements on top of the posts in the standard box median barrier (Aluminum) designs MB7 and MB7B.

MB7 AND MB7B
ALUMINUM RAIL SUPPORT PLATE

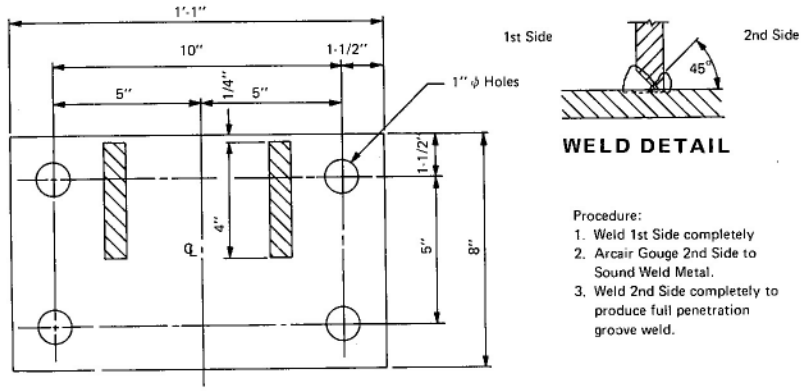
HM-TF-13

STANDARD

P-13-73



POST



SECTION "A-A"

WELD DETAIL

Procedure:
1. Weld 1st Side completely
2. Arcair Gouge 2nd Side to Sound Weld Metal.
3. Weld 2nd Side completely to produce full penetration groove weld.

MK	Quan.	Description
a	2	PL 4" X 3/4" X 11 5/8" Lg.
b	1	PL 3" X 1" X 5" Lg.
d	1	PL 8" X 1" X 1'-1" Lg.

SPECIFICATIONS

Post plates, post spacers, and base plates shall conform to A.S.T.M. A588 and shall be welded to conform with the current requirements of the American Welding Society Structural Welding Code, A.W.S. D1.1.

Fabricated posts are to be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

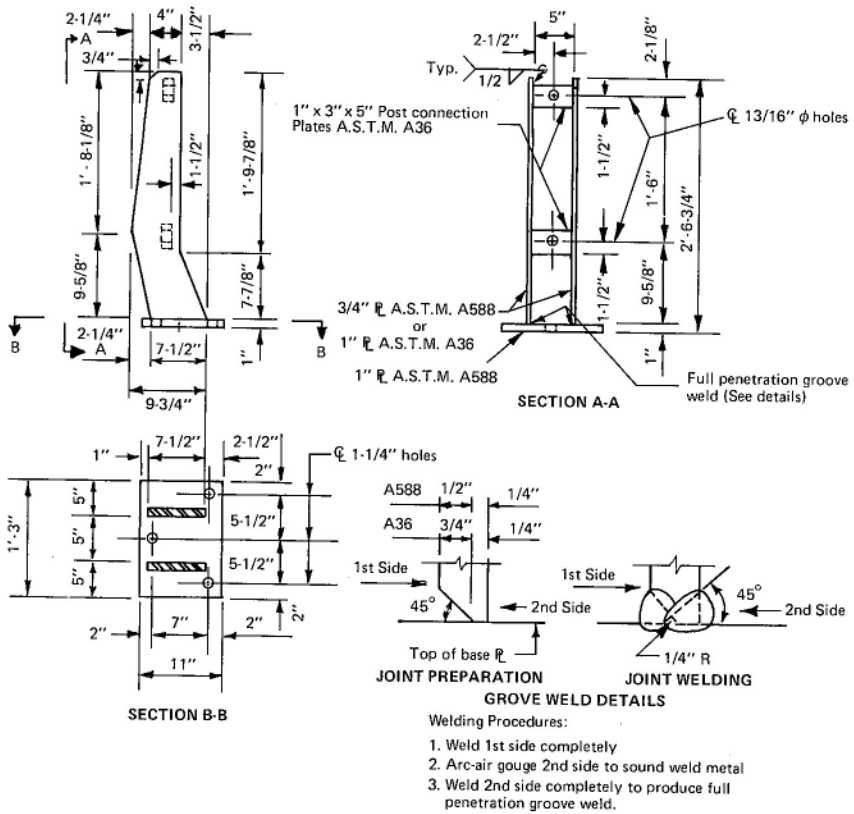
This post is used to support rail elements in bridge railing design BR1 (Steel) Type A.

BR1 (STEEL) TYPE A STRUCTURAL PLATE POST

HM-TF-13

STANDARD

P - 14 - 79



Welding Procedures:

1. Weld 1st side completely
2. Arc-air gouge 2nd side to sound weld metal
3. Weld 2nd side completely to produce full penetration groove weld.

SPECIFICATIONS

Post side plates shall conform to A.S.T.M. A588 or A36 as indicated, connection plates to A.S.T.M. A36 and base plates to A.S.T.M. A588 and shall be welded to conform with the current requirements of the American Welding Society Structural Welding Code, A.W.S. D1.1.

Grind all edges of side plates and base plates prior to galvanizing so that all sharp edges are removed.

Fabricated posts are to be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in the bridge railing design BR2 (Steel) Type A.

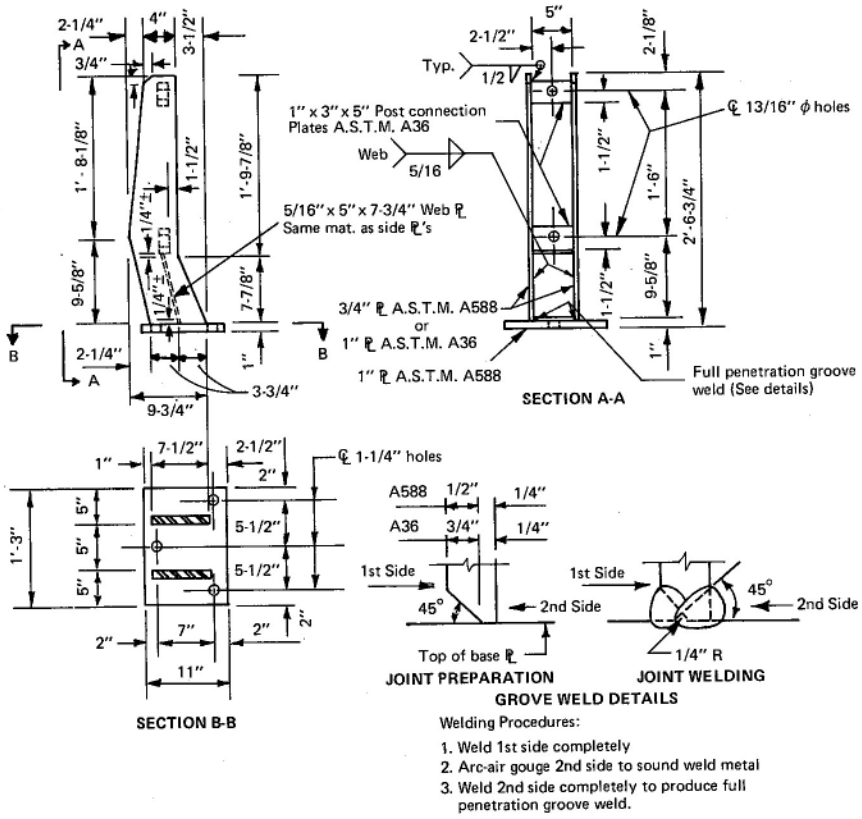
Rails for this design, BR2 (Steel) Type A, shall span a minimum of three posts. If this is impossible, the absolute minimum shall be two posts, with one of the posts being a special post P-16-73.

BR2 (STEEL) TYPE A STRUCTURAL PLATE POST

HM-TF-13

STANDARD

P - 15 - 79



Welding Procedures:

1. Weld 1st side completely
2. Arc-air gouge 2nd side to sound weld metal
3. Weld 2nd side completely to produce full penetration groove weld.

SPECIFICATIONS

Post side plates shall conform to A.S.T.M. A588 or A36 as indicated, connection plates to A.S.T.M. A36, web plates to the same as used in side plates and base plates to A.S.T.M. A588 and shall be welded to conform with the current requirements of the American Welding Society Structural Welding Code, A.W.S. D1.1.

Grind all edges of side plates and base plates prior to galvanizing so that all sharp edges are removed.

Fabricated posts are to be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This is a special post used to support rail elements in bridge railing design BR2(Steel) Type A.

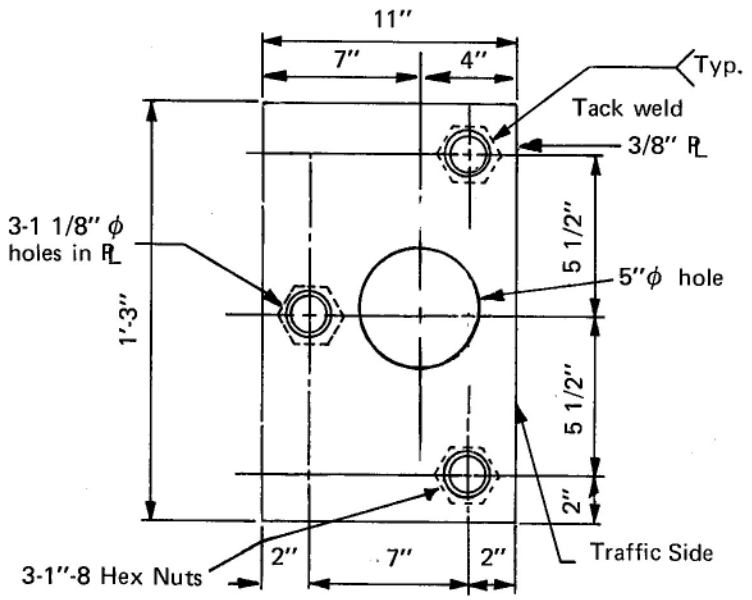
Rails for design BR2 (Steel) Type A shall span a minimum of three posts. If this is impossible, the absolute minimum shall be two posts, with one of the posts being the post shown in this standard.

BR2 (STEEL) TYPE A
STRUCTURAL PLATE POST (SPECIAL)

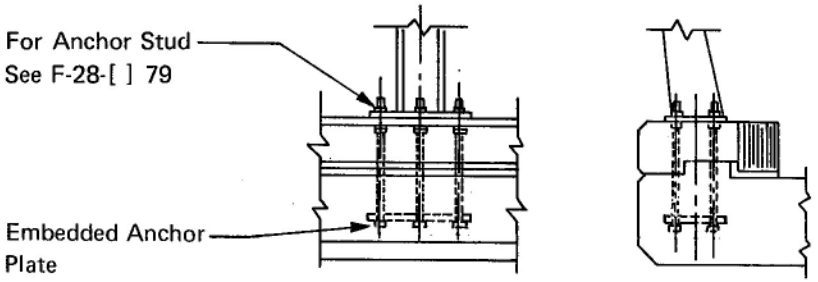
HM-TF-13

STANDARD

P - 16 - 79



EMBEDDED ANCHOR PLATE



ANCHORAGE DETAIL

SPECIFICATIONS

Embedded anchor plates shall conform to the requirements of A.S.T.M. A36 and nuts shall conform to the requirements of A.S.T.M. A563, Grade A or better with threads topped for galvanized bolts. Do not galvanize nor oil this assembly

All welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

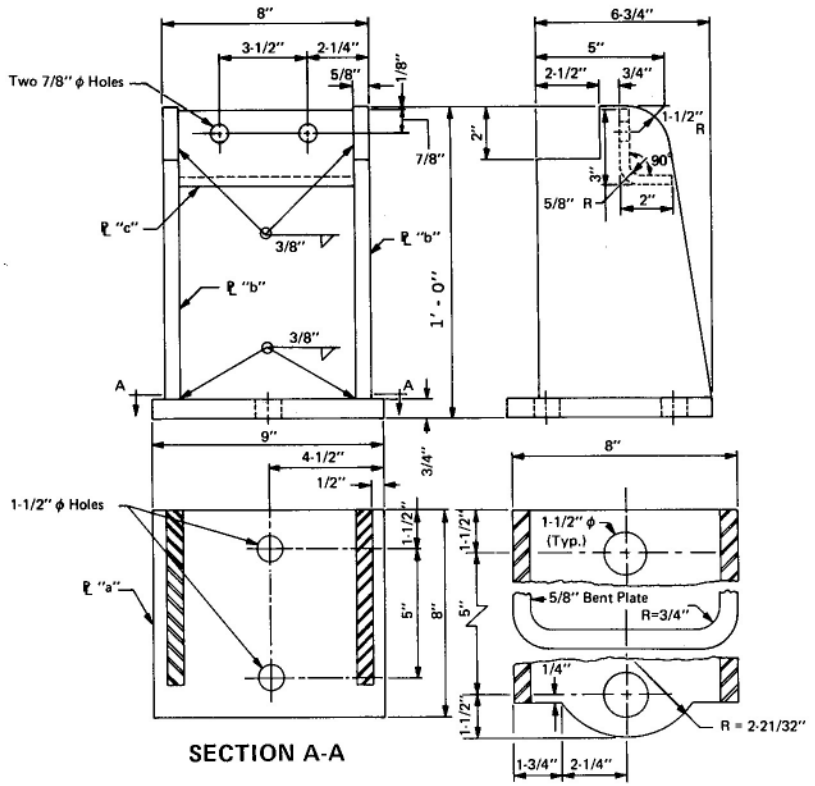
The embedded anchor plates are to be used with posts in bridge railing designs BR2 (Steel) Type A.

BR2 (STEEL) TYPE A POST ANCHOR PLATE

HM-TF-13

STANDARD

P - 18 - 79



SECTION A-A

BENT PLATE DESIGN (ALTERNATE)**

WELDED BASE DESIGN

MK	Quan.	Description
a	1	℄ 8" X 3/4" X 9" Lg.
b	2	℄ 6-3/4" X 5/8" X 11-1/4" Lg.
c	1	Bt ℄ 4-13/16" X 3/8" X 6-3/4" Lg.*

*L 3 X 2 X 3/8, 6-3/4 Lg. may be used

**Dimensions and details at top of post are the same as in welded base design

SPECIFICATIONS

Posts and post plates shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123.

Welding shall conform to the current requirements of the American Welding Society Structural Welding Code, A.W.S. D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

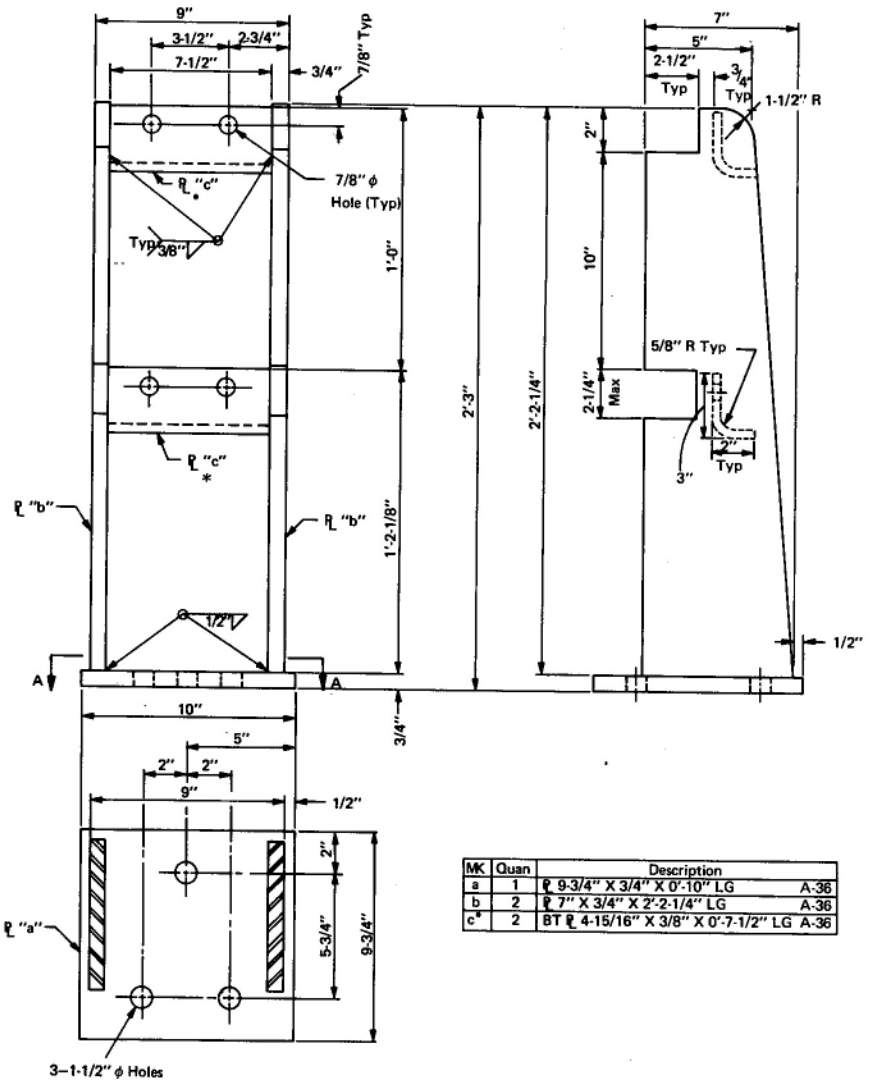
This post is used to support rail elements in bridge railing design BR1 (Steel) Type B.

BR1 (STEEL) TYPE B STRUCTURAL PLATE POST

HM-TF-13

STANDARD

P-19 -73



MK	Quan	Description
a	1	℄ 9-3/4" X 3/4" X 0'-10" LG A-36
b	2	℄ 7" X 3/4" X 2'-2-1/4" LG A-36
c*	2	BT ℄ 4-15/16" X 3/8" X 0'-7-1/2" LG A-36

*A L 3" x 2" x 3/8", 7-1/2" Long
Unequal leg angle may be used.

SPECIFICATIONS

Posts and post plates shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123.

Welding shall conform to the current requirements contained in the American Welding Society Structural Welding Code, A.W.S. D1.1.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

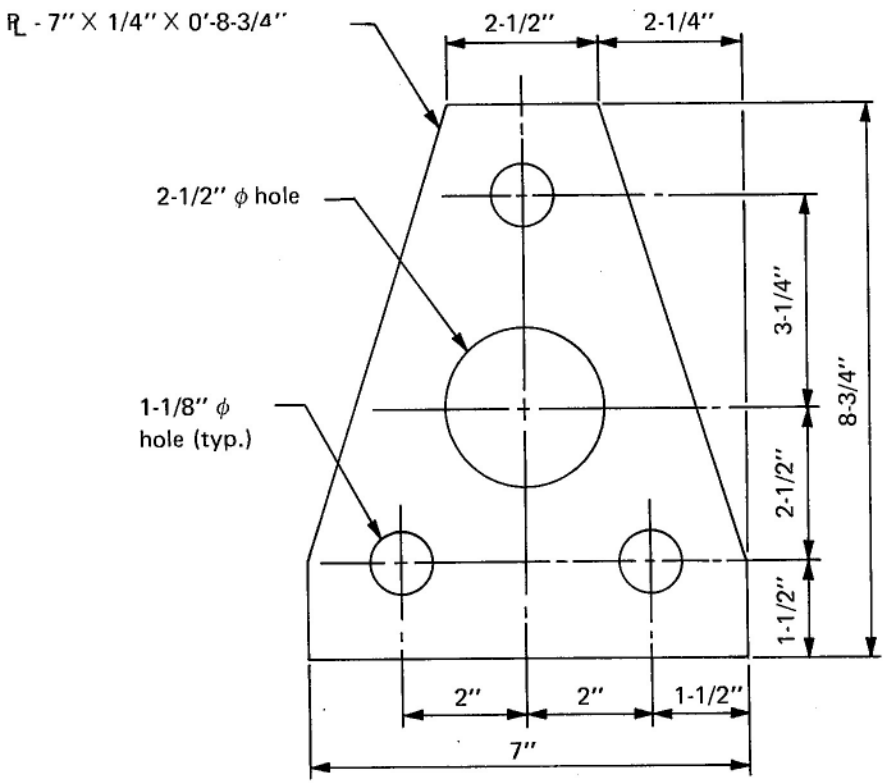
This post is used to support rail elements in bridge railing design BR2 (Steel) Type B.

BR2 (STEEL) TYPE B STRUCTURAL PLATE POST

HM-TF-13

STANDARD

P-20-73



ANCHOR PLATE

SPECIFICATIONS

The anchor plates shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with the requirements of A.S.T.M. A123, except embedded anchor plates shall not be galvanized nor oiled.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

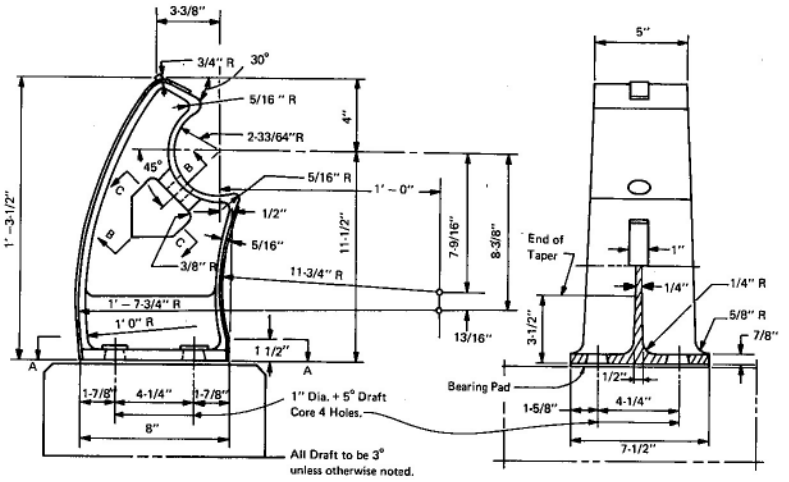
The post anchor plate is to be used as part of the anchorage in BR2 (Steel) Type B. (For anchor bolt see F-26[ ]-73.)

BR2 (STEEL) TYPE B POST ANCHOR PLATE

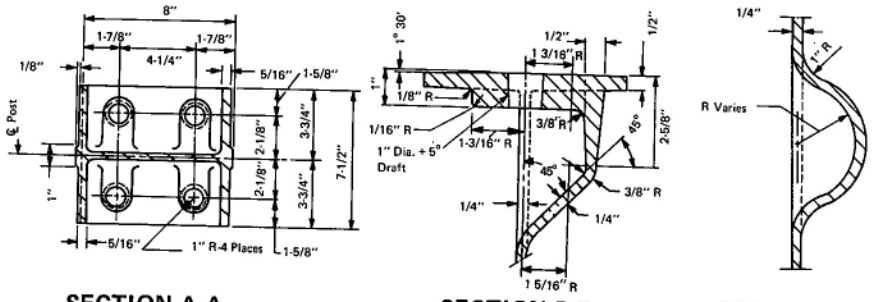
HM-TF-13

STANDARD

P-21-73



SIDE ELEVATION **FRONT ELEVATION**



SECTION A-A **SECTION B-B** **SECTION C-C**

SPECIFICATION

Cast aluminum posts shall conform to the requirements of AASHTO M193-77, or latest revision, and to the requirements of A.S.T.M. B108, alloy A444-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR1 (Aluminum) Type A.

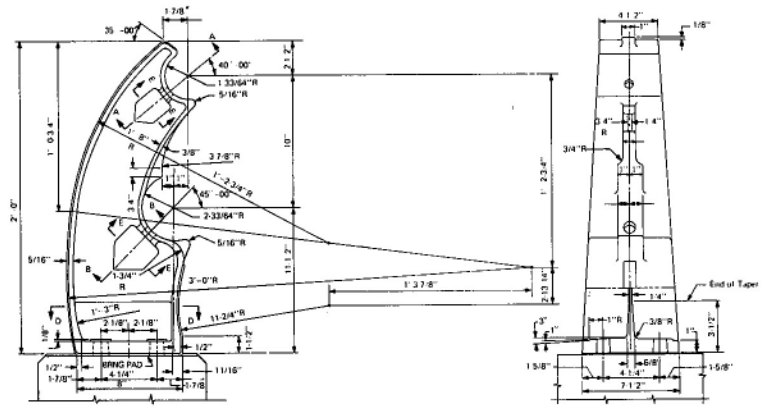
Note: This standard is intended to establish rail center(s), relative location of anchor bolt holes, and post silhouette dimensions to insure interchangeability of posts from different foundries. All other dimensions are approximate and may be adjusted to meet the strength requirements of the AASHTO bridge specifications.

BR1 (ALUMINUM) TYPE A CAST POST

HM-TF-13

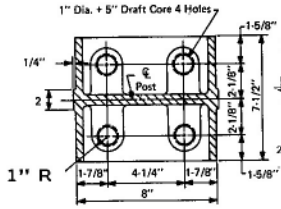
STANDARD

P-28-73

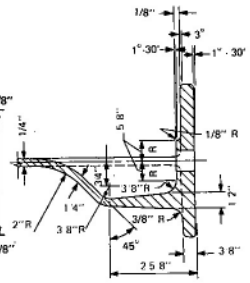


SIDE ELEVATION

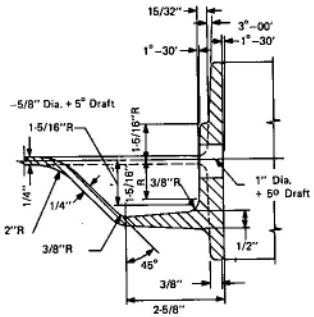
FRONT ELEVATION



SECTION D-D

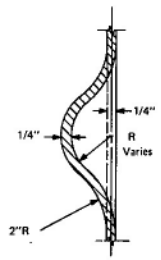


SECTION A-A



SECTION B-B

Note, unless otherwise shown:
Radii—1/8"; Fillets—1/4"; Drafts—3°



SECTION E-E

SPECIFICATIONS

Cast aluminum posts shall conform to the requirements of AASHTO M193-77, or latest revision, and to the requirements of A.S.T.M. B108, alloy A444-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR2A (Aluminum) Type A.

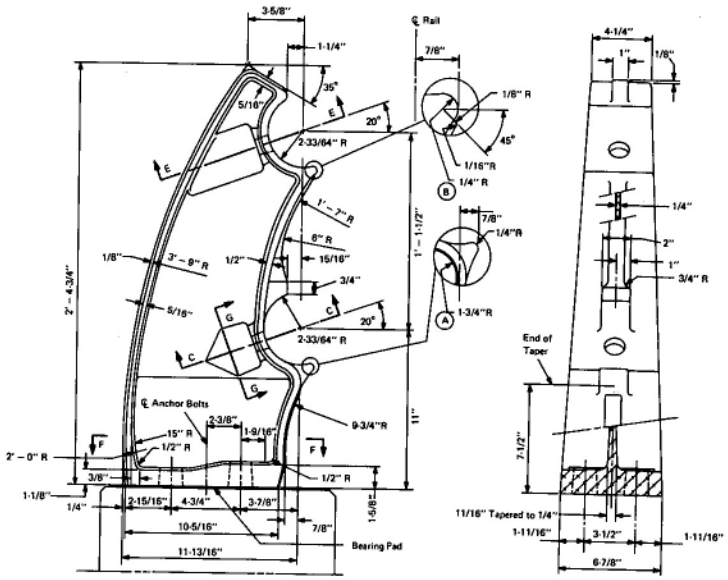
Note: This standard is intended to establish rail center(s), relative location of anchor bolt holes, and post silhouette dimensions to insure interchangeability of posts from different foundries. All other dimensions are approximate and may be adjusted to meet the strength requirements of the AASHTO bridge specifications.

BR2A (ALUMINUM) TYPE A CAST POST

HM-TF-13

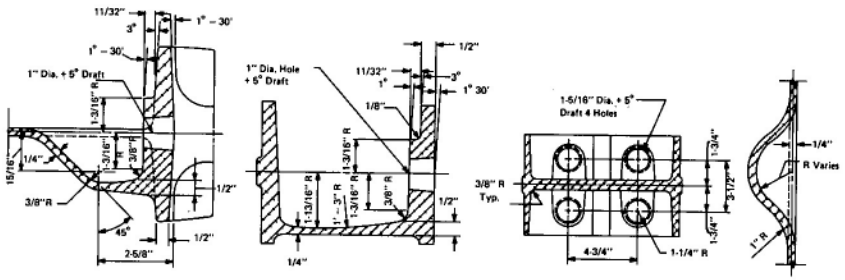
STANDARD

P-29-73



SIDE ELEVATION

FRONT ELEVATION



SECTION C-C

SECTION E-E

SECTION F-F

SECTION G-G

SPECIFICATIONS

Cast aluminum posts shall conform to the requirements of AASHTO M193-77, or latest revision, and to the requirements of A.S.T.M. B108, alloy A444-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR2 (Aluminum) Type A.

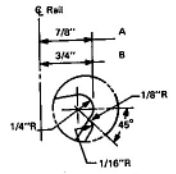
Note: This standard is intended to establish rail center(s), relative location of anchor bolt holes, and post silhouette dimensions to insure interchangeability of posts from different foundries. All other dimensions are approximate and may be adjusted to meet the strength requirements of the AASHTO bridge specifications.

BR2 (ALUMINUM) TYPE A CAST POST

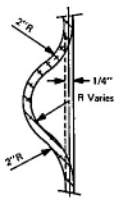
HM-TF-13

STANDARD

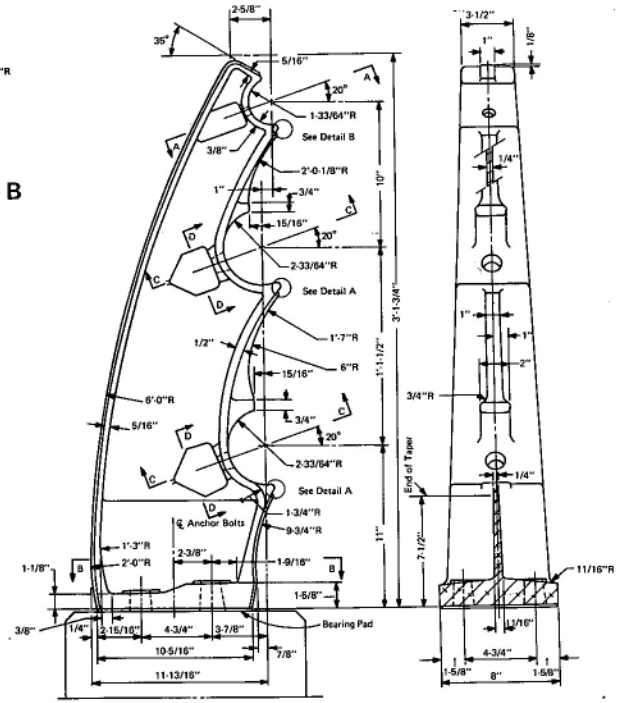
P-30-73



DETAILS A & B

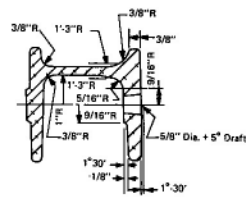


SECTION D-D

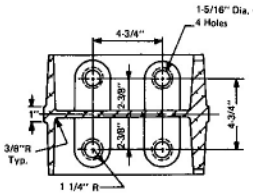


SIDE ELEVATION

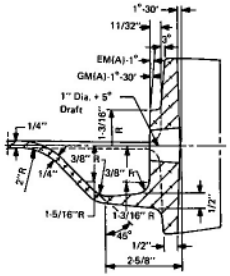
FRONT ELEVATION



SECTION A-A



SECTION B-B



SECTION C-C

SPECIFICATIONS

Cast aluminum posts shall conform to the requirements of AASHTO M193-77, or latest revision, and to the requirements of A.S.T.M. B108, alloy A444-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR3A (Aluminum) Type A.

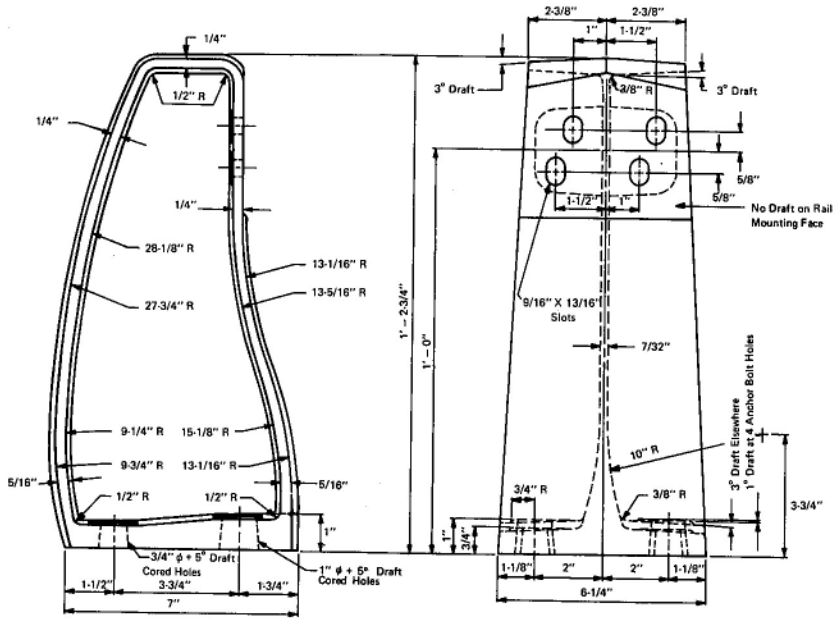
Note: This standard is intended to establish rail center(s), relative location of anchor bolt holes, and post silhouette dimensions to insure interchangeability of posts from different foundries. All other dimensions are approximate and may be adjusted to meet the strength requirements of the AASHTO bridge design specifications.

BR3A (ALUMINUM) TYPE A CAST POST

HM-TF-13

STANDARD

P-31-73



Note: Provide 1° draft under bolt washers. 1° draft must be raised from 3° draft.

SPECIFICATIONS

Cast aluminum posts shall conform to the requirements of AASHTO M193-77, or latest revision, and to the requirements of A.S.T.M. B108, alloy A444-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR1 (Aluminum) Type B.

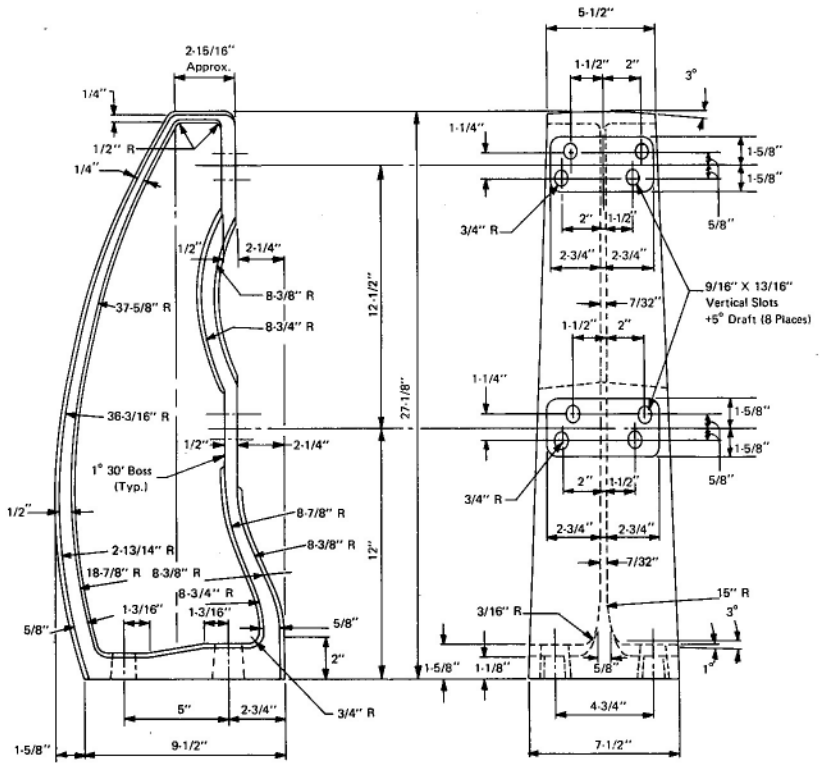
Note: This standard is intended to establish rail center(s), relative location of anchor bolt holes, and post silhouette dimensions to insure interchangeability of posts from different foundries. All other dimensions are approximate and may be adjusted to meet the strength requirements of the AASHTO bridge design specifications.

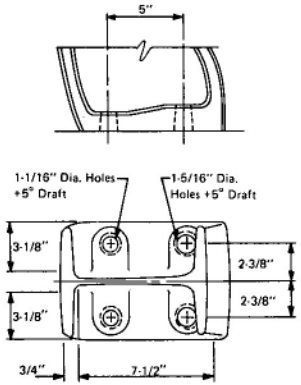
BR1 (ALUMINUM) TYPE B CAST POST

HM-TF-13

STANDARD

P-32-73





SPECIFICATIONS

Cast aluminum posts shall conform to the requirements of AASHTO M193-77, or latest revision, and to the requirements of A.S.T.M. B108, alloy A444-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR2 (Aluminum) Type B.

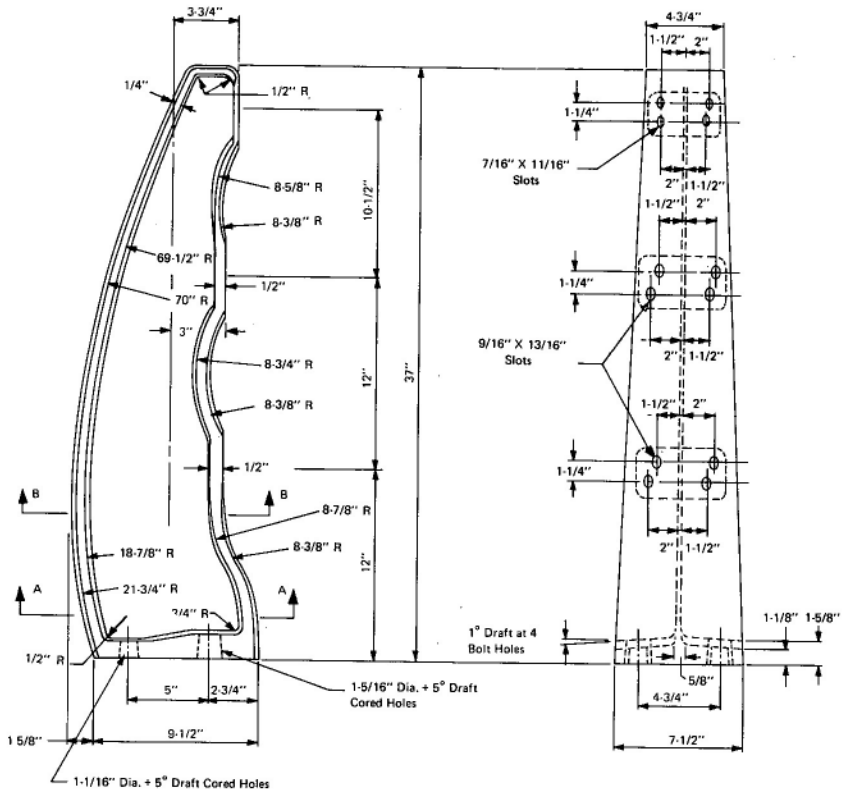
Note: This standard is intended to establish rail center(s), relative location of anchor bolt holes, and post silhouette dimensions to insure interchangeability of posts from different foundries. All other dimensions are approximate and may be adjusted to meet the strength requirements of the AASHTO bridge specifications.

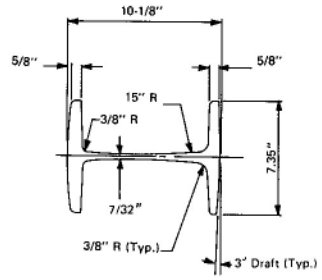
BR2 (ALUMINUM) TYPE B CAST POST

HM-TF-13

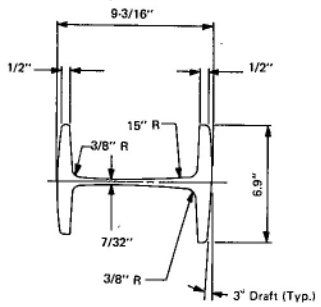
STANDARD

P-33-73





SECTION A-A



SECTION B-B

SPECIFICATIONS

Cast aluminum posts shall conform to the requirements of AASHTO M193-77, or latest revision, and to the requirements of A.S.T.M. B108, alloy A444-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR3A (Aluminum) Type B.

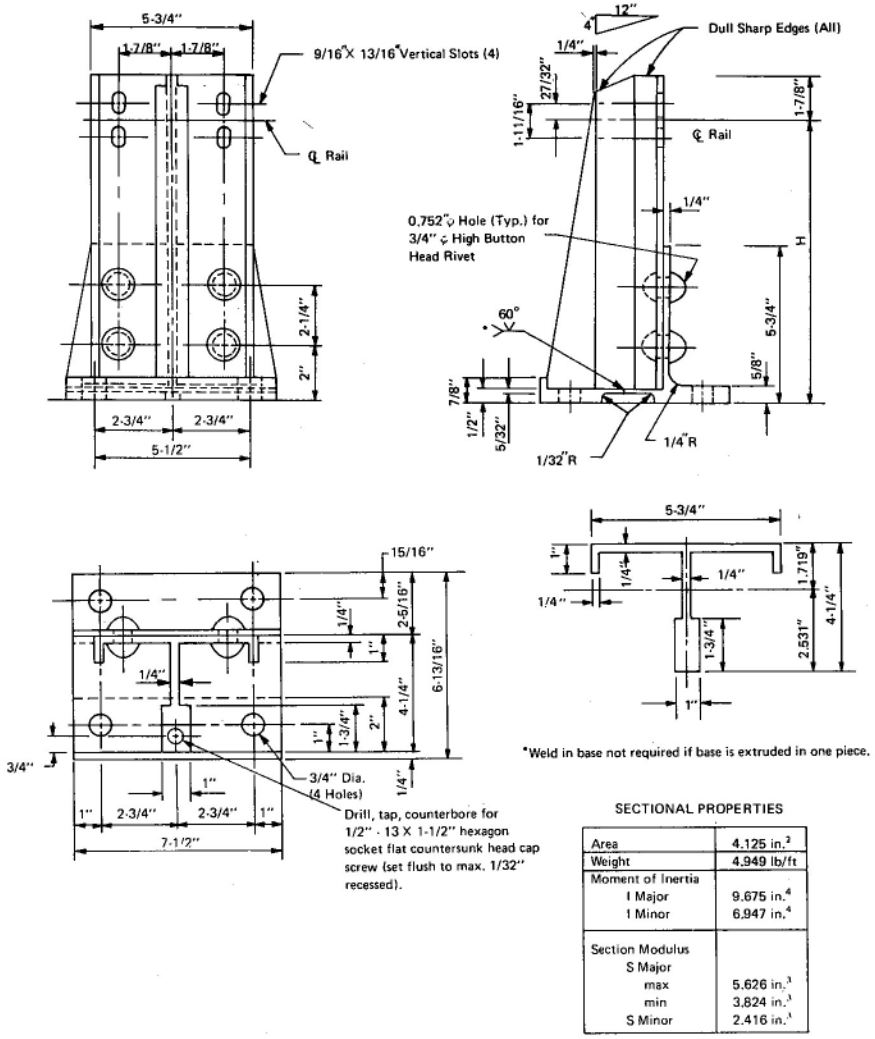
Note: This standard is intended to establish rail center(s), relative location of anchor bolt holes, and post silhouette dimensions to insure interchangeability of posts from different foundries. All other dimensions are approximate and may be adjusted to meet the strength requirements of the AASHTO bridge design specifications.

BR3A (ALUMINUM) TYPE B CAST POST

HM-TF-13

STANDARD

P-34-73



*Weld in base not required if base is extruded in one piece.

SECTIONAL PROPERTIES

Area	4.125 in.^{2}
Weight	4.949 lb/ft
Moment of Inertia	
I Major	9.675 in.^{4}
I Minor	6.947 in.^{4}
Section Modulus	
S Major	
max	5.626 in.^{3}
min	3.824 in.^{3}
S Minor	2.416 in.^{3}

SPECIFICATIONS

Extruded aluminum shapes shall conform to the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Cap screw shall meet the requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.3.

Rivet material shall meet the requirements of A.S.T.M. B316 or B221, alloy 6061-T6. Rivets shall have manufactured high button heads meeting the dimensional requirements of A.N.S.I. B18.4, shall have driven cone point heads, and shall meet the requirements of Section 6.5 of the Aluminum Association's Specifications for Aluminum Bridge and Other Highway Structures.

Post base may be made from a single extrusion. When the base is made from two extrusions it shall be welded in accordance with the requirements of Section 1.5.5 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR1 (Aluminum) Type C.

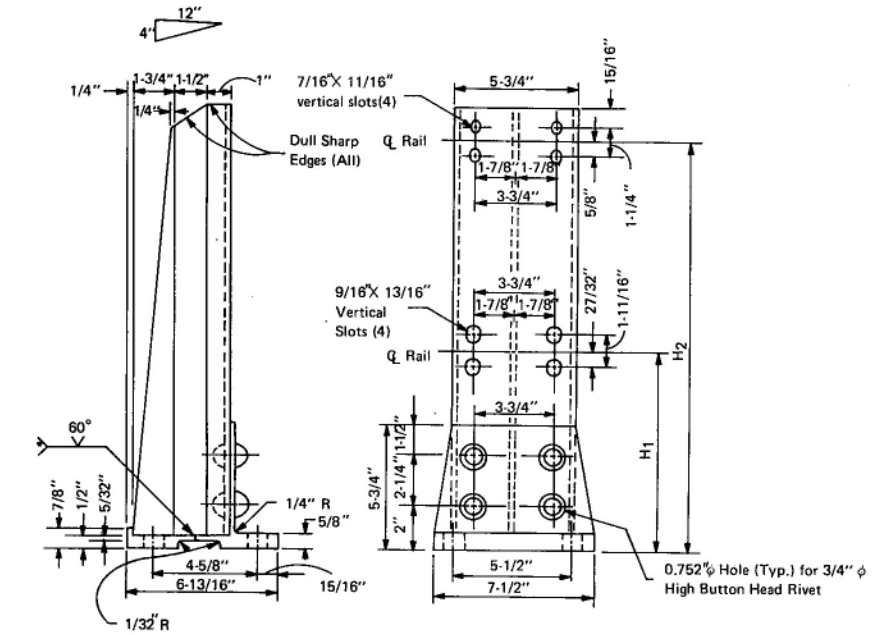
Height of post is not detailed in drawing. Post height will be determined by designating the desired center of rail mounting height (H) above the bottom of post base. H = 10" is suggested as a standard center of rail height for this barrier design. This would be shown as P - 35 [10"] - 73.

BR1 (ALUMINUM) TYPE C FABRICATED POST

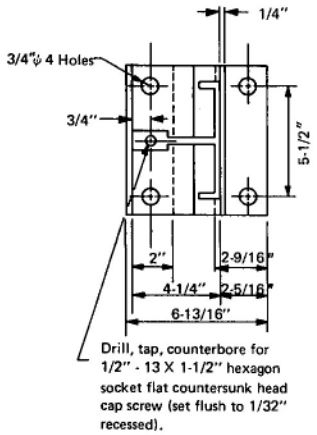
HM-TF-13

STANDARD

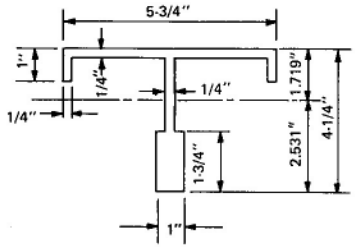
P-35 [DESIGNATE RAIL CENTER HEIGHT] - 73



*Weld in base not required if base is extruded in one piece.



Drill, tap, counterbore for 1/2" - 13 X 1-1/2" hexagon socket flat countersunk head cap screw (set flush to 1/32" recessed).



SECTIONAL PROPERTIES

Area	4.125 in.^{2}
Weight	4.949 lb/ft
Moment of Inertia	
I Major	9.675 in.^{4}
I Minor	6.947 in.^{4}
Section Modulus	
S Major	
max	5.626 in.^{3}
min	3.824 in.^{3}
S Minor	2.416 in.^{3}

SPECIFICATIONS

Extruded aluminum shapes shall conform to the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Cap screw shall meet the requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.3.

Rivet material shall meet the requirements of A.S.T.M. B316 or B221, alloy 6061-T6. Rivets shall have manufactured high button heads meeting the dimensional requirements of A.N.S.I. B18.4, shall have driven cone point heads, and shall meet the requirements of Section 6.5 of the Aluminum Association's Specifications for Aluminum Bridge and Other Highway Structures.

Post base may be made from a single extrusion. When the base is made from two extrusions it shall be welded in accordance with the requirements of Section 1.5.5 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR2A (Aluminum) Type C.

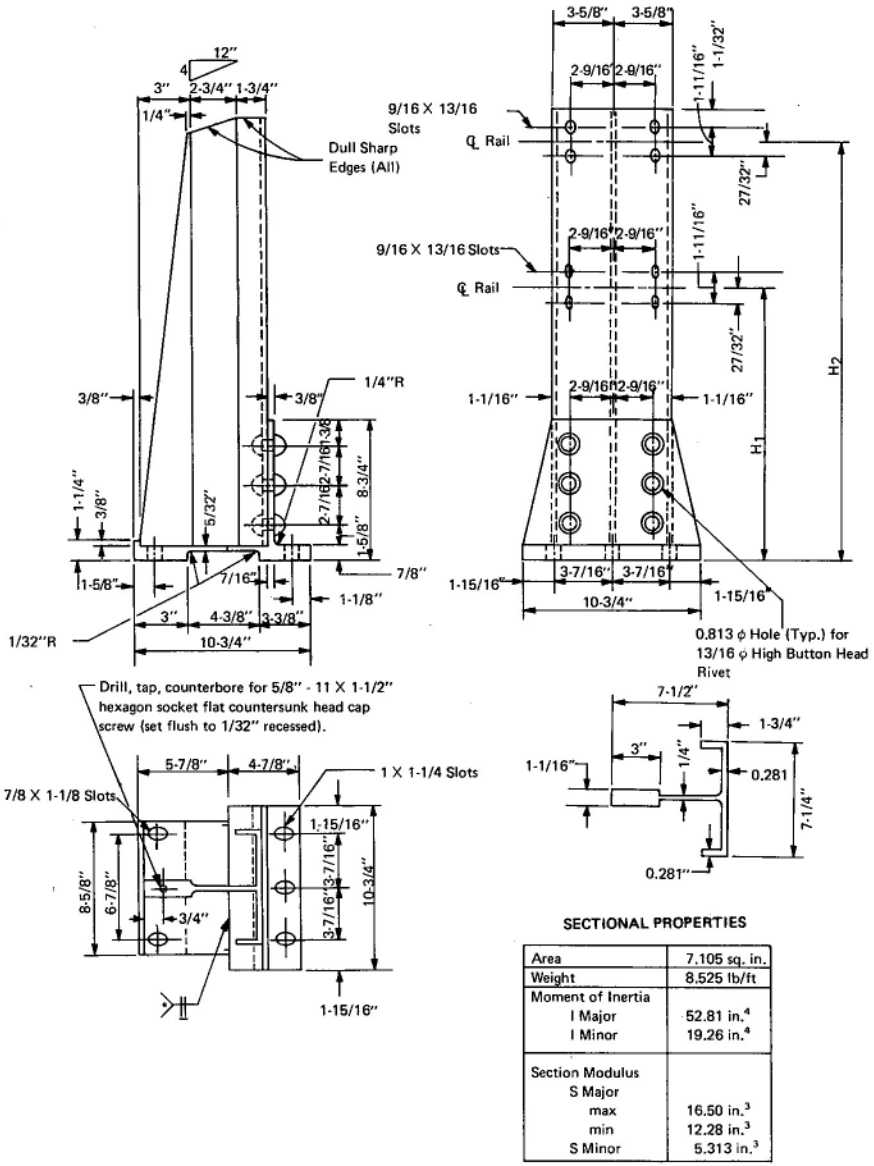
Height of post and rail mounting hole locations are not shown on drawing. Post height and rail mounting hole locations will be determined by designating the desired center of rail mounting heights (H_1 and H_2) above the bottom of post base. If H_1 = 9-1/4" and H_2 = 19-7/16" were used as center of rail heights for this barrier design, this would be shown as P-36 [9-1/4" 19-7/16"]-73.

BR2A (ALUMINUM) TYPE C FABRICATED POST

HM-TF-13

STANDARD

P-36 [DESIGNATE RAIL CENTER HEIGHTS] - 73



SECTIONAL PROPERTIES

Area	7.105 sq. in.
Weight	8.525 lb/ft
Moment of Inertia	
I Major	52.81 in.^{4}
I Minor	19.26 in.^{4}
Section Modulus	
S Major	
max	16.50 in.^{3}
min	12.28 in.^{3}
S Minor	5.313 in.^{3}

*Weld in base not required if base is extruded in one piece.

SPECIFICATIONS

Extruded aluminum shapes shall conform to the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Cap screw shall meet the requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.3.

Rivet material shall meet the requirements of A.S.T.M. B316 or B221, alloy 6061-T6. Rivets shall have manufactured high button heads meeting the dimensional requirements of A.N.S.I. B18.4, shall have driven cone point heads, and shall meet the requirements of Section 6.5 of the Aluminum Association's Specifications for Aluminum Bridge and Other Highway Structures.

Post base may be made from a single extrusion. When the base is made from two extrusions it shall be welded in accordance with the requirements of Section 1.5.5 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR2 (Aluminum) Type D.

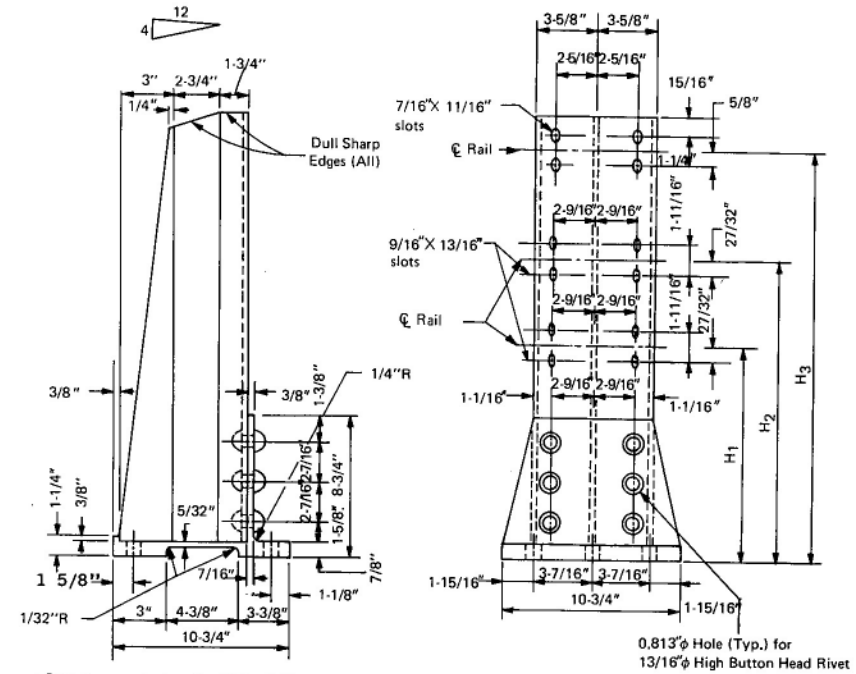
Height of post and rail mounting hole locations are not shown on drawing. Post height and rail mounting hole locations will be determined by designating the desired center of rail mounting heights (H_1 and H_2) above the bottom of post base. If H_1 = 12-1/2" and H_2 = 25-1/8" were used as standard center of rail heights for this barrier design, this would be shown as P-37[12-1/2" - 25-1/8"]-73.

BR2 (ALUMINUM) TYPE D FABRICATED POST

HM-TF-13

STANDARD

P-37 [DESIGNATE RAIL CENTER HEIGHTS] - 73



SECTIONAL PROPERTIES

Area	7.1052 sq. in.
Weight	8.525 lb/ft
Moment of Inertia	
I Major	52.81 in.^{4}
I Minor	19.26 in.^{4}
Section Modulus	
S Major	
max	16.50 in.^{3}
min	12.28 in.^{3}
S Minor	5.313 in.^{3}

*Weld in base not required if base is extruded in one piece.

SPECIFICATIONS

Extruded aluminum shapes shall conform to the requirements of A.S.T.M. B221, alloy 6061-T6 or 6351-T5 (minimum elongation 10%).

Cap screw shall meet the requirements of A.S.T.M. A276, Type 430 and the dimensional requirements of A.N.S.I. B18.3.

Rivet material shall meet the requirements of A.S.T.M. B316 or B221, alloy 6061-T6. Rivets shall have manufactured high button heads meeting the dimensional requirements of A.N.S.I. B18.4, shall have driven cone point heads, and shall meet the requirements of Section 6.5 of the Aluminum Association's Specifications for Aluminum Bridge and Other Highway Structures.

Post base may be made from a single extrusion. When the base is made from two extrusions it shall be welded in accordance with the requirements of Section 1.5.5 of the A.A.S.H.T.O. Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in bridge railing design BR3A (Aluminum) Type D.

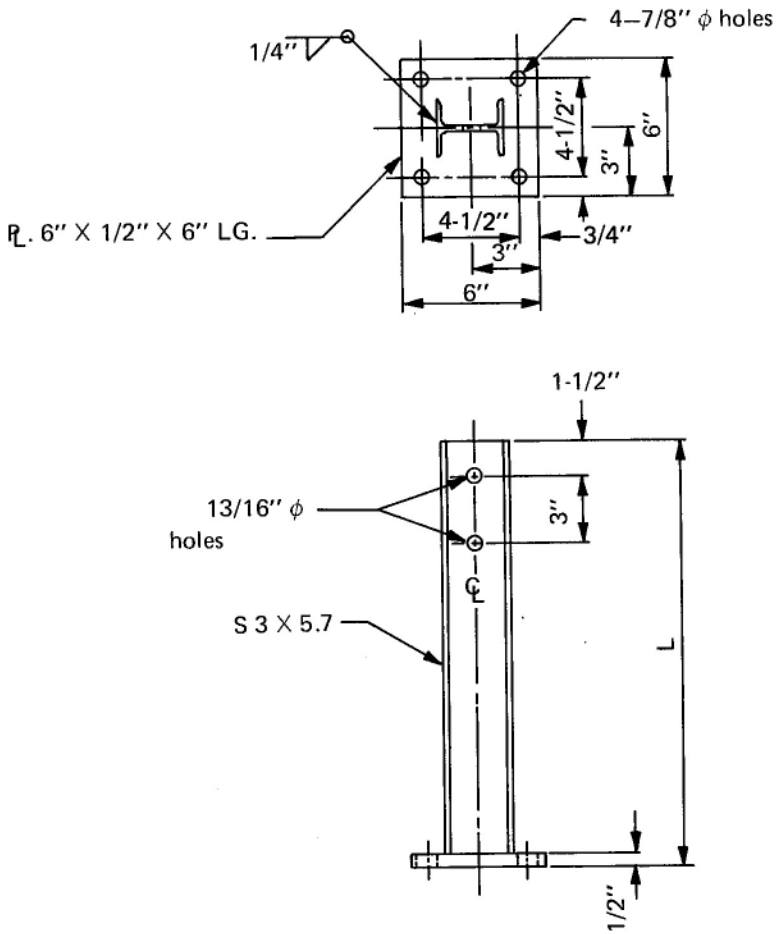
Height of post and rail mounting hole locations are not shown on drawing. Post height and rail mounting hole locations will be determined by designating the desired center of rail mounting heights (H_1, H_2, and H_3) above the bottom of post base. If H_1 = 12-1/2", H_2 = 25-1/8" and H_3 = 38" were used as center of rail heights for this barrier design, this would be shown as P-38[12-1/2" - 25-1/8" - 38"]-73.

BR3A (ALUMINUM) TYPE D FABRICATED POST

HM-TF-13

STANDARD

P-38 [DESIGNATE RAIL CENTER HEIGHTS] - 73



STRUCTURE MOUNTED MEDIAN BARRIER POST

SPECIFICATIONS

Posts and post plates shall conform to the requirements of ASTM A36 and shall be galvanized in accordance with ASTM A123.

Welding shall meet the current requirements of the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

1. (L = 1′-8″) Post for median barrier design MB7B with top of rail mounted 2′-3-1/4″ above bottom of post base.

2. (L = 1′-11-3/4″) Post for median barrier design MB3B with top of rail mounted 2′-6″ above bottom of post base.

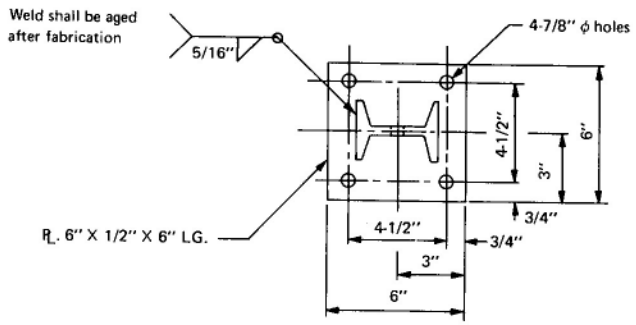
Note: This post may be used as an alternate to P-40[ ]-73 and P-51[ ]-76.

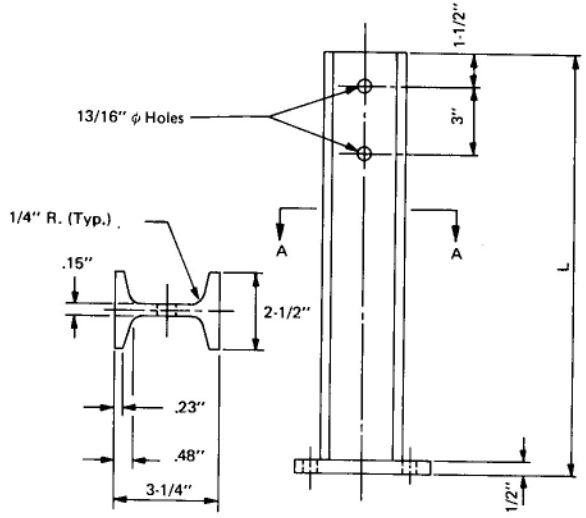
MB3B AND MB7B STRUCTURAL SHAPE POST (STEEL)

HM-TF-13

STANDARD

P-39 [LENGTH DESIGNATION]-73





SECTION A - A

STRUCTURE MOUNTED MEDIAN BARRIER POST

SPECIFICATIONS

Extruded shape and post plate shall conform to the requirements of A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5 (minimum elongation-10%).

Welding shall conform to the requirements contained in Section 1.5.5 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

1. (L = 1′-8″) Post for median barrier design MB7B with top of rail mounted 2′-3-1/4″ above bottom of post base.

2. (L = 1′-11-3/4″) Post for median barrier design MB3B with top of rail mounted 2′-6″ above bottom of post base.

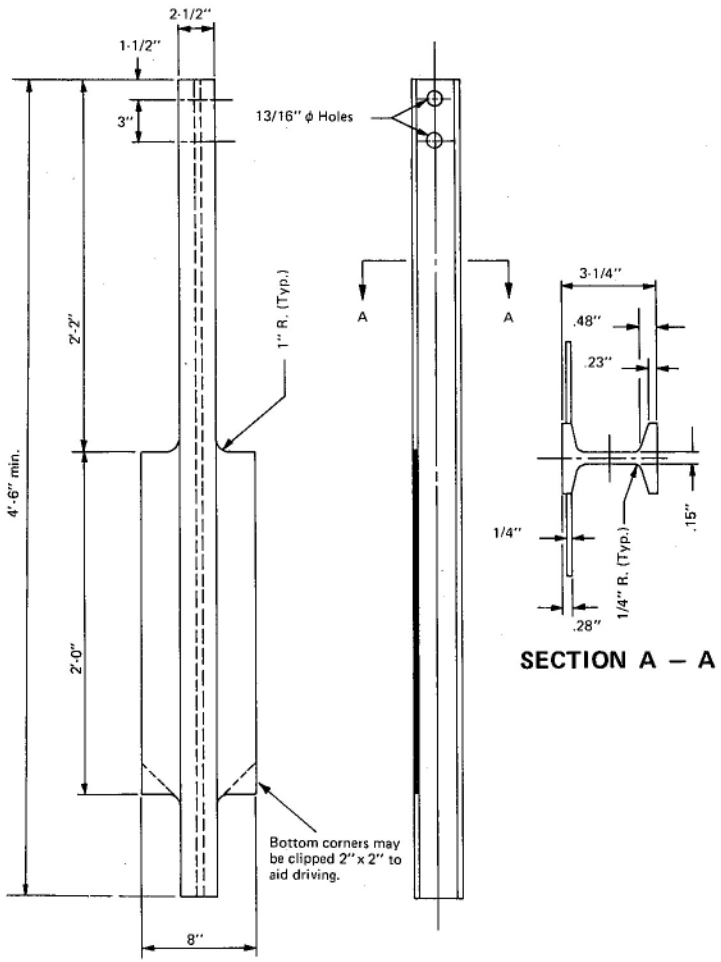
Note: This post may be used as an alternate to P-39[ ]-73 and P-51[ ]-76.

MB3B AND MB7B
STRUCTURAL SHAPE POST (ALUMINUM)

HM-TF-13

STANDARD

P-40 [LENGTH DESIGNATION] -73



SECTION A – A

SPECIFICATIONS

Extruded shape shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in the standard box beam median barrier designs MB3 and MB7.

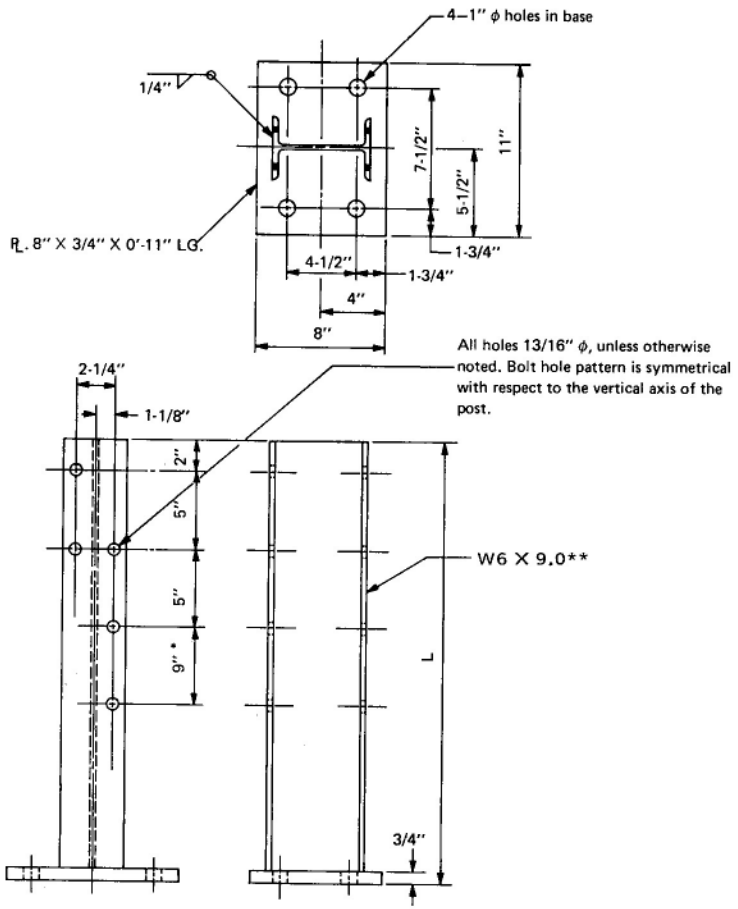
Note: This post may be used as an alternate to P-6-79 and P-50-76.

MB3 AND MB7
STRUCTURAL SHAPE POST (ALUMINUM)

HM-TF-13

STANDARD

P-41-79



*For 30" top of "w" beam and 10" center of rubrail mounting heights above bottom of base. Lower holes only required where rubrail is used.

** Replaced W6 X 8.5, which is acceptable as an alternate.

SPECIFICATIONS

Posts and post plates shall conform to the requirements of ASTM A36 and shall be galvanized in accordance with ASTM A123.

Welding shall meet the current requirements of the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

1. (L = 2'-4") Post for median barrier design MB4B with top of rail mounted 2'-3" above bottom of post base.

2. (L = 2'-7") Post for median barrier design MB4B with rub rail added, and top of traffic rail mounted 2'-6" above bottom of post base.

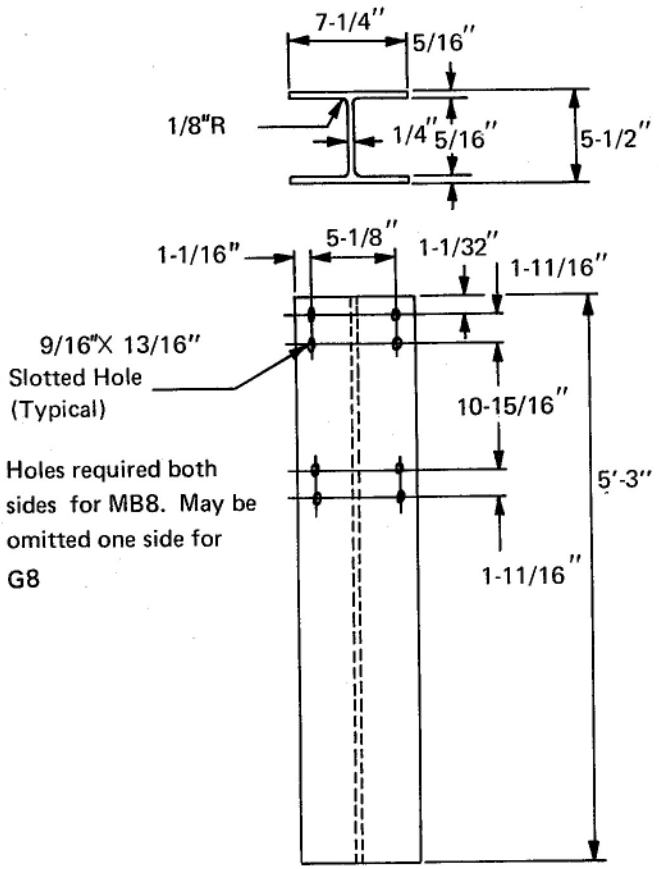
Note: This post may be used as an alternate to P-53-76. See P-10-79 for block details.

MB4B
STRUCTURAL SHAPE POST

HM-TF-13

STANDARD

P-42 [LENGTH DESIGNATION] -79



POST DETAIL

SECTIONAL PROPERTIES

Area		5.756 sq. in.
Weight		6.807 lb per ft
Moment of Inertia	Ixx	32.91 in^4
	Iyy	19.85 in^4
Section Modulus	Sxx	11.97 in^3
	Syy	5.47 in^3

SPECIFICATIONS

Extruded shape shall conform to ASTM B221 alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

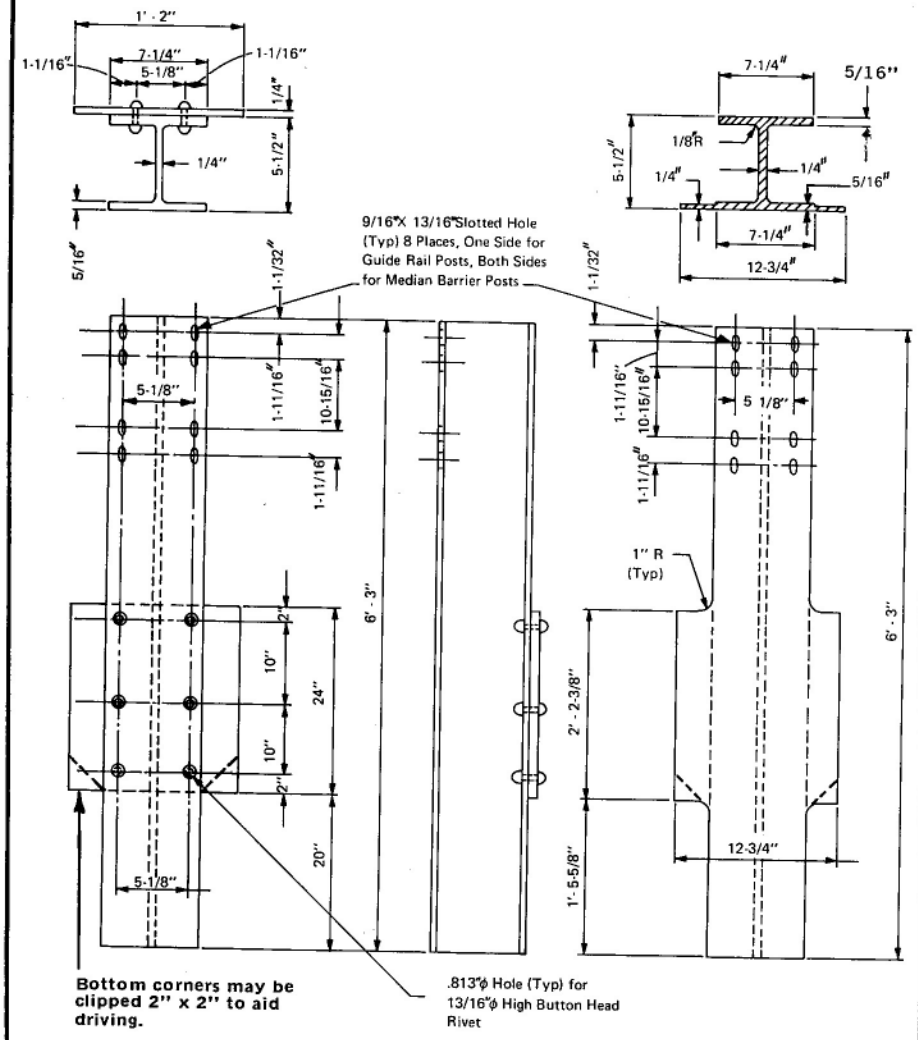
This post is used to support rail elements in the median barrier design MB8 and guardrail design G8.

G8 AND MB8 STRUCTURAL SHAPE POST

HM-TF-13

STANDARD

P-43-73



ALTERNATE 1
RIVETED SOIL PLATE

ALTERNATE 2
ONE PIECE POST
AND SOIL PLATE

SPECIFICATIONS

Extruded shapes shall conform to A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5.

Soil plate shall conform to A.S.T.M. B209, alloy 6061-T6.

Rivet material shall meet the requirements of A.S.T.M. B316 or B221, alloy 6061-T6. Rivets shall have manufactured high button heads meeting the dimensional requirements of A.N.S.I. B18.4, shall have driven cone point heads, and shall meet the requirements of Section 6.5 of the Aluminum Association's Specifications for Aluminum Bridge and Other Highway Structures.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

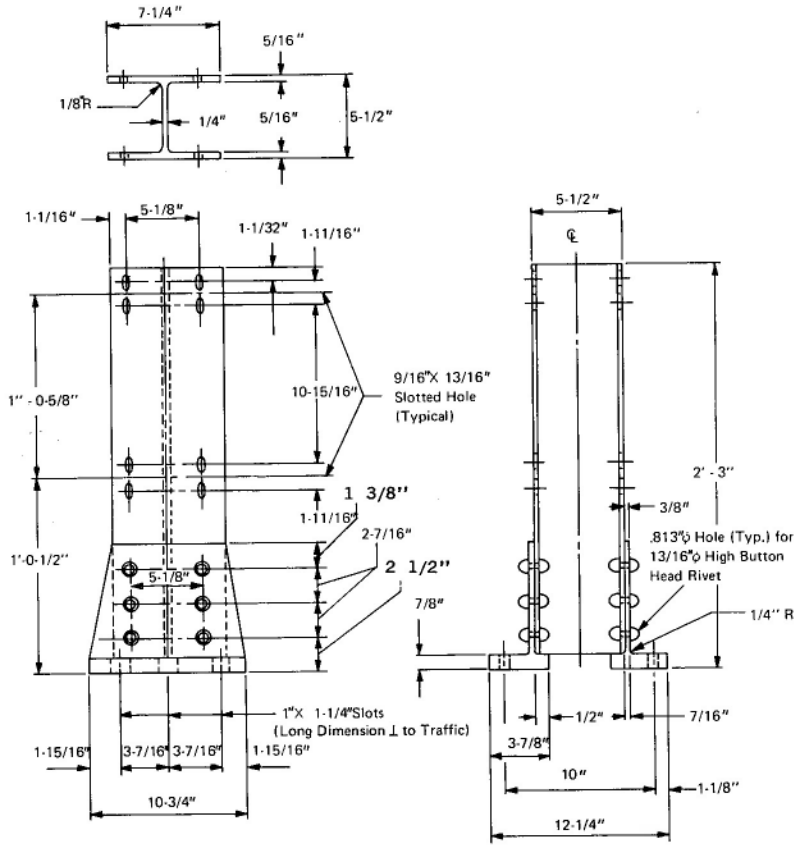
This post is used to support rail elements in the transition sections between guardrail design G8 and bridge railing designs BR2 (Aluminum) Type D and BR3A (Aluminum) Type D, and between median barrier designs MB8 and MB8B.

G8 AND MB8
STRUCTURAL SHAPE POST
(TRANSITION SECTION)

HM-TF-13

STANDARD

P-44-73



SPECIFICATIONS

Extruded shapes shall conform to A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5.

Rivet material shall meet the requirements of A.S.T.M. B316 or B221, alloy 6061-T6. Rivets shall have manufactured high button heads meeting the dimensional requirements of A.N.S.I. B18.4, shall have driven cone point heads, and shall meet the requirements of Section 6.5 of the Aluminum Association's Specifications for Aluminum Bridge and Other Highway Structures.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

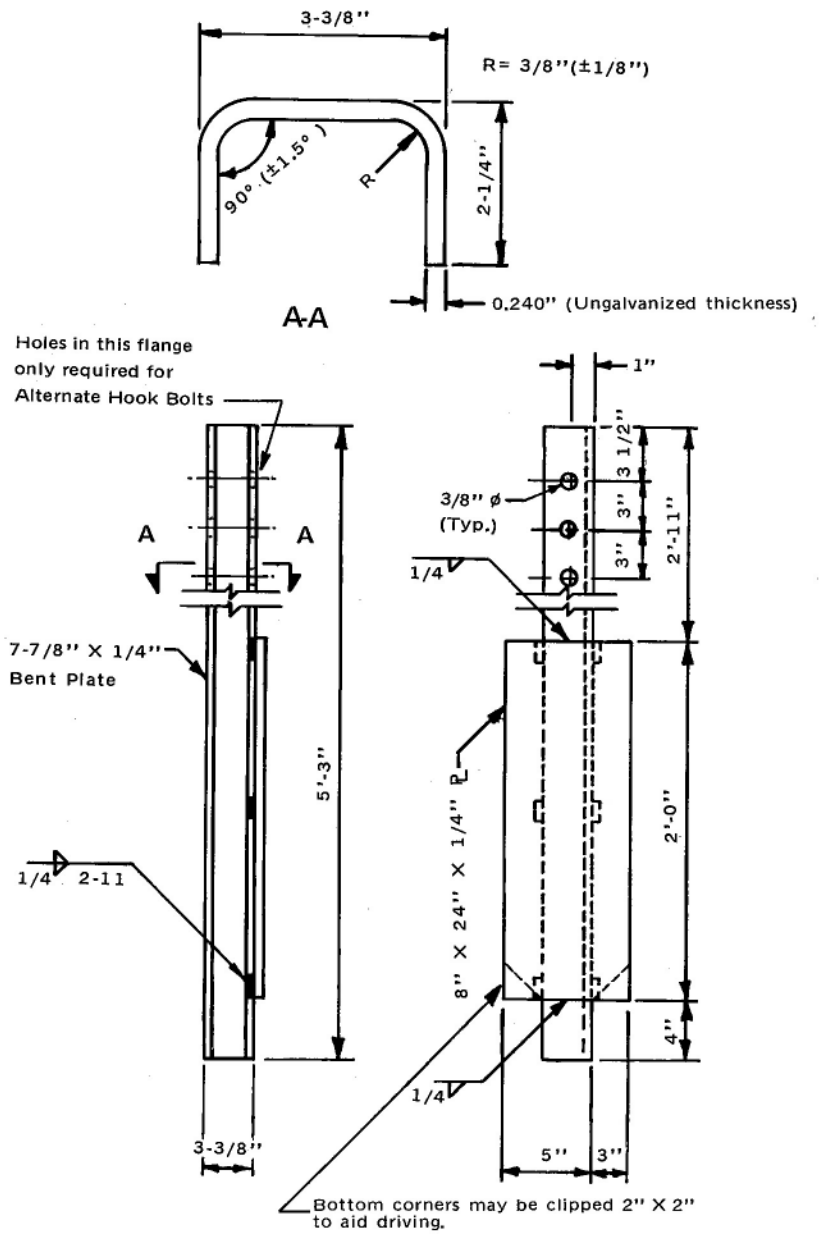
This post is used to support rail elements in median barrier design MB8B.

MB8B
FABRICATED POST

HM-TF-13

STANDARD

P-45-73



SPECIFICATIONS

Posts and post plates shall conform to the mechanical requirements of A.S.T.M. A36 and shall be welded to meet the current requirements of the American Welding Society Structural Welding Code, AWS D1.1. Fabricated posts shall be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used in the standard cable design G1.

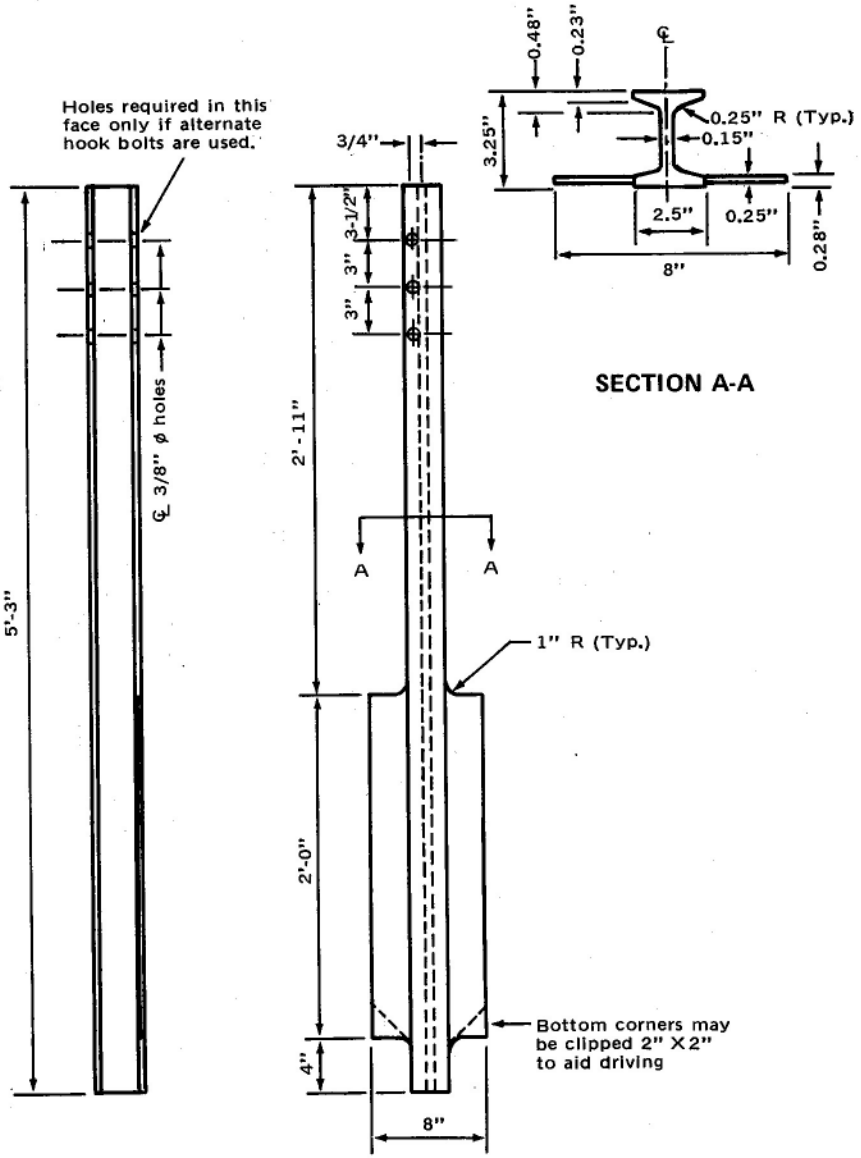
Note: This post may be used as an alternate to P-1-76 and P-47-79.

G1 BENT PLATE LINE POST (STEEL)

HM-TF-13

STANDARD

P-46-76



SECTION A-A

SPECIFICATIONS

Extruded Shape shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5.

Dimension tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used for intermediate cable support in the standard cable guardrail system G1.

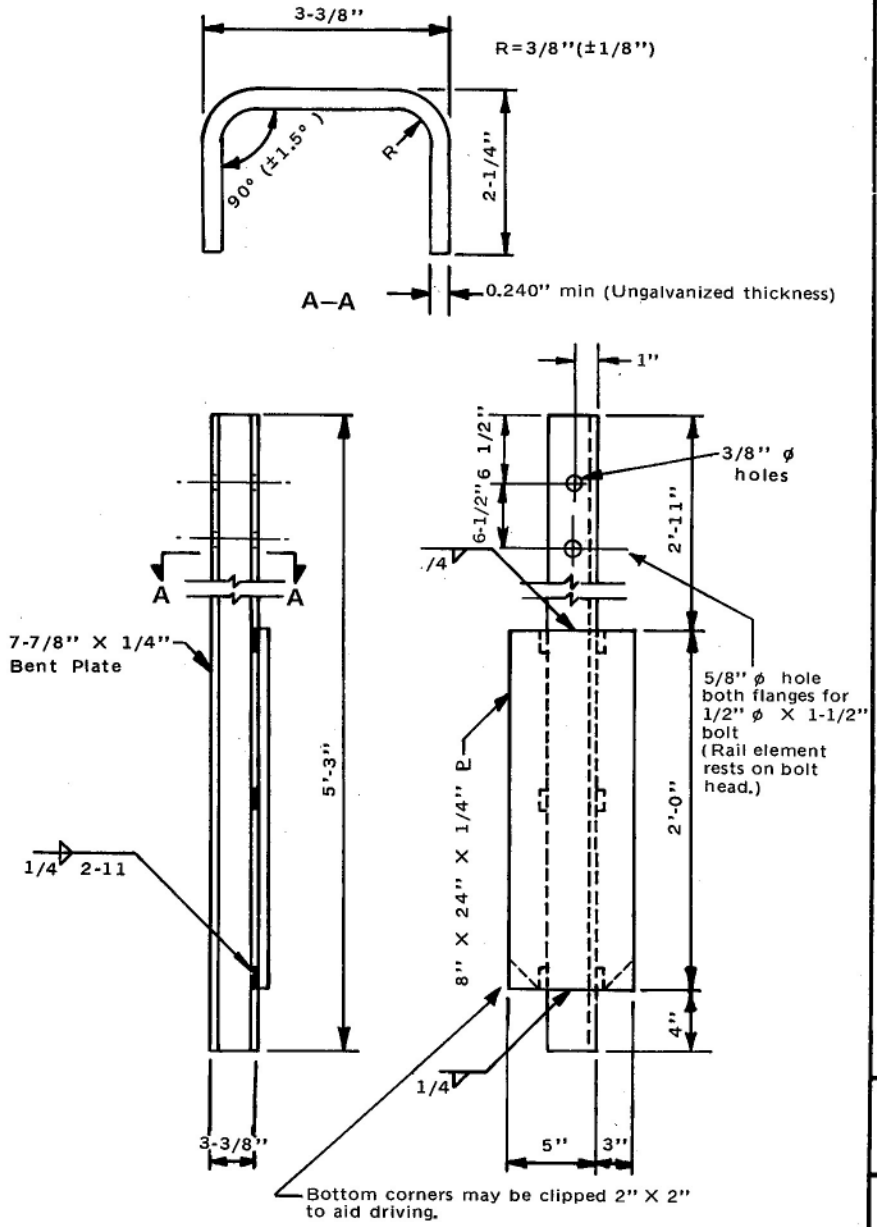
Note: This post may be used as an alternate to P-1 and P-46.

G1 STRUCTURAL SHAPE LINE POST (ALUMINUM)

HM-TF-13

STANDARD

P-47-79



SPECIFICATIONS

Posts and post plates shall conform to the mechanical requirements of A.S.T.M. A36 and shall be welded to meet the current requirements of the American Welding Society Structural Welding Code, AWS D1.1. Fabricated posts shall be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used in the standard barrier designs G2 and MB2.

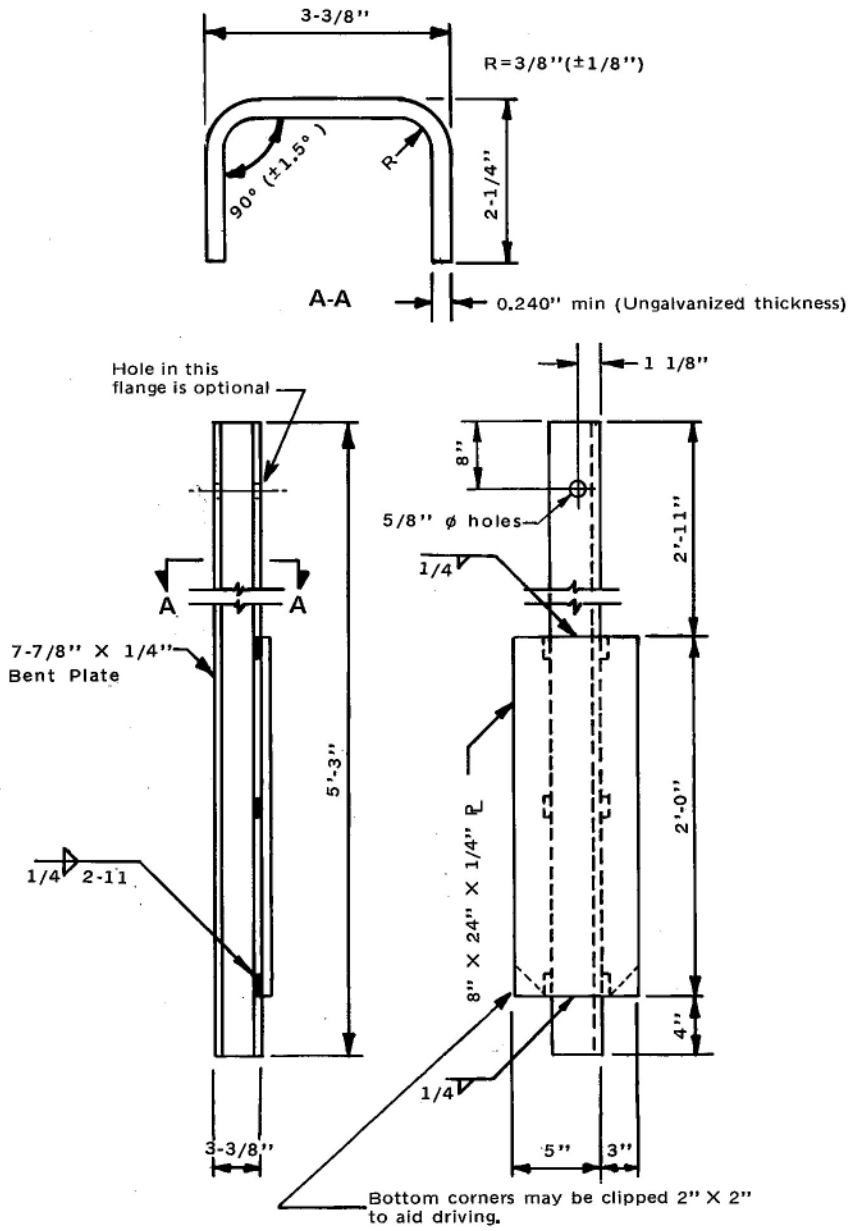
Note: This post may be used as an alternate to P-3-76 and P-63-79.

G2 AND MB2
BENT PLATE POST (STEEL)

HM-TF-13

STANDARD

P-48-76



SPECIFICATIONS

Posts and post plates shall conform to the mechanical requirements of A.S.T.M. A36 and shall be welded to meet the current requirements of the American Welding Society Structural Welding Code, AWS D1.1. Fabricated posts shall be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used in the standard barrier design G3.

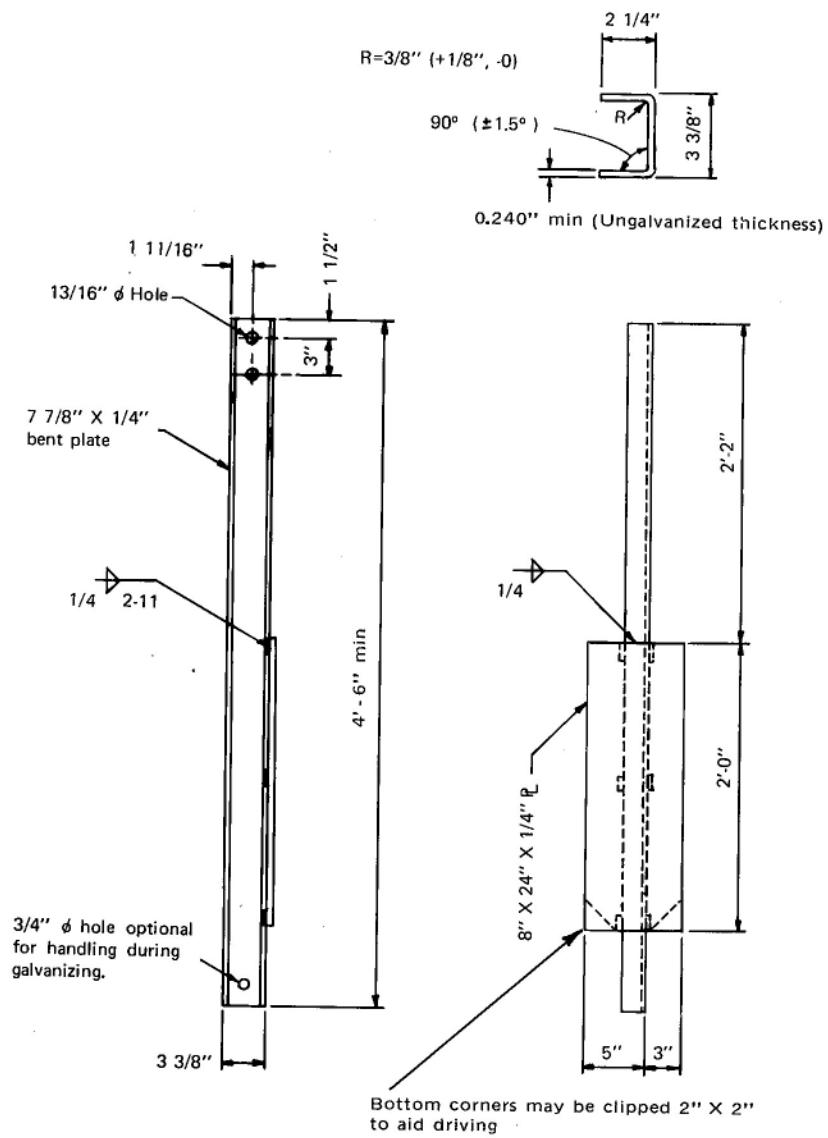
Note: See P-5-76 for Rail Support Angle details. This post may be used as an alternate to P-4-76 and P-64-79.

G3 BENT PLATE POST (STEEL)

HM-TF-13

STANDARD

P-49-76



SPECIFICATIONS

Posts and post plates shall conform to the mechanical requirements of A.S.T.M. A36 and shall be welded to meet the current requirements of the American Welding Society Structural Welding Code, AWS D1.1. Fabricated posts shall be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used in the standard barrier designs MB3 and MB7.

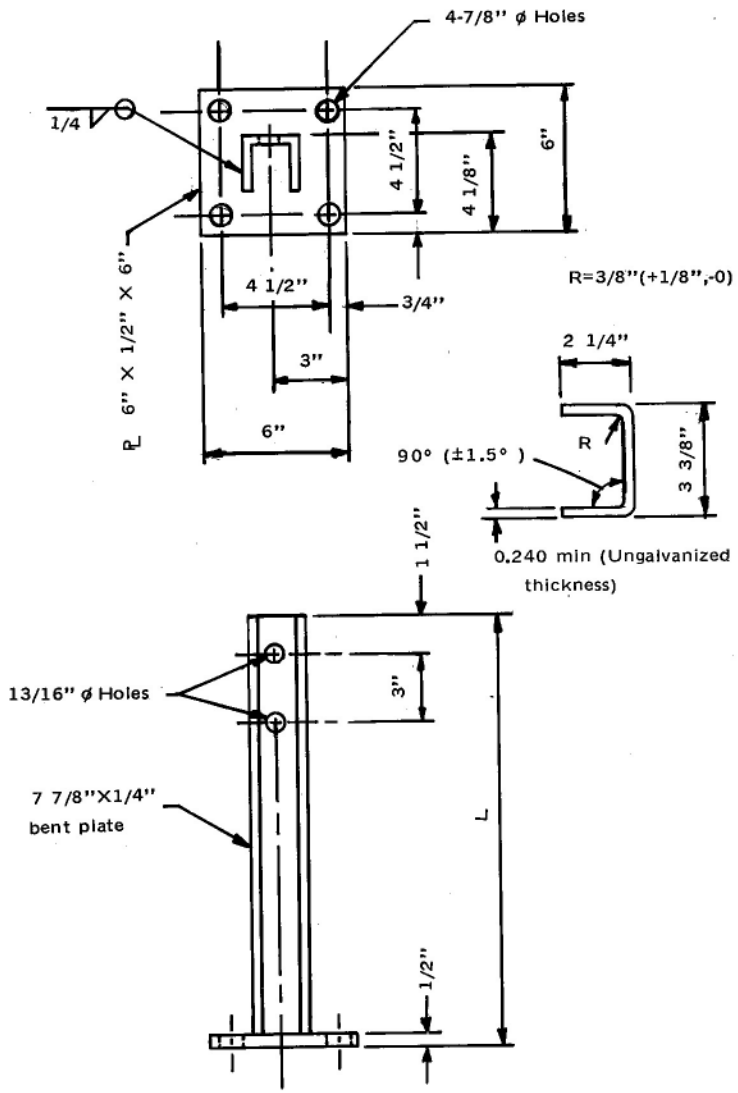
Note: This post may be used as an alternate to P-6-79 and P-41-79.

MB3 AND MB7
BENT PLATE POST (STEEL)

HM-TF-13

STANDARD

P-50 -76



STRUCTURE MOUNTED MEDIAN BARRIER POST

SPECIFICATIONS

Posts and post plates shall conform to the mechanical requirements of A.S.T.M. A36 and shall be welded to meet the current requirements of the American Welding Society Structural Welding Code, AWS D1.1. Fabricated posts shall be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

1. (L=1'-8") Post for median barrier design MB7B with top of rail mounted 2'–3-1/4" above bottom of post base.

2. (L=1'–11-3/4") Post for median barrier design MB3B with top of rail mounted 2'-6" above bottom of post base.

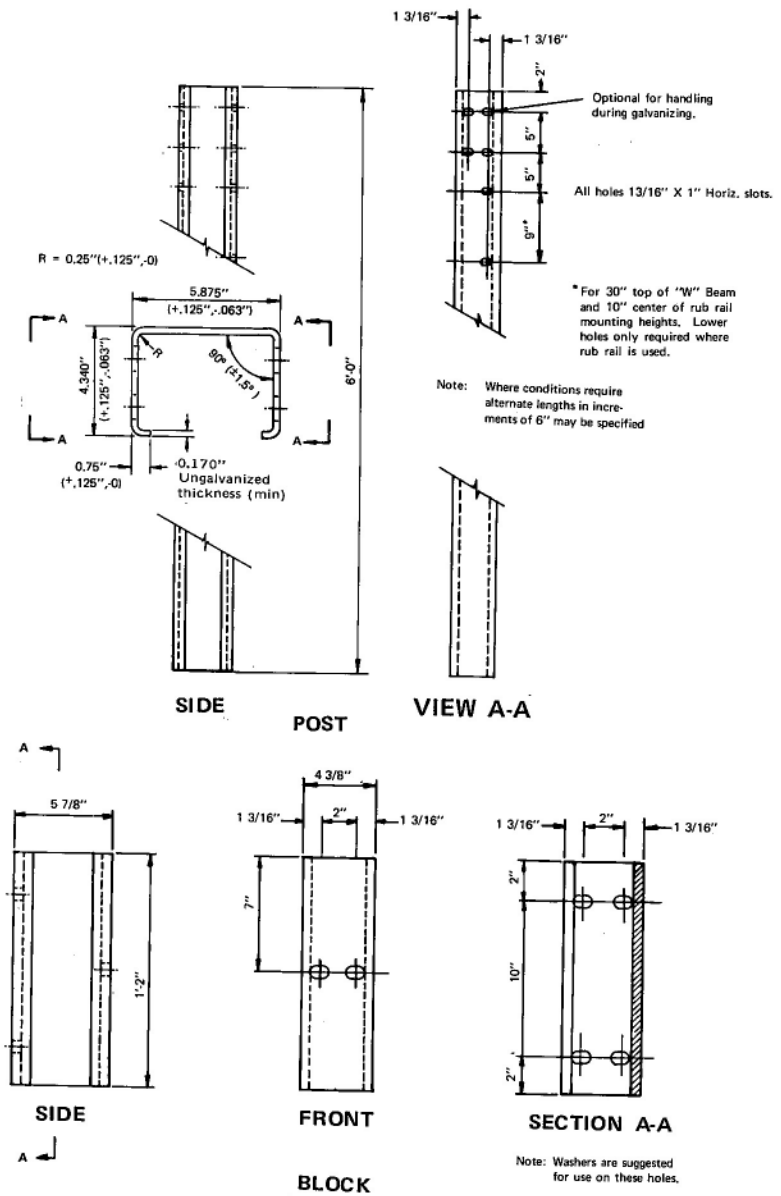
Note: This post may be used as an alternate to P-39[ ]-73 and P-40[ ]-73.

MB3B AND MB7B BENT PLATE POST (STEEL)

HM-TF-13

STANDARD

P-51 [LENGTH DESIGNATION] -76



SPECIFICATIONS

Posts and blocks shall conform to the requirements of A.S.T.M. A570 with mechanical properties equal to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post and block are used in the standard barrier designs G4 and MB4.

Notes: This post and block may be used as alternates to P-10-79 and P-65-79.

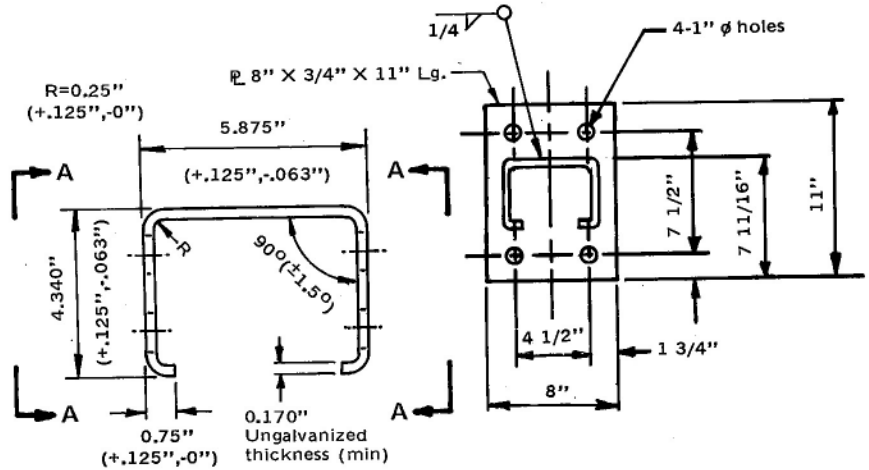
Some barrier stiffness transition designs call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

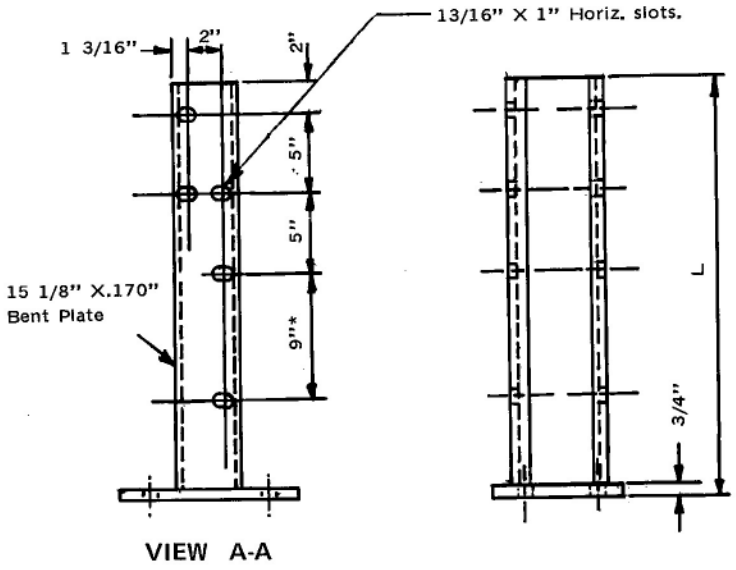
G4 AND MB4
BENT PLATE POST AND BLOCK (STEEL)

HM-TF-13

STANDARD

P-52-76





VIEW A-A

Note: Washers are suggested for use on these holes.

*For 30" top of 'W' Beam and 10" center of rub rail mounting heights above bottom of base. Lower holes only required where rub rail is used.

SPECIFICATIONS

Posts and base plates shall conform to the requirements of A.S.T.M. A570 with mechanical properties equal to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123.

Welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

1. (L = 2'-4") Post for median barrier design MB4B with top of rail mounted 2'-3" above bottom of post base.

2. (L = 2'-7") Post for median barrier design MB4B with rub rail added, and top of traffic rail mounted 2'-6" above bottom of post base.

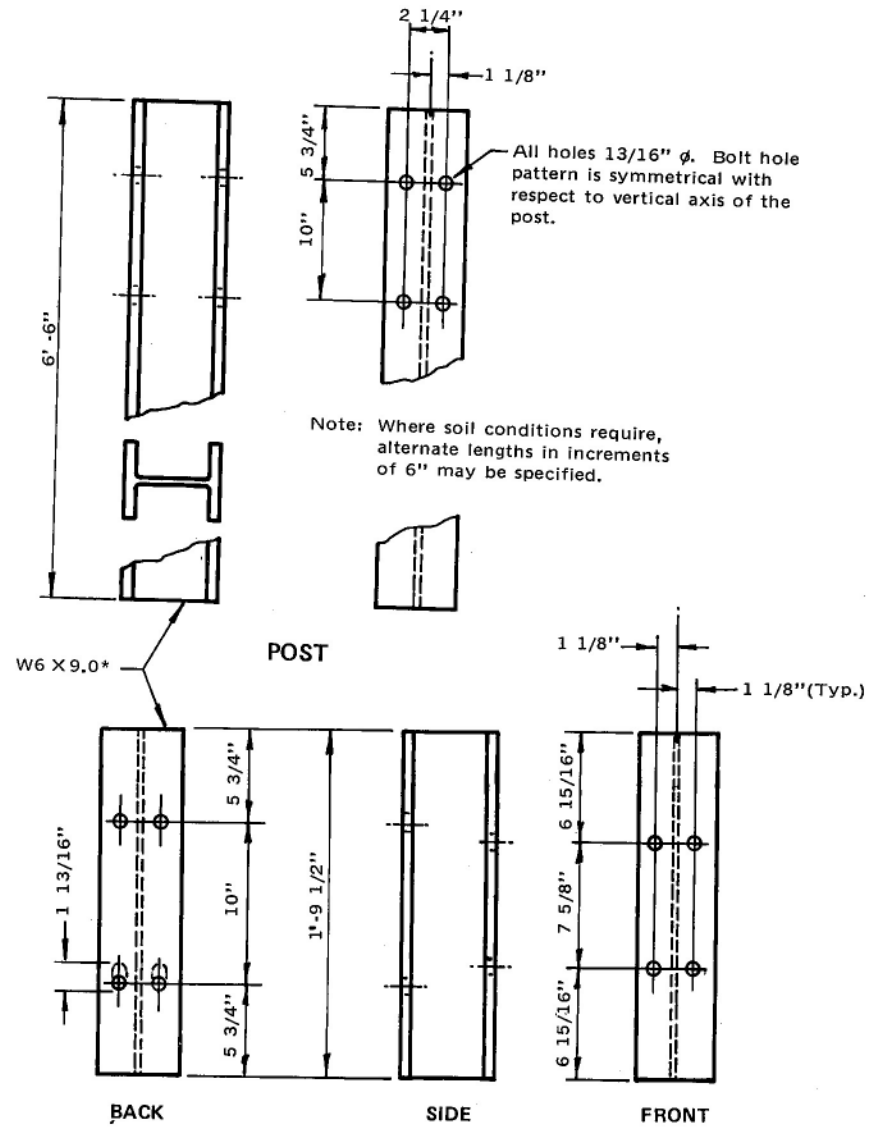
Note: See P-52-76 for block details. This post may be used as an alternate to P-42-79.

MB4B BENT PLATE POST (STEEL)

HM-TF-13

STANDARD

P-53 [LENGTH DESIGNATION] -76



SPECIFICATIONS

Posts and blocks shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel posts are requested in which case posts and blocks shall conform to A.S.T.M. A588 and shall not be painted or galvanized.

No punching, drilling, or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post and block are used in the standard barrier designs G9 and MB9.

Notes: This post may be used as an alternate to P-56-76 and P-66-79.

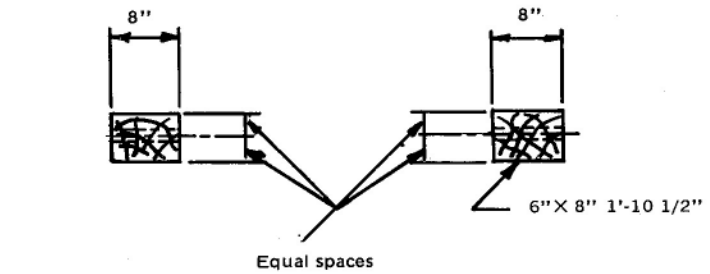
Some barrier stiffness transition designs call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

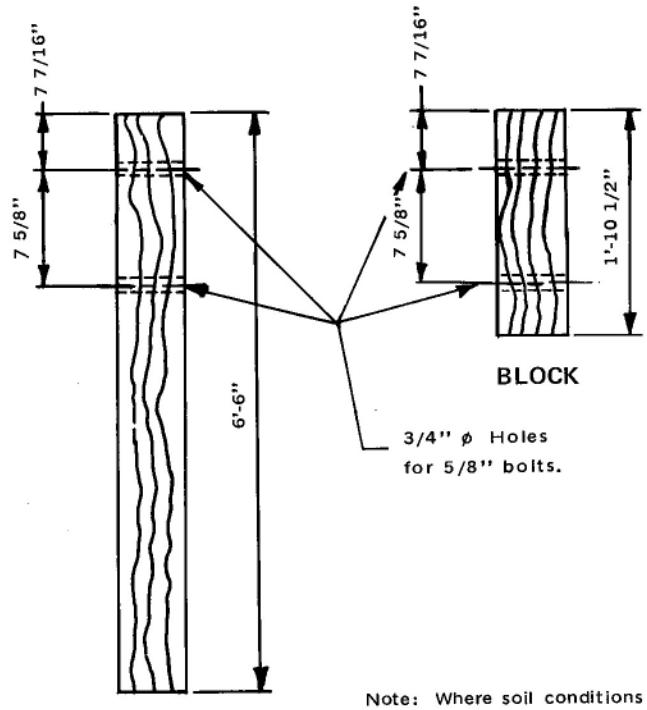
G9 AND MB9
STRUCTURAL SHAPE POST AND BLOCK

HM-TF-13

STANDARD

P - 54 - 79





Note: Where soil conditions require, alternate lengths in increments of 6" may be specified.

POST

SPECIFICATIONS

Posts and blocks shall be of timber with a stress grade of 1200 psi or more. Testing shall be in accordance with the West Coast Lumber Inspection Bureau, the Southern Pine Inspection Bureau, or other appropriate timber association. Timber for posts and blocks shall be rough sawn (unplaned) or S4S with nominal dimensions indicated. The size tolerance of rough sawn blocks in the direction of the bolt holes shall be not more than ± 1/4 inch. Only one combination of post and block finish shall be used for any one continuous length of guardrail.

All timber shall receive a preservation treatment in accordance with A.A.S.H.T.O. M133.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post and block are used in the standard barrier designs G9 and MB9.

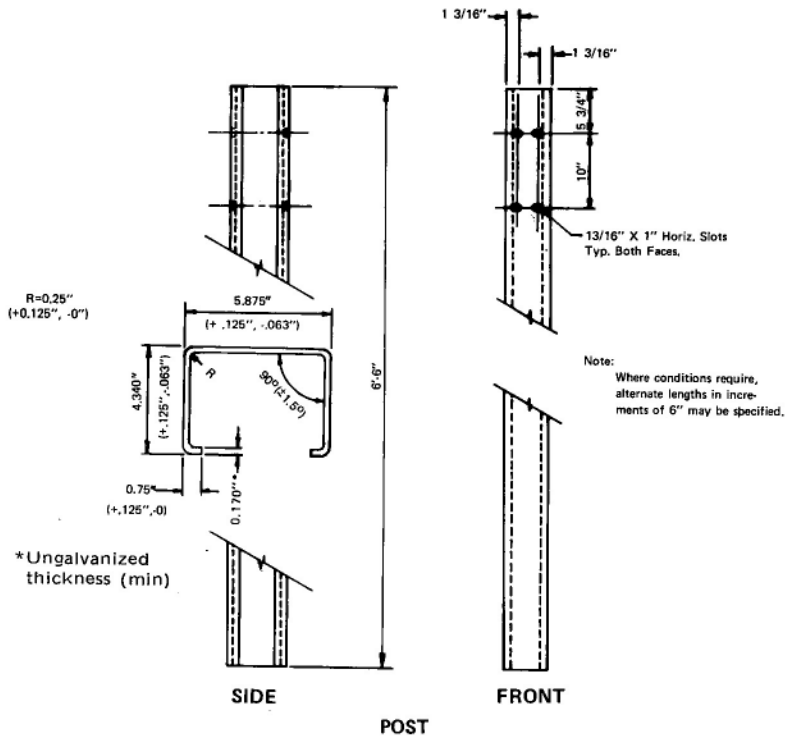
Note: Some barrier stiffness transition designes call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

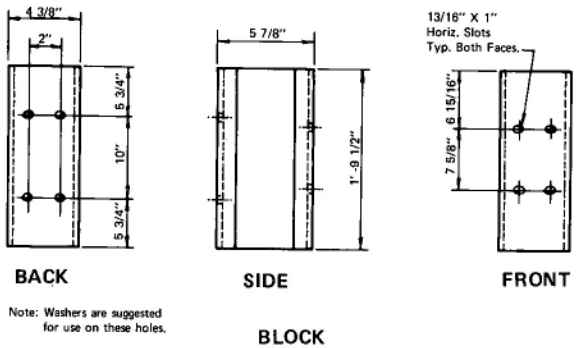
G9 AND MB9
6 X 8 TIMBER POST AND BLOCK

HM-TF-13

STANDARD

P-55-79





SPECIFICATIONS

Posts and blocks shall conform to the requirements of A.S.T.M. A570 with mechanical properties equal to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123.

No punching, drilling, or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post and block are used in the standard barrier designs G9 and MB9.

Notes: This post and block may be used as alternates to P-54-79 and P-66-79.

Some barrier stiffness transition designs call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

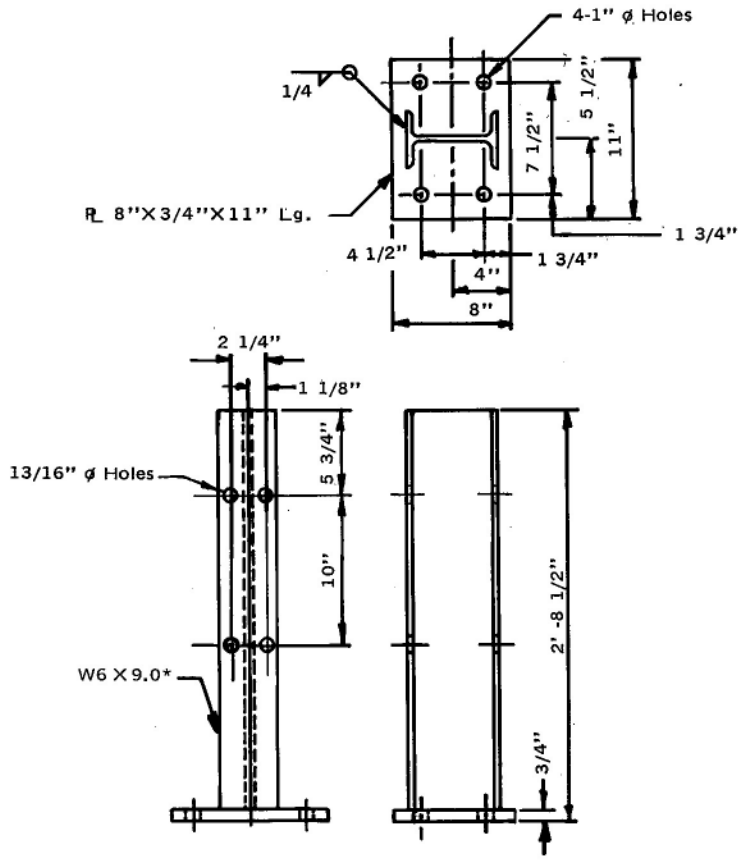
G9 AND MB9

BENT PLATE POST AND BLOCK (STEEL)

HM-TF-13

STANDARD

P-56 -76



Note: Bolt hole pattern is symmetrical with respect to vertical axis of the post.

* Replaced W6 X 8.5, which is acceptable as an alternate.

SPECIFICATIONS

Post and post plate shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123.

Welding shall conform to the current requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used in the median barrier design MB9B.

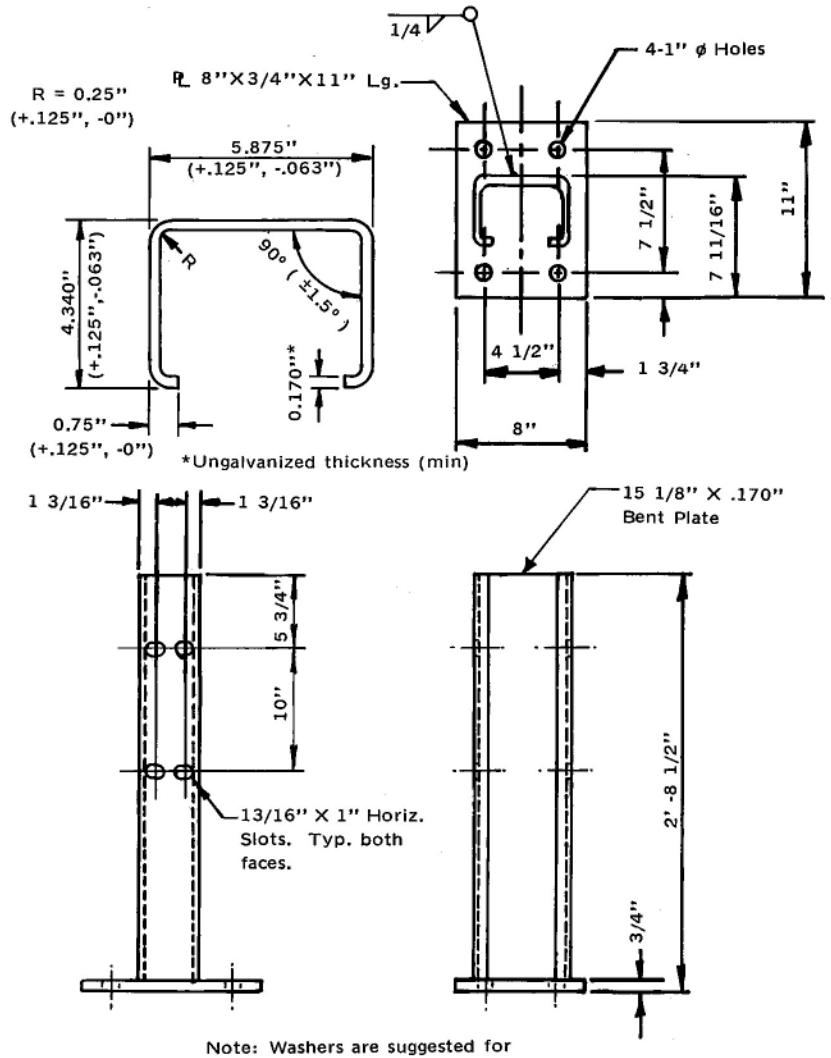
Note: This post may be used as an alternate to P-58-76. See P-54-79 for block details.

MB9B STRUCTURAL SHAPE POST

HM-TF-13

STANDARD

P - 57 - 79



SPECIFICATIONS

Posts and base plates shall conform to ASTM A570 with mechanical properties equal to ASTM A36 and shall be galvanized in accordance with ASTM A123.

Welding shall conform to the mechanical requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post is used in the median barrier design MB9B.

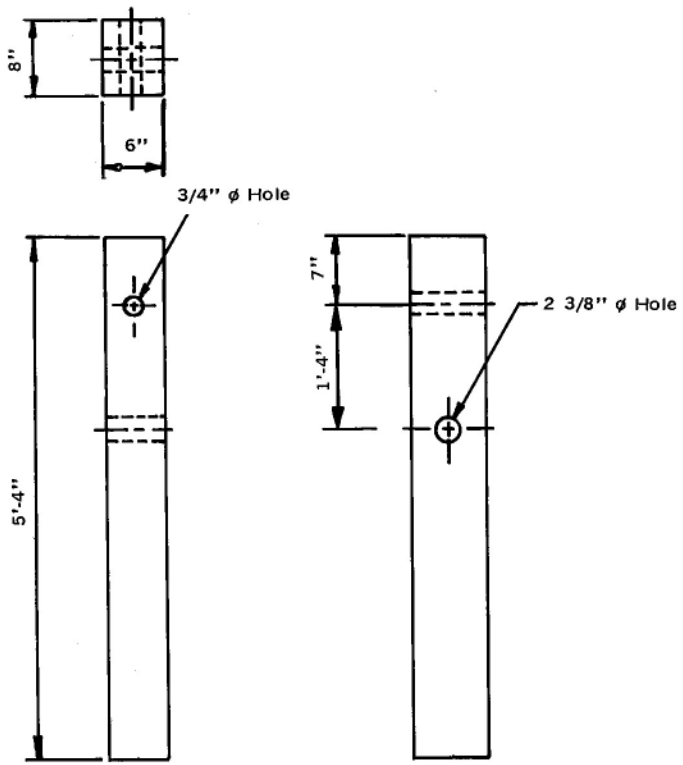
Note: This post may be used as an alternate to P-57-79. See P-56-76 for block details.

MB9B BENT PLATE POST (STEEL)

HM-TF-13

STANDARD

P-58-76



TIMBER POST

SPECIFICATIONS

Posts shall be of timber with a stress grade of 1200 psi or more. Testing shall be in accordance with West Coast Lumber Inspection Bureau, Southern Pine Inspection Bureau or other appropriate timber association. Timber for posts shall be rough sawn (unplaned) or S4S with nominal dimensions indicated.

All timber shall receive a preservation treatment in accordance with AASHTO M-133.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

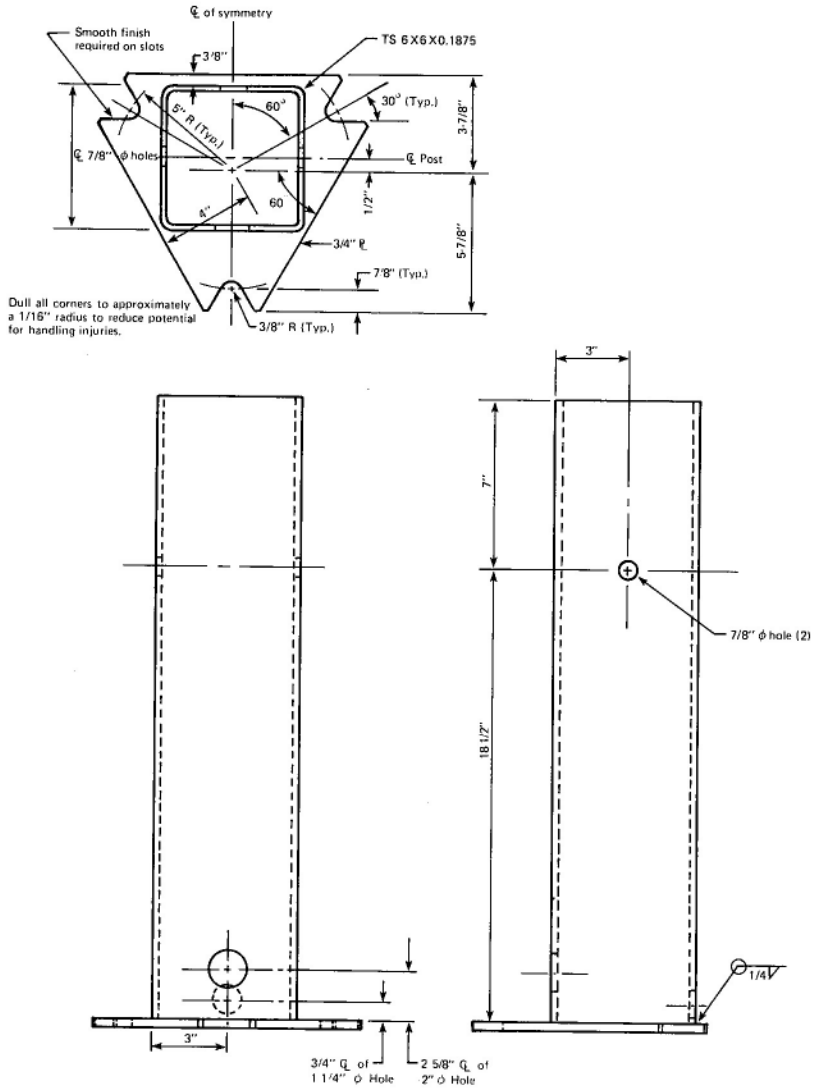
This post is used in the standard breakaway cable terminal design as shown in Appendix A.4.

BCT TERMINAL POST (TIMBER)

HM-TF-13

STANDARD

P-59 -76



SPECIFICATIONS

Tabular sections shall meet the requirements of A.S.T.M. A500, Grade B, or A.S.T.M. A501 except when corrosion resistant steel is requested, in which case the posts shall be made of steel meeting the dimensional and mechanical requirements of A.S.T.M. A500, Grade B, or A.S.T.M. A501 and having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper. Plates shall meet the requirements of A.S.T.M. A36 except when corrosion resistant steel is requested, in which case the plates shall meet the requirements of A.S.T.M. A588.

Welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1.

Posts shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel is requested, in which case posts shall not be galvanized or painted.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

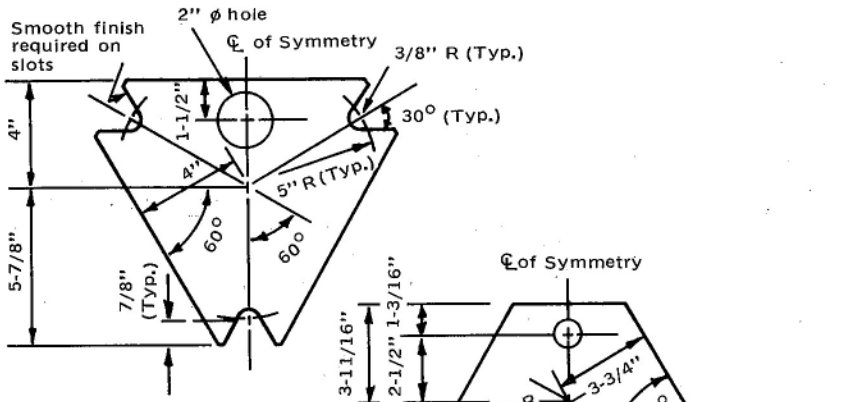
This post is bolted to P-61-79 or P-62-79 to form terminal post used in the breakaway cable terminal design shown in Appendix A.5.

BCT TERMINAL POST (STEEL)

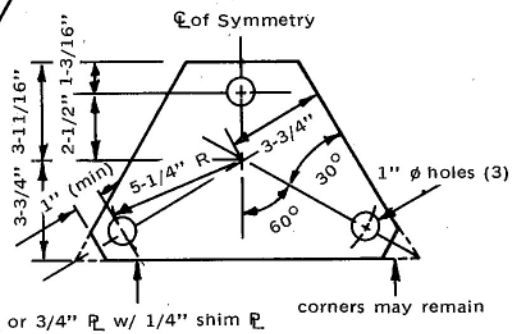
HM-TF-13

STANDARD

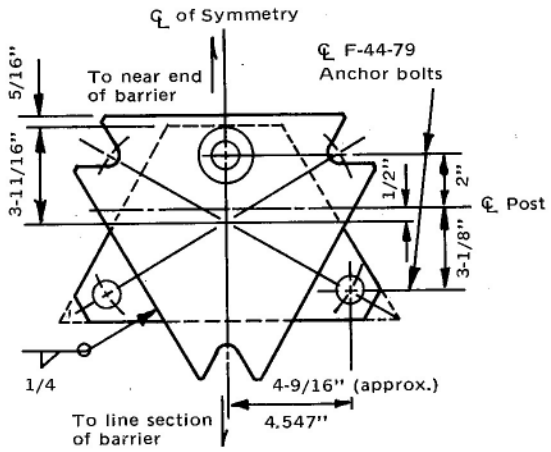
P-60-79



TOP PLATE



BOTTOM PLATE



Dull all corners to approximately a 1/16" radius to reduce potential for handling injuries.

TOP VIEW

SPECIFICATIONS

Plates shall meet the requirements of A.S.T.M. A36 except when corrosion resistant steel is requested, in which case the plates shall meet the requirements of A.S.T.M. A588.

Welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1.

Foundation Plates, including shim plates, if used, shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel is requested, in which case the plates shall not be galvanized or painted.

No punching, drilling, cutting, or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

P-60-79 bolts to these foundation plates to form a terminal post used in the breakaway cable terminal design shown in Appencix A.5.

BCT (STEEL) FOUNDATION PLATES

HM-TF-13

STANDARD

P-61-79

Form FHWA 121 (6/79)

140a

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

UNITED STATES GOVERNMENT

memorandum

Subject: Distribution of: (1) "A Guide to Standardized Highway Lighting Pole Hardware" and (2) "A Guide to Standardized Highway Barrier Rail Hardware"

Date MAR 26 1981

From: Chief, Bridge Division
Office of Engineering
Washington, D.C. 20590

Reply to Attn. of: HNG-34

To: Regional Federal Highway Administrator
Regions 1-10: Division Administrators and
Division Engineer, Region 15

In the interest of information exchange, the Joint Cooperative Committee of the American Association of State Highway and Transportation Officials (AASHTO), Associated General Contractors (AGC), and the American Road and Transportation Builders Association (ARTBA) has prepared the two subject documents.

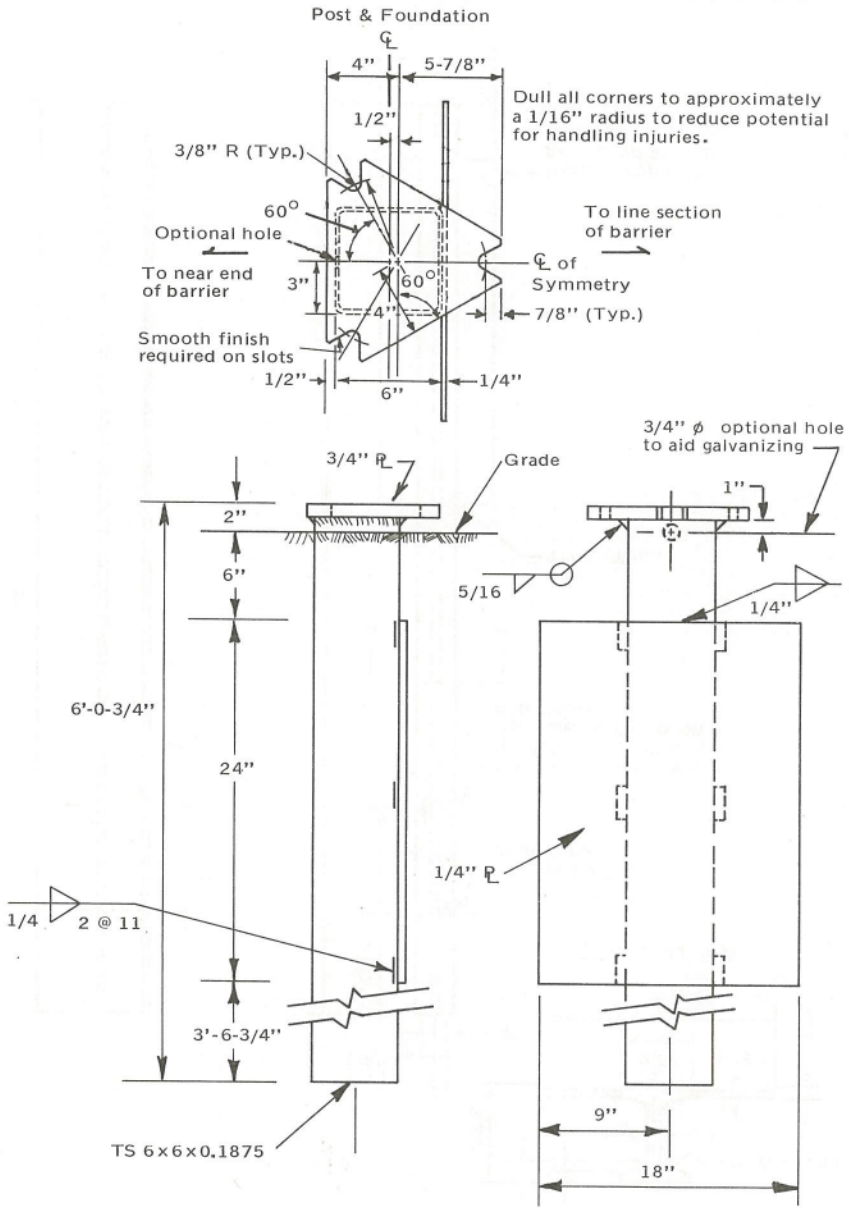
Under separate cover, Regional and Division Offices are being sent, respectively, 6 and 4 copies of each document.

Please note certain errors and omissions in the documents which should be corrected. On page 34 of (1), "A Guide to Standardized Highway Lighting Pole Hardware," the minimum restrained shear shown in the Dimension Table should be 3.0 kips instead of 30 kips. On page 140 of (2), "A Guide to Standardized Highway Barrier Rail Hardware," the thickness of the Top Plate should be shown as 3/4". On page 209 of the same document the thickness of the Anchor Plate should be shown as 3/16". Please make the corrections.

We would point out that the crash tests performed on Barrier Types BR 1 (Aluminum) Type C and BR 2 (Aluminum) Type D showed that the failure mechanism of the base plates resulted in strengths less than those required by the AASHTO specifications. The BR 2 (Aluminum) Type D railing appears particularly vulnerable to vehicle snagging on posts. We, therefore, recommend that these barrier types not be used on high-volume and/or high-speed roadways. The manufacturers of these rails are working on design modifications to avoid the problems observed in crash tests. These modified designs should be available in the near future.

Stanley Gordon

Federal Highway Administration
HNG-34:JHatton/HNG-21:CALeonin:60426:glb:3-24-81
cc:
Files--3113
Reader-3113
Chron--3113



SPECIFICATIONS

Tubular sections shall meet the requirements of A.S.T.M. A500, Grade B, or A.S.T.M. A501 except when corrosion resistant steel is requested, in which case the posts shall be made of steel meeting the dimensional and mechanical requirements of A.S.T.M. A500, Grade B, or A.S.T.M. A501 and having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper. Plates shall meet the requirements of A.S.T.M. A36 except when corrosion resistant steel is requested, in which case the plates shall meet the requirements of A.S.T.M. A588.

Welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1.

Foundations shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel is requested, in which case posts shall not be galvanized or painted.

No punching, drilling, cutting or welding will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

P-60-79 bolts to this foundation to form a terminal post used in the breakaway cable terminal design shown in Appendix A.5.

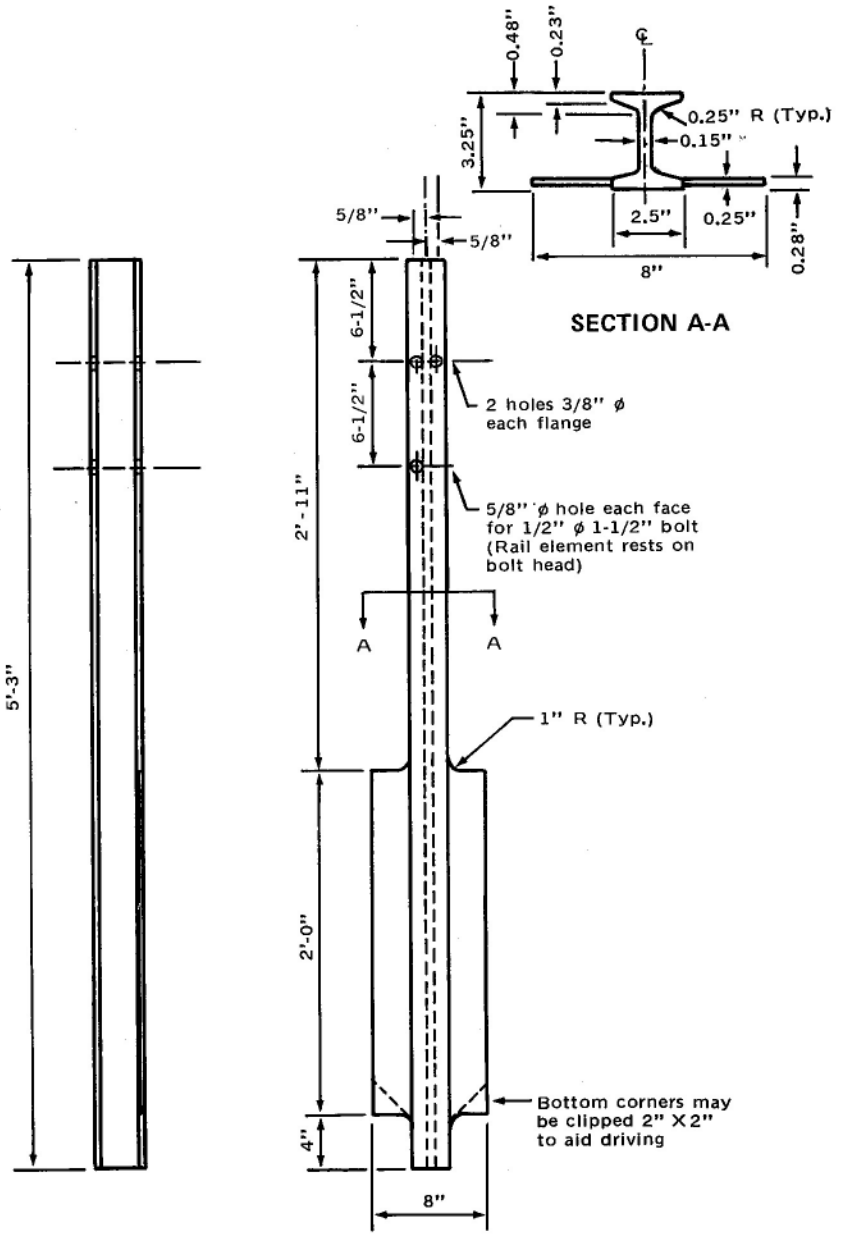
Note: This foundation is ONLY recommended for soil conditions as defined in NCHRP Report 153 and TRB Circular 191. (See NCHRP Research Results Digest 102).

BCT (STEEL) TERMINAL POST FOUNDATION

HM-TF-13

STANDARD

P-62-79



SPECIFICATIONS

Extruded shape shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5.

Dimension tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in guardrail and median barrier designs G2 and MB2.

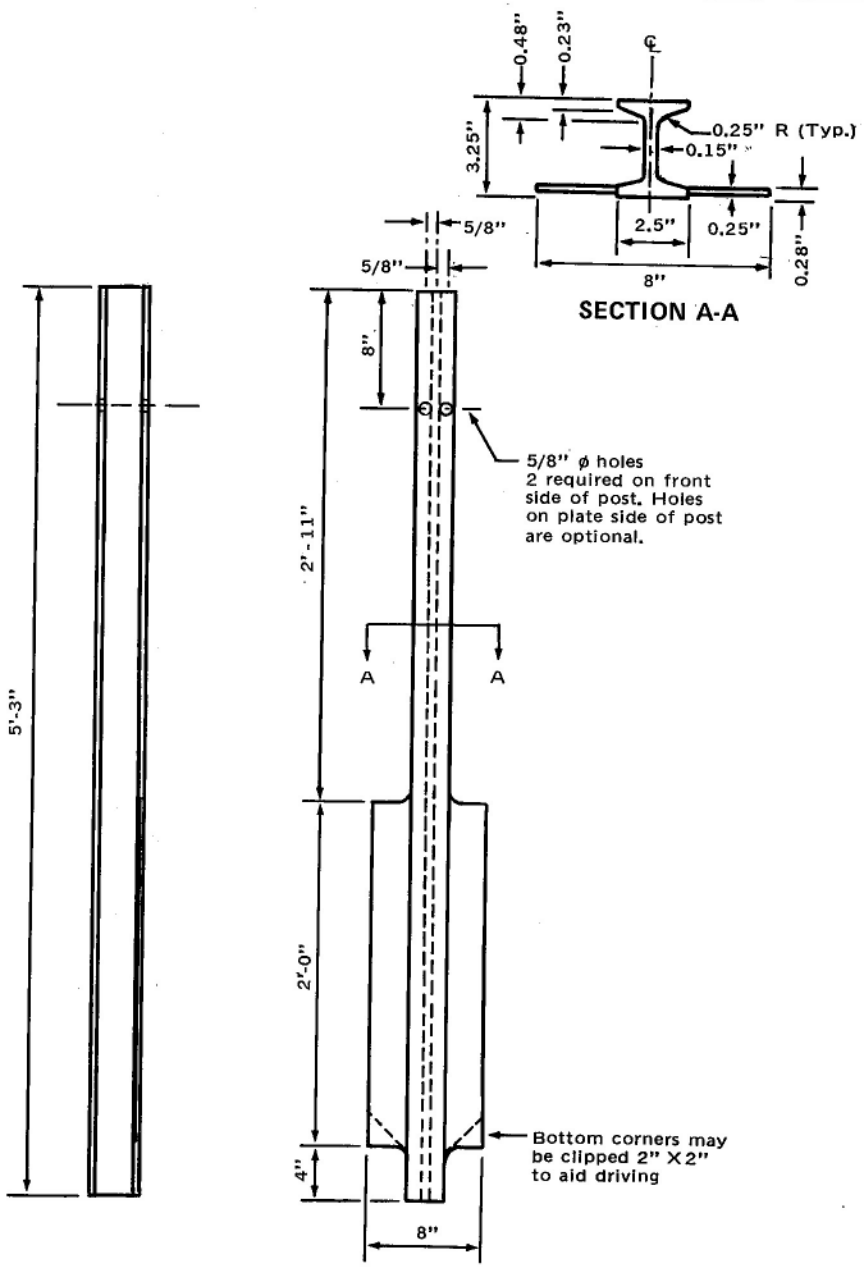
Note: This post may be used as an alternate to P-3-76 and P-48-76.

G2 AND MB2
STRUCTURAL SHAPE POST (ALUMINUM)

HM-TF-13

STANDARD

P - 63 - 79



SPECIFICATIONS

Extruded shape shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5.

Dimension tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post is used to support rail elements in the box beam guardrail system G3.

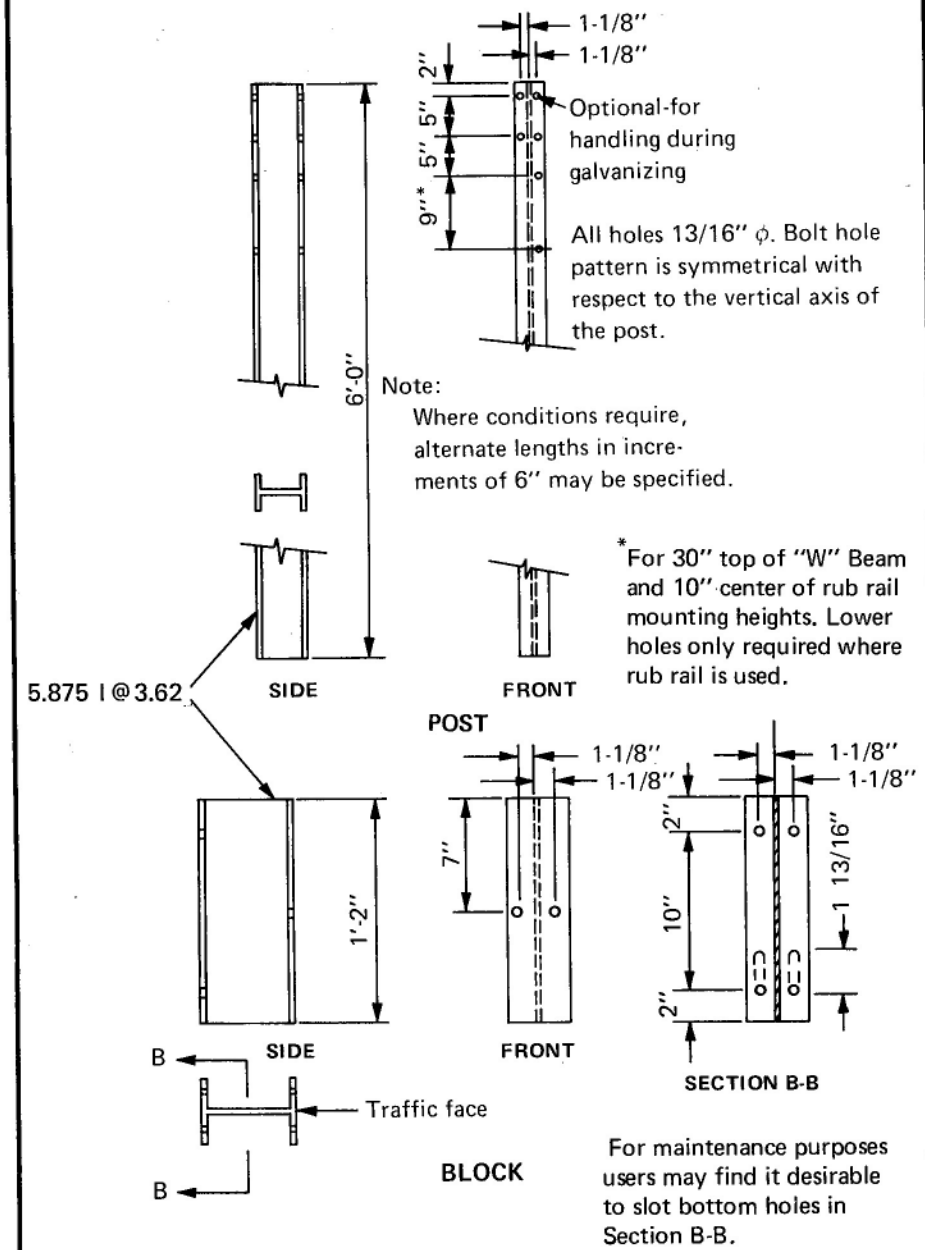
Notes: See P-5-76 for rail support angle details. This post may be used as an alternate to P-4-76 and P-49-76.

G3 STRUCTURAL SHAPE POST (ALUMINUM)

HM-TF-13

STANDARD

P - 64 - 79



SPECIFICATIONS

Posts shall conform to A.S.T.M. B209, alloy 6601-T6. Blocks shall conform to B209, alloy 6061-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This post and block are used in the standard barrier designs G4 and MB4.

Notes: This post may be used as an alternate to P-10-79 and P-52-76.

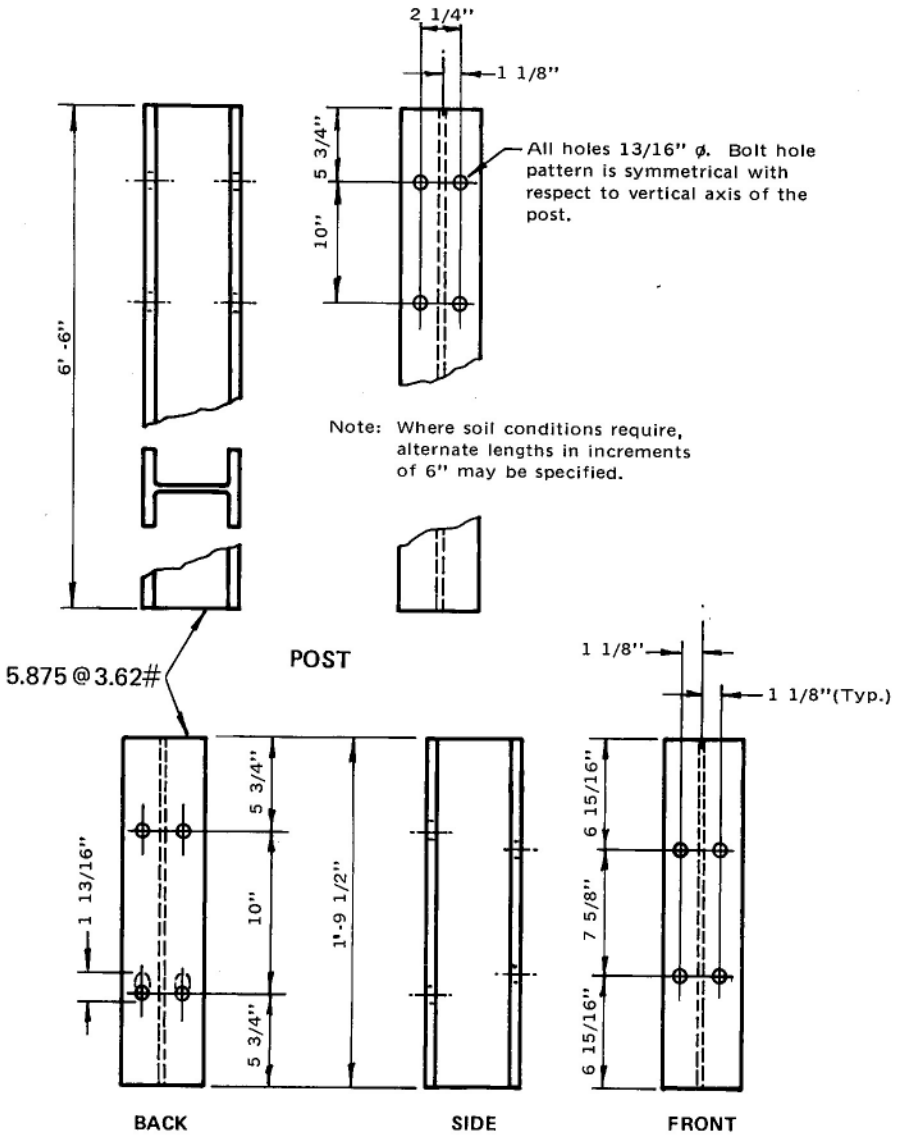
Some barrier stiffness transition designs call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

G4 AND MB4
STRUCTURAL SHAPE POST AND BLOCK (ALUMINUM)

HM-TF-13

STANDARD

P-65-79



SPECIFICATIONS

Posts shall conform to A.S.T.M. B209, alloy 6061-T6. Blocks shall conform to B209, alloy 6061-T4.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post and block are used in the standard barrier designs G9 and MB9.

Notes: This post may be used as an alternate to P-54-76 and P-56-76.

Some barrier stiffness transition designes call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

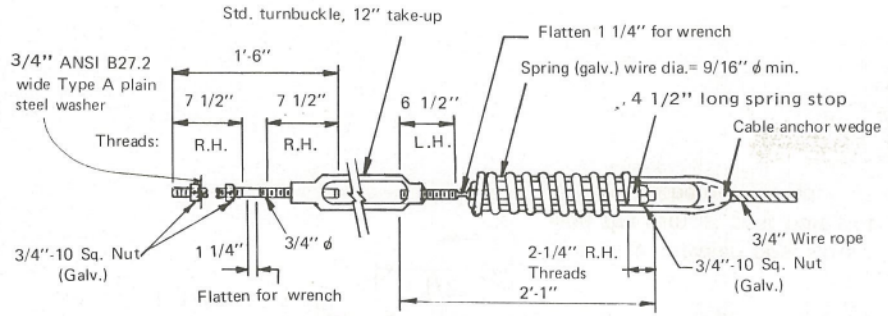
G9 AND MB9
STRUCTURAL SHAPE POST AND BLOCK (ALUMINUM)

HM-TF-13

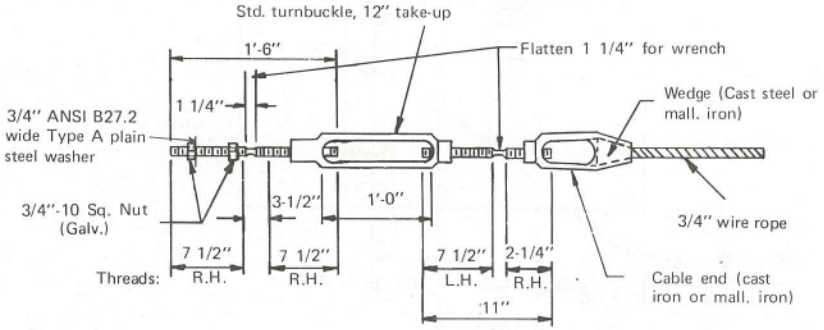
STANDARD

P - 66 - 79

RAIL ELEMENTS

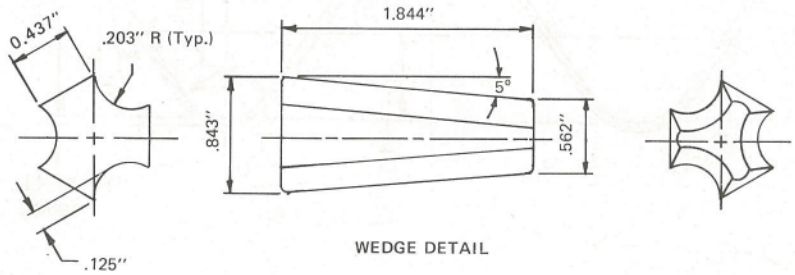


COMPENSATING CABLE END ASSEMBLY



TURNBUCKLE CABLE END ASSEMBLY

3/4" - 3 X 7 WIRE ROPE



WEDGE DETAIL

SPECIFICATIONS

Wire rope and connecting hardware shall conform to the requirements of AASHTO M-30 Class A 3/4-inch rope. Connecting hardware shall develop the full strength of a single cable (25,000 lbs). Cast steel components shall conform to the requirements of AASHTO M-103 (ASTM A27). Malleable iron castings shall conform to the requirements of AASHTO M-106 (ASTM A47).

At all locations where the cable is connected to a cable socket with a wedge type connection, one wire of the wire rope shall be crimped over the base of the wedge to hold it firmly in place.

Compensating devices shall have spring constants of 450 pounds per inch, plus or minus 50 pounds per inch, and permit a travel of 6 inches, plus or minus 1 inch.

Sockets baskets shall be designed for use with the wedge detailed in this standard.

Alternate hardware designs will be considered for approval provided their connection details, for the purpose of maintenance substitutions, are compatible with the details of this standard and their operating characteristics are similar to those of the hardware shown in this standard.

Threads of externally threaded parts shall be UNC, Class 2A Tolerance (A.N.S.I. B1.1). Internally threaded parts shall meet the dimensional requirements of ASTM A563.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

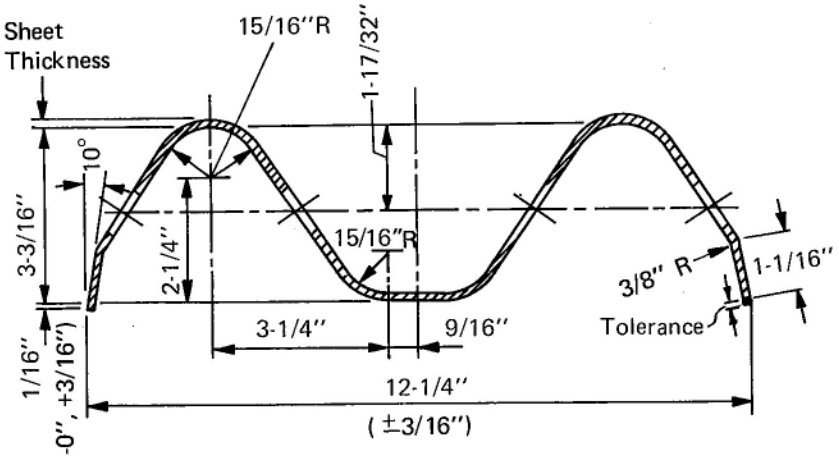
This wire rope and associated connecting hardware are used for the rail elements in the standard Cable Guardrail design G1.

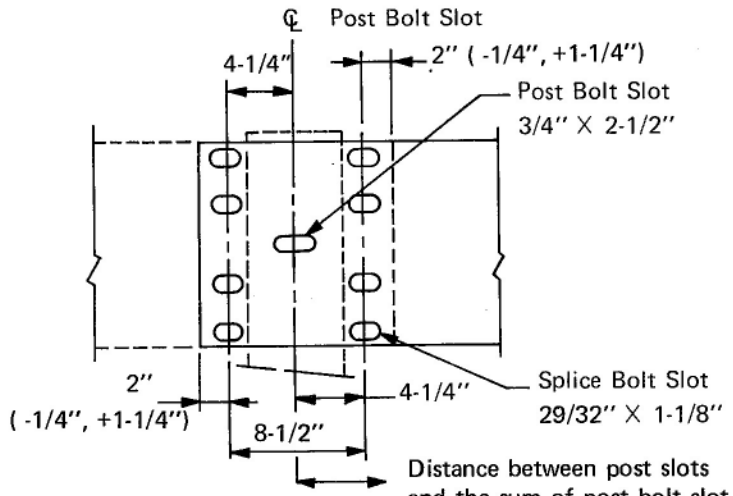
3/4" WIRE ROPE (3 X 7)

HM-TF-13

STANDARD

RE-1-76





SPECIFICATIONS

Corrugated sheet steel beams shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This corrugated sheet steel beam is used as a rail element in standard barrier designs G2, G4, MB2, MB4, MB4B, and BCT.

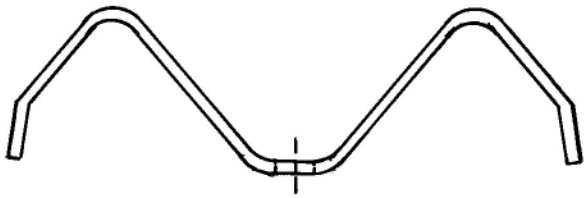
Note: Typical designations are RE-3[2@6'-3"=12'-6"]-73 and RE-3[4@6'-3"=25'-0"]-73.

* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly: RE-3[2@6'-3"=12'-6" Class A, Type 4]-73.

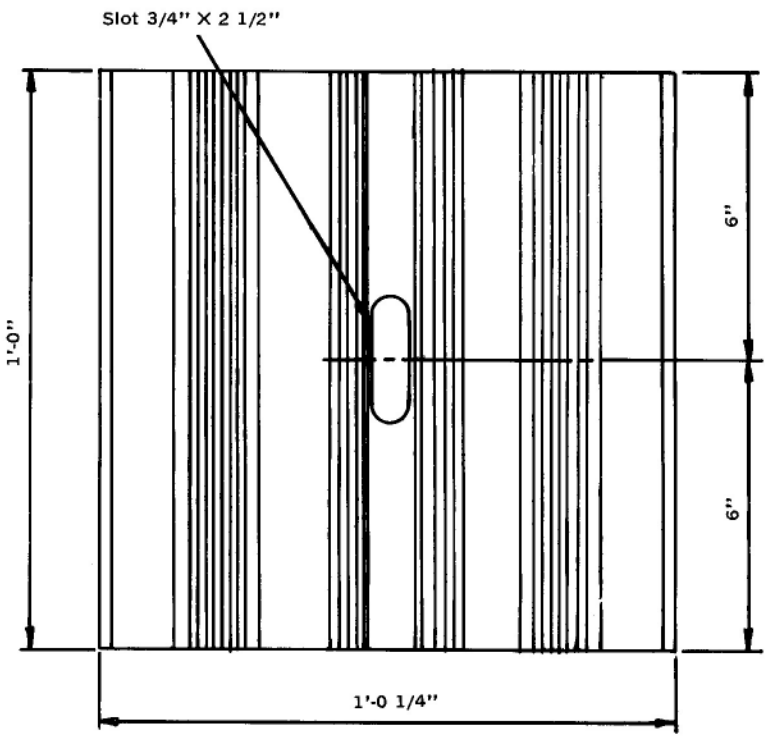
W BEAM

HM-TF-13 STANDARD

RE-3 DESIGNATE POST SLOT CENTERS & SUM OF CENTERS -73



Dimensions same as RE-3-73



SPECIFICATIONS

Back-up plates shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This back-up plate is placed behind rail elements at intermediate steel posts (non-splice posts) in the standard "W" Beam Guardrail and "W" Beam Median Barrier designs G4, MB4, and MB4B.

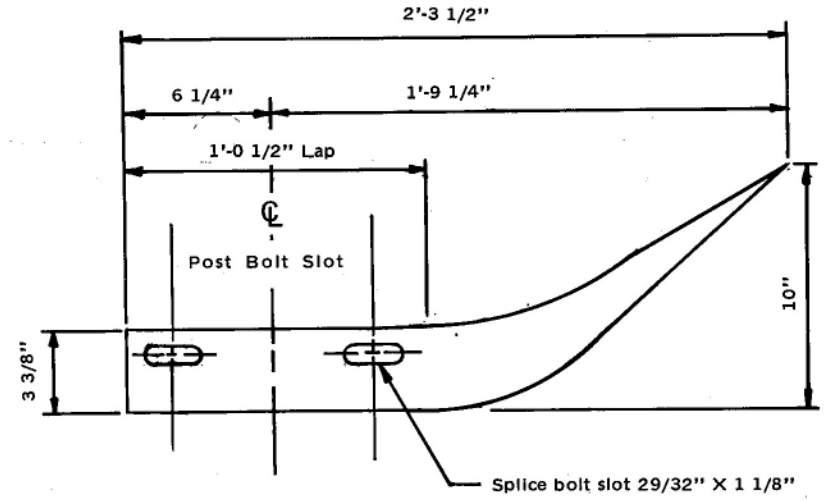
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly: RE-4[Class A, Type 4]-76.

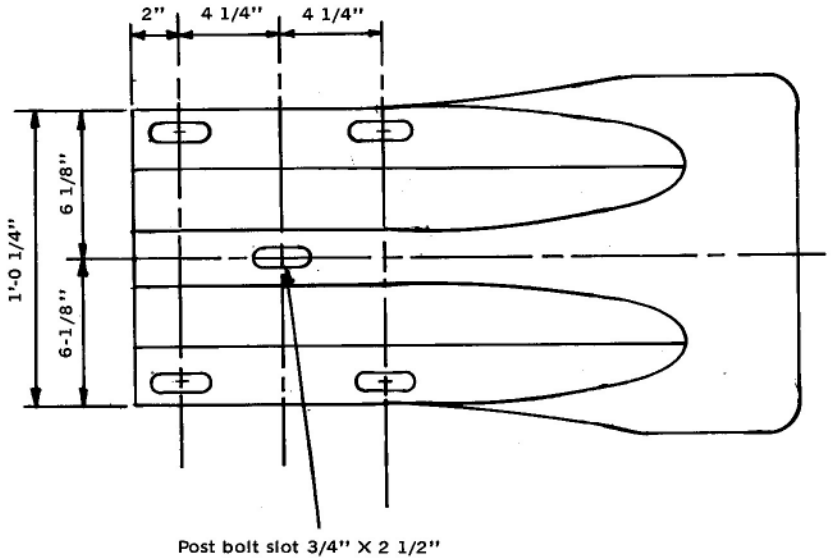
W BEAM BACK–UP PLATE

HM-TF-13

STANDARD

RE-4-76





SPECIFICATIONS

Flared end terminal sections shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This end section is used in some of the terminal configurations employed with the standard "W" Beam barrier designs G2 and G4.

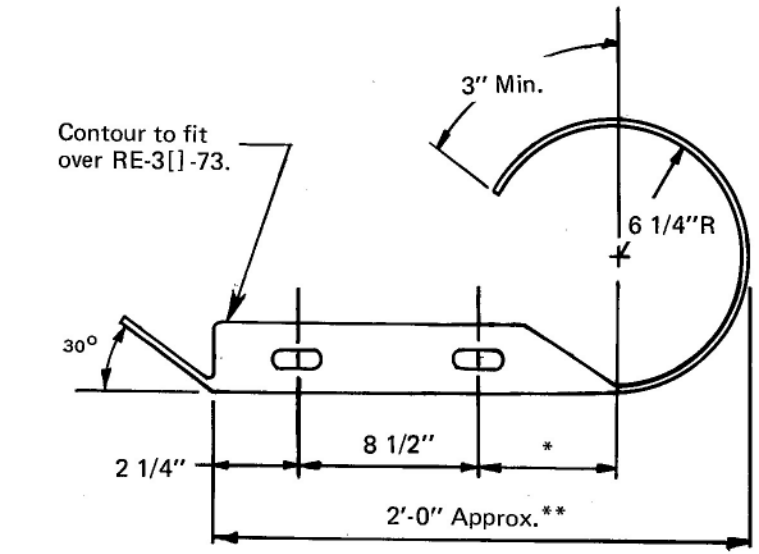
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly: RE-5[Class A, Type 4]-76.

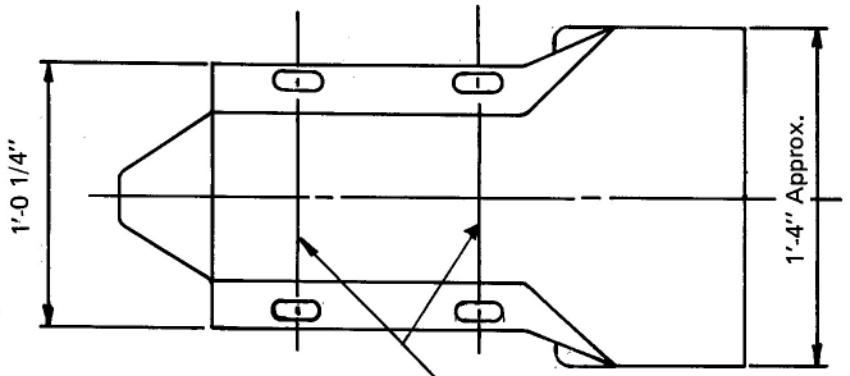
W BEAM END SECTION (FLARED)

HM-TF-13

STANDARD

RE-5-76





* This dimension is 7-1/2" in RE-7-79. If the same dimension is used in this part, it will give an acceptable overall length (**) of approximately 2'-1-1/2".

Splice bolt slot
29/32" X 1 1/8"

SPECIFICATIONS

Curved end terminal sections shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This end section is used in some of the rail element terminal configurations employed with the standard "W" Beam guardrail designs G4.

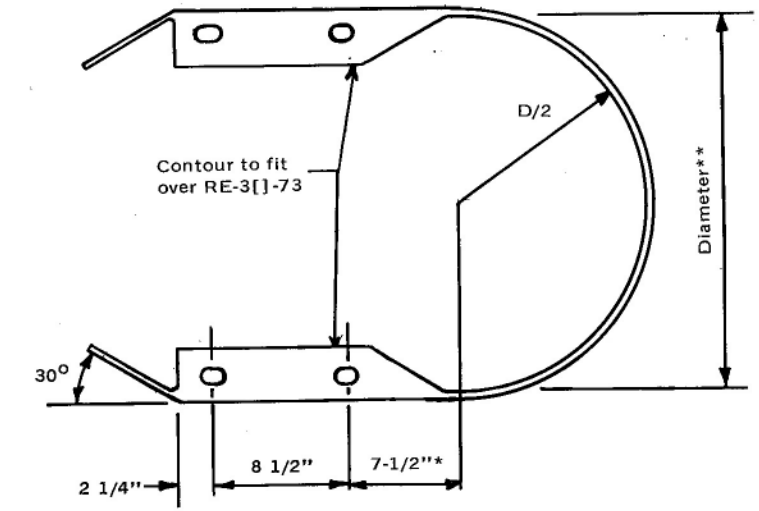
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly:
RE-6[Class A, Type 4]-79.

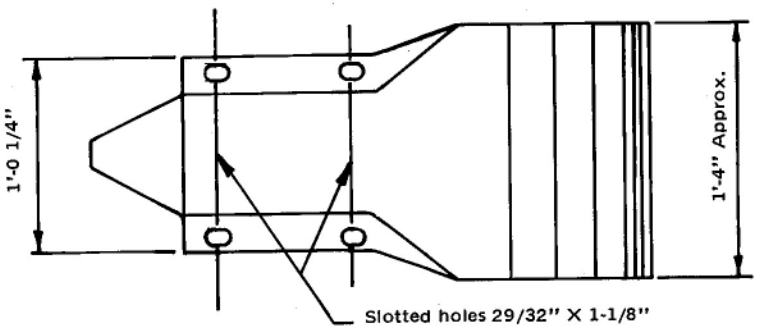
W BEAM END SECTION (ROUNDED)

HM-TF-13

STANDARD

RE-6-79





* This dimension is proposed for use with the RE-7[24]-79 detailed for BCT's in Appendixes A.4 and A.5. Variations would be acceptable for other diameters.

** Standard diameters of 12-1/2", 24", and 30" are suggested.

SPECIFICATIONS

Double face terminal sections shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This end section is used in some of the rail element terminal configurations employed with the standard "W" Beam median barrier designs MB4 and MB4B; and in the standard breakaway cable terminal design as shown in Appendixes A.4 and A.5.

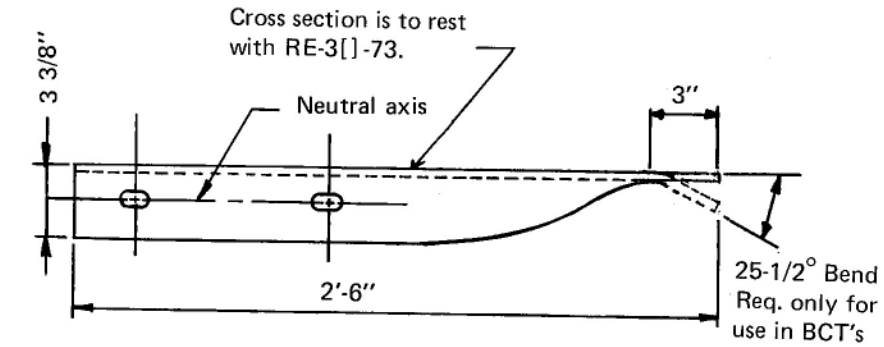
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly:
RE-7[Diameter, Class A, Type 4]-79.

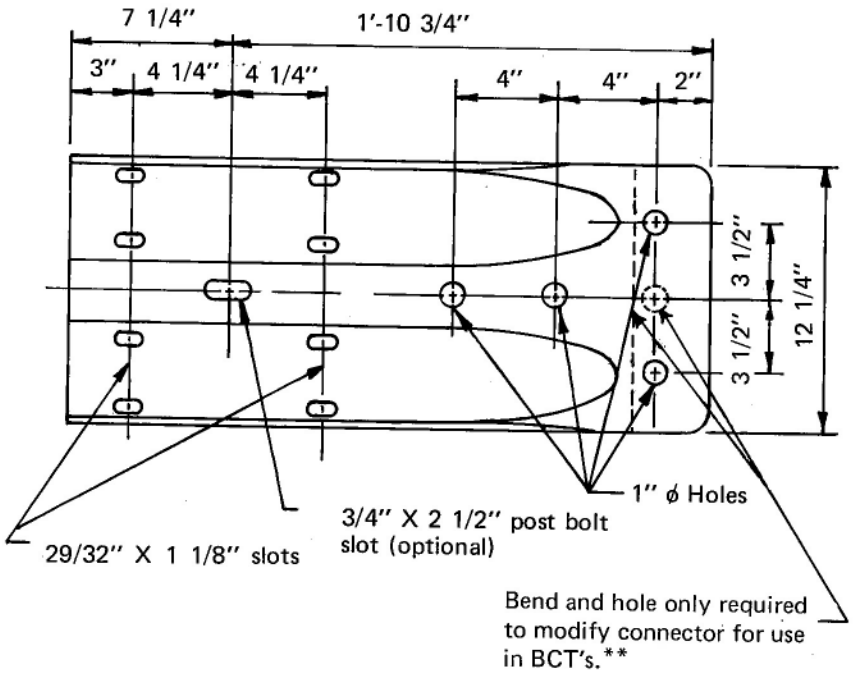
W BEAM END SECTION (BUFFER)

HM-TF-13

STANDARD

RE-7 [DIAMETER] -79





** To obtain BCT details show part number as RE-8[BCT]-79.

SPECIFICATIONS

Terminal connector shall conform to the current requirements of A.A.S.H.T.O. M180, Class B, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This terminal connector is used in some of the rail element terminal configurations employed with the standard "W" Beam barrier designs G2, G4, MB2, MB4, and MB4B; and in the standard breakaway cable terminal design as shown in Appendixes A.4 and A.5.

Note: See F-33-73 for Concrete Insert Anchor Assembly.

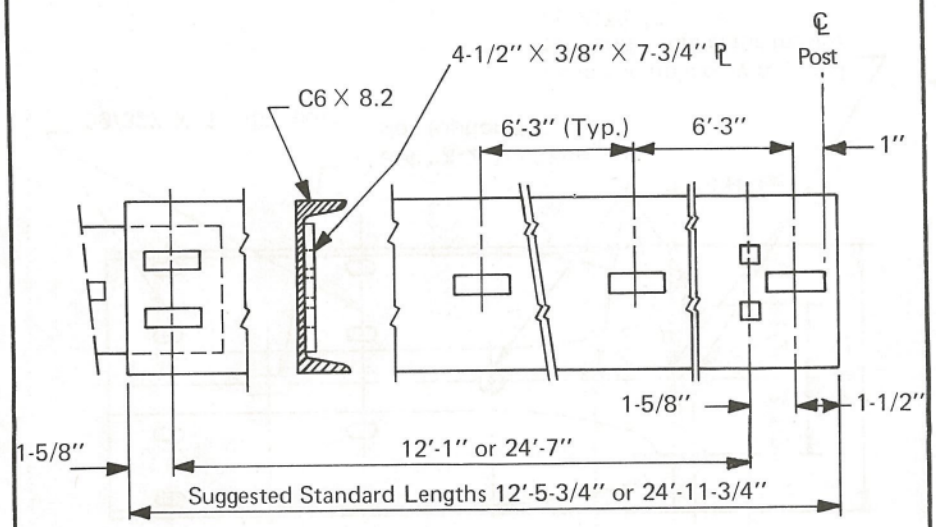
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly:
RE-8[Class B, Type 4]-79.

W BEAM TERMINAL CONNECTOR

HM-TF-13

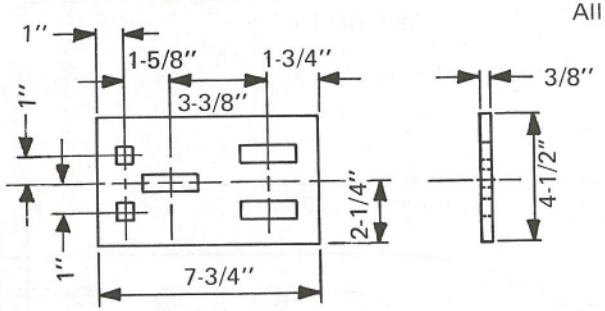
STANDARD

RE-8-79



RUB RAIL

Note: All Slots 11/16" X 2"
All Square Holes 11/16"



SPLICE PL

SPECIFICATIONS

Rub rails and splices shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant rails are requested, in which case rub rails and splices shall conform to A.S.T.M. A588 and shall not be painted or galvanized.

No punching, drilling, or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This channel is used as a rub rail in the standard "W" Beam Guardrail and "W" Beam Median Barrier systems G4, MB4, and MB4B.

Note: This rail may be used as an alternate to RE-72-76.
For splice bolts see F-9[1 1/2"]-73.

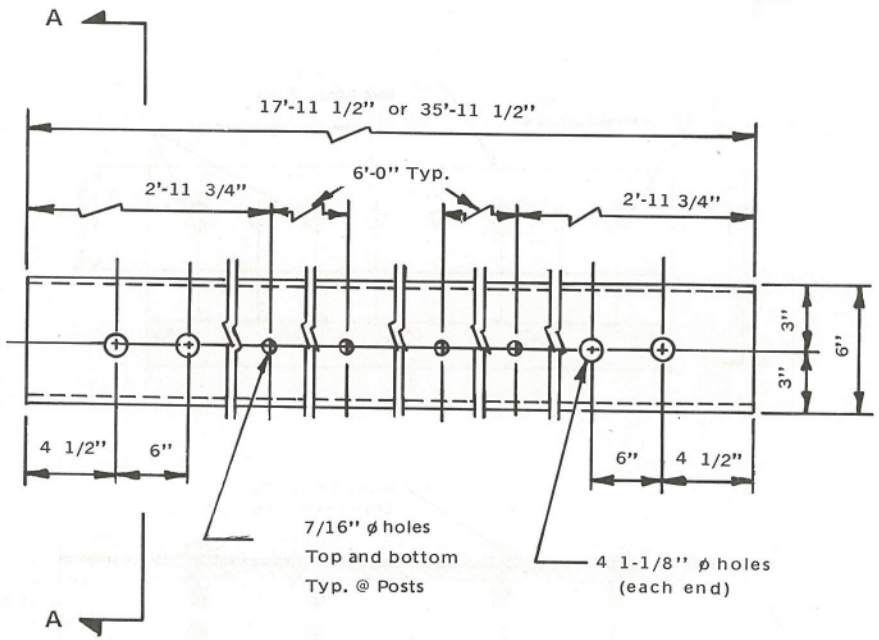
C6 X 8.2 RUB RAIL AND SPLICE PLATE

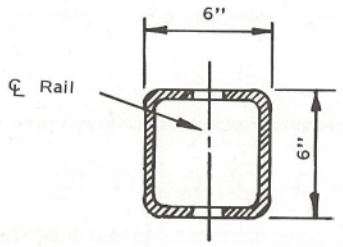
HM-TF-13

STANDARD

RE-9 [LENGTH DESIGNATION]-73

Note: Weld or galvanizing protrusions not permitted on top or bottom inside walls in splice area. (For splice details see RE-11-73.)





SECTION A-A

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below and shall be galvanized in accordance with the requirements of A.S.T.M. A123 except when corrosion resistant steel rail elements are requested, in which case rail elements shall be made of steel meeting the dimensional and mechanical requirements of A.S.T.M. A500, Grade B, as modified below and having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be painted nor galvanized.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

For galvanized rails, tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2" x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from galvanized rail specimens.

The percent shear area will be determined by testing nine specimens, three from each of three sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

No punching, drilling, cutting or welding will be permitted after galvanizing. No Mill transverse welds will be permitted on the rail sections. Rail elements to be used in curves having radii of 715 feet or less shall be shop formed to required curvature.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

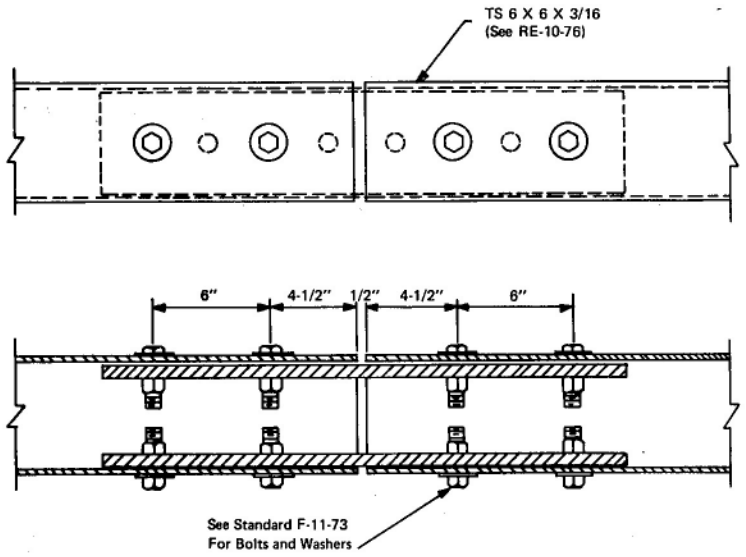
This rail element is used in the standard box beam guardrail design G3.

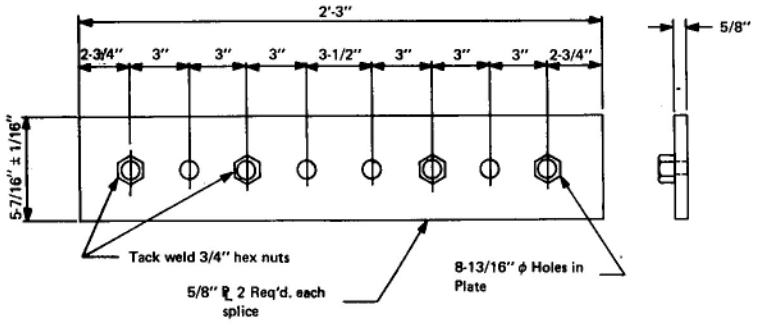
TS 6 X 6 X .188 BOX BEAM

HM-TF-13

STANDARD

RE-10 [LENGTH DESIGNATION] -76





SPECIFICATIONS

Splice plates shall conform to the requirements of A.S.T.M. A36 and nuts shall conform to the requirements of A.S.T.M. A563, Grade A or better, and the plate with the nuts attached shall be galvanized in accordance with the requirements of A.S.T.M. A123 except when corrosion resistant steel is requested. When corrosion resistant steel is requested the plates shall conform to the requirements of A.S.T.M. A588 and the nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A563, Grade A, and be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper. Corrosion resistant plates and nuts shall not be painted or galvanized.

All welding shall conform to the current requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting or welding will be permitted after galvanizing except that an excess zinc deposit on the threads of the nuts shall be removed by tapping or brushing the threads.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

These plates are for splicing the rail elements in the standard box beam guardrail system G3 .

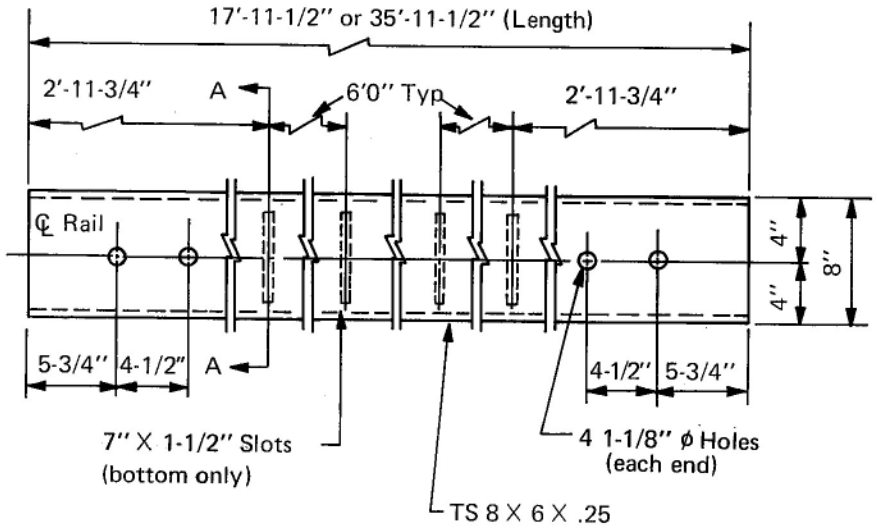
TS 6 X 6 X .188 RAIL SPLICE PLATES

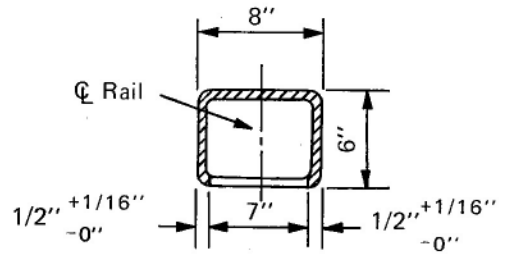
HM-TF-13

STANDARD

RE-11-73

Note: Weld or galvanizing protrusions not permitted on top or bottom inside walls in splice area. (For splice details see RE-13-73)





SECTION A-A

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below and shall be galvanized in accordance with the requirements of A.S.T.M. A123 except when corrosion resistant steel rail elements are requested, in which case rail elements shall be made of steel meeting the dimensional and mechanical requirements of A.S.T.M. A500, Grade B, as modified below and having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper and shall not be painted nor galvanized.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

For galvanized rails, tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2"x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from galvanized rail specimens.

The percent shear area will be determined by testing nine specimens, three from each of three sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

No punching, drilling, cutting or welding will be permitted after galvanizing. No mill transverse welds will be permitted on the rail sections. Rail elements to be used in curves having radii of 1350 feet or less shall be shop formed to required curvature.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

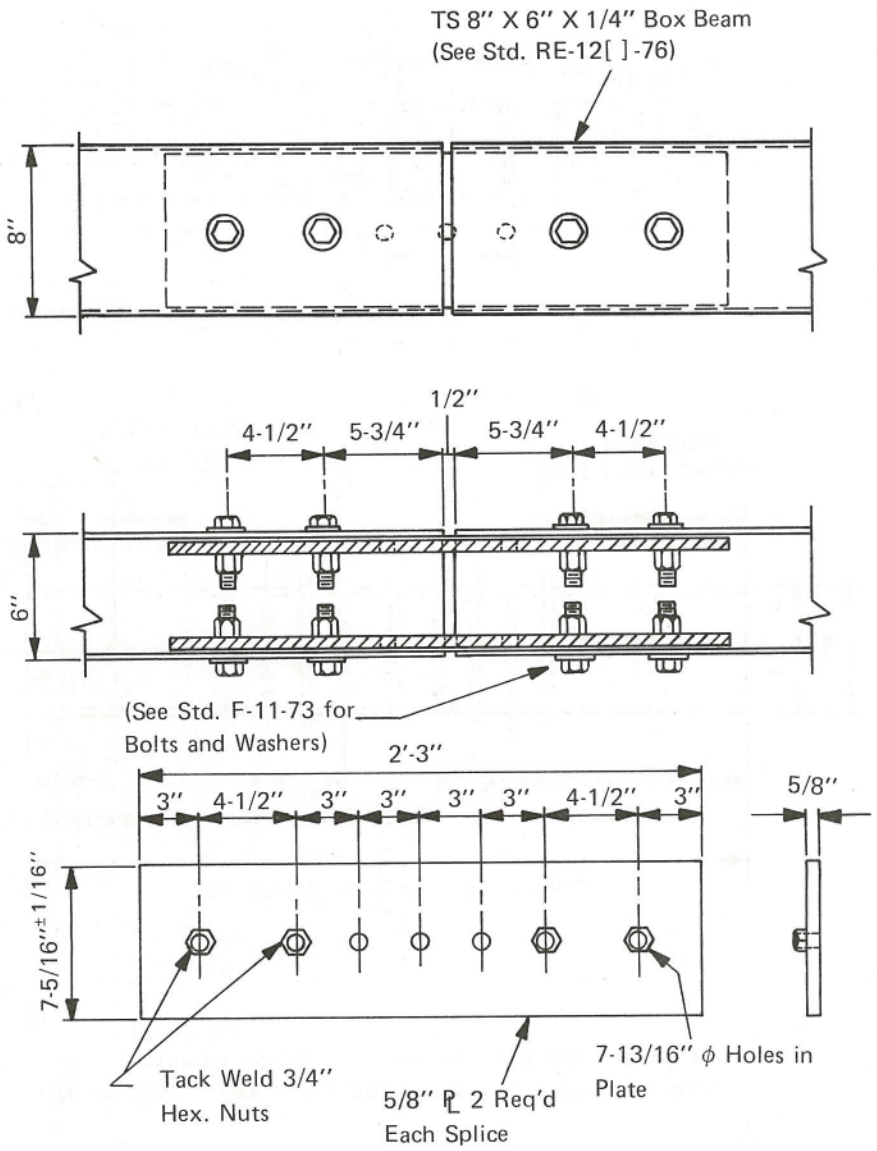
This rail element is used in the standard box beam median barrier designs MB3 and MB3B.

TS 8 X 6 X .25 RAIL

HM-TF-13

STANDARD

RE-12 [LENGTH DESIGNATION] -76



SPECIFICATIONS

Splice plates shall conform to the requirements of A.S.T.M. A36 and nuts shall conform to the requirements of A.S.T.M. A563, Grade A or better, and the plate with the nuts attached shall be galvanized in accordance with the requirements of A.S.T.M. A123 except when corrosion resistant steel is requested. When corrosion resistant steel is requested the plates shall conform to the requirements of A.S.T.M. A588 and the nuts shall conform to or exceed the mechanical requirements of A.S.T.M. A563, Grade A, and be made of steel having an atmospheric corrosion resistance approximately two times that of carbon structural steel with copper. Corrosion resistant plates and nuts shall not be painted or galvanized.

All welding shall conform to the current requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing except that an excess zinc deposit on the threads of the nuts shall be removed by tapping or brushing the threads.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

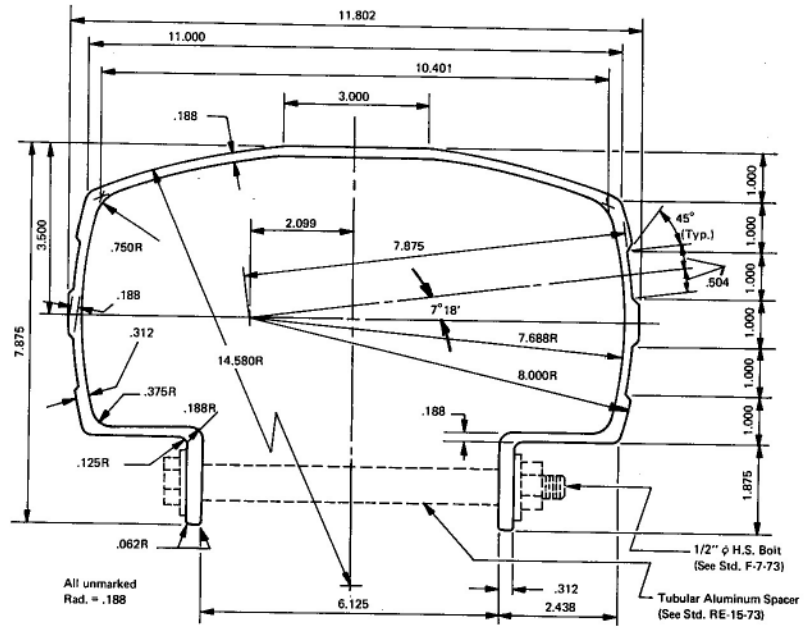
These plates are for splicing the rail elements in the standard box beam median barrier designs MB3 and MB3B.

TS 8 X 6 X .25 RAIL SPLICE PLATES

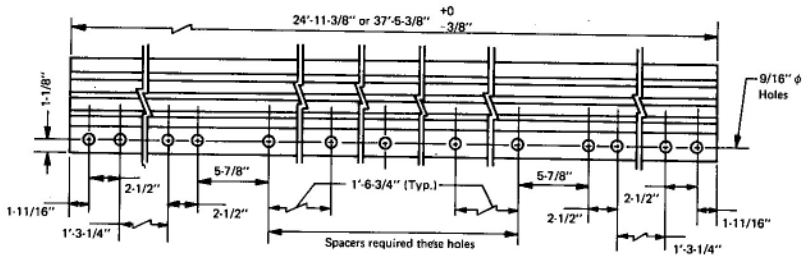
HM-TF-13

STANDARD

RE-13-73



RAIL EXTRUSION CROSS SECTION



RAIL LAYOUT

SPECIFICATIONS

Rails shall conform to A.S.T.M. B221 aluminum alloy extruded bars, rods, shapes, and tubes for alloy/temper 6351-T51; and shall also conform to the Aluminum Association standard tolerances for extruded shapes.

No welds are permitted.

Curved sections shall be constructed as chords with shop or field bent splices as specified.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

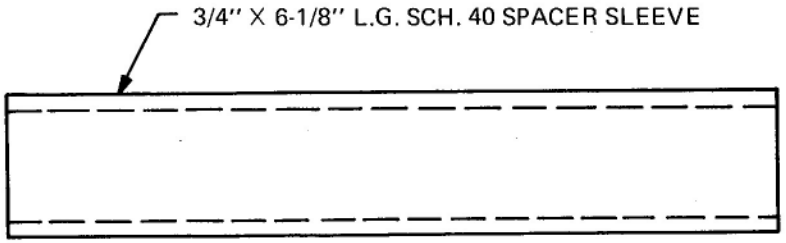
This rail element is used in the standard box beam median barrier (Aluminum) designs MB7 and MB7B.

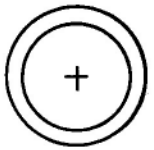
EXTRUDED ALUMINUM MEDIAN RAIL

HM-TF-13

STANDARD

RE-14-73





END VIEW

SPECIFICATIONS

Spacer sleeve shall conform to A.S.T.M. B241 aluminum alloy seamless pipe and seamless extruded tube or B429 aluminum-alloy extruded structural pipe and tube. Alloy/temper 6061-T6 or 6351-T5.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

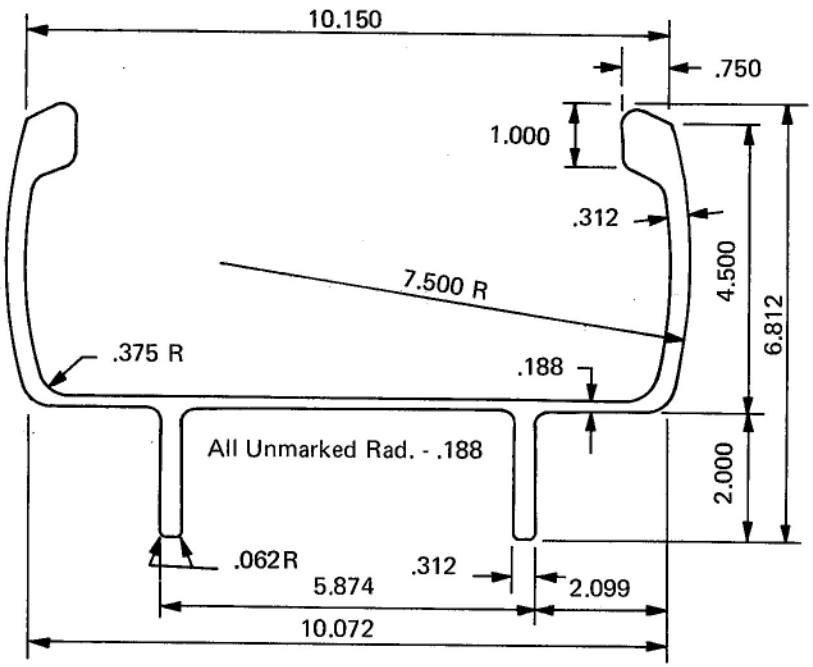
This spacer sleeve is used as a spreader in the opening in the bottom of the extruded aluminum median rail used in the standard box beam median barrier (Aluminum) designs MB7 and MB7B.

SPACER SLEEVE

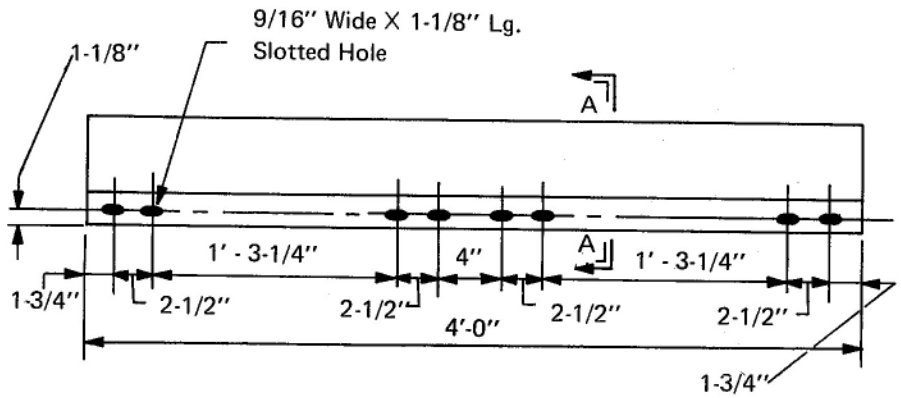
HM-TF-13

STANDARD

RE-15-73



SECTION A-A
SPLICE EXTRUSION



SPECIFICATIONS

Splice shall conform to A.S.T.M. B221 aluminum alloy extruded bars, rods, shapes, and tubes for alloy/temper 6351-T51; and shall also conform to the Aluminum Association standard tolerances for extruded shapes.

No welds are permitted.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

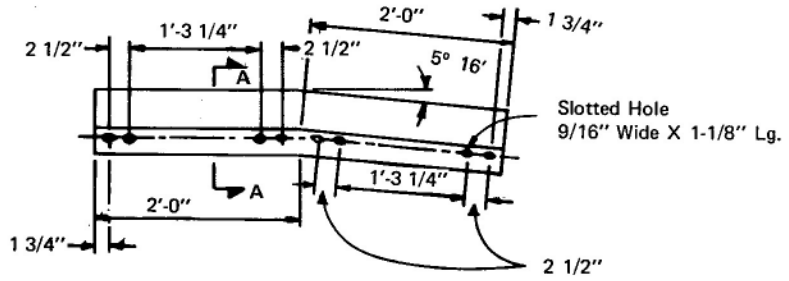
This extraction is used for splicing the rail elements in the standard box beam median barrier (Aluminum) designs MB7 and MB7B.

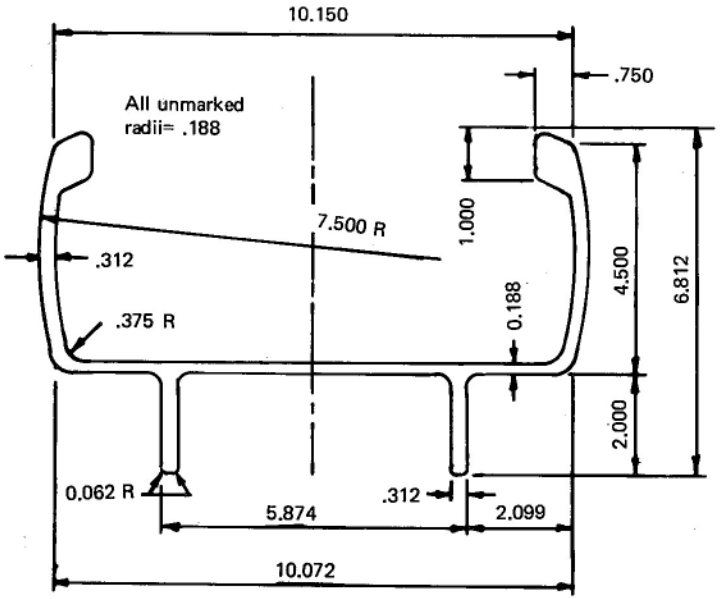
ALUMINUM MEDIAN RAIL SPLICE

HM-TF-13

STANDARD

RE-16-73





SECTION A-A
SPLICE EXTRUSION

SPECIFICATIONS

Splice shall conform to A.S.T.M. B221 aluminum alloy extruded bars, rods, shapes, and tubes for alloy/temper 6351-T51 and shall also conform to the Aluminum Association standard tolerances for extruded shapes.

No welds are permitted.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

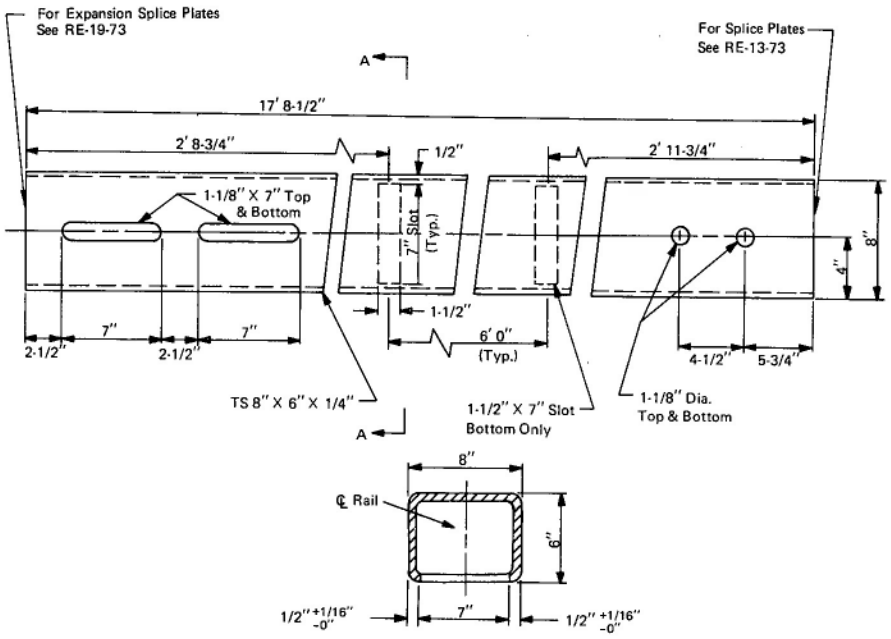
This bent extrusion is used in some of the terminal designs used with the standard Box Beam Median Barrier (Aluminum) design MB7.

ALUMINUM MEDIAN RAIL TERMINAL SPLICE

HM-TF-13

STANDARD

RE-17-76



SECTION A-A

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below and shall be galvanized in accordance with A.S.T.M. A123.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

Tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2"x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from specimens.

The percent shear area will be determined by testing nine specimens, three from each of three sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

No punching, drilling, cutting or welding will be permitted after galvanizing. No mill transverse welds will be permitted on the rail sections. Rail elements to be used in curves having radii of 1350 feet or less shall be shop formed to the required curvature.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

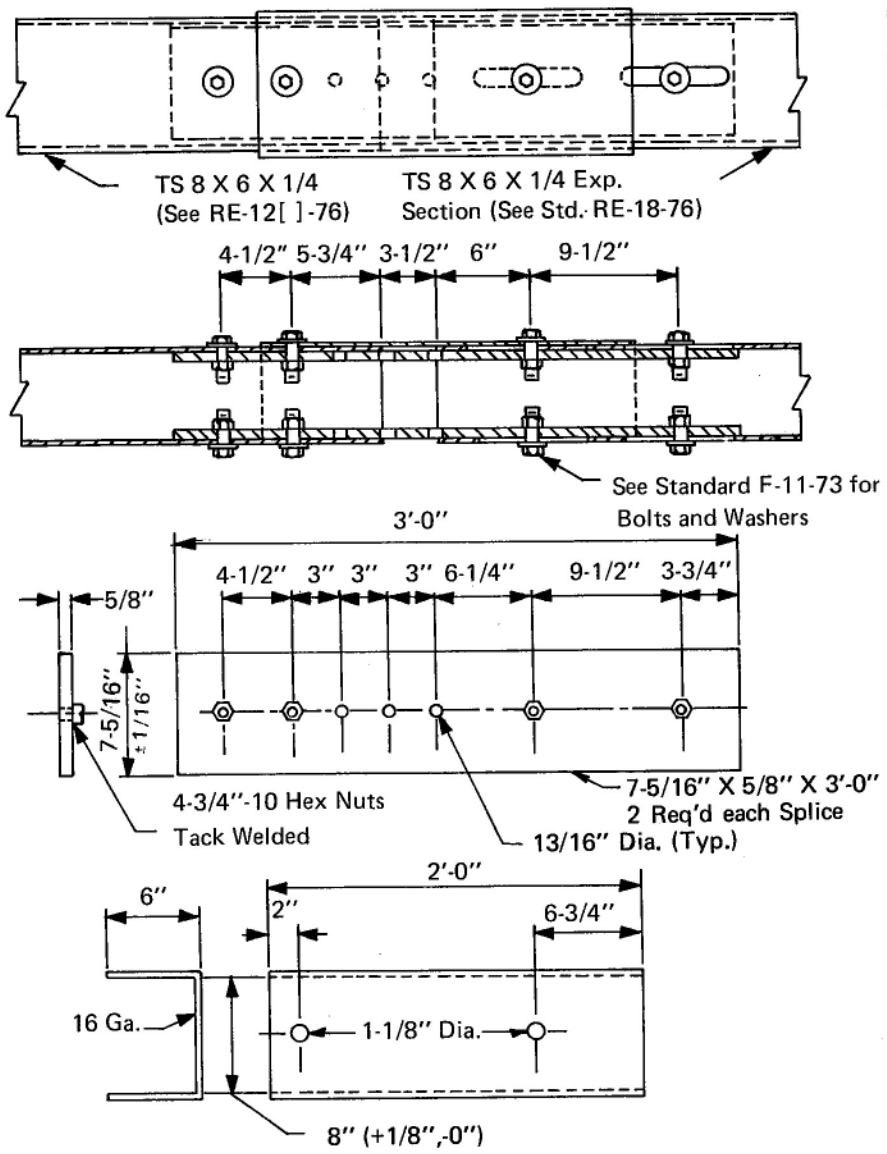
This rail element is used at bridge expansion joints in median barrier designs MB3 and MB3B.

TS 8 X 6 X .25 RAIL EXPANSION SECTION

HM-TF-13

STANDARD

RE - 18 - 76



SPECIFICATIONS

Splice plates and splice cover shall conform to the requirements of A.S.T.M. A36 and nuts to the requirements of A.S.T.M. A563, Grade A or better. Splice plates with nuts attached and splice cover shall be galvanized in accordance with the requirements of A.S.T.M. A123.

All welding shall conform to the current requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing except that an excess zinc deposit on the threads of the nut shall be removed by tapping or brushing the threads.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

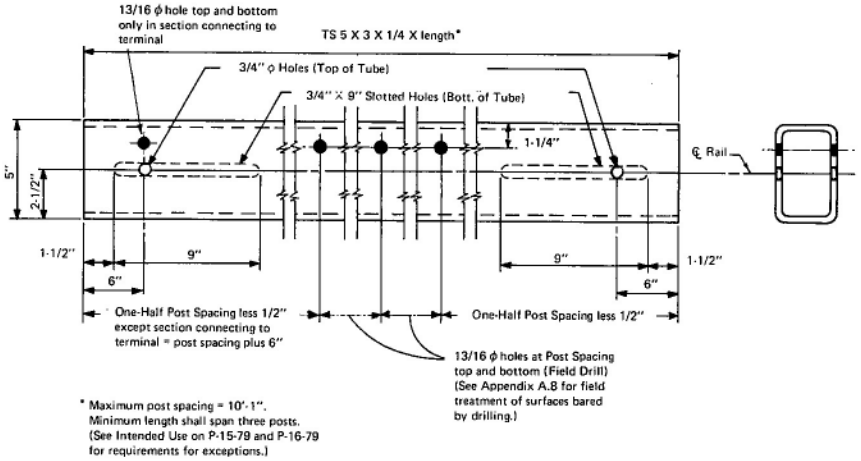
This splice assembly is used at bridge expansion joints in median barrier designs MB3 and MB3B.

TS 8 X 6 X .25 RAIL EXPANSION SPLICE PLATES W/COVER

HM-TF-13

STANDARD

RE-19-73



* Maximum post spacing = 10'-1". Minimum length shall span three posts. (See Intended Use on P-15-79 and P-16-79 for requirements for exceptions.)

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below and shall be galvanized in accordance with A.S.T.M. A123.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

Tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2" x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from specimens.

The percent shear area will be determined by testing nine specimens, three from each of three sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

No punching, drilling, cutting or welding will be permitted after galvanizing, except as otherwise indicated. No mill transverse welds will be permitted on the rail sections. Rail elements to be used in curves having radii of 1000 feet or less shall be shop formed to the required curvature.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This rail element is used in bridge railing designs BR1 (Steel) Type A and BR2 (Steel) Type A.

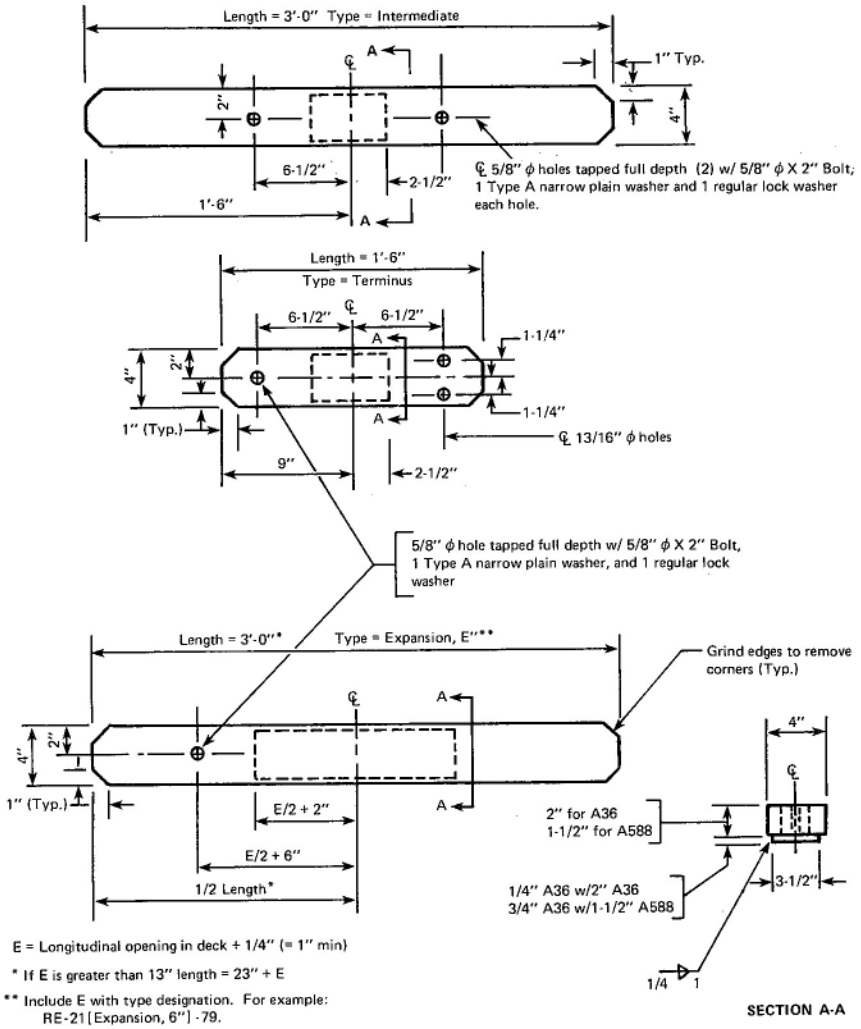
Note: An example designation is RE-20[29'-11"]-79. (Three 10-foot post spaces minus 1".)

TS 5 X 3 X .25 RAIL

HM-TF-13

STANDARD

RE-20 [LENGTH DESIGNATION] -79



E = Longitudinal opening in deck + 1/4" (= 1" min)

* If E is greater than 13" length = 23" + E

** Include E with type designation. For example: RE-21[Expansion, 6"]-79.

SPECIFICATIONS

Splice plates shall meet the requirements of A.S.T.M. A36 or A588 and be galvanized in accordance with the requirements of A.S.T.M. A123.

All welding shall meet the current requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

Threads in tapped holes shall be tapped oversize by a minimum diametral amount of 0.015 inches to the requirements of A.N.S.I. B1.1 UNC Class 2A to mate with galvanized bolts.

Splice bolts shall meet the requirements of A.S.T.M. A307 and meet the dimensional requirements of A.N.S.I. B1.1 UNC Class A. Washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.1 and B27.2. Bolts and washers shall be galvanized in accordance with the requirements of A.S.T.M. A153.

No punching, drilling, cutting or welding will be permitted after galvanizing except that an excess zinc deposit on the threads of the tapped holes shall be removed by tapping or brushing the threads.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

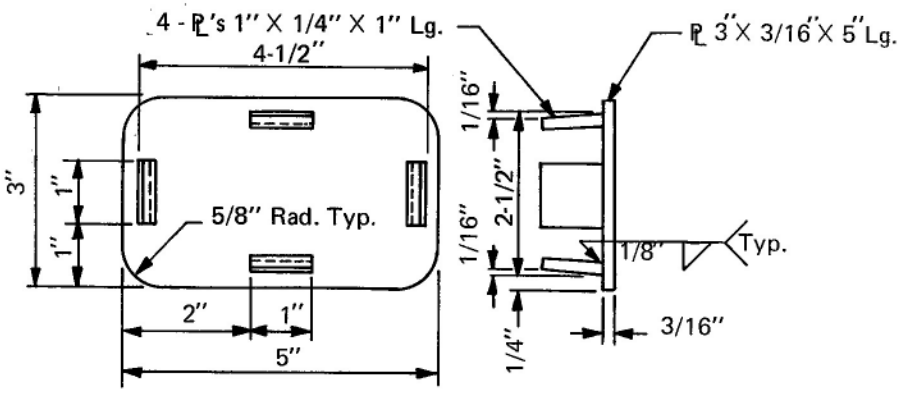
This bar is for splicing TS5 X 3 X 0.25 rails in bridge railing designs BR1 (Steel) TypeA and BR2 (Steel) Type A.

TS 5 X 3 X 0.25 RAIL SPLICE

HM-TF-13

STANDARD

RE-21 TYPE -79



END CAP

SPECIFICATIONS

Plates shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with the requirements of A.S.T.M. A123.

All welding shall conform to the current requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

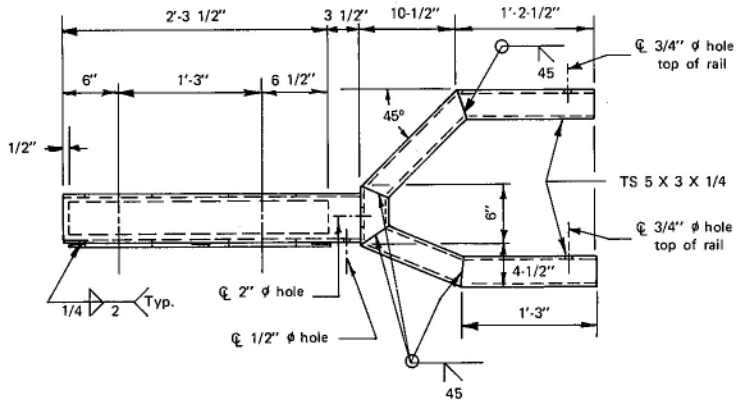
This end cap is to be used as part of bridge railing designs BR1 (Steel) Type A and BR2 (Steel) Type A.

TS 5 X 3 X .25 RAIL END CAP

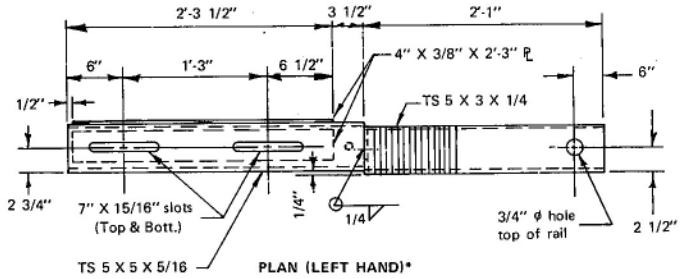
HM-TF-13

STANDARD

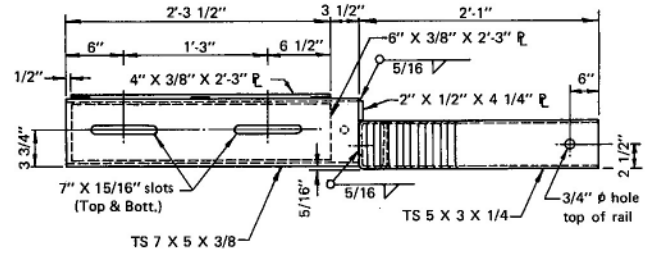
RE-22-73



TYPICAL ELEVATION



PLAN FOR CONNECTION TO G3 GUARDRAIL (LEFT HAND)*



PLAN FOR CONNECTION TO MB3 AND MB3B MEDIAN BARRIERS (LEFT HAND)*

*Right hand end assembly similar with approach rail connection to right of post.

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below, the shim plates shall conform to A.S.T.M. A36, and the entire assembly shall be galvanized in accordance with A.S.T.M. A123.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

Tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2" x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from specimens.

The percent shear area will be determined by testing nine specimens, three from each of three sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

All welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1. No punching, drilling, cutting or welding will be permitted after galvanizing. No mill transverse weld will be permitted on rail sections.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

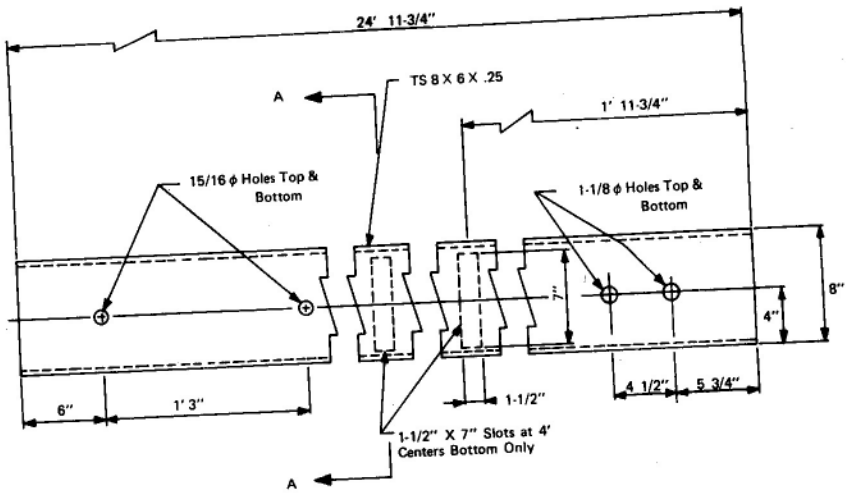
INTENDED USE

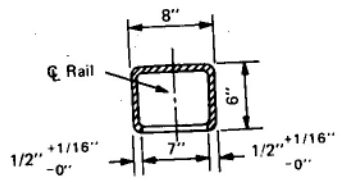
This rail assembly is used in the transition between bridge railing design BR2 (Steel) Type A and guardrail or median barrier designs G3, MB3, or MB3B.

Note: An example designation is RE-23[G3L.H.]-79.

BR2 (STEEL) TYPE A RAIL END ASSEMBLY

HM-TF-13			
STANDARD	RE-23	APPR. BARRIER TYPE R. or L. HAND	- 79





SECTION A-A

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below and shall be galvanized in accordance with A.S.T.M. A123.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

Tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2" x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from specimens.

The percent shear area will be determined by testing nine specimens, three from each of three sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

No punching, drilling, cutting or welding will be permitted after galvanizing. No mill transverse welds will be permitted on the rail sections. Rail elements to be used in curves having radii of 1350 feet or less shall be shop formed to the required curvature.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

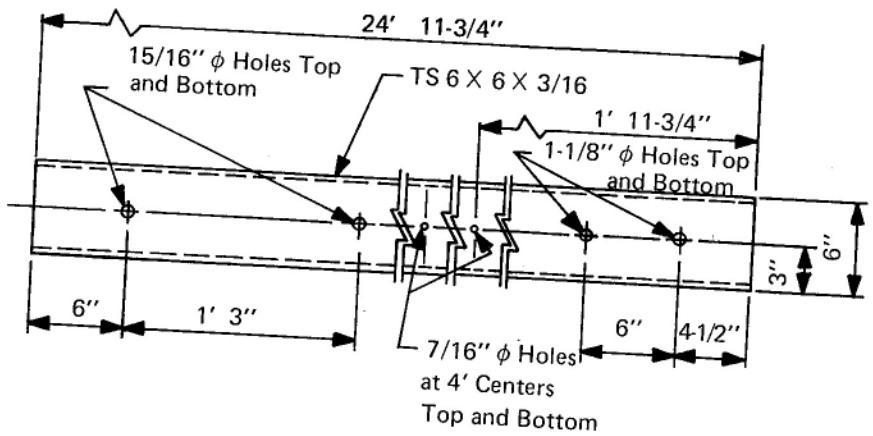
This rail element is for fastening median barrier design MB3 to the rail end assembly of BR2 (Steel) Type A.

TS 8 X 6 X 0.25 RAIL SPECIAL SECTION

HM-TF-13

STANDARD

RE-25-76



SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below and shall be galvanized in accordance with A.S.T.M. A123.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

Tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of −18°C on 2" x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from specimens.

The percent shear area will be determined by testing nine specimens, three from each of three sides not containing a weld. The shear areas of the three specimens from the side with the lowest average shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

No punching, drilling, cutting or welding will be permitted after galvanizing. No mill transverse welds will be permitted on the rail sections. Rail elements to be used in curves having radii of 715 feet or less shall be shop formed to the required curvature.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

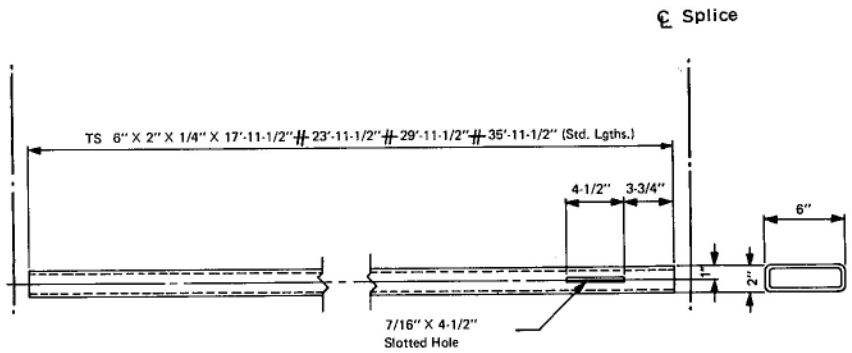
This rail element is for fastening guardrail design G3 to the rail end assemblie of BR2 (Steel) Type A.

TS 6 X 6 X .188 RAIL SPECIAL SECTION

HM-TF-13

STANDARD

RE-26-76



STANDARD RAIL

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below and shall be galvanized in accordance with A.S.T.M. A123.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

Tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2" x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from specimens.

The percentage shear area will be determined by testing eight specimens from the 6-inch side or sides not containing a weld. (Four specimens from each 6-inch side if both are unwelded.) The shear area of the specimen with the lowest shear area and the shear area of the specimen with the highest shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

No punching, drilling, cutting or welding will be permitted after galvanizing. No mill transverse welds will be permitted on the rail sections. Rail elements to be used in curves having radii of 1000 feet or less shall be shop formed to the required curvature.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

The rail element is used in bridge railing designs BR1 (Steel) Type B and BR2 (Steel) Type B.

Note: It is suggested that this rail be mounted with a rail clamp, F--17-73. Designers wishing to weld studs directly to rails see Standard F-17-73 for stud and stud welding specifications.

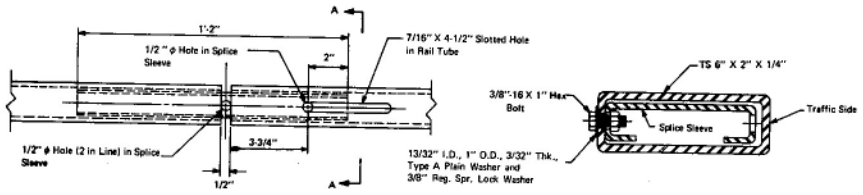
Example designation is RE-31[23' - 11-1/2"] -76.

TS 6 X 2 X .25 RAIL

HM-TF-13

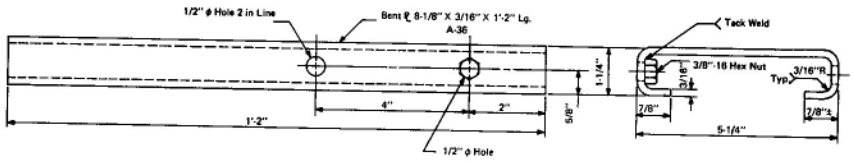
STANDARD

RE-31 [LENGTH DESIGNATION] -76



RAIL SPLICE ASSEMBLY

SECTION A–A



RAIL SPLICE SLEEVE

SPECIFICATIONS

Splice sleeve shall meet the requirements of A.S.T.M. A36; nuts shall meet the requirements of A.S.T.M. A563, Grade A or better; and the sleeve with the nuts attached shall be galvanized in accordance with the requirements of A.S.T.M. A123.

Splice bolts shall meet the requirements of A.S.T.M. A307. Plain washers shall be made of steel and shall meet the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers. Spring lock washers shall meet the requirements of A.N.S.I. B27.1 Regular Spring Lock Washers. Bolts and washers shall be galvanized in accordance with the requirements of A.S.T.M. A153.

All welding shall meet the current requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

No punching, drilling, cutting, or welding will be permitted after galvanizing except that an excess zinc deposit on the threads of the nuts shall be removed by tapping or brushing the threads.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

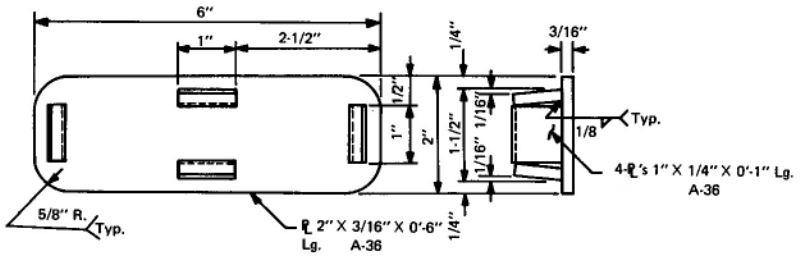
This sleeve is for splicing rails in bridge railing designs BR1 (Steel) Type B and BR2 (Steel) Type B.

TS 6 X 2 X .25 RAIL SPLICE

HM-TF-13

STANDARD

RE-32-73



END CAP

SPECIFICATIONS

Plates shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with the requirements of A.S.T.M. A123.

All welding shall conform to the current requirements contained in the American Welding Society Structural Welding Code, AWS D1.1.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

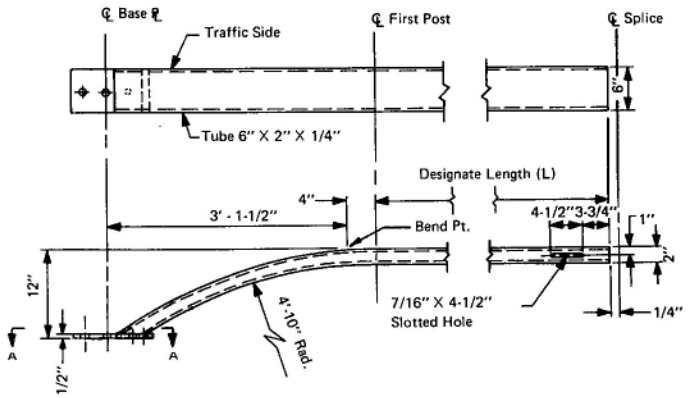
This end cap is to be used as part of bridge railing designs BR1 (Steel) Type B and BR2 (Steel) Type B.

TS 6 X 2 X .25 RAIL END CAP

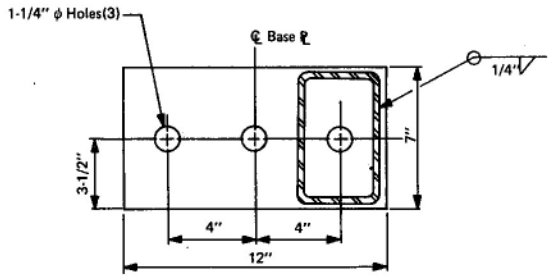
HM-TF-13

STANDARD

RE-33-73



END RAIL (RIGHT HAND)*



SECTION A-A

* Left hand assembly same except slotted holes on opposite face of rail.

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below, the anchor plates shall confirm to A.S.T.M. A36, and the entire assembly shall be galvanized in accordance with A.S.T.M. A123.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

Tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2" x 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from specimens.

The percentage shear area will be determined by testing eight specimens from the 6-inch side or sides not containing a weld. (Four specimens from each 6-inch side if both are unwelded.) The shear area of the specimen with the lowest shear area and the shear area of the specimen with the highest shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

All welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1. No punching, drilling, cutting or welding will be permitted after galvanizing. No mill transverse welds will be permitted on rail sections.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This assembly is used in bridge railing desigh BR1 (Steel) Type B.

Note: It is suggested that this rail be mounted with a rail clamp, F-17-73. Designers wishing to weld studs directly to rails see Standard F-17-73 for stud and welding specifications.

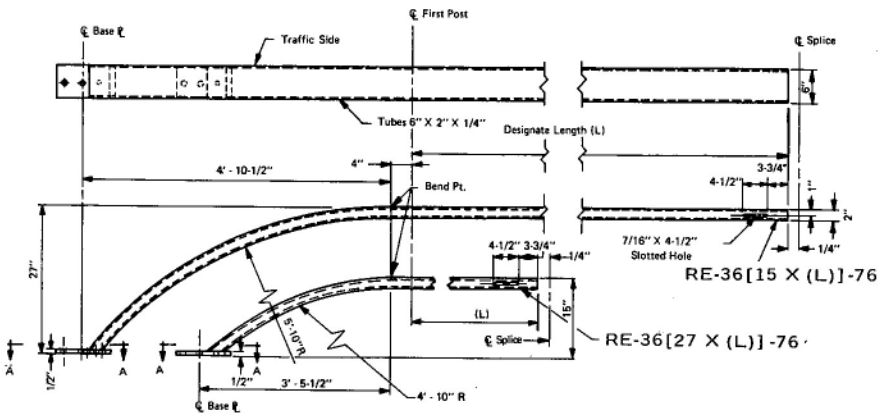
Example designation is RE-34[17'-11-3/4"]-76.

TS 6 X 2 X 0.25 RAIL END ASSEMBLY (12")

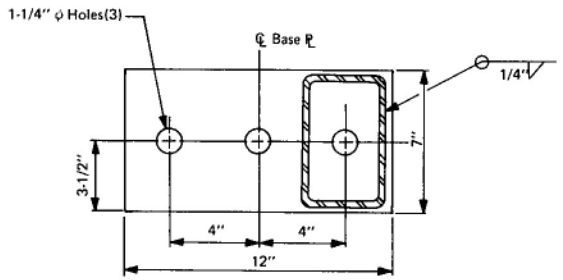
HM-TF-13

STANDARD

RE-34 [LENGTH DESIGNATION] -76



END RAIL (RIGHT HAND)*



SECTION A-A

* Left hand assembly same except slotted holes on opposite face of rail.

SPECIFICATIONS

Rail elements shall conform to the requirements of A.S.T.M. A500, Grade B, as modified below, the anchor plates shall conform to A.S.T.M. A36 and the entire assembly shall ve galvanized in accordance with A.S.T.M. A123.

Rail elements from all heats supplied shall be tested in accordance with A.S.T.M. E436, Standard Method for Drop-Weight Tear Tests of Ferritic Steels, except as modified below.

Tests shall be done after all galvanizing and associated operations have been performed. Testing shall be conducted at a temperature of $-18^{\circ}C$ on 2" X 9" specimens supported to achieve a 7" span. Galvanizing shall not be removed from specimens.

The percentage shear area will be determined by testing eight specimens from the 6-inch side or sides not containing a weld. (Four specimens from each 6-inch side if both are unwelded.) The shear area of the specimen with the lowest shear area and the shear area of the specimen with the highest shear area shall be disregarded and the final average based on the remaining six specimens. If the average percent shear area falls below 50 the material represented by these tests shall be rejected, except that if the average shear area is 30 or greater one retest at a sampling frequency three times that of the first test and with no samples excluded in calculating the average will be permitted. Material not having an average percent shear area of 50 upon retest shall be rejected. (See Appendix A.6 for discussion of specification.)

To facilitate acceptance and rejection of material, the manufacturer of the structural shape shall, before galvanizing, identify the product with the steel heat number, or some number that is traceable to the heat number, and his own unique identification code. The identification method shall be such that it can be read after the structural shape is galvanized. Identification marks shall be on only one face of the section, shall be no more than four feet apart, and shall not extend into the curved surface at the corners. The face marked shall not be the traffic face or its opposite.

All welding shall conform to the current requirements of the American Welding Society Structural Welding Code, AWS D1.1. No punching, drilling, cutting or welding will be permitted after galvanizing. No mill transverse welds will be permitted on rail sections.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This assembly is used in bridge railing design BR2 (Steel) Type B.

Note: It is suggested that this rail be mounted with a rail clamp, F-17-73. Designers wishing to weld studs directly to rails see Standard F-17-73 for stud and stud welding specifications.

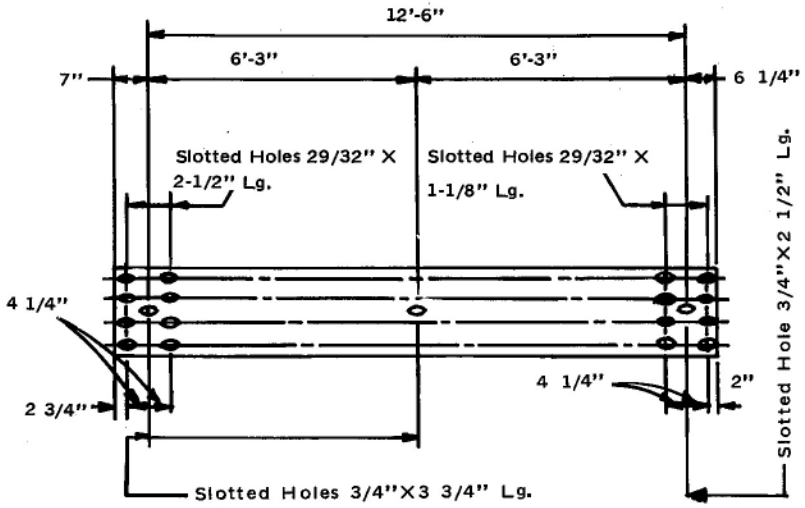
Example designation is RE-35[15" X 17" - 11-3/4"] - 76.

TS 6 X 2 X 0.25 RAIL END ASSEMBLIES (15" AND 27")

HM-TF-13

STANDARD

RE-35 [DESIGNATE HEIGHT AND LENGTH] -76



"W" BEAM EXPANSION SECTION

SPECIFICATIONS

Corrugated sheet steel beam shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2, except as modified in this standard. *

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This rail element is used to accommodate longitudinal movement where special treatment is required in the standard Median Barrier design MB4B.

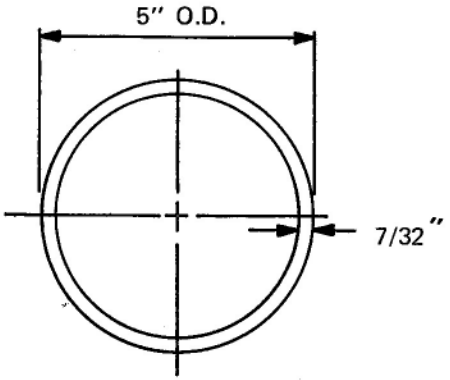
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly:
RE-38 [Class A, Type 4] -76.

W BEAM EXPANSION SECTION

HM-TF-13

STANDARD

RE-38-76



SECTIONAL PROPERTIES

Area	3.286 sq. in.
Weight	3.87 lb/ft
Moment of Inertia	9.4089 $in.^4$
Section Modulus	3.7636 $in.^3$

SPECIFICATIONS

Rail elements shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

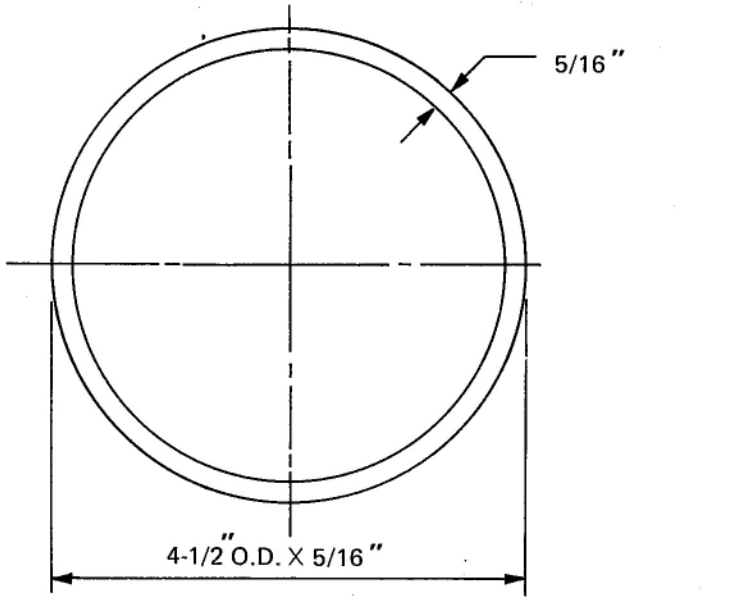
This tubular section is used as a rail element in bridge railing designs BR1 (Aluminum) Type A, BR2A (Aluminum) Type A, BR2 (Aluminum) Type A, and BR3A (Aluminum) Type A.

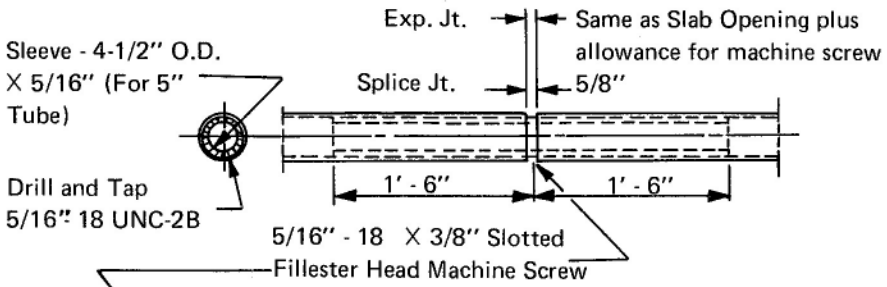
5" O.D. TUBULAR RAIL

HM-TF-13

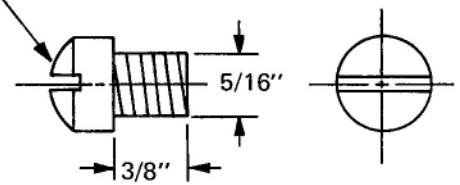
STANDARD

RE-39-73





SPLICE & EXP. JOINT–ALUMINUM RAILS



SPECIFICATIONS

Rail splice shall meet the requirements of A.S.T.M. B221, alloys 6061-T6 or 6351-T5 (minimum elongation 10%); and shall be threaded to meet the dimensional requirements of A.N.S.I. B1.1, UNC, Class 2B Tolerance.

The machine screw shall meet the requirements of A.S.T.M. A276, Type 316 Condition A, and the dimensional requirements of A.N.S.I. B18.6.3.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

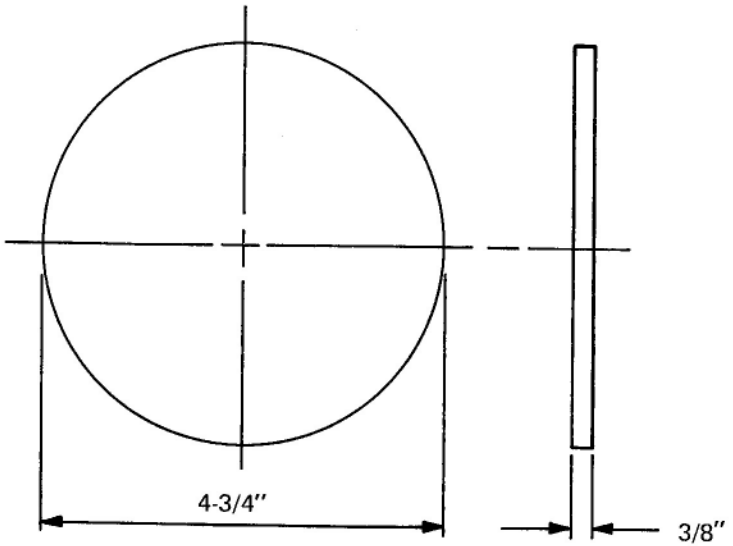
This tubular section is used to splice 5-inch O.D. rails in bridge railing designs BR1 (Aluminum) Type A, BR2A (Aluminum) Type A, BR2 (Aluminum) Type A, and BR3A (Aluminum) Type A.

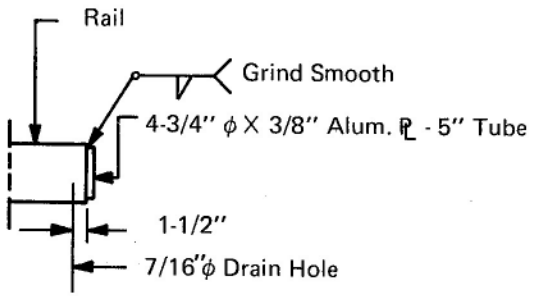
5" O.D. TUBULAR RAIL SPLICE

HM-TF-13

STANDARD

RE-40-73





RAIL END CAP

SPECIFICATIONS

Rail cap shall conform to A.S.T.M. B209, alloy 6061-T6 (minimum elongation 10%).

Welding shall conform to the requirements contained in Section 1.5.5 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

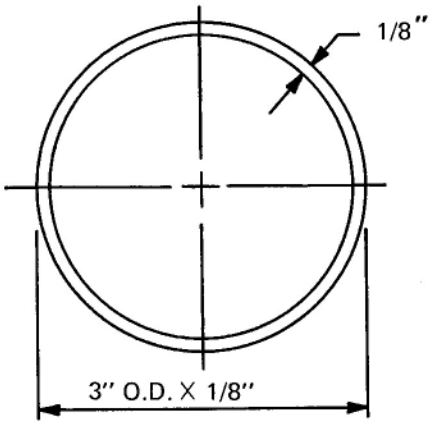
This plate disc is used as an end cap for traffic rail elements in bridge railing designs BR1 (Aluminum) Type A, BR2A (Aluminum) Type A, BR2 (Aluminum) Type A, and BR3A (Aluminum) Type A.

5" O.D. TUBULAR RAIL END CAP

HM-TF-13

STANDARD

RE-41-73



SECTIONAL PROPERTIES

Area	1.129 sq. in.
Weight	1.33 lb/ft.
Moment of Inertia	1.1687 $in.^4$
Section Modulus	0.7791 $in.^3$

SPECIFICATIONS

Rail elements shall conform to A.S.T.M. B221 alloy 6061-T6 or 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

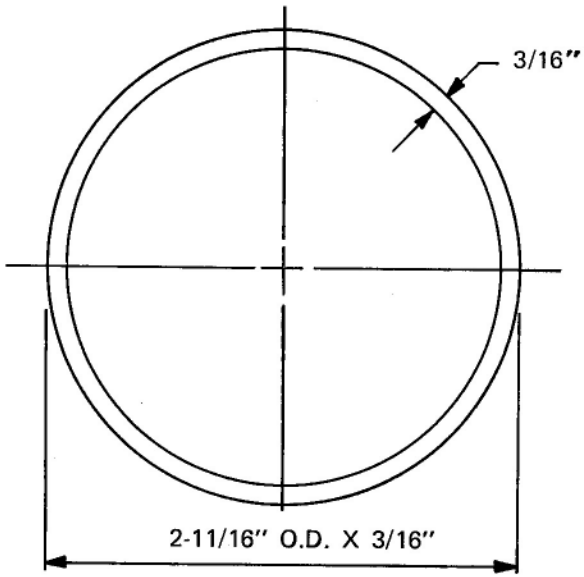
This tubular section is used as a hand rail element in BR2A (Aluminum) Type A, and BR3A (Aluminum) Type A.

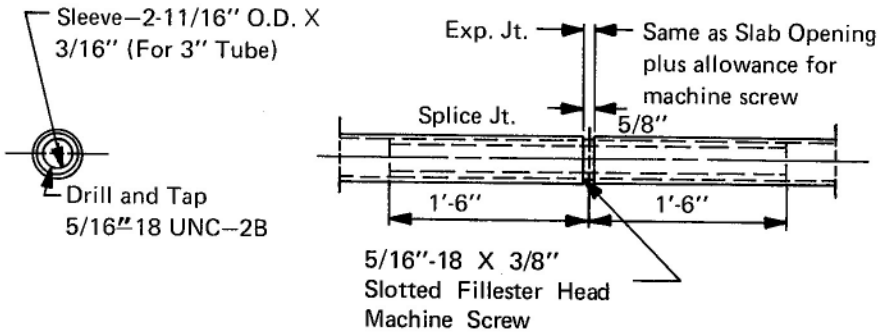
3" O.D. TUBULAR RAIL

HM-TF-13

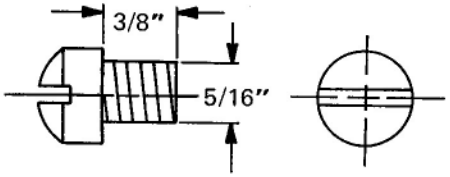
STANDARD

RE-42-73





SPLICE & EXP. JOINT—ALUMINUM RAILS



5/16"-18 X 3/8" SLOTTED FILLESTER HEAD MACHINE SCREW

SPECIFICATIONS

Rail splice shall meet the requirements of A.S.T.M. B221, alloys 6061-T6 or 6351-T5 (minimum elongation 10%) and shall be threaded to meet the dimensional requirements of A.N.S.I. B1.1 Class 2B Tolerance.

The machine screw shall meet the requirements of A.S.T.M. A276, Type 316 Condition A, and the dimensional requirements of A.N.S.I. B18.6.3.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

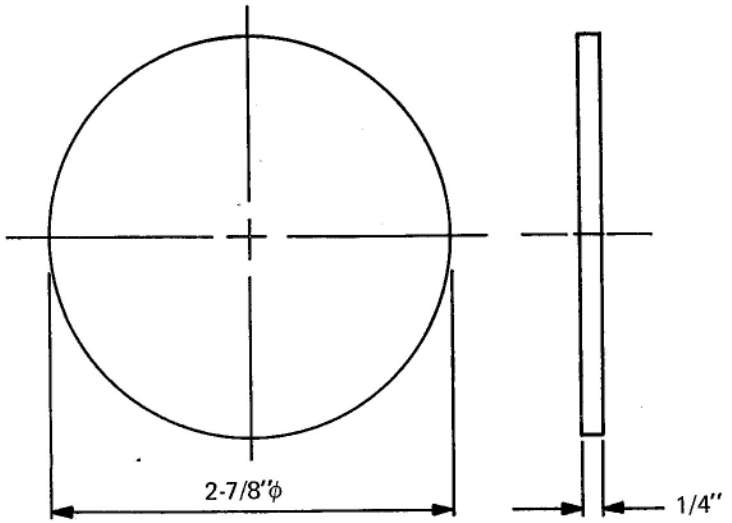
This tubular section is used to splice 3-inch O.D. rails in bridge railing designs BR2A (Aluminum) Type A and BR3A (Aluminum) Type A.

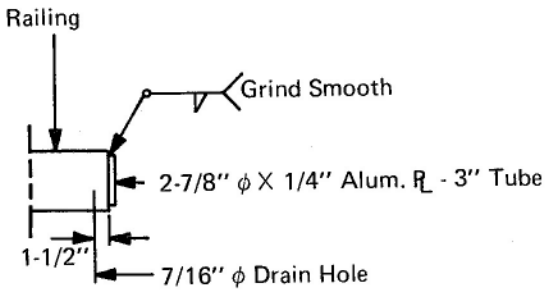
3" O.D. TUBULAR RAIL SPLICE

HM-TF-13

STANDARD

RE-43-73





RAIL END CAP

SPECIFICATIONS

End cap shall conform to A.S.T.M. B209 alloy 6061-T6 (minimum elongation 10%).

Welding shall conform to the requirements contained in Section 1.5.5 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

INTENDED USE

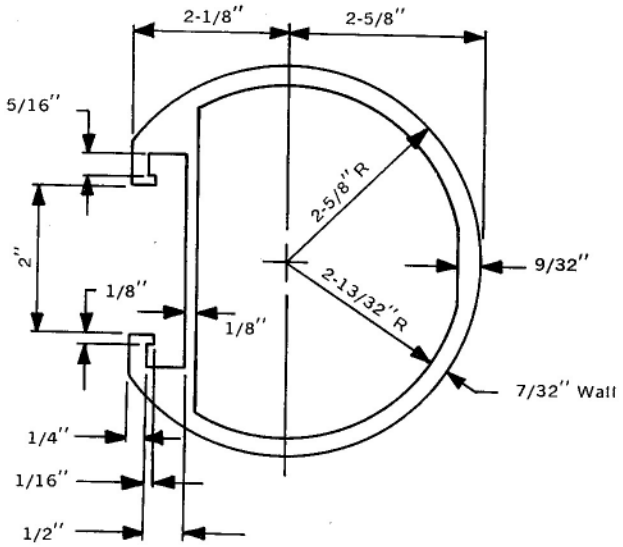
This plate disc is used as an end cap for hand rail elements in bridge railing designs BR2A (Aluminum) Type A and BR3A (Aluminum) Type A.

3" O.D. TUBULAR RAIL END CAP

HM-TF-13

STANDARD

RE-44-73



RAIL DETAIL

SECTIONAL PROPERTIES

Area		3.894 sq. in.
Weight		4.673 lb. per ft.
Moment of Inertia	Ixx	10.026 $in.^4$
	Iyy	12.368 $in.^4$
Section Modulus	Sxx max	4.681 $in.^3$
	min	3.843 $in.^3$
	Syy	4.711 $in.^3$

SPECIFICATIONS

Rail elements shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Rails shall be continuous for not less than 2 and preferably 4 panels.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

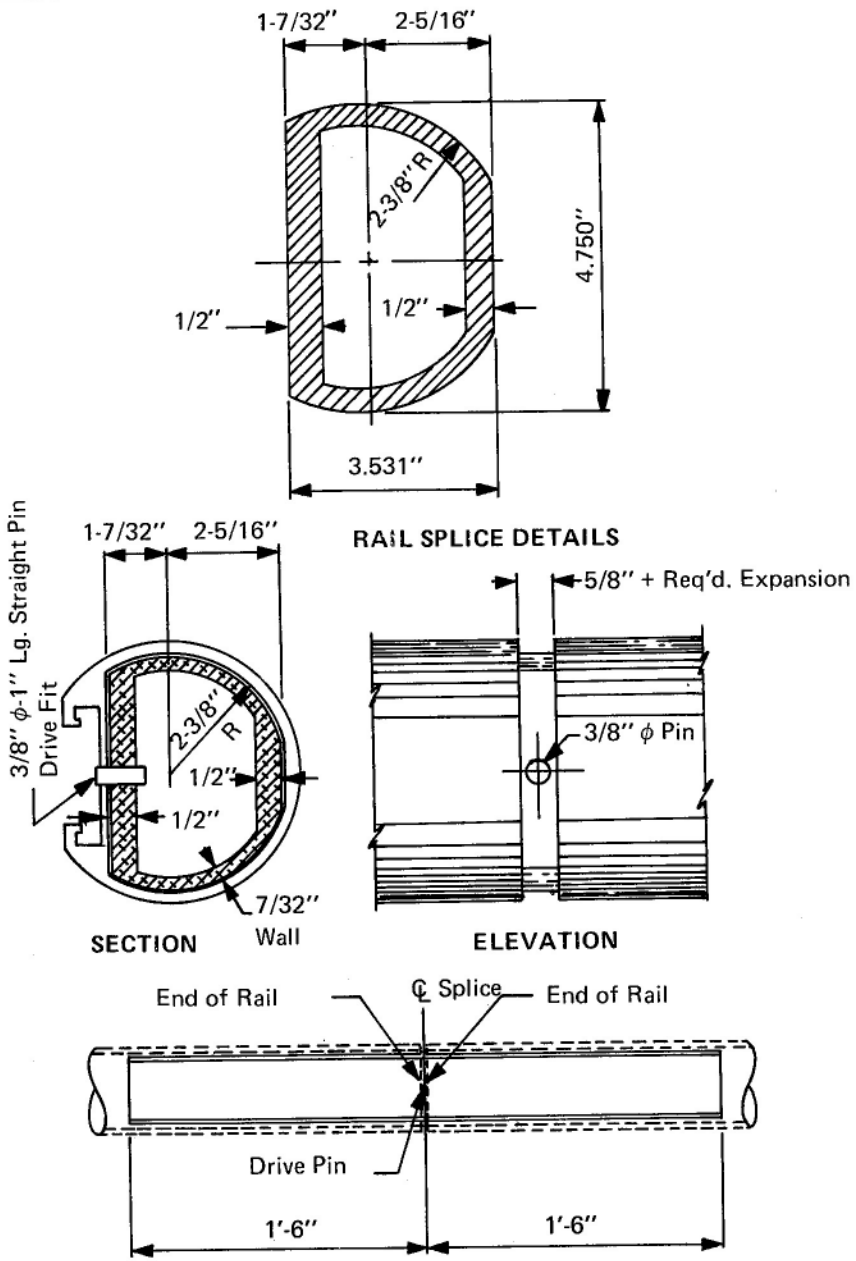
This tubular section is used as a traffic rail element in bridge railing designs BR1 (Aluminum) Type B, BR2 (Aluminum) Type B, and BR3A (Aluminum) Type B.

5-1/4" TUBULAR RAIL

HM-TF-13

STANDARD

RE-45-73



SPECIFICATIONS

Splice tube shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Drive pin shall meet the strength requirements of A.S.T.M. A276, Type 316 Condition A, and the dimensional requirements of A.N.S.I. B5.20.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

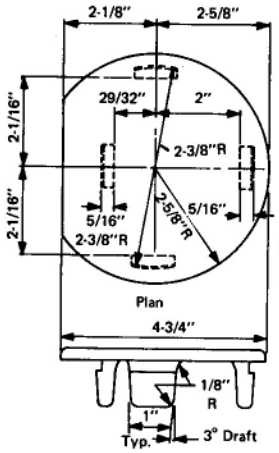
This tubular section is used to splice traffic rail elements in bridge railing designs BR1 (Aluminum) Type B, BR2 (Aluminum) Type B and BR3A (Aluminum) Type B.

5-1/4" TUBULAR RAIL SPLICE

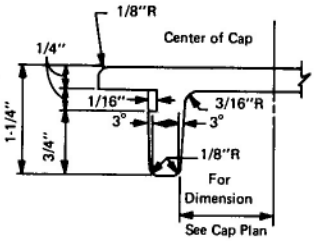
HM-TF-13

STANDARD

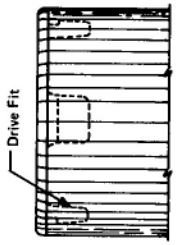
RE-46-73



ELEVATION



SECTION AT PRONG



CAP IN PLACE

RAIL CAP DETAILS

SPECIFICATIONS

Cast end caps shall conform to ASTM B26, alloy 356-F.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

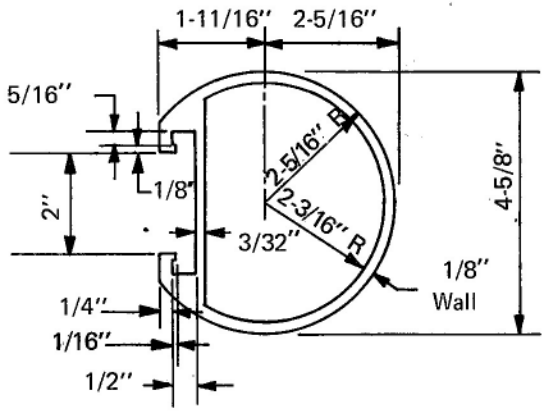
This casting is used as an end cap on traffic rails in bridge railing designs BR1 (Aluminum) Type B, BR2 (Aluminum) Type B and BR3A (Aluminum) Type B.

5-1/4" TUBULAR RAIL END CAP

HM-TF-13

STANDARD

RE-47-73



RAIL DETAIL

SECTIONAL PROPERTIES

Area	1.847 sq. in.
Weight	2.217 lb/ft
Moment of Inertia Ixx	3.401 $in.^4$
Iyy	4.771 $in.^4$
Section Modulus Sxx max	1.865 $in.^3$
min	1.565 $in.^3$
Syy	2.064 $in.^4$

SPECIFICATIONS

Rail elements shall conform to A.S.T.M. B221 alloy 6061-T6 or 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

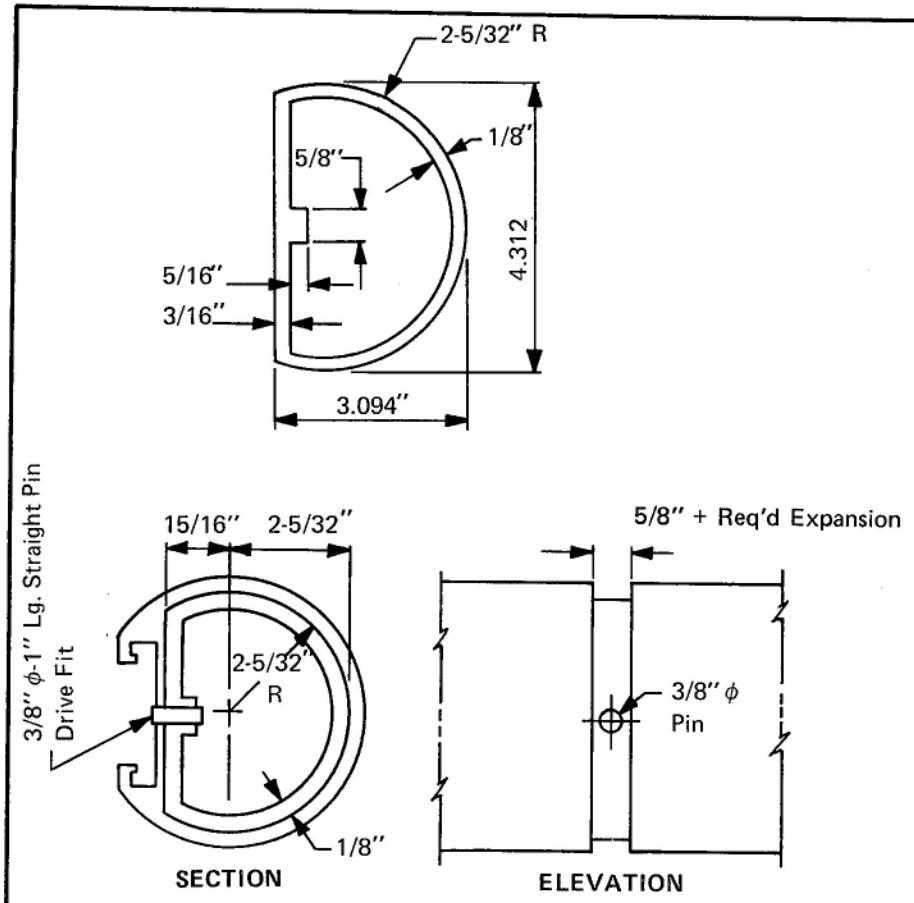
This tubular section is used as a hand rail element in bridge railing design BR3A (Aluminum) Type B.

4-5/8" TUBULAR RAIL

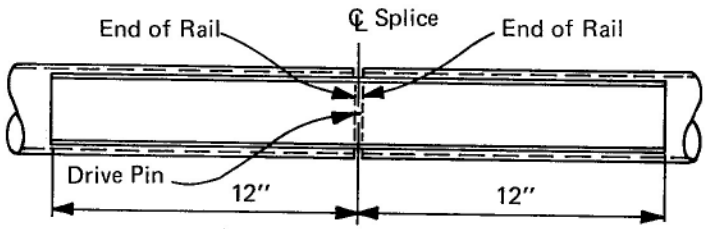
HM-TF-13

STANDARD

RE-48-73



RAIL SPLICE DETAILS



SPECIFICATIONS

Splice tube shall conform to A.S.T.M. B221 alloy 6061-T6 or 6351-T5 (minimum elongation 10%).

Drive pin shall meet the strength requirements of A.S.T.M. A276, Type 316 Condition A, and the dimensional requirements of A.N.S.I. B5.20.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

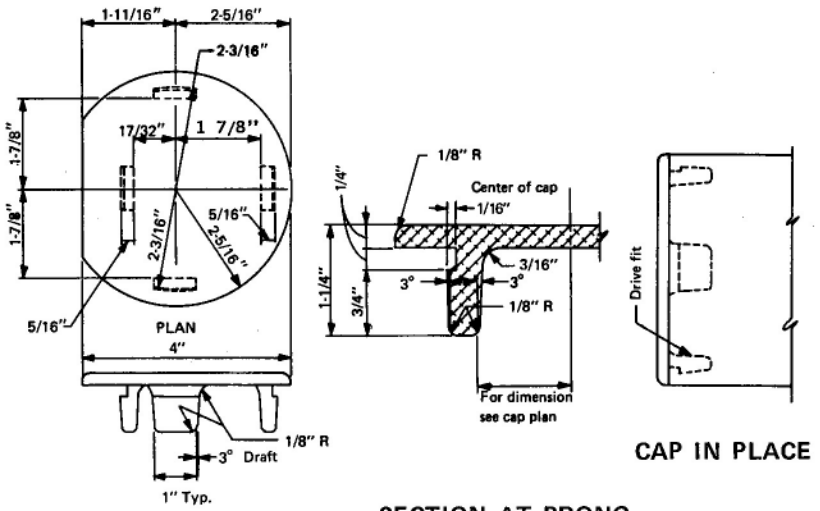
This tubular section is used to splice traffic rail elements in bridge railing design BR3A (Aluminum) Type B.

4-5/8" TUBULAR RAIL SPLICE

HM-TF-13

STANDARD

RE-49-73



ELEVATION

SECTION AT PRONG

CAP IN PLACE

RAIL CAP DETAILS

SPECIFICATIONS

Cast end caps shall conform to ASTM B26, alloy 356-F.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

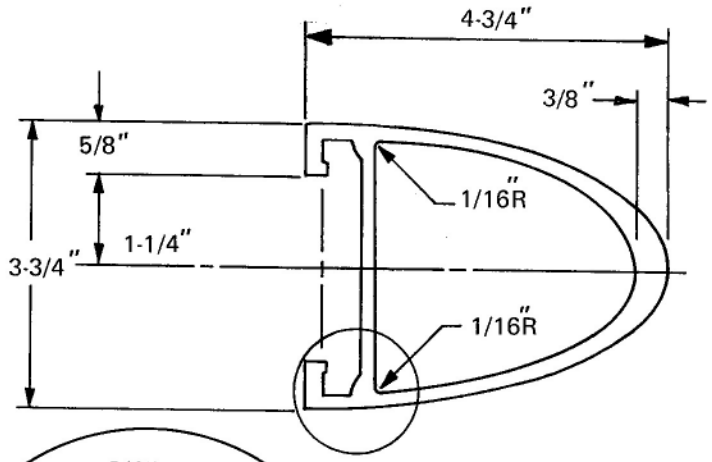
This casting is used as an end cap on hand rails in bridge railing design BR3A (Aluminum) Type B.

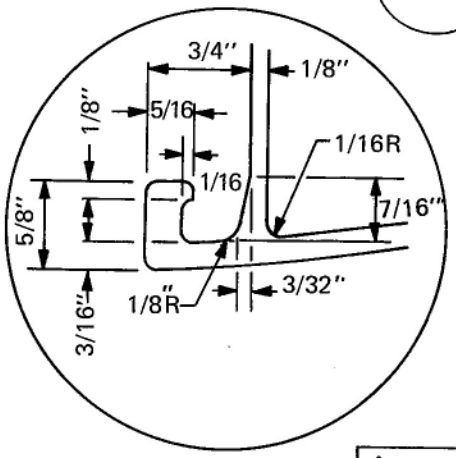
4-5/8" TUBULAR RAIL END CAP

HM-TF-13

STANDARD

RE-50-73





SECTIONAL PROPERTIES

Area	3.112 sq. in.
Weight	3.734 lb/ft
Moment of Inertia Ixx	7.592 in.^{4}
Iyy	5.158 in.^{4}
Section Modulus Sxx	
max	3.296 in.^{3}
min	3.102 in.^{3}
Syy	2.751 in.^{3}

SPECIFICATIONS

Rail element shall conform to the requirements of A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

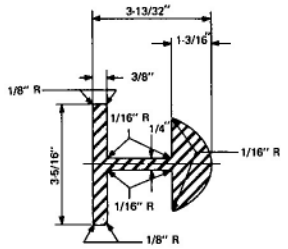
INTENDED USE

This section is used as a traffic rail element in bridge railing designs BR1 (Aluminum) Type C, BR2A (Aluminum) Type C, BR2 (Aluminum) Type D and BR3A (Aluminum) Type D, in guardrail design G8, and in median barrier designs MB8 and MB8B.

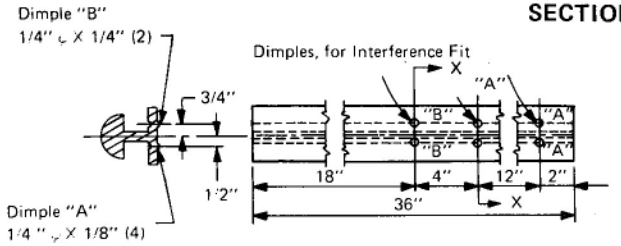
4-3/4" X 3-3/4" SEMI-ELLIPSE RAIL

HM-TF-13

STANDARD **RE-51-73**

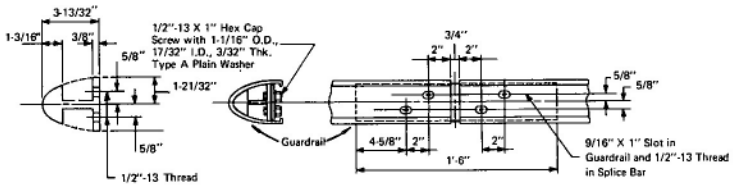


SECTION



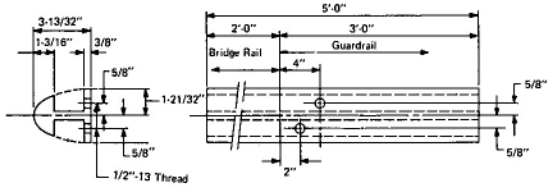
BRIDGE RAIL SPLICE BAR

RE-52 [Bridge Rail Splice] -73



GUARDRAIL SPLICE DETAIL

RE-52 [Guardrail Splice] -73



TRANSITION SPLICE BAR

RE-52 [Transition Splice] -73

SPECIFICATIONS

Splice bar shall meet the requirements of A.S.T.M. B221, alloys 6061-T6 or 6351-T5 (minimum elongation 10%), and shall be threaded to meet the requirements of A.N.S.I. B1.1 Class 2B Tolerance.

Cap Screws shall meet the requirements of stainless steel A.S.T.M. A276, Type 430; and the dimensional requirements of A.N.S.I. B18.2.1. Washers shall be made of aluminum A.S.T.M. B209, Alloy 2024-T3 alclad and shall meet the dimensional requirements of A.N.S.I. B27.2, Type A Plain Washer.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

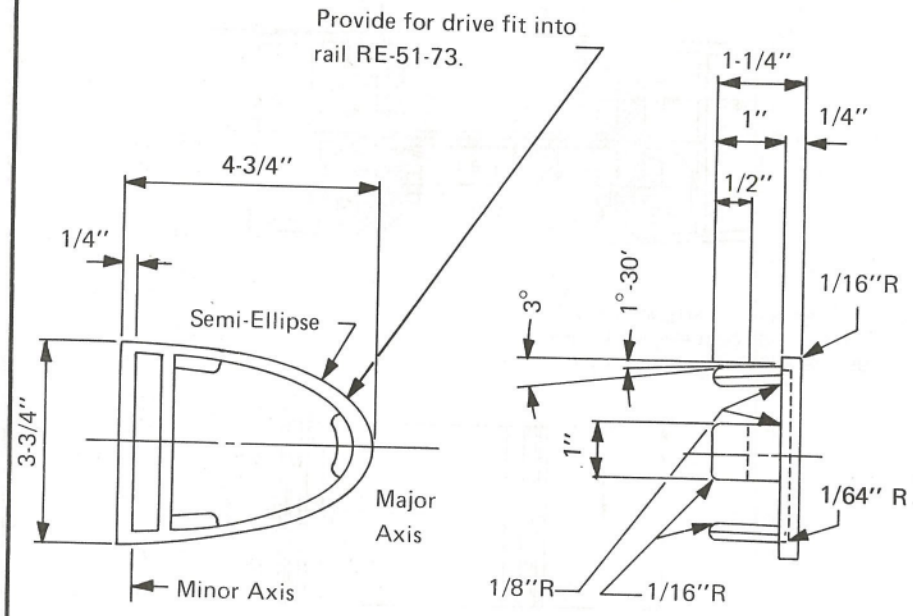
This section is used to splice rails in bridge railing designs BR1 (Aluminum) Type C, BR2A (Aluminum) Type C, BR2 (Aluminum) Type D, BR3A (Aluminum) Type D; in guardrail design G8; and in median barrier designs MB8 and MB8B.

4-3/4" X 3-3/4" SEMI-ELLIPSE RAIL SPLICE

HM-TF-13

STANDARD

RE-52 [DESIGNATE SPLICE TYPE] - 73



RAIL END CAP

SPECIFICATIONS

Cast end caps shall conform to ASTM B26, alloy 356-F.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

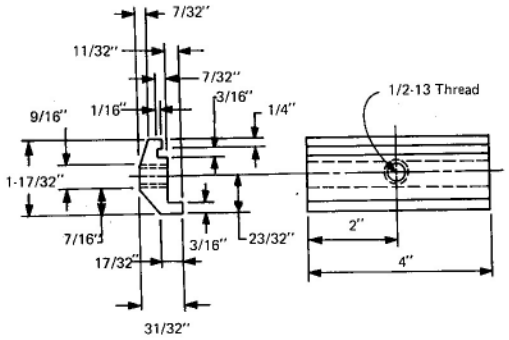
This casting is used as an end cap on 4-3/4"x3-3/4" semi-ellipse traffic rails in bridge railing designs BR1 (Aluminum) Type C, BR2A (Aluminum) Type C, BR2 (Aluminum) Type D and BR3A (Aluminum) Type D, in guardrail design G8, and in median barrier designs MB8 and MB8B.

4-3/4" X 3-3/4" SEMI-ELLIPSE RAIL END CAP

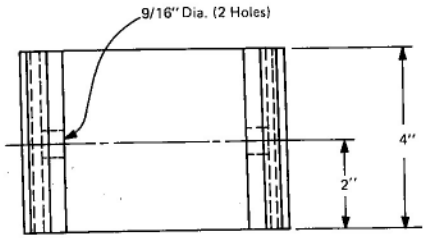
HM-TF-13

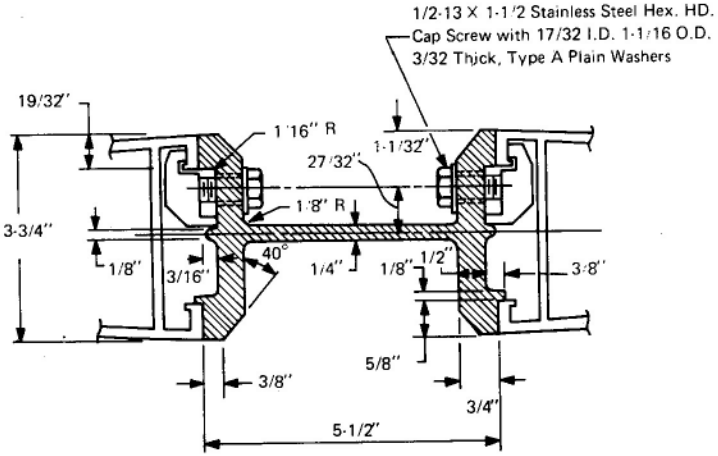
STANDARD

RE-53-73



DIAPHRAGM CLAMP BAR





DIAPHRAGM

SPECIFICATIONS

Aluminum diaphragm and clamp bar shall conform to the requirements of A.S.T.M. B221, alloys 6061-T6 or 6351-T5 (minimum elongation 10%); and shall be threaded to meet the requirements of A.N.S.I. B1.1 Class 2B Tolerance.

Cap screws shall meet the requirements of A.S.T.M. A276, Type 430, and the dimensional requirements of A.N.S.I. B18.2.1. Washers shall meet the requirements of stainless steel A.S.T.M. A276, Type 302; or, the requirements of aluminum A.S.T.M. B209, alloy 2024-T3 alclad. They shall meet the dimensional requirements of A.N.S.I. B27.2, Type A Plain Washers.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

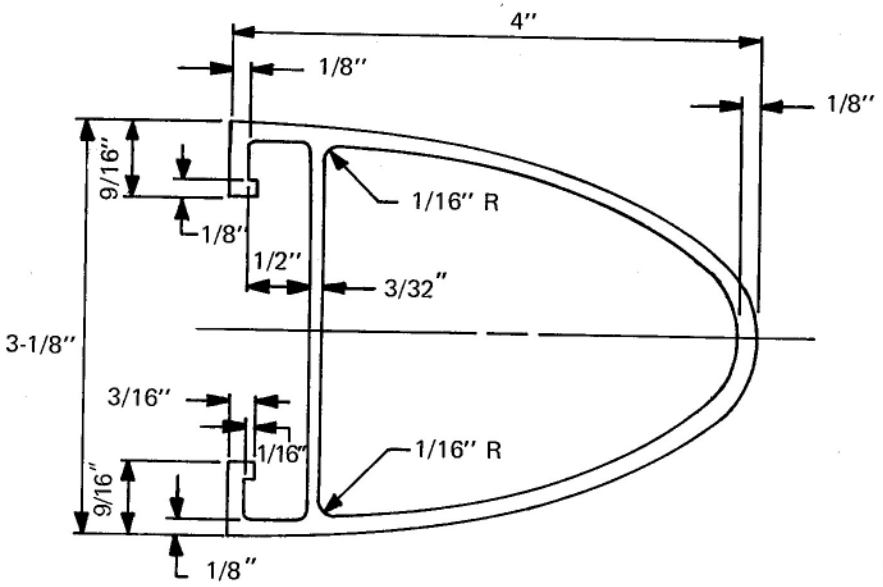
This diaphragm is intended for use as a spacer between 4-3/4" X 3-3/4" or 4-3/4" X 4" semi-ellipse rails in median barrier designs MB8 and MB8B.

4-3/4" X 3-3/4" SEMI-ELLIPSE RAIL DIAPHRAGM AND CLAMP

HM-TF-13

STANDARD

RE-54-73



SECTIONAL PROPERTIES

Area		1.459 sq. in.
Weight		1.751 lb/ft
Moment of Inertia	Ixx	2.383 $in.^4$
	Iyy	1.852 $in.^4$
Section Modulus	Sxx	
	max	1.406 $in.^3$
	min	1.034 $in.^3$
	Syy	1.185 $in.^3$

SPECIFICATIONS

Rail element shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

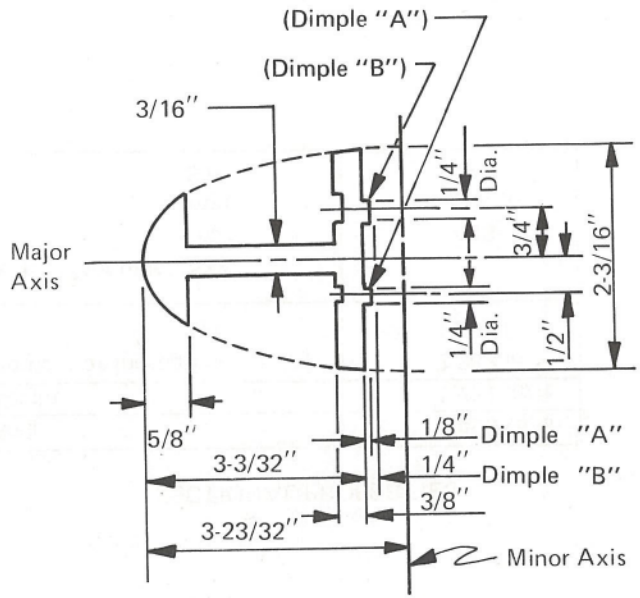
This section is used as a hand rail element in bridge railing designs BR2A (Aluminum) Type C and BR3A (Aluminum) Type D.

4" X 3-1/8" SEMI-ELLIPSE RAIL

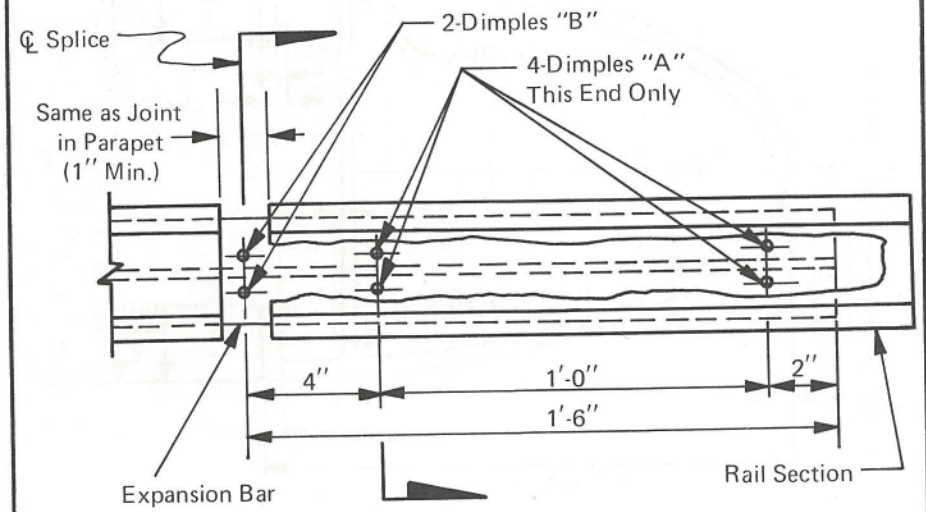
HM-TF-13

STANDARD

RE-55-73



SECTION



ELEVATION

SPECIFICATIONS

Splice bar shall conform to A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

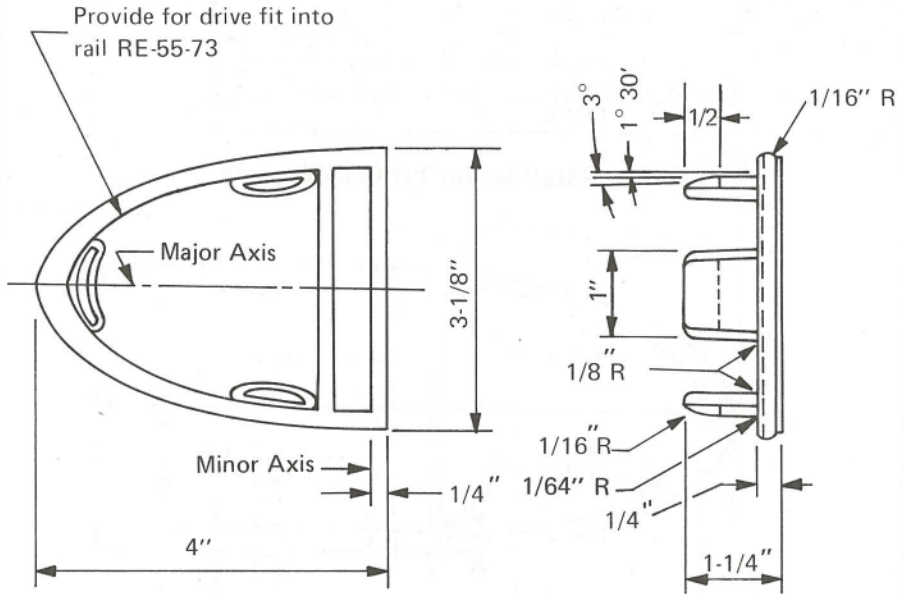
This section is used to splice hand rail elements in bridge railing designs BR2A (Aluminum) Type C and BR3A (Aluminum) Type D.

4" X 3-1/8" SEMI-ELLIPSE RAIL SPLICE

HM-TF-13

STANDARD

RE-56-73



SPECIFICATIONS

Cast end caps shall conform to ASTM B26, alloy 356-F.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

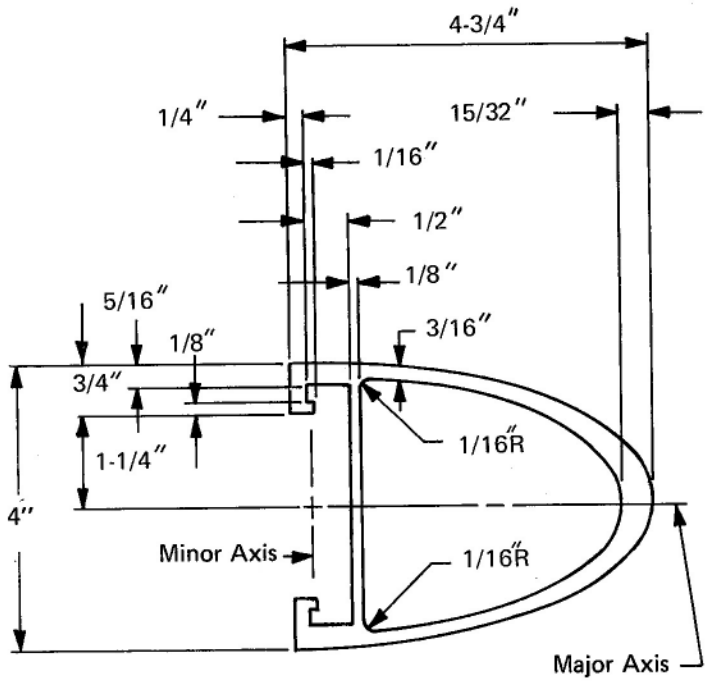
This casting is used as an end cap on hand rails in bridge railing designs BR2A (Aluminum) Type C and BR3A (Aluminum) Type D.

4" X 3-1/8" SEMI-ELLIPSE RAIL END CAP

HM-TF-13

STANDARD

RE-57-73



SECTIONAL PROPERTIES

Area	3.636 sq. in.
Weight	4.363 lb/ft
Moment of Inertia Ixx	9.178 in.^{4}
Iyy	6.640 in.^{4}
Section Modulus Sxx	
max	3.921 in.^{3}
min	3.809 in.^{3}
Syy	3.320 in.^{3}

SPECIFICATIONS

Rail element shall conform to A.S.T.M. B221 alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

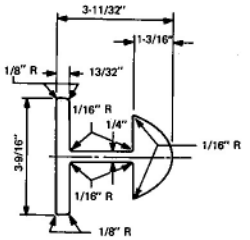
This section is an alternate traffic rail element used in bridge railing designs BR1 (Aluminum) Type C, BR2A (Aluminum) Type C, BR2 (Aluminum) Type D, and BR3A (Aluminum) Type D, in median barrier designs MB8 and MB8B, and in guardrail design G8.

4-3/4" X 4" SEMI-ELLIPSE RAIL

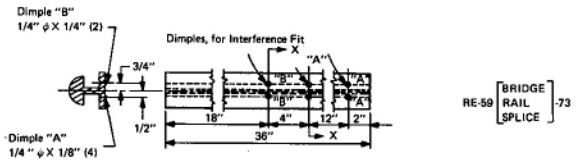
HM-TF-13

STANDARD

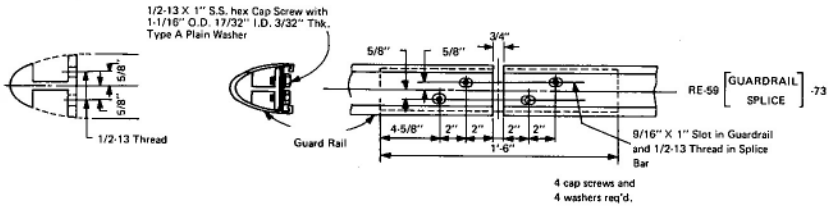
RE-58-73



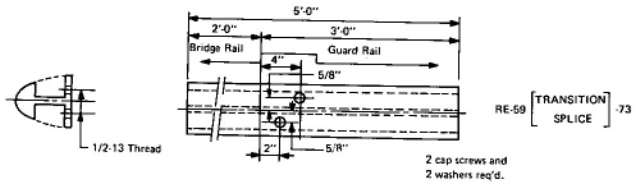
SECTION



BRIDGE RAIL SPLICE BAR



GUARDRAIL SPLICE DETAIL



TRANSITION SPLICE BAR

SPECIFICATIONS

Splice bar shall meet the requirements of A.S.T.M. B221, alloys 6061-T6 or 6351-T5 (minimum elongation 10%); and shall be threaded to meet the requirements of A.N.S.I. B1.1 Class 2B Tolerance.

Cap screws shall meet the requirements of stainless steel A.S.T.M. A276, Type 430; and the dimensional requirements of A.N.S.I. B18.2.1.Washers shall be made of aluminum A.S.T.M. B209, Alloy 2024-T3 alclad and shall meet the dimensional requirements of A.N.S.I. B27.2, Type A Plain Washer.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

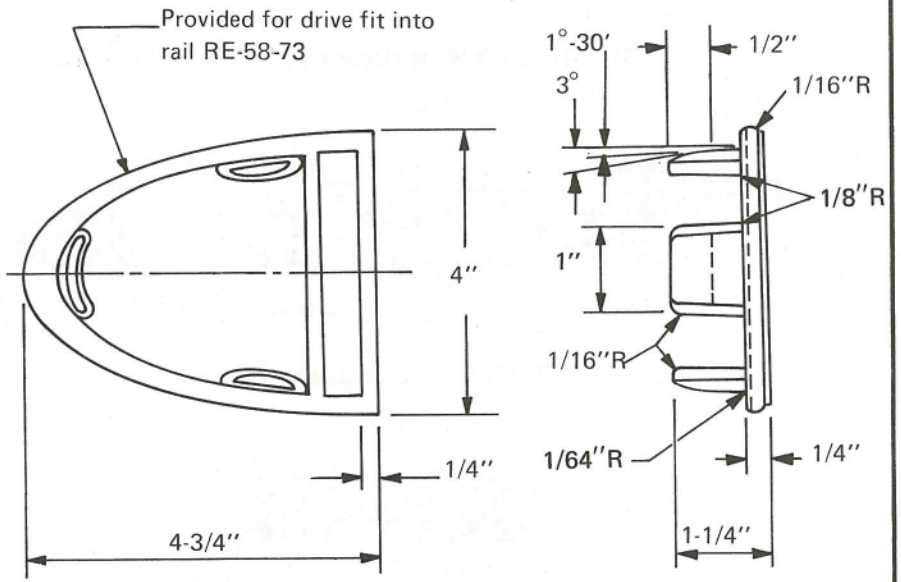
This section is used to splice alternate rail RE-58-73 in bridge railing designs BR1 (Aluminum) Type C, BR2A (Aluminum) Type C, BR2 (Aluminum) Type D and BR3A (Aluminum) Type D, in median barrier designs MB8 and MB8B, and in guardrail design G8.

4-3/4" X 4" SEMI-ELLIPSE RAIL SPLICE

HM-TF-13

STANDARD

RE-59 [DESIGNATE SPLICE TYPE] -73



SPECIFICATIONS

Cast end caps shall conform to ASTM B26, alloy 356-F.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

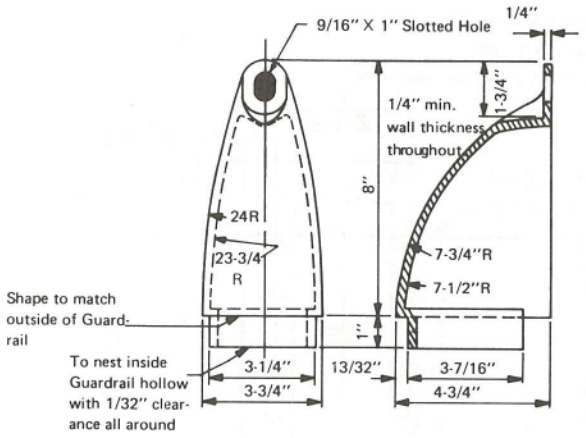
This part is used as an end cap on alternate rail RE-58-73 in bridge railing designs BR1 (Aluminum) Type C, BR2A (Aluminum) Type C, BR2 (Aluminum) Type D and BR3A (Aluminum) Type D, in guardrail design G8, and in median barrier designs MB8 and MB8B.

4-3/4" X 4" SEMI-ELLIPSE RAIL END CAP

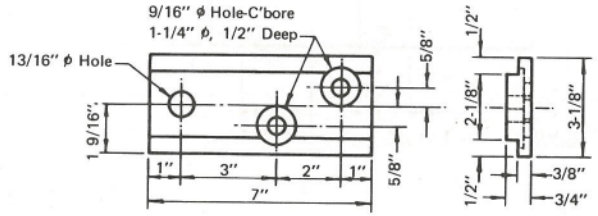
HM-TF-13

STANDARD

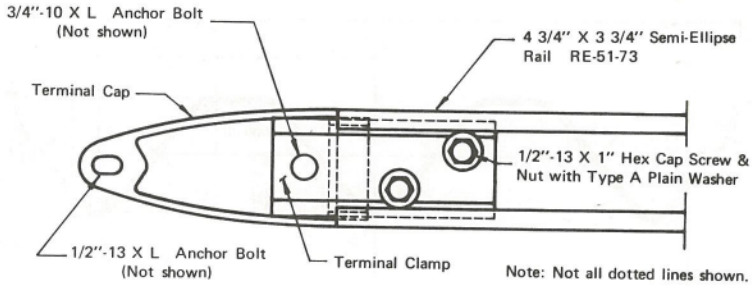
RE-60-73



TERMINAL CAP



TERMINAL CLAMP



TERMINAL CLAMP & CAP ASSEMBLY
(View is looking toward traffic)

SPECIFICATIONS

Cast end caps shall conform to A.S.T.M. B26, alloy 356-F. Terminal clamps shall meet the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Cap screws and anchor bolts shall meet the strength requirements of A.S.T.M. A276, Type 430, and the dimensional requirements of A.N.S.I. B18.2.1; and the nuts shall meet the requirements of A.S.T.M. A276, Type 302, and A.N.S.I. B18.2.2. Aluminum washers shall meet the requirements of A.S.T.M. B209, 2024-T3 alclad and the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washer.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

These parts are used to anchor the ends of 4 3/4" X 3 3/4" semi-ellipse traffic rails to concrete abutments, walls, etc., in guardrail design G8 and in bridge railing designs BR1 (Aluminum) Type C and BR2 (Aluminum) Type D.

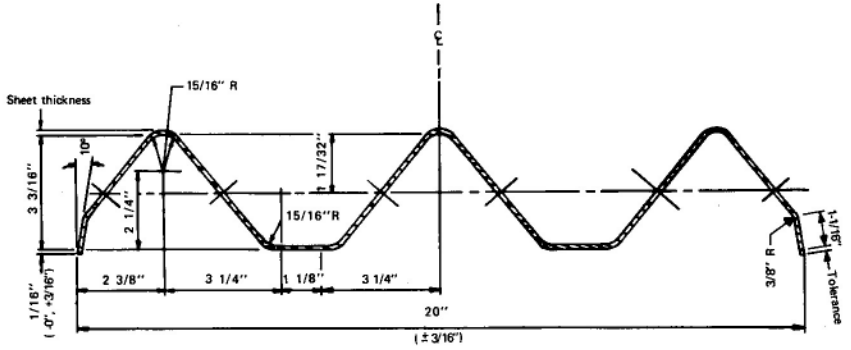
Note: Anchor bolt length and other anchorage details are subject to unknown conditions such as quality and geometry of original concrete.

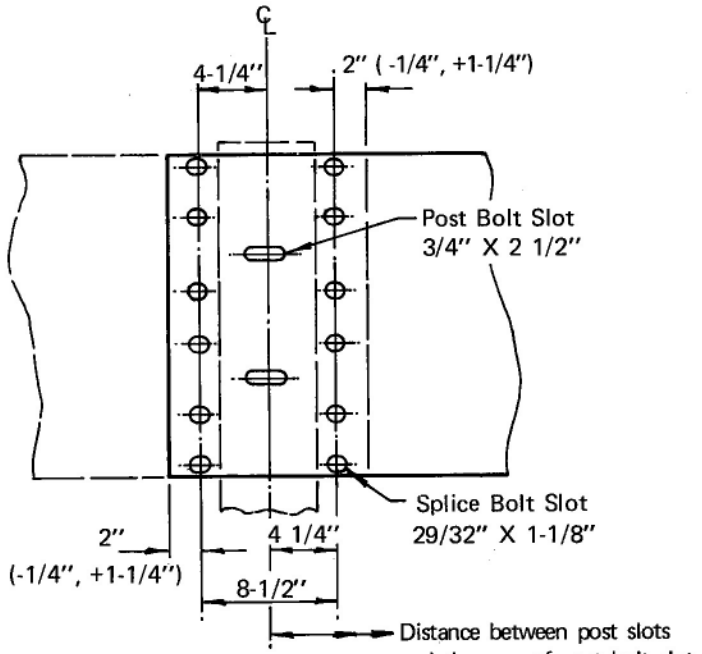
4-3/4" X 3-3/4" SEMI-ELLIPSE RAIL TERMINAL CLAMP AND CAP

HM-TF-13

STANDARD

RE-61-76





SPECIFICATIONS

Corrugated sheet steel beams shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This corrugated sheet steel beam is used as a rail element in standard barrier designs G9, MB9, and MB9B.

Note: Typical designations are RE-63[2@6'-3"=12'-6"]-76 and RE-63[4@6'-3"=25'-0"]-76.

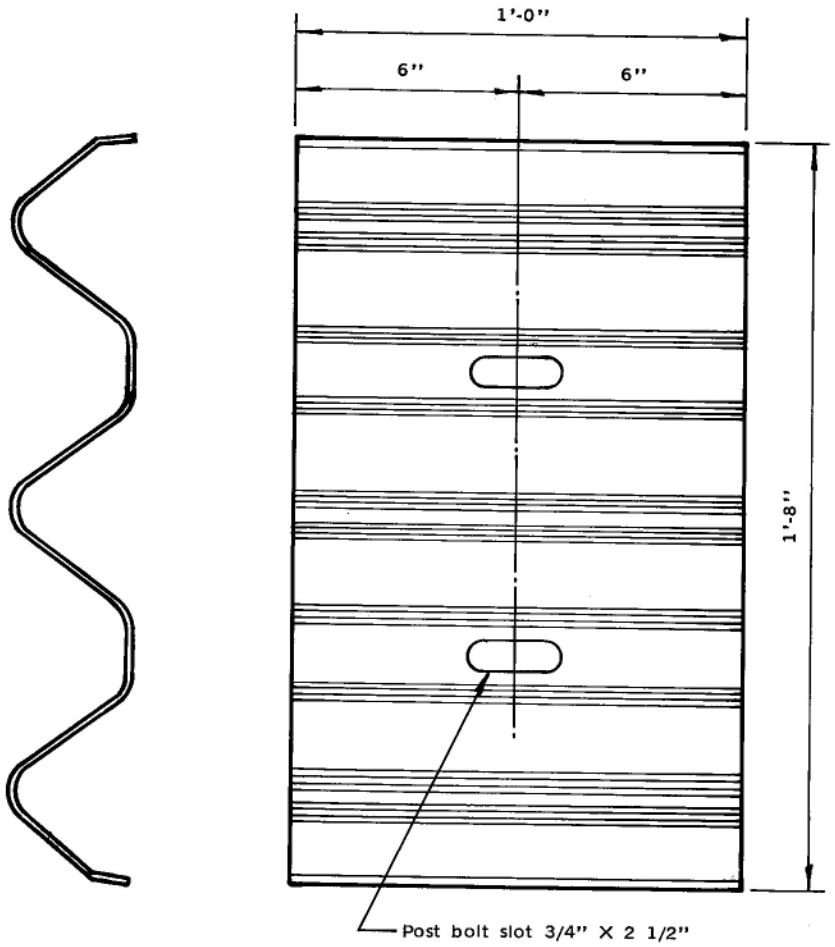
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly: RE-63[2@6"-3" = 12'-6" Class A, Type 4] - 76.

THRIE BEAM

HM-TF-13

STANDARD

RE-63 [DESIGNATE POST SLOT CENTERS & SUM OF CENTERS] -76



BACK UP PLATE

SPECIFICATIONS

Back-up plates shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This back-up plate is placed behind rail elements at intermediate steel posts (non-splice posts) in the standard Thrie Beam Guardrail and Median Barrier designs G9, MB9, and MB9B.

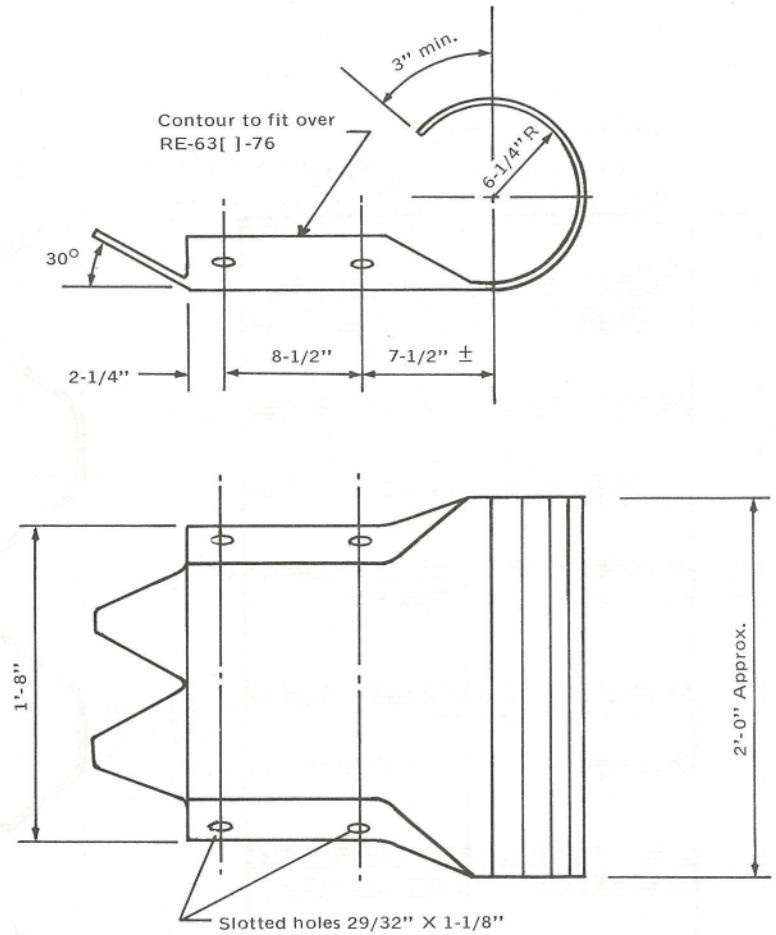
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly:
RE-64[Class A, Type 4]-76.

THRIE BEAM BACK UP PLATE

HM-TF-13

STANDARD

RE-64-76



SPECIFICATIONS

Flared end terminal sections shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This end section is used in some of the terminal configurations employed with the standard Thrie Beam guardrail design G9.

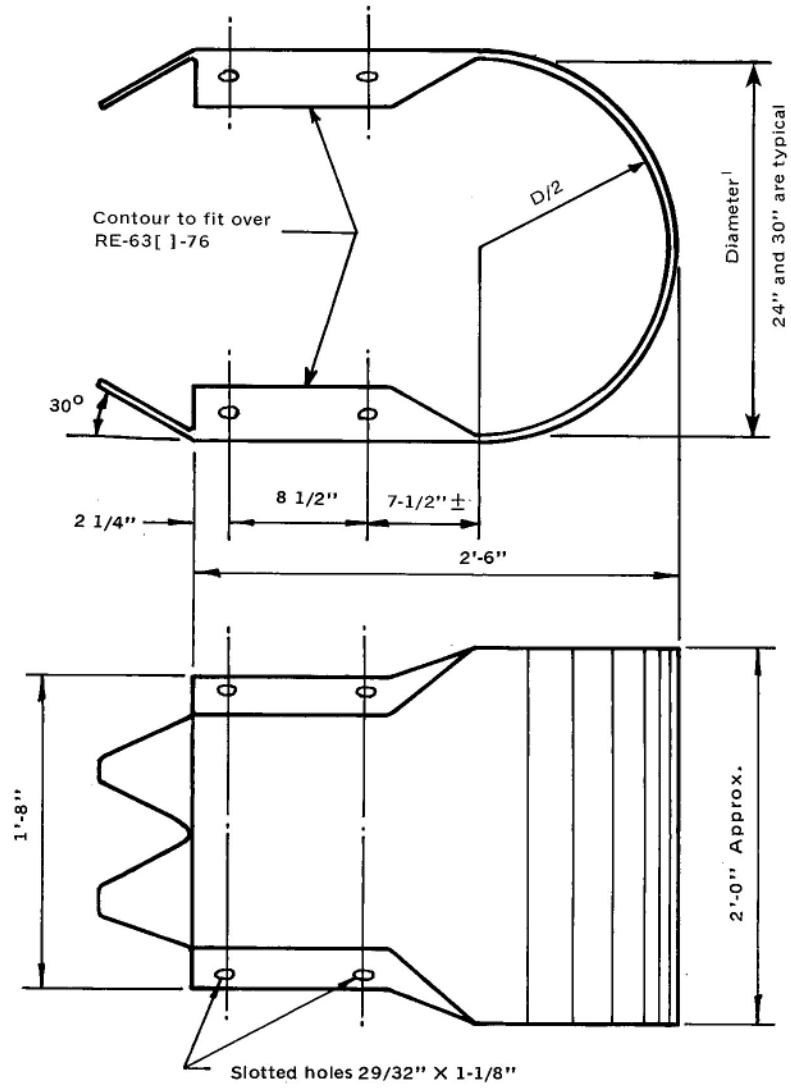
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly: RE-65[Class A, Type 4]-79.

THRIE BEAM END SECTION (ROUNDED)

HM-TF-13

STANDARD

RE-65-79



BUFFER END SECTION

SPECIFICATIONS

Double face terminal sections shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This end section is used in some of the rail element terminal configurations employed with the standard Thrie Beam median barrier designs MB9 and MB9B.

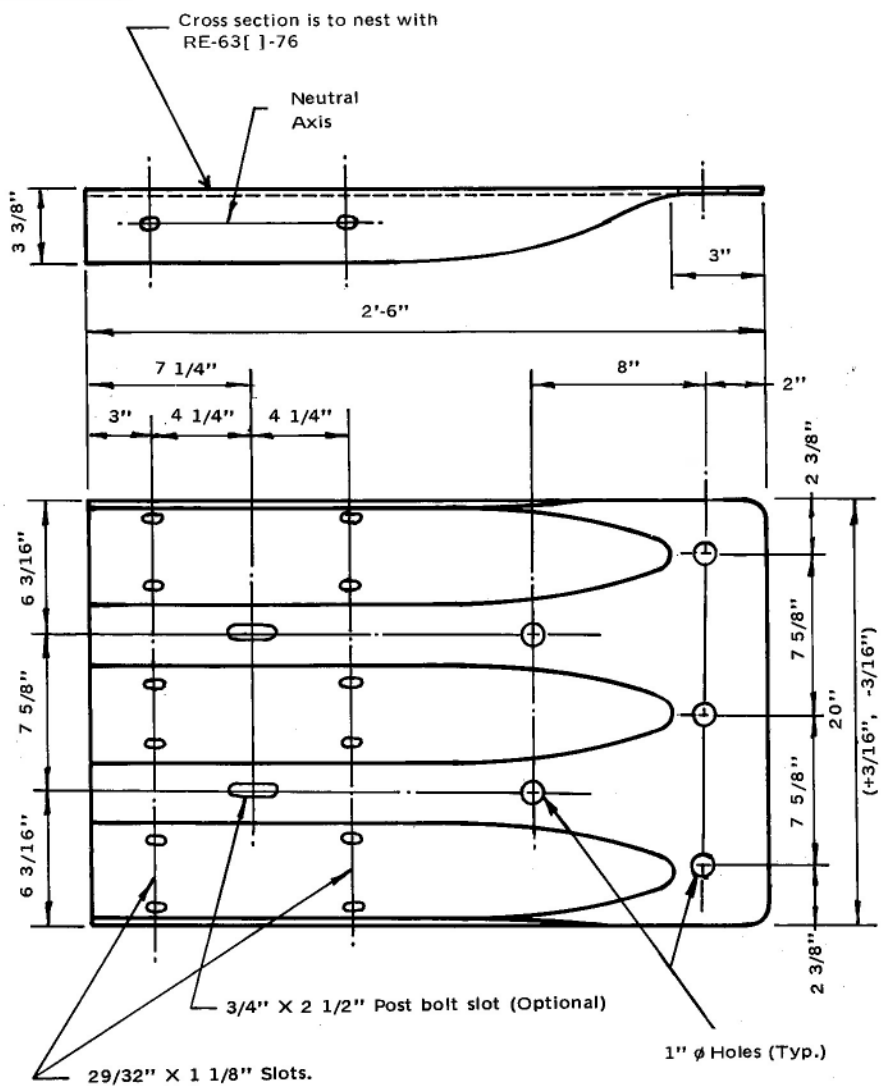
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly:
RE-66[Diameter, Class A, Type 4]-79.

THRIE BEAM END SECTION (BUFFER)

HM-TF-13

STANDARD

RE-66 [DIAMETER]-79



TERMINAL CONNECTOR

SPECIFICATIONS

Terminal connector shall conform to the current requirements of A.A.S.H.T.O. M180, Class B, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This terminal connector is used in some of the rail element terminal configurations employed with the standard Thrie Beam barrier designs G9, MB9, and MB9B.

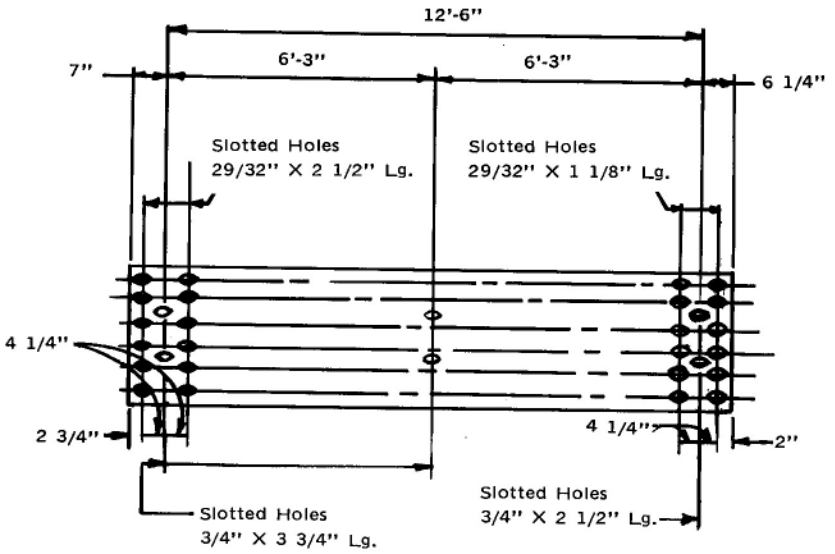
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly: RE-67[Class B, Type 4]-76.

THRIE BEAM TERMINAL CONNECTOR

HM-TF-13

STANDARD

RE-67 -76



SPECIFICATIONS

Corrugated sheet steel beams shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2, except as modified in this standard.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This rail element is used to accommodate longitudinal movement where special treatment is required in the standard median barrier design MB9B.

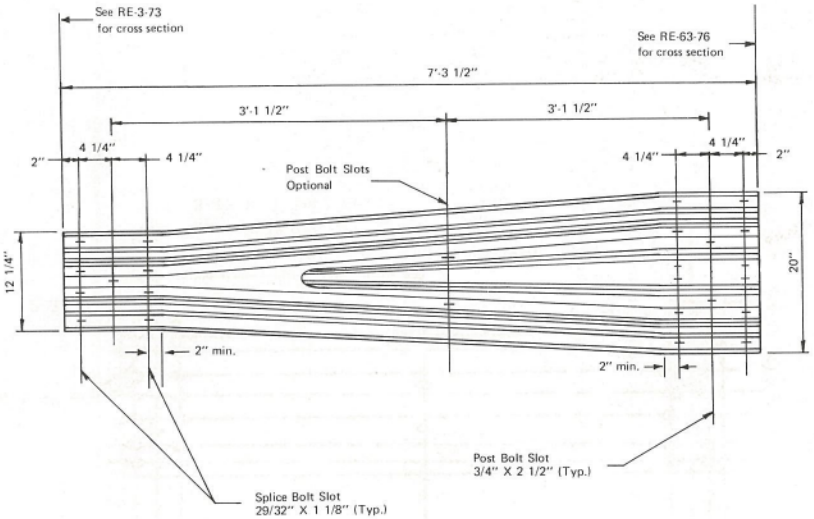
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly:
RE-[Class A, Type 4]-76.

THRIE BEAM EXPANSION SECTION

HM-TF-13

STANDARD

RE-68-76



SPECIFICATIONS

Corrugated sheet steel beam shall conform to the current requirements of A.A.S.H.T.O. M180, Class A, Type 2.*

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This rail element is used as the transition section between the 'W' Beam and the Thrie Beam barrier designs.

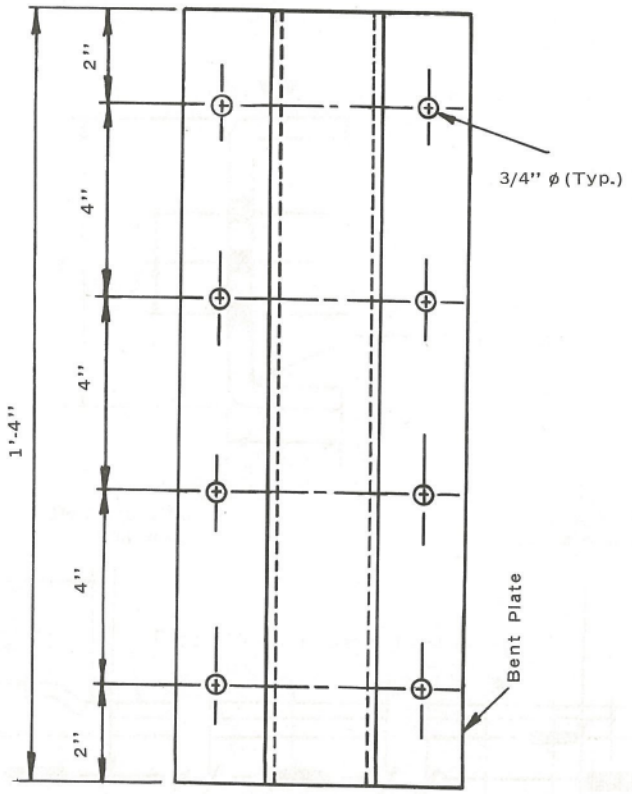
* If another class or type is required this should be indicated by a modified part number. For example, if corrosion resistant steel is required show thusly:
RE - 69 [Class A, Type 4] - 76.

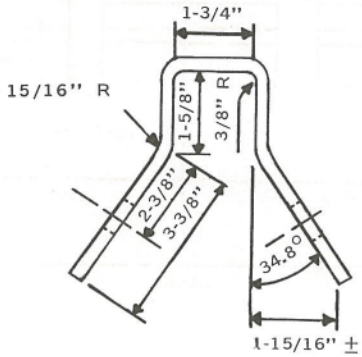
W - THRIE BEAM TRANSITION SECTION

HM-TF-13

STANDARD

RE-69-76





ANCHOR PLATE

SPECIFICATIONS

Anchor plates shall conform to the requirements of A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant steel is requested, in which case anchor plates shall conform to the requirements of A.S.T.M. A588 and shall not be painted nor galvanized.

No punching, drilling, or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This anchor plate is used to anchor the cable assembly (F-37-76) to the rail in the standard breakaway cable terminal designs as shown in Appendixes A.4 and A.5.

Note: For attachment bolts and washers see F-8-76 and F-13-73 respectively.

BCT ANCHOR PLATE

HM-TF-13

STANDARD

RE - 71 - 79

Form FHWA 121 (6/79)

209a

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

UNITED STATES GOVERNMENT

memorandum

Subject: Distribution of: (1) "A Guide to Standardized Highway Lighting Pole Hardware" and (2) "A Guide to Standardized Highway Barrier Rail Hardware"

Date: MAR 26 1981

From: Chief, Bridge Division
Office of Engineering
Washington, D.C. 20590

Reply to Attn. of: HNG-34

To: Regional Federal Highway Administrator
Regions 1-10: Division Administrators and
Division Engineer, Region 15

In the interest of information exchange, the Joint Cooperative Committee of the American Association of State Highway and Transportation Officials (AASHTO), Associated General Contractors (AGC), and the American Road and Transportation Builders Association (ARTBA) has prepared the two subject documents.

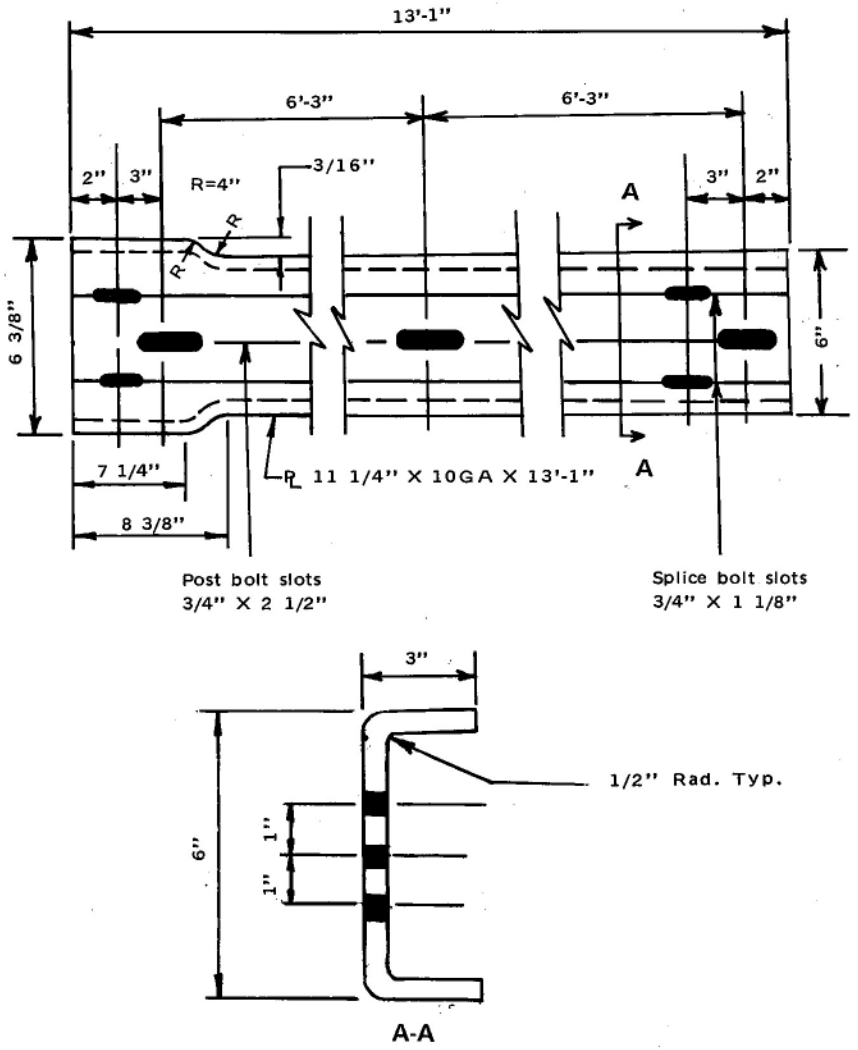
Under separate cover, Regional and Division Offices are being sent, respectively, 6 and 4 copies of each document.

Please note certain errors and omissions in the documents which should be corrected. On page 34 of (1), "A Guide to Standardized Highway Lighting Pole Hardware," the minimum restrained shear shown in the Dimension Table should be 3.0 kips instead of 30 kips. On page 140 of (2), "A Guide to Standardized Highway Barrier Rail Hardware," the thickness of the Top Plate should be shown as 3/4". On page 209 of the same document the thickness of the Anchor Plate should be shown as 3/16". Please make the corrections.

We would point out that the crash tests performed on Barrier Types BR 1 (Aluminum) Type C and BR 2 (Aluminum) Type D showed that the failure mechanism of the base plates resulted in strengths less than those required by the AASHTO specifications. The BR 2 (Aluminum) Type D railing appears particularly vulnerable to vehicle snagging on posts. We, therefore, recommend that these barrier types not be used on high-volume and/or high-speed roadways. The manufacturers of these rails are working on design modifications to avoid the problems observed in crash tests. These modified designs should be available in the near future.

Stanley Gordon

Federal Highway Administration
HNG-34:JHatton/HNG-21:CALeonin:60426:glb:3-24-81
cc:
Files--3113
Reader-3113
Chron--3113



SPECIFICATIONS

Rub rails shall conform to A.S.T.M. A36 and shall be galvanized in accordance with A.S.T.M. A123 except when corrosion resistant rails are requested, in which case rub rails shall conform to A.S.T.M. A588 and shall not be painted nor galvanized.

No punching, drilling, or cutting will be permitted after galvanizing.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This channel is used as a rub rail in the standard 'W' Beam Guardrail and 'W' Beam Median Barrier designs G4, MB4, and MB4B.

Note: This rail may be used as an alternate to RE-9[ ]-73.
For splice bolts see F-9[1 1/2"]-73.

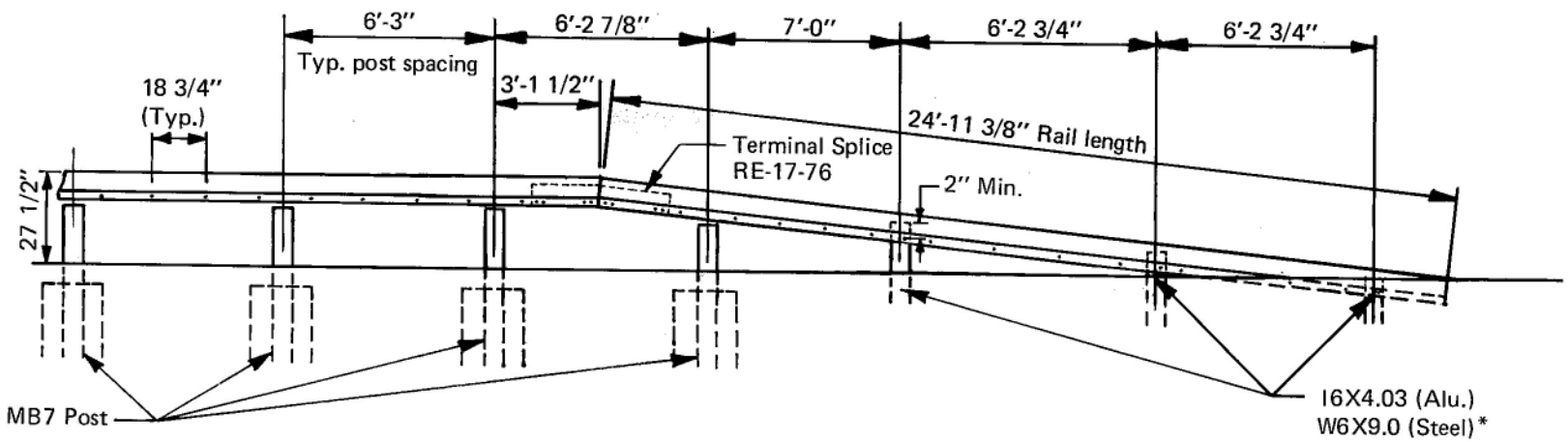
BENT PLATE RUB RAIL

HM-TF-13

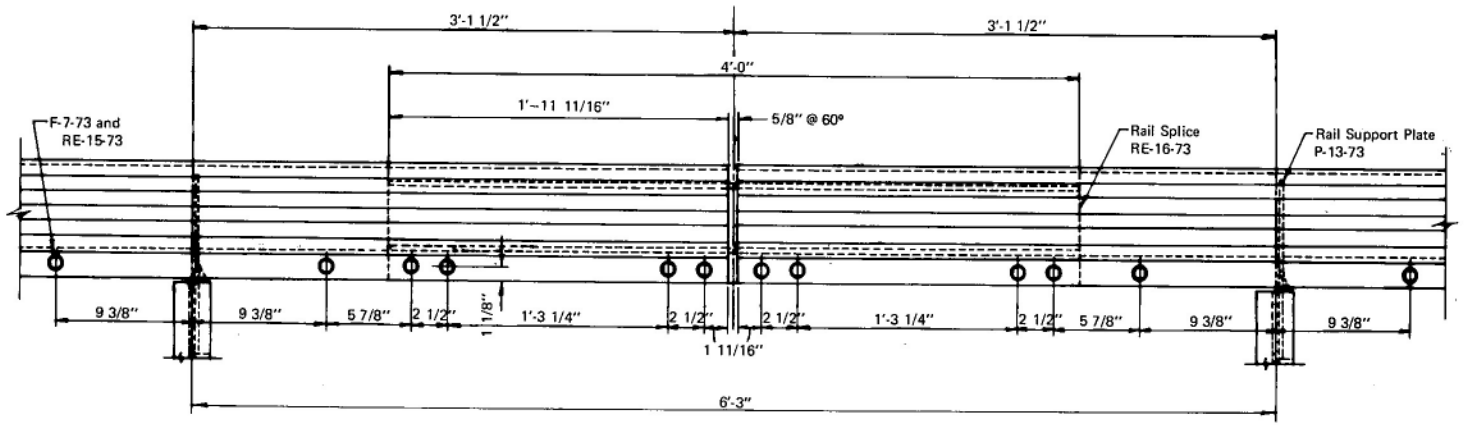
STANDARD

RE-72-76

APPENDIX
SUGGESTED BARRIER DETAILS



TERMINAL DETAIL



TYPICAL SPLICE DETAIL

* Replaced W6X8.5, which is acceptable.

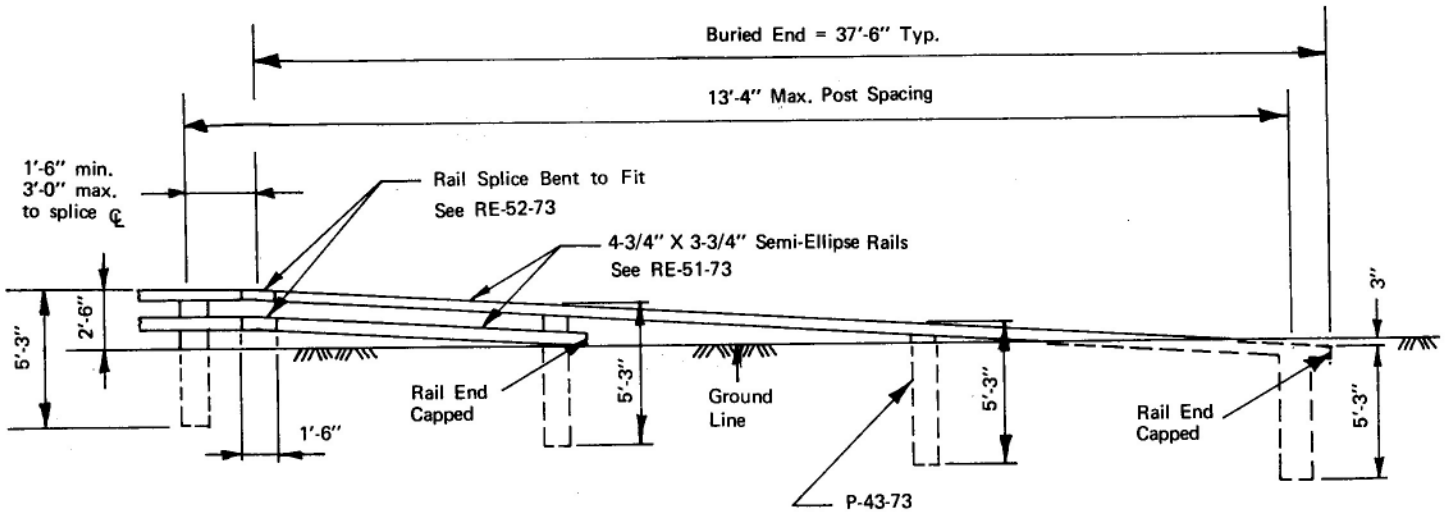
NOTE

Posts shall be driven to a minimum depth of 3 feet with post spacing as shown. Curved sections shall be constructed as chords with chord lengths and shop or field bent splices as specified. Splice bolts shall be torqued to 60 - 70 ft-lbs.

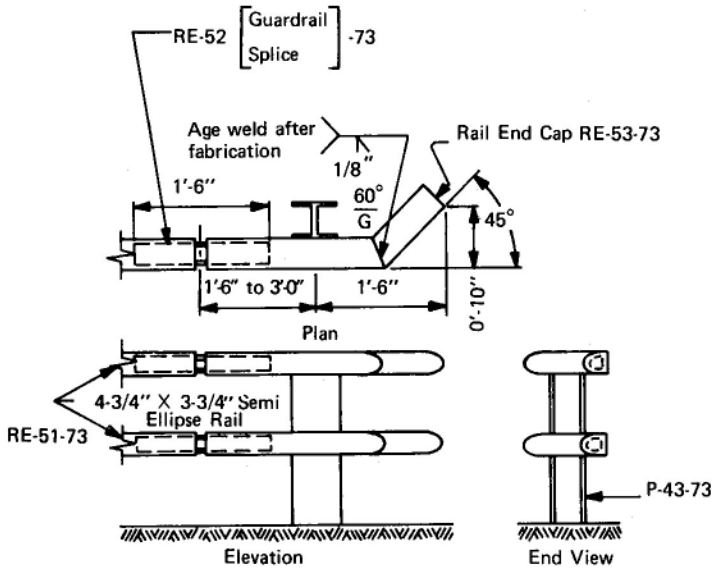
LAYOUT : MB7

HM-TF-13

APPENDIX **A.1**



G8 or MB8
TERMINAL DESIGN



G8 TERMINAL DESIGN

NOTE

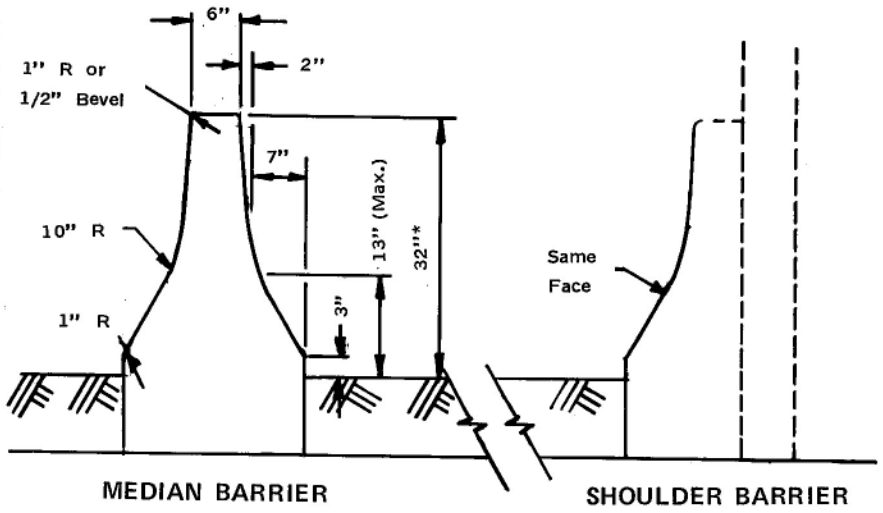
Shown are terminal layouts for both guardrail design G8 and median barrier design MB8.

Welding shall conform to the requirements contained in Section 1.5.5 of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

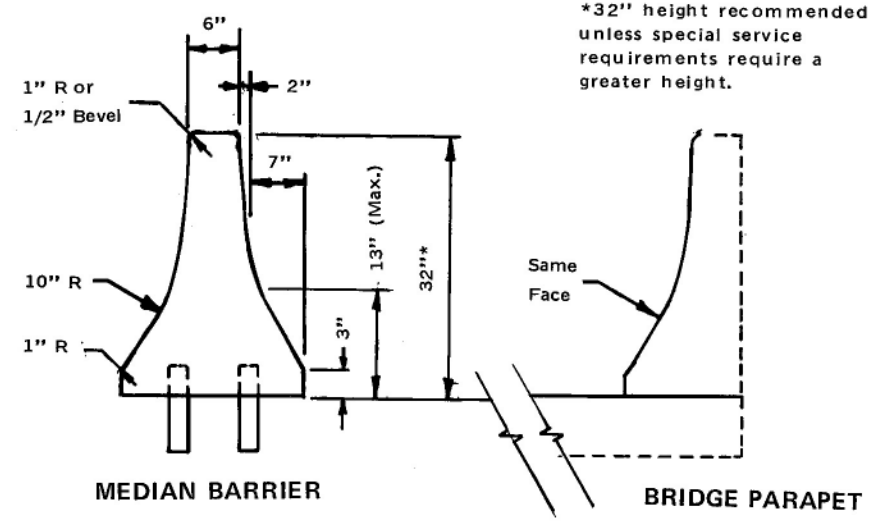
LAYOUT: G8 AND MB8 TERMINAL DESIGNS

HM-TF-13

APPENDIX **A.2**



GROUND MOUNTED



SURFACE MOUNTED

NOTE

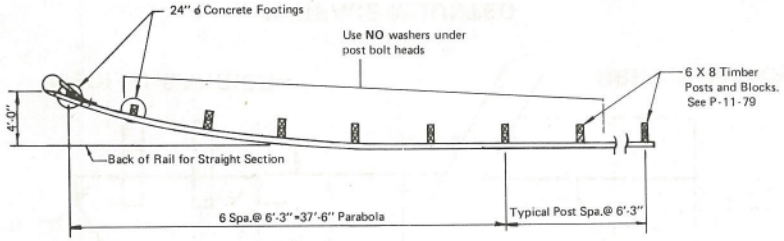
Shown are the two standard concrete median barrier designs MB5 and MB5B with respective shoulder applications.

The designer of a concrete barrier should provide base and reinforcement details adequate to insure needed barrier stability and serviceability.

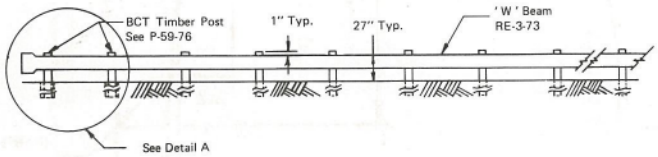
MB5 AND MB5B
STANDARD CONCRETE BARRIERS

HM-TF-13

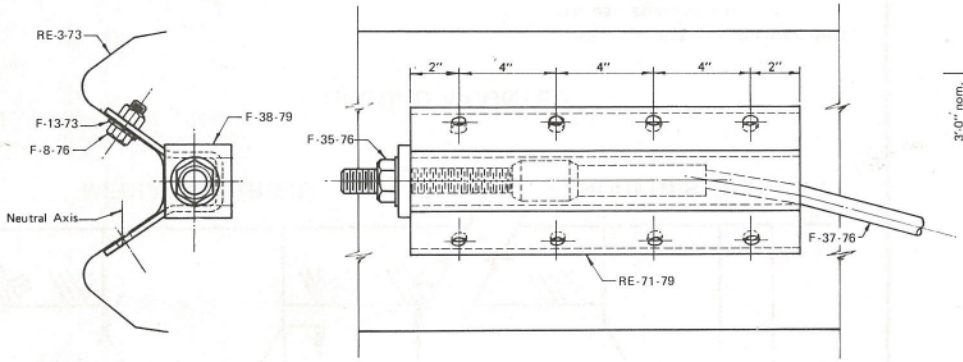
APPENDIX **A.3**



PLAN

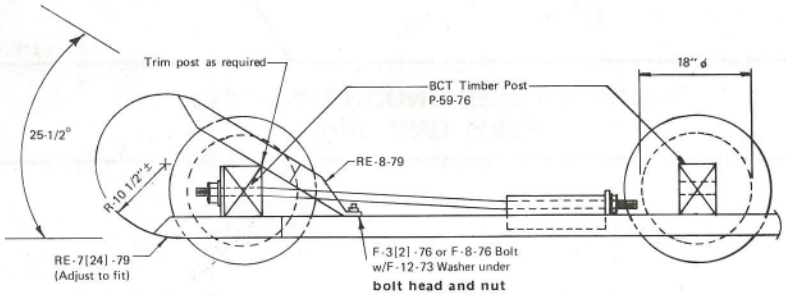


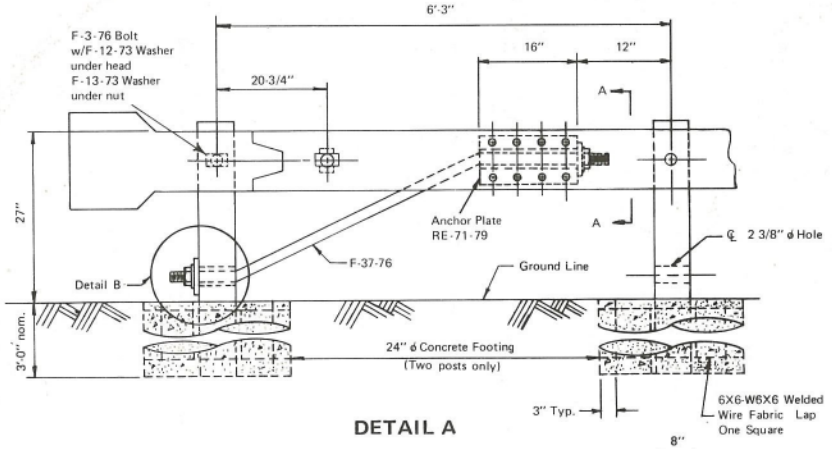
ELEVATION



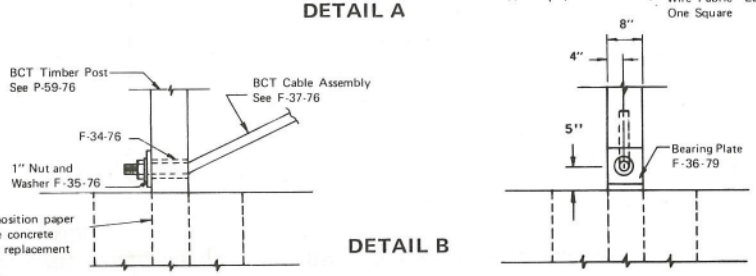
SECTION A-A

Comment: For discussion of design and testing of this terminal see National Cooperative Highway Research Program Research Results Digests 43, 84, and 102. Details shown in this guide differ slightly from those shown in the research digests.





DETAIL A



DETAIL B

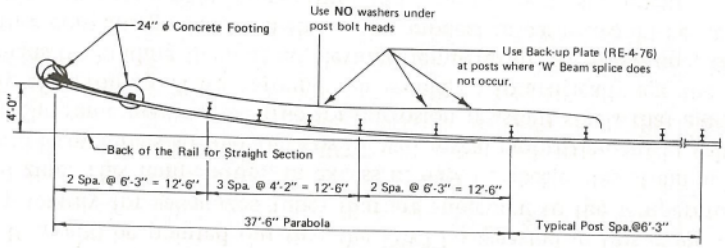
Note: A double wrap of composition paper around end posts before concrete placement will facilitate replacement of damaged posts.

BREAKAWAY CABLE TERMINAL ASSEMBLY (TIMBER POSTS)

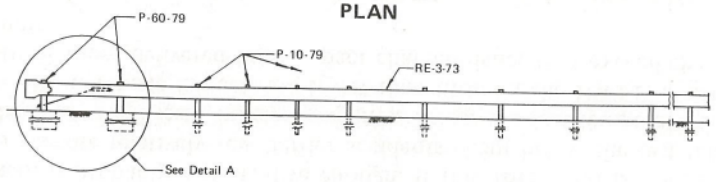
HM-TF-13

APPENDIX

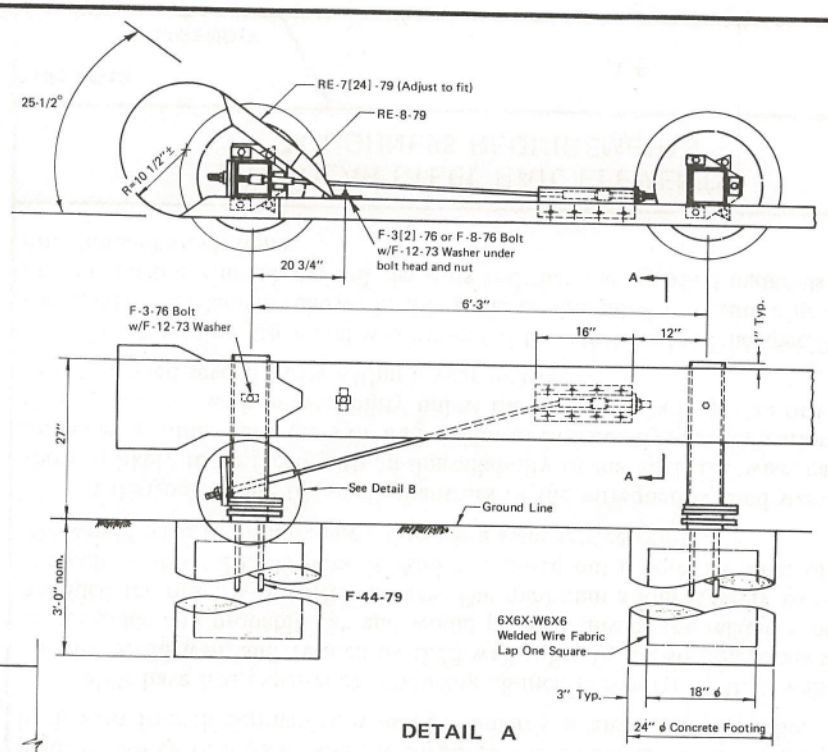
A.4



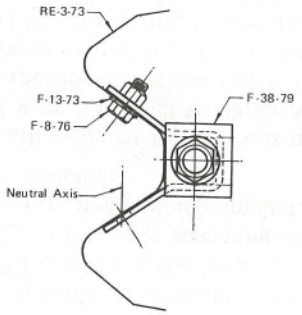
PLAN



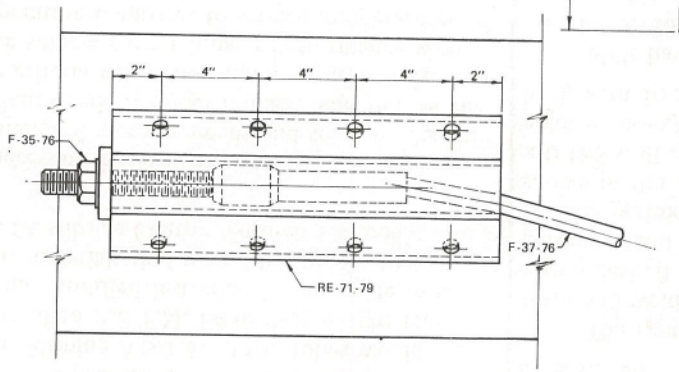
ELEVATION



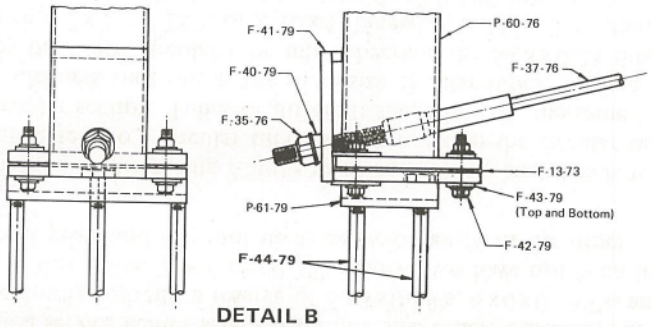
DETAIL A



SECTION A-A



Comment: For discussion of design and testing of this terminal see National Cooperative Highway Research Program Research Results Digests 84 and 102. Details shown in this guide differ slightly from those shown in the research digests.



DETAIL B

BREAKAWAY CABLE TERMINAL ASSEMBLY (STEEL POSTS)

HM-TF-13

APPENDIX A.5

Because of unavailability, A.S.T.M. A501, Hot-Formed Tubing, has been deleted from this guide and only A.S.T.M. A500, Cold-Formed Tubing, is shown.

Several years ago A.S.T.M. A500 tubular steel rail elements were dropped and fractured while being unloaded from a delivery truck. This unacceptable performance was judged to be the result of strain age embrittlement caused by the cold forming of the tubes and worsened by the galvanizing process they underwent. Inasmuch as not all steels are susceptible to embrittlement and barrier service experience had not revealed severe problems with embrittled material it was believed that many steels used in forming A.S.T.M. A500 tubes would result in serviceable rail elements. A modified A.S.T.M. E436 drop-weight tear test (DWTT), which is the basis for the modified test cited in this guide, was proposed as a means of screening out materials that would be subject to brittle fracture upon vehicle impact. (A subsize Charpy V-notch test could also have been selected.)

Modification of the test was necessary because some of the tube sizes to be tested were too small to obtain standard size specimens and some of the thin wall test specimens buckled rather than breaking under impact. Selection of the test temperature and the acceptance criteria was done somewhat arbitrarily, in that there was no testing to correlate vehicle barrier impact performance with DWTT results. The $-18^{\circ}C$ test temperature compares to service temperatures of $-30^{\circ}C$ that can be expected a few times a year in the State that instituted the test. In view of the fact that when the DWTT requirement was imposed the tube producers had to use different steels to consistently produce an acceptable product, one might infer, on the basis of past barrier experience, that the new requirement is probably conservative enough. If this assessment is true, it is probably so because relatively few barrier accidents occur below the test temperature, the tubes have significant impact toughness below the test temperature, the loading rates from vehicle impacts are lower than those in the DWTT, and the majority of tubes delivered have impact characteristics that exceed the required minimums.

It should be pointed out that the DWTT suggested in this guide was developed primarily for galvanized tubes that are subjected to the temperature of melted zinc. This temperature, in excess of $419^{\circ}C$, accelerates strain aging in susceptible materials so that the DWTT will reveal embrittlement in galvanized tubes. The same may not be true for corrosion resistant steels that are tested shortly after rolling. A way around this would be to artifically age the test specimens by holding them at an elevated temperature for sometime. Unless the literature contains guidance on this, some modest research would be needed to determine an appropriate temperature and time for aging specimens.

The consequence of imposing the DWTT requirement has been to increase the mill price of tubes about 10 to 15 percent over the basic cost of A.S.T.M. A500 tubes. However, if a fabricator cannot purchase a mill lot, about 40,000 pounds of steel, he will have to pruchase through a steel service center, which adds 25 to 30 percent to the mill tube price. At the present time service centers are not stocking tubes meeting the specifications in this guide. This could cause delivery delays while a service center assembles a mill size order. Currently, at least one mill is attempting to build a reserve of 5x3x0.25's, 6x6x0.188's, and 6x8x0.25's shown in this guide. The 6x2x0.25's also shown have not been in wide demand in recent years and may not be as easily obtained as the other sizes shown.

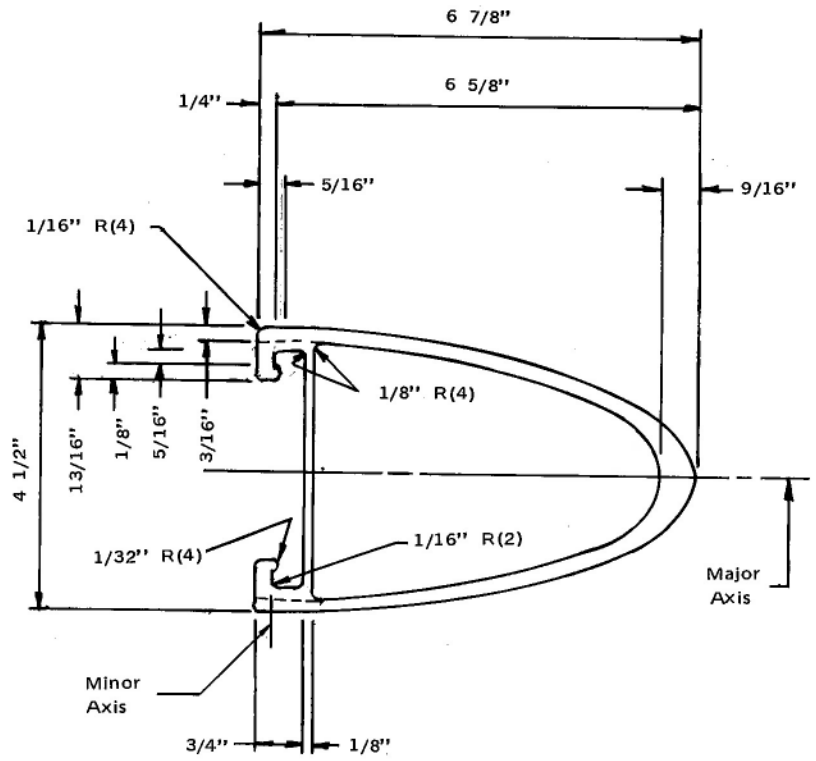
The typical method of producing A500 square and retangular tubes is to form and weld a flat plate into a circular tube and then reform the circular tube into a desired rectangular section. Tubes of different shape but of the same perimeter and wall thickness start out as the same size circular tubes. Thus, a 28-inch perimeter by 0.25-inch circular tube might become the 6x8x0.25 tube shown in this guide or a 7x7, a 12x2, or a 10x4. Likewise, a 24-inch perimeter x 0.188 wall circular tube might be formed into the 6x6x0.188 tube of the guide or a 4x8 or a 5x7. And the 6x20.25 and 6x3x0.25 tubes of the guide, both with 16-inch perimeters, would be similarly related to a 4x4 tube.

Mills have had experience producing 28-inch perimeter by 0.25 wall, 24-inch by 0.188 wall, and 16-inch by 0.25 wall tubes to the specifications shown in this guide and probably can and would produce any of the related tube sizes provided the order is of sufficient size. The minimum a mill is likely to roll is one coil or about 20,000 pounds. And as pointed out before, an order of this size would have to be purchased through a steel service center.

A designer calling for small quantities of the infrequently used sizes cited above is likely to be faced with an unavailability of material. Likewise, calling for tubes of other perimeters or wall thickness to meet these specifications is likely to be met with unavailability unless the order is of a large size or is likely to be repeated several times within a year or two.

The foregoing discussion was presented to point out that the specifications for tubular rail elements shown in this guide are intended to ensure a necessary impact toughness in tubular rail elements and that the specified materials are not standard stock items.

TUBULAR STEEL RAIL ELEMENTS TOUGHNESS REQUIREMENTS



SECTIONAL PROPERTIES

Area		4.82 in^2
Weight		5.91 lb/ft
Moment of Inertia	Ixx	27.05 in^4
	Iyy	12.087 in^4
Section Modulus	Sxx (max)	7.94 in^3
	Sxx (min)	7.79 in^3
	Syy	5.372 in^3

SPECIFICATIONS

Rail element shall conform to the requirements of A.S.T.M. B221, alloy 6061-T6 or alloy 6351-T5 (minimum elongation 10%).

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

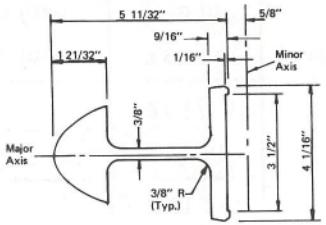
This section is used as a traffic rail element for special service conditions.

Note: For clamp bar to fasten rail to a post see F-21-76.

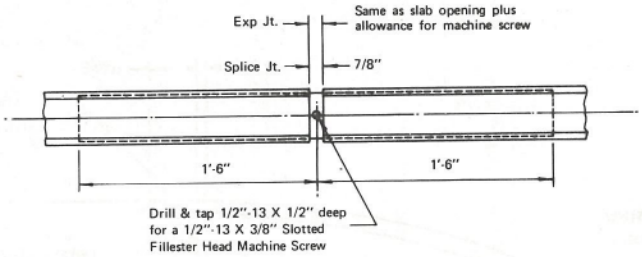
6 7/8" X 4 1/2" SEMI–ELLIPSE RAIL

HM-TF-13

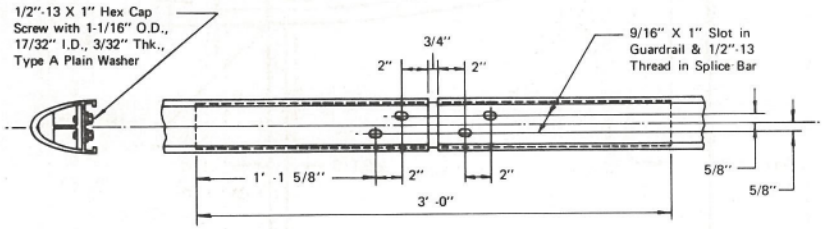
APPENDIX A.7.1



SECTION



BRIDGE RAIL SPLICE DETAIL RE-74 [Bridge Rail Splice] -76



GUARDRAIL SPLICE DETAIL RE-74 [Guardrail Splice] -76

SPECIFICATIONS

Splice bar shall conform to A.S.T.M. B221, alloys 6061-T6 or 6351-T5 (minimum elongation 10%), and shall be threaded to meet the requirements of A.N.S.I. B1.1 Class 2B Tolerance.

Cap screws shall meet the requirements of A.S.T.M. A276, Type 430, and the dimensional requirements of A.N.S.I. B18.2.1. Washers shall meet the requirements of A.S.T.M. B209, alloy 2024-T3 alclad, and the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers.

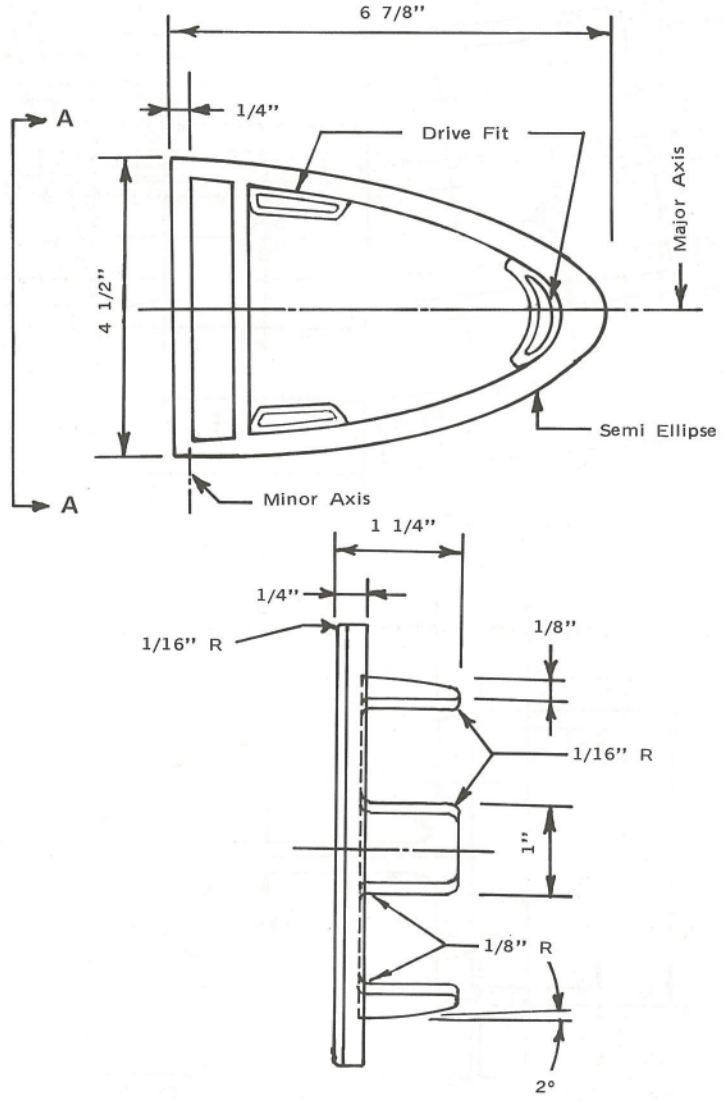
Machine screws shall meet the requirements of A.S.T.M. A276, Type 316 Condition A, and the dimensional requirements of A.N.S.I. B18.6.3.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This section is used to splice rail element shown in Appendix A.7.1.

6 7/8" X 4 1/2" SEMI-ELLIPSE RAIL SPLICE



A-A

SPECIFICATIONS

Cast end caps shall conform to A.S.T.M. B26, alloy 356-F.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

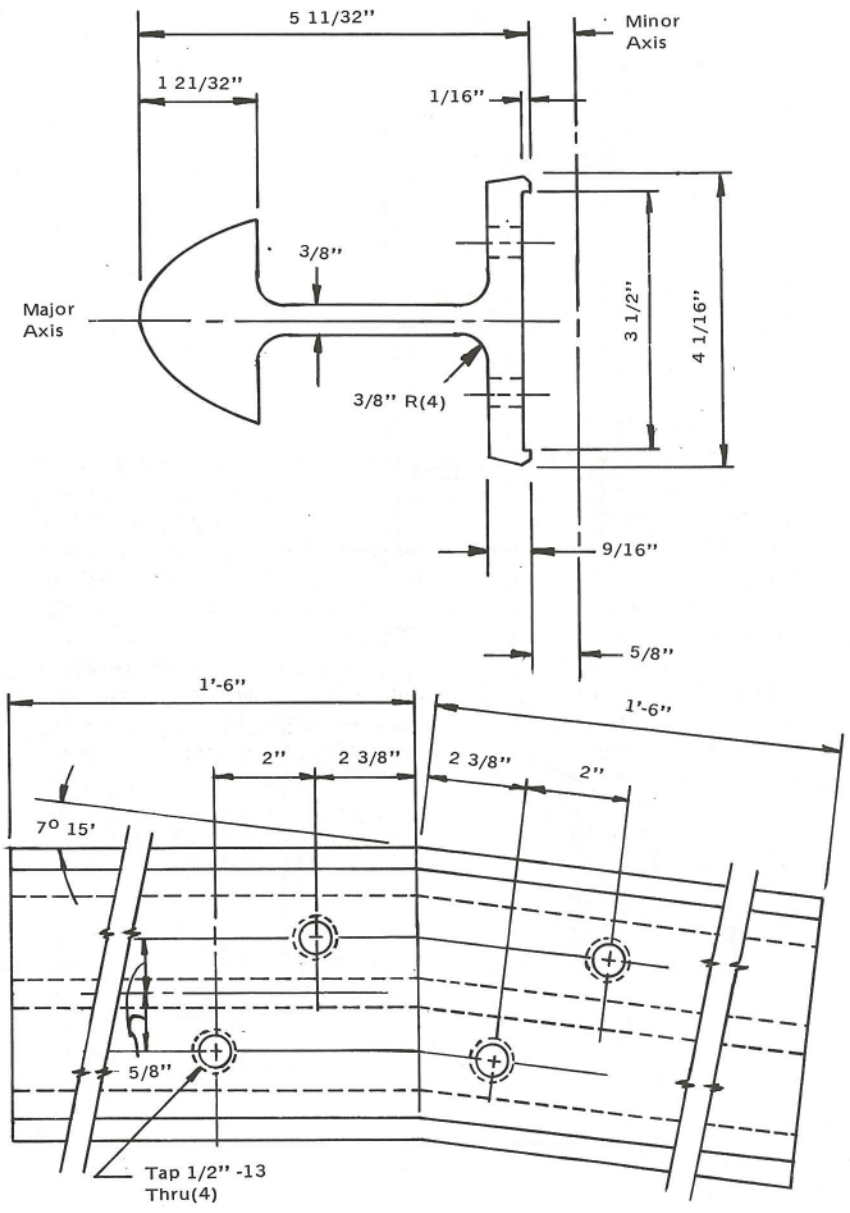
INTENDED USE

This end cap is for closing the end of the rail element shown in Appendix A.7.1.

6 7/8" X 4 1/2" SEMI–ELLIPSE RAIL END CAP

HM-TF-13

APPENDIX A.7.3



SPECIFICATIONS

Splice bar shall meet the requirements of A.S.T.M. B221, alloys 6061-T6 or 6351-T5, and shall be threaded to meet the requirements of A.N.S.I. B1.1 Class 2B Tolerance.

Cap screws shall meet the requirements of stainless steel A.S.T.M. A276, Type 430, and the dimensional requirements of A.N.S.I. B18.2.1. Washers shall be made of aluminum A.S.T.M. B209, alloy 2024-T3 alclad, and shall meet the dimensional requirements of A.N.S.I. B27.2 Type A Plain Washers.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance and accepted manufacturing practices.

INTENDED USE

This bent splice is used in the terminals of traffic barriers utilizing the rail element shown in Appendix A.7.1.

6-7/8" X 4-1/2" SEMI-ELLIPSE RAIL SPLICE (BENT)

HM-TF-13

APPENDIX A.7.4

Except for internal fastener threads that are tapped after galvanizing and left untreated and rail element RE-20[ ]-79, there are no galvanized parts shown in this guide that are to be subjected to any procedure after galvanizing that would damage its galvanized surface. RE-20[ ]-79, the rail element used in Type A bridge railings, calls for holes to be field drilled in it to accommodate post to rail fasteners. The bare steel surfaces left after drilling these holes should be throughly cleaned to bare metal for at least one-half inch away from the damaged area to remove any oil, dirt, or loose surface material and painted with a zinc dust-zinc oxide paint conforming to Federal Specification TT-P-641 or Mil-P-21035. Of course, a similar procedure might be used to repair small imperfections or damaged areas elsewhere in galvanized surfaces. The manufacturer's recommendations should be followed in applying the paint. When spray paints are used, two coats should be applied.

MATERIALS FOR USE IN REPAIRING GALVANIZED SURFACES

PRICE $6.00

AVAILABLE FROM:

AMERICAN ROAD & TRANSPORTATION
BUILDERS ASSOCIATION
525 SCHOOL STREET, S.W.
WASHINGTON, D. C. 20024

THE ASSOCIATED GENERAL
CONTRACTORS OF AMERICA
1957 E STREET, N.W.
WASHINGTON, D. C. 20006