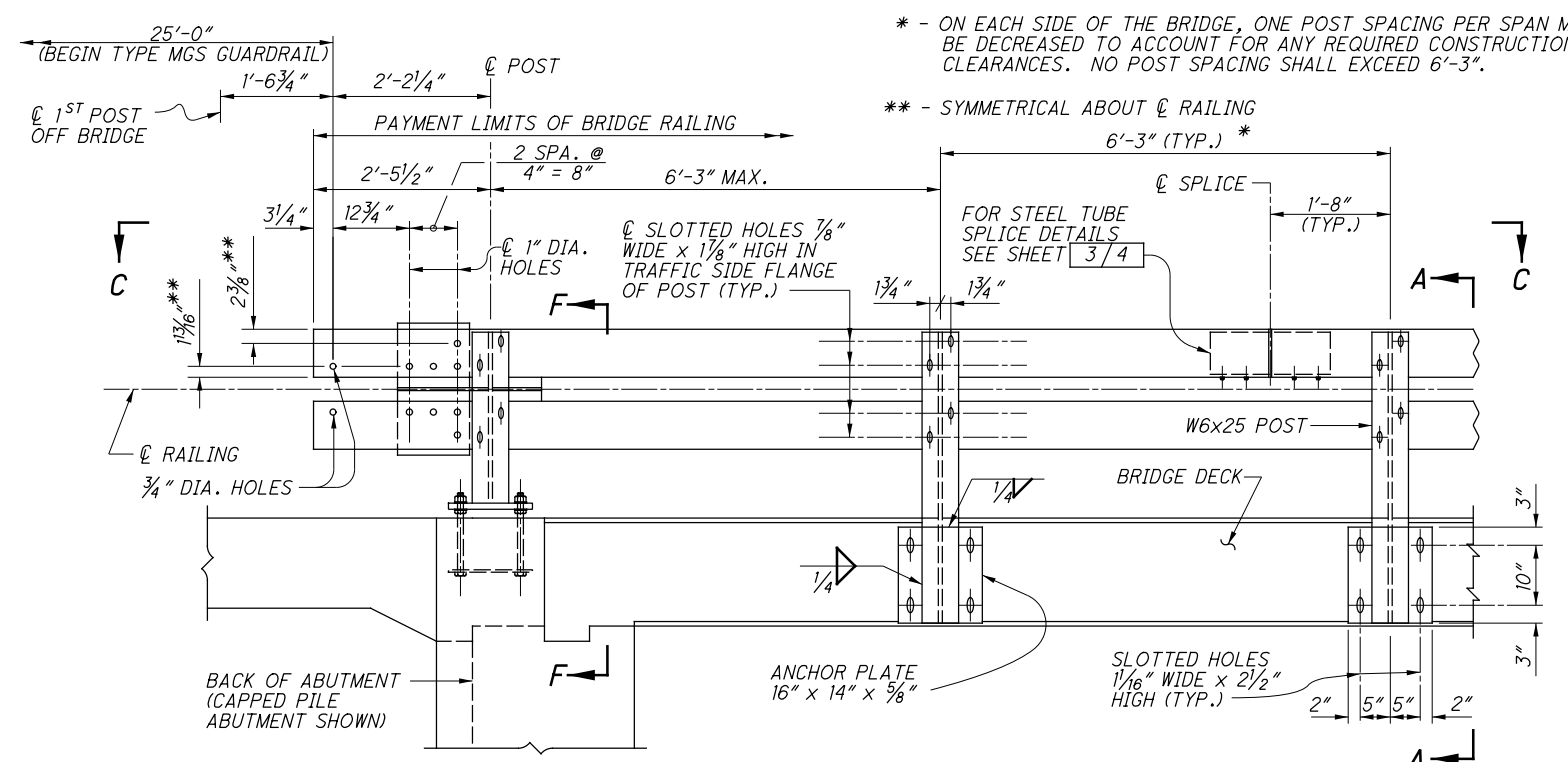


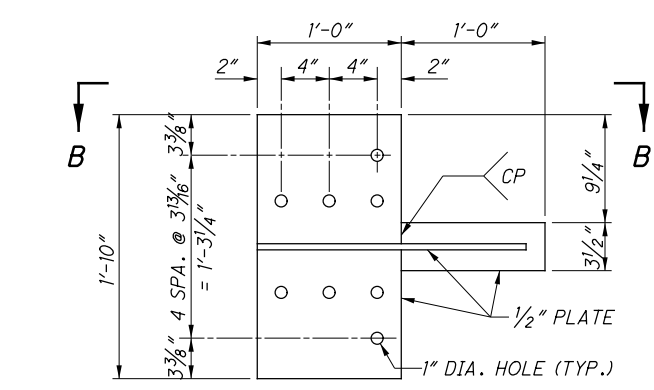
VIEW C-C



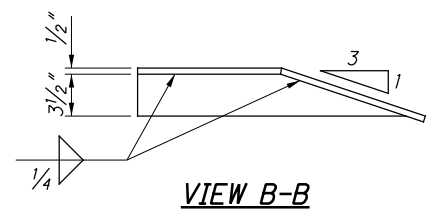
RAILING ELEVATION ON CONCRETE SLAB

BRIDGE TERMINAL ASSEMBLY NOT SHOWN. REFER TO STANDARD CONSTRUCTION DRAWING MGS-3.1 FOR DETAILS.

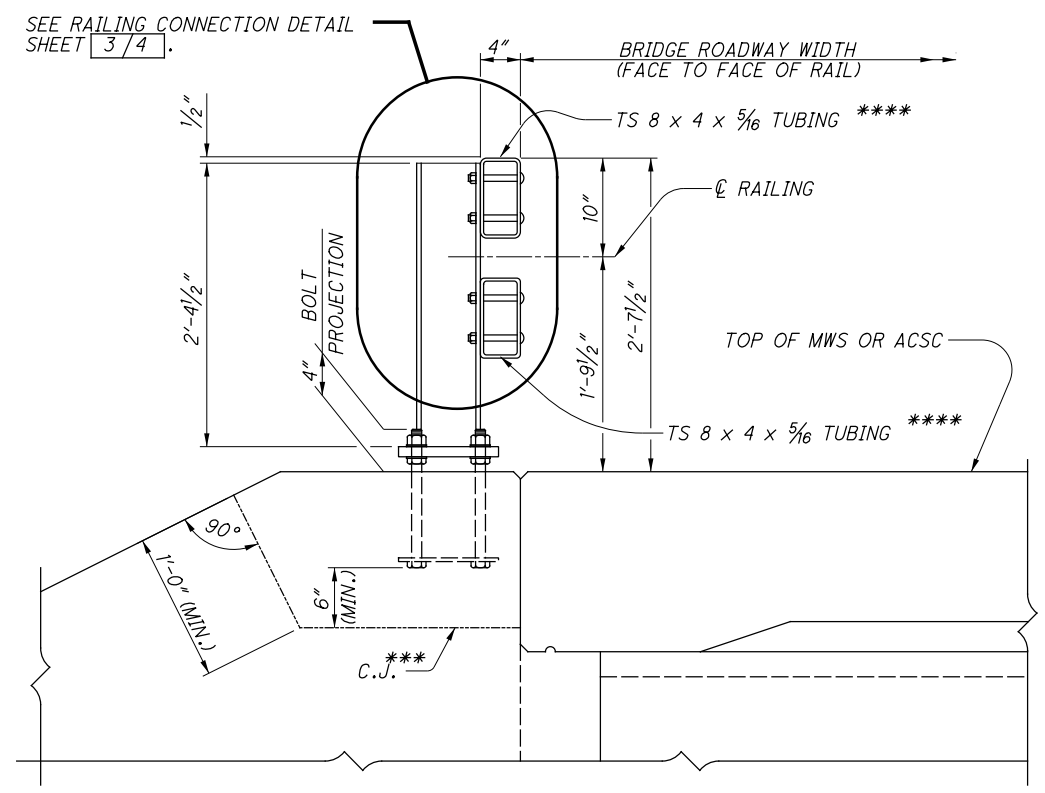
FOR SECTION A-A SEE SHEET 2/4.



GUARDRAIL CONNECTION PLATE DETAILS

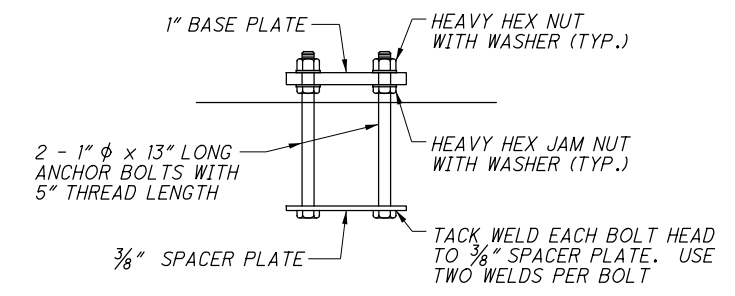


VIEW B-B



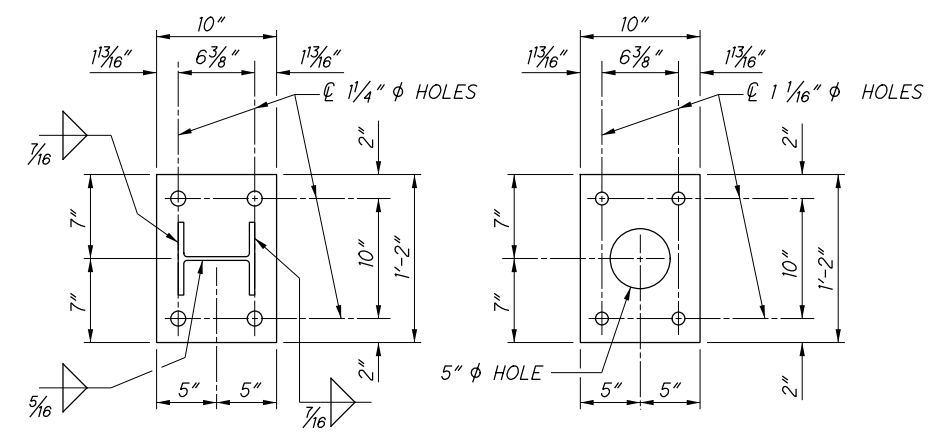
SECTION F-F

*** - PLACE THE CONCRETE ABOVE THE CONSTRUCTION JOINT AFTER INSTALLATION OF THE RAILING IS COMPLETE.
 **** - IN LIEU OF PROVIDING THE WINGWALL CONSTRUCTION JOINT, THE CONTRACTOR MAY FIELD DRILL HOLES IN THE TUBING FOR POST-TO-TUBE RAIL CONNECTIONS AT ALL FLUSH MOUNTED POST LOCATIONS. REPAIR GALVANIZING ACCORDING TO C&MS 711.02.
 MWS - MONOLITHIC WEARING SURFACE
 ACSC - ASPHALT CONCRETE SURFACE COURSE



FLUSH MOUNTED POST ANCHOR DETAIL

(POST NOT SHOWN)



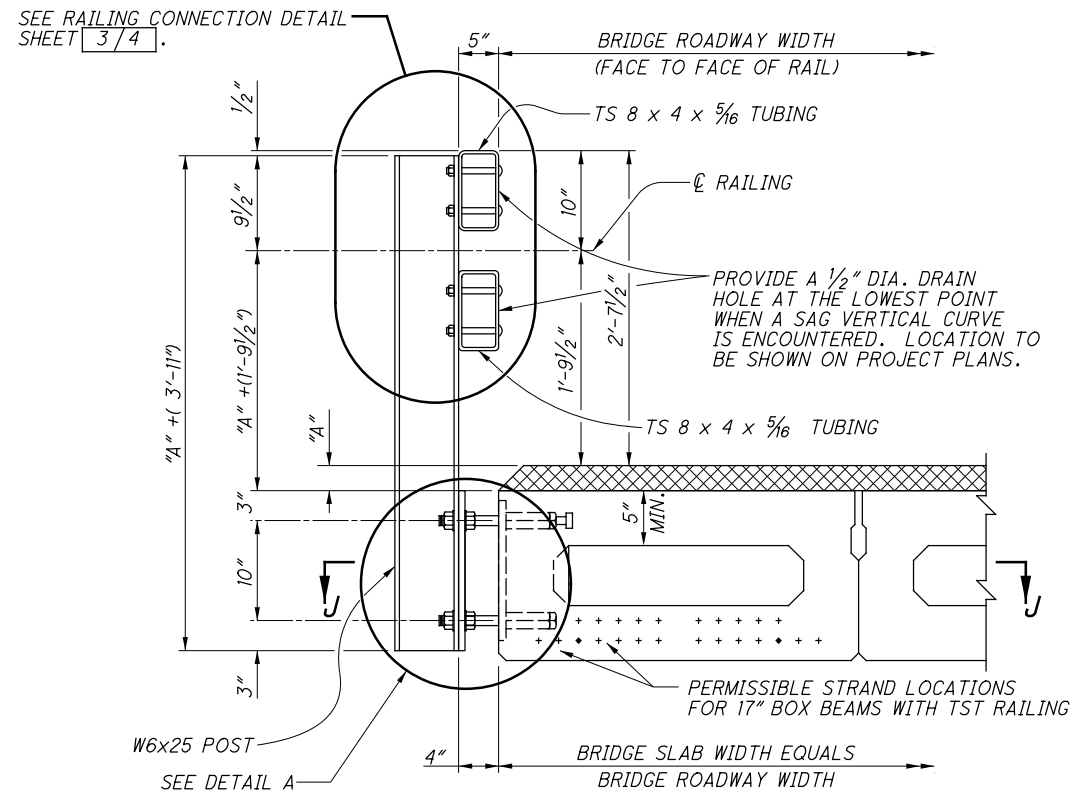
BASE PLATE
(1" PLATE)

SPACER PLATE
(3/8" PLATE)

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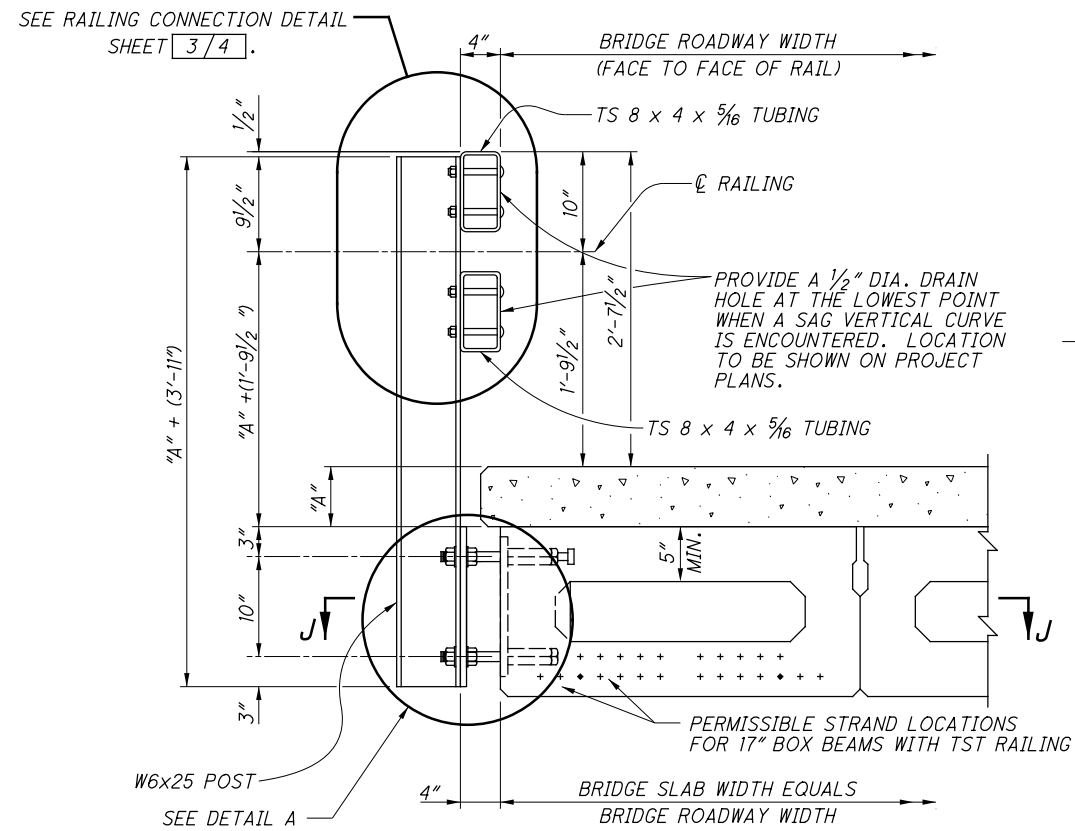
STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR <i>Brad Fogwell</i>	DATE 07-06-99
DESIGNED AUM/SAM DRAWN SAM	CHECKED JS REVIEWED WTL
OFFICE OF STRUCTURAL ENGINEERING	
STANDARD BRIDGE DRAWING TWIN STEEL TUBE BRIDGE RAILING	
SCD NUMBER TST-1-99	1 / 4

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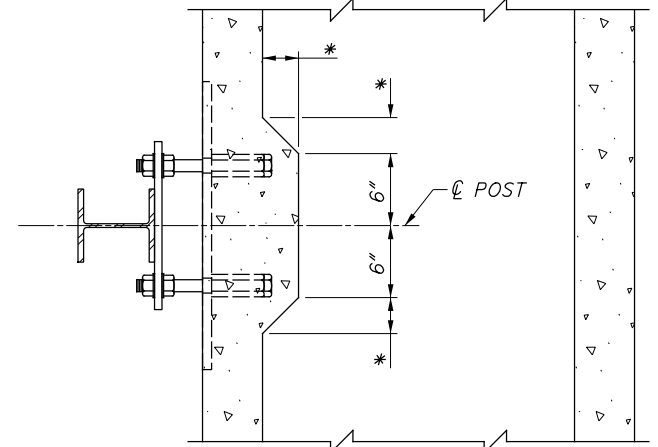
SECTION A-A

(FOR 17" AND DEEPER NONCOMPOSITE PRESTRESSED BOX BEAM BRIDGES)



SECTION A-A

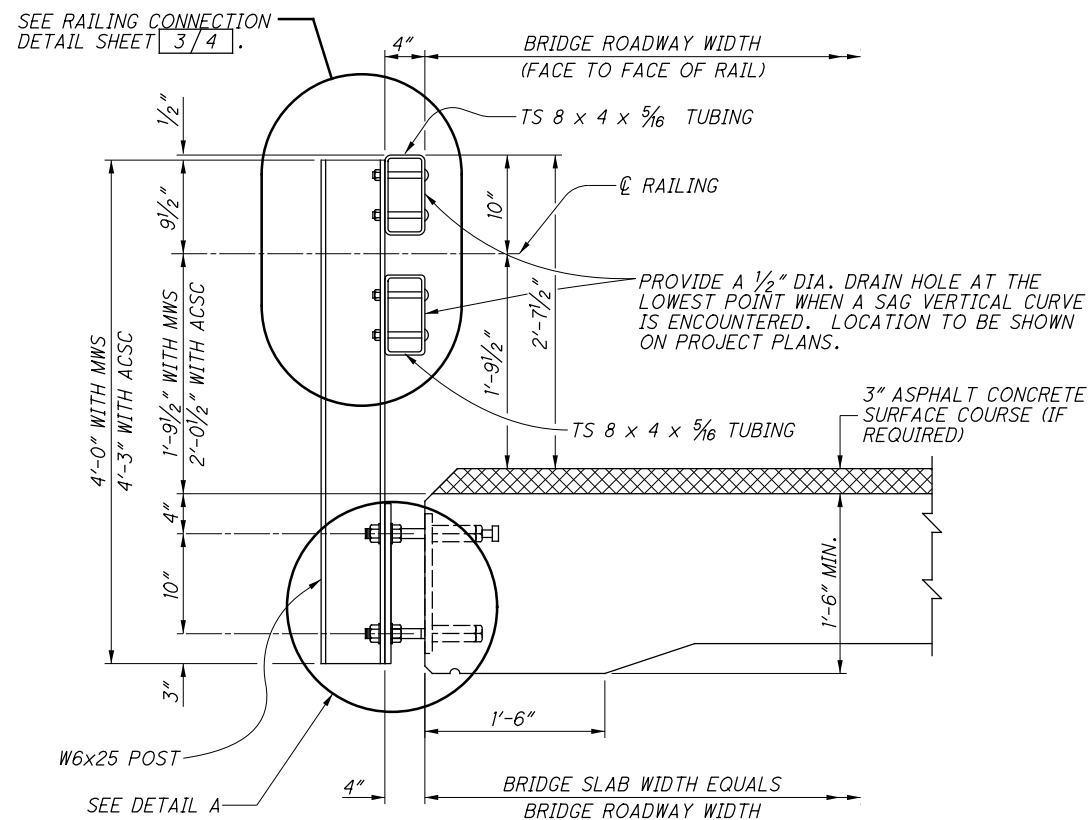
(FOR 17" AND DEEPER COMPOSITE PRESTRESSED BOX BEAM BRIDGES)



SECTION J-J

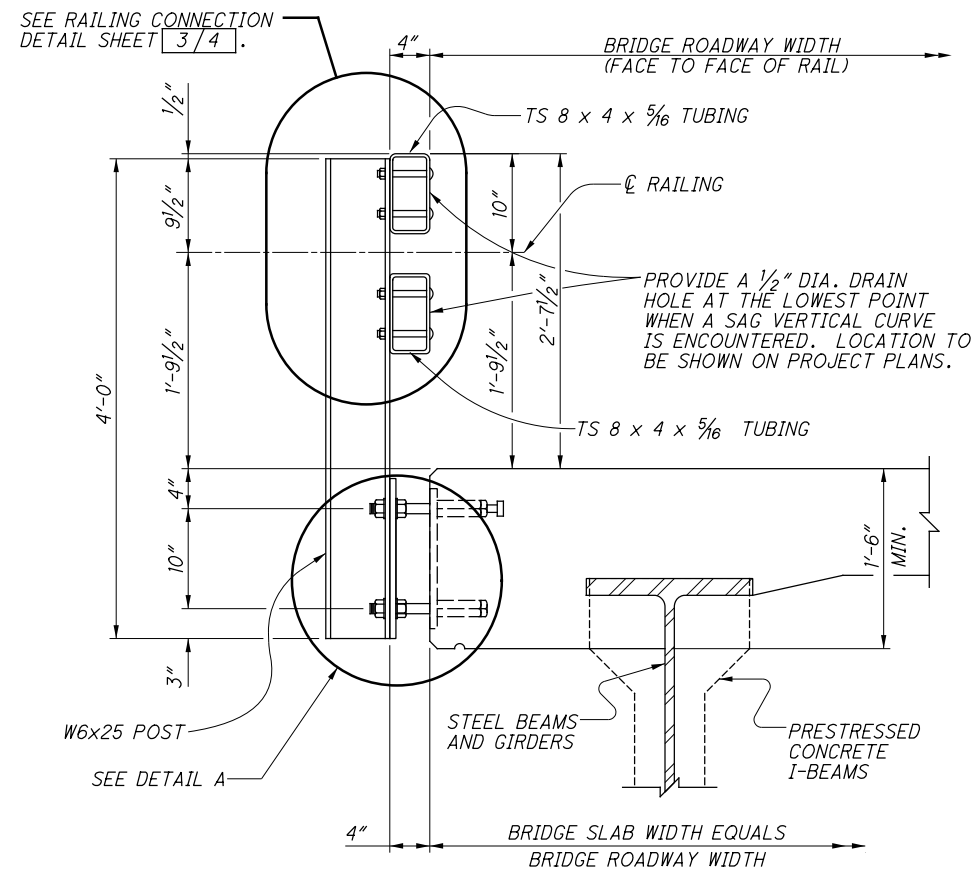
LEGEND

- MWS - MONOLITHIC WEARING SURFACE
- ACSC - ASPHALT CONCRETE SURFACE COURSE
- "A" - DECK OR OVERLAY THICKNESS, THIS DIMENSION VARIES ACROSS THE LENGTH OF THE BRIDGE.
- * - THIS DIMENSION IS THE SAME AS THE WIDTH OF FILLET IN THE BOX BEAMS'S VOID.



SECTION A-A

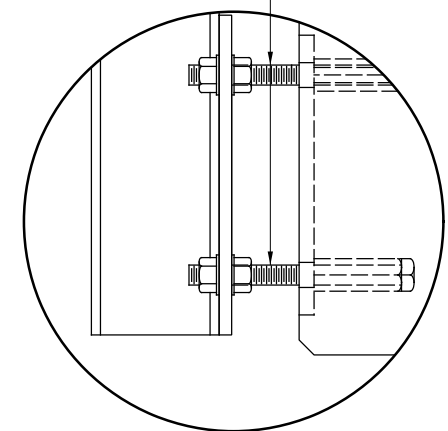
(FOR SLAB BRIDGES)



SECTION A-A

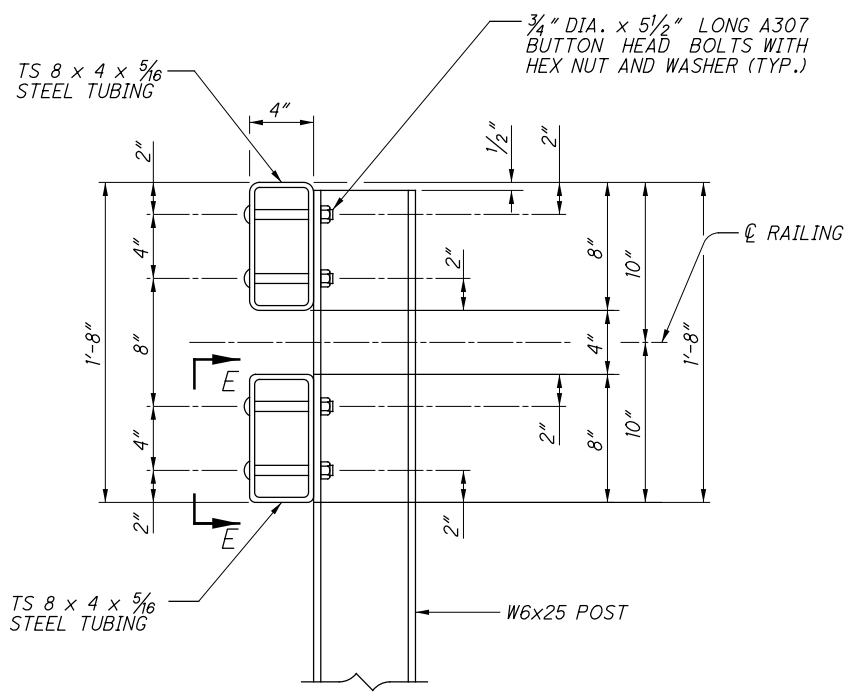
(FOR CONCRETE OR STEEL I-BEAM BRIDGES)

2 - 1" DIA. x 12" LONG ANCHOR BOLTS WITH MACHINE THREADS FULL LENGTH AND TWO HEX NUTS AND TWO 3" x 3" x 5/16" PLATE WASHERS PER BOLT.

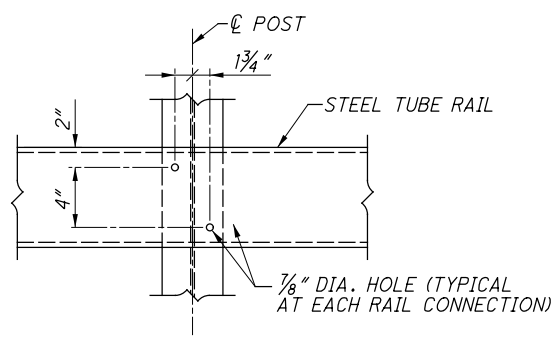


DETAIL A

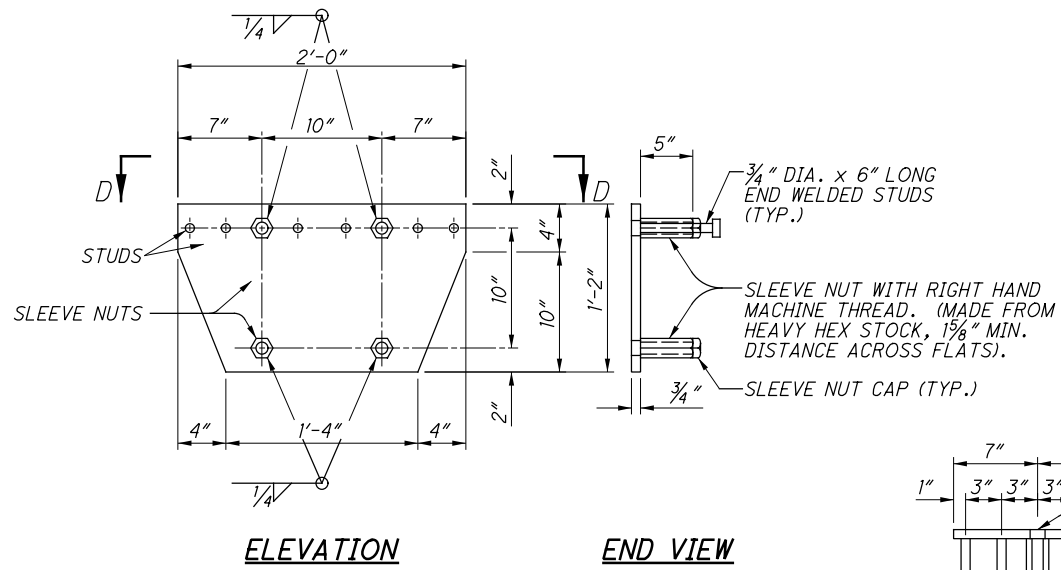
STATE OF OHIO DEPARTMENT OF TRANSPORTATION	ADMINISTRATOR	DATE	07-06-99
BRAD TAGUELL			
DESIGNED	CHECKED	REVIEWED	DATE
AUM/SAM	JS	WTL	
DRAWN	REVIEWED	DATE	
SAM	WTL		
OFFICE OF STRUCTURAL ENGINEERING			
STANDARD BRIDGE DRAWING			
TWIN STEEL TUBE BRIDGE RAILING			
SCD NUMBER			
TST-1-99			
2	4		



RAILING CONNECTION DETAIL



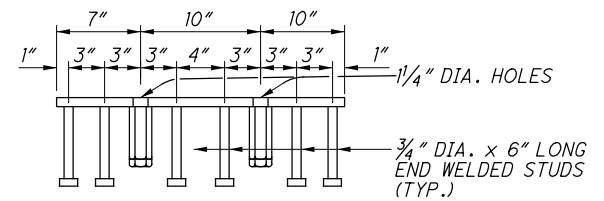
VIEW E-E



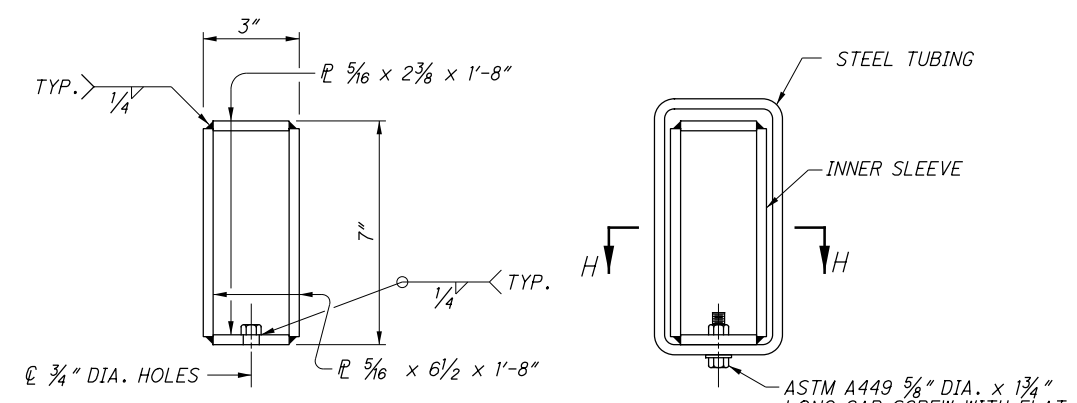
ELEVATION

END VIEW

POST ANCHOR DEVICE

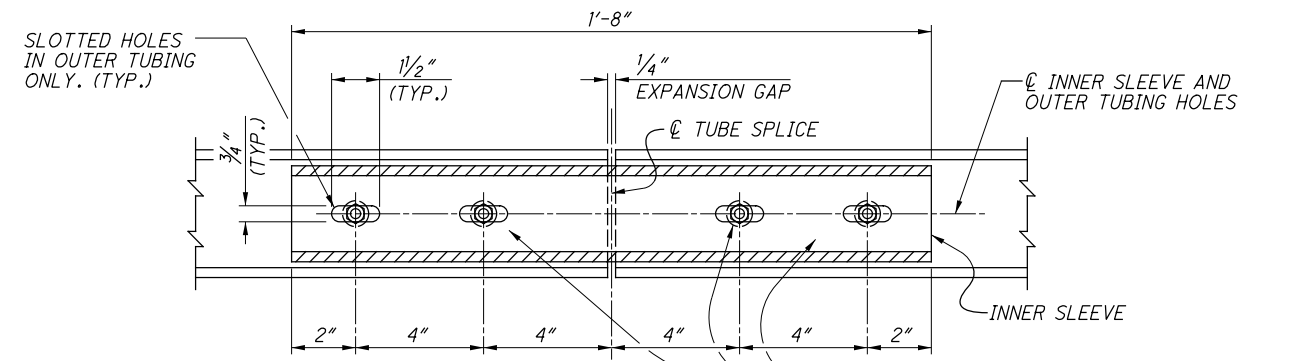


VIEW D-D



FINISHED DIMENSIONS OF INNER SLEEVE

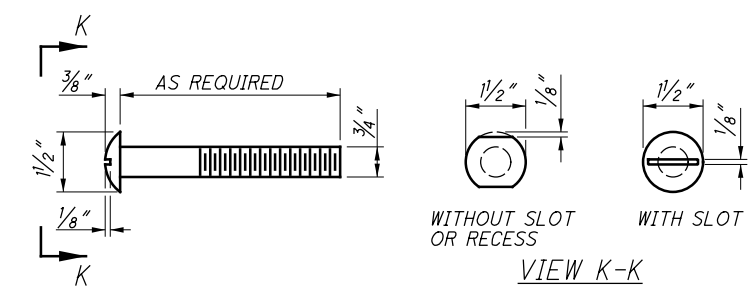
SECTION THRU SPLICE



SECTION H-H

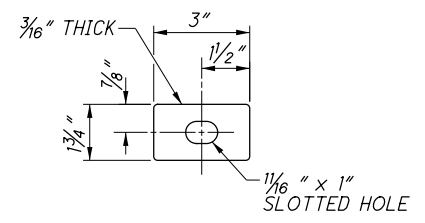
STEEL TUBE SPLICE DETAILS

BOLTS IN SLOTTED HOLES SHALL NOT BE DRAWN UP SO TIGHT AS TO PREVENT SLIDING BETWEEN THE OUTER TUBE AND THE INNER SPLICE.



VIEW K-K

DETAIL OF 3/4" DIA. ROUND HEAD BOLT



SPECIAL WASHER

PLACE WASHER BETWEEN BOLT HEAD AND FACE OF THRIE BEAM RAIL.

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STATE OF OHIO DEPARTMENT OF TRANSPORTATION		DATE 07-06-99	
ADMINISTRATOR Brad Fogwell		DATE 07-06-99	
REVISIONS	10-20-00	07-19-02	04-18-03
04-18-08	01-17-14	07-15-16	07-20-18
01-15-21			
CHECKED	JS	REVIEWED	WTL
DESIGNED	AJM/SAM	DRAWN	SAM
OFFICE OF STRUCTURAL ENGINEERING			
STANDARD BRIDGE DRAWING			
TWIN STEEL TUBE BRIDGE RAILING			
SCD NUMBER	TST-1-99		
3		4	

TST-1-99 GENERAL NOTES:

GENERAL: THIS DRAWING PROVIDES DESIGN AND CONSTRUCTION DETAILS. THE PROJECT PLANS FOR EACH STRUCTURE SHALL PROVIDE NECESSARY ADDITIONAL RAILING DIMENSIONS INCLUDING RAILING LENGTHS, POST SPACINGS, POST LENGTHS AND ANY OTHER PERTINENT INFORMATION INCLUDING SPECIAL NOTES AND DETAILS. FOR ADDITIONAL GUARDRAIL DETAILS, SEE STD. CONSTR. DWGS. MGS-1.1, MGS-2.1 AND OTHER DRAWINGS PERTAINING TO DESIGN OF SPECIFIC GUARDRAIL TYPES.

APPLICATION: THIS RAILING SYSTEM HAS BEEN ACCEPTED TO THE TL-4 CRITERIA OF NCHRP REPORT 350. THE TWIN STEEL TUBE RAILING SHALL BE USED ON STRUCTURES DESIGNED TO DRAIN SURFACE WATER OVER THE SIDES OF THE STRUCTURE. THIS RAILING IS NOT APPLICABLE TO COMPOSITE BOX BEAM BRIDGES WITH DESIGN OVERHANGS GREATER THAN 2" OR TOP FLANGE THICKNESSES LESS THAN 5".

CONNECT THE APPROACH AND TRAILING ENDS OF THE TWIN STEEL TUBE RAILING TO THE BRIDGE TERMINAL ASSEMBLY DETAILED IN STANDARD CONSTRUCTION DRAWING MGS-3.1. THE FIRST POST AT THE APPROACH END AND THE LAST POST AT THE TRAILING END OF THE BRIDGE RAILING SHALL BE FLUSH MOUNTED AS SHOWN ON SHEET 1 OF 4.

DESIGN DATA:

REINFORCING STEEL - MINIMUM YIELD STRENGTH = 60,000 PSI
 STEEL TUBING - MINIMUM YIELD STRENGTH = 46,000 PSI
 ALL OTHER STEEL - MINIMUM YIELD STRENGTH = 50,000 PSI

MATERIALS: FURNISH SHAPED STRUCTURAL TUBING ACCORDING TO 707.10 (ASTM A500, GRADE B). IN LIEU OF THE "DROP WEIGHT TEAR TEST" (ASTM E436), THE MANUFACTURER MAY CHOOSE TO SUPPLY TUBING THAT MEETS IMPACT TOUGHNESS ACCORDING TO AASHTO T266, "NOTCHED BAR IMPACT TESTING OF METALLIC MATERIALS (CVN)". THE CVN IMPACT REQUIREMENTS SHALL BE 15 FT-LBS AT 0°F. FOR EACH HEAT SUPPLIED, THE MANUFACTURER SHALL FURNISH ONE 2" x 18" SPECIMEN, MARKED WITH ITS HEAT NUMBER, FOR IMPACT TESTING.

FURNISH STRUCTURAL STEEL SHAPES, PLATES AND PLATE WASHERS ACCORDING TO 711.01.

GALVANIZING: GALVANIZE ALL SHAPED STRUCTURAL TUBES, POSTS, PLATES, HARDWARE AND ACCESSORIES IN ACCORDANCE WITH 711.02. PRIOR TO GALVANIZING, ROUND ALL STRUCTURAL TUBING ENDS AND REMOVE BURRS FROM ALL STEEL TUBING, SHAPES AND PLATES.

HORIZONTAL CURVATURE: THIS STANDARD IS APPLICABLE TO STRUCTURES HAVING A RAILING CURVATURE RADIUS OF 20 FEET OR MORE. FOR A RADIUS OF LESS THAN 20 FEET, THE DESIGN SHALL BE SPECIAL. FOR ALL CURVED STRUCTURES, HEAT CURVE THE HORIZONTAL RAIL ELEMENTS ACCORDING TO THE AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATIONS.

TUBE SPLICES: LOCATE SPLICES SO THAT EACH TUBE SEGMENT IS CONNECTED TO NOT LESS THAN TWO POSTS. STAGGER SPLICES IN THE TOP AND BOTTOM TUBES TO AVOID OCCURRENCES IN THE SAME PANEL.

FASTENERS: FURNISH MATERIAL CONFORMING TO THE FOLLOWING:

ALL ANCHOR BOLTS, SLEEVE NUTS, NUTS AND WASHERS SHALL CONFORM TO ASTM A 449.

END WELDED STUDS SHALL CONFORM TO ASTM A108.

THE TUBE RAIL TO POST CONNECTION BOLTS AND HEX NUTS SHALL CONFORM TO 711.10 (ASTM A307). REFER TO STANDARD CONSTRUCTION DRAWING MGS-3.1 FOR THE BRIDGE TERMINAL ASSEMBLY CONNECTION HARDWARE.

THE HEX CAP SCREWS (BOLTS), HEX NUTS AND WASHERS SHALL CONFORM TO ASTM A 449.

TIGHTEN ALL FASTENERS PER C&MS 513.20.

BOX BEAMS: THE DISTANCE FROM THE CENTERLINE OF A GUARDRAIL POST TO THE ABUTMENT END OF THE BEAM OR TO THE CENTERLINE OF A TIE ROD SHALL NOT BE LESS THAN 1'-8". THE DISTANCE FROM THE CENTERLINE OF A GUARDRAIL POST TO THE PIER END OF THE BEAM SHALL NOT BE LESS THAN 2'-10". THE LOCATION OF THE HORIZONTAL TIE RODS MAY NEED TO BE ADJUSTED IN ORDER TO ACCOMMODATE EACH POST ANCHOR DEVICE.

METHOD OF MEASUREMENT: THE DEPARTMENT WILL MEASURE TWIN STEEL TUBE BRIDGE RAILING BY THE NUMBER OF FEET. THE DEPARTMENT WILL MEASURE THE LENGTH OF RAILING AS THE DISTANCE BETWEEN THE CENTERS OF THE FLUSH MOUNTED POSTS AT THE APPROACH AND TRAILING ENDS PLUS 4'-11".

BASIS OF PAYMENT: THE DEPARTMENT WILL CONSIDER THE COSTS ASSOCIATED WITH FURNISHING AND INSTALLING STEEL TUBING, STEEL POSTS, POST ANCHOR DEVICES, ANCHOR PLATES, TUBE SPLICE PLATES, STEEL SHIM PLATES, GUARDRAIL CONNECTION PLATES, ANCHOR BOLTS, 3/4" ROUND HEAD BOLTS, SLEEVE NUTS, NUTS, CAP SCREWS, WASHERS AND OTHER HARDWARE TO BE INCLUDED WITH THE TWIN STEEL TUBE RAILING. THE DEPARTMENT WILL PAY FOR ACCEPTED QUANTITIES AT THE CONTRACT PRICE FOR ITEM 517, RAILING (TWIN STEEL TUBE).

THE DEPARTMENT WILL PAY FOR BRIDGE TERMINAL ASSEMBLY HARDWARE SEPARATELY.

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SCD NUMBER TST-1-99	STANDARD BRIDGE DRAWING TWIN STEEL TUBE BRIDGE RAILING	OFFICE OF STRUCTURAL ENGINEERING	STATE OF OHIO DEPARTMENT OF TRANSPORTATION <i>Brad Fogwell</i> ADMINISTRATOR																				
4 / 4			DATE 07-06-99																				
			<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">DESIGNED AJM/SAM</td> <td style="width: 50%; text-align: center;">CHECKED JS</td> </tr> <tr> <td style="width: 50%; text-align: center;">DRAWN SAM</td> <td style="width: 50%; text-align: center;">REVIEWED WTL</td> </tr> </table>	DESIGNED AJM/SAM	CHECKED JS	DRAWN SAM	REVIEWED WTL																
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			<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">REVISIONS</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">10-20-00</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">07-19-02</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">04-18-03</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">10-17-03</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">04-18-08</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">01-17-14</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">07-15-16</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">07-20-18</td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;">01-15-21</td> <td style="width: 50%;"></td> </tr> </table>	REVISIONS		10-20-00		07-19-02		04-18-03		10-17-03		04-18-08		01-17-14		07-15-16		07-20-18		01-15-21	
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