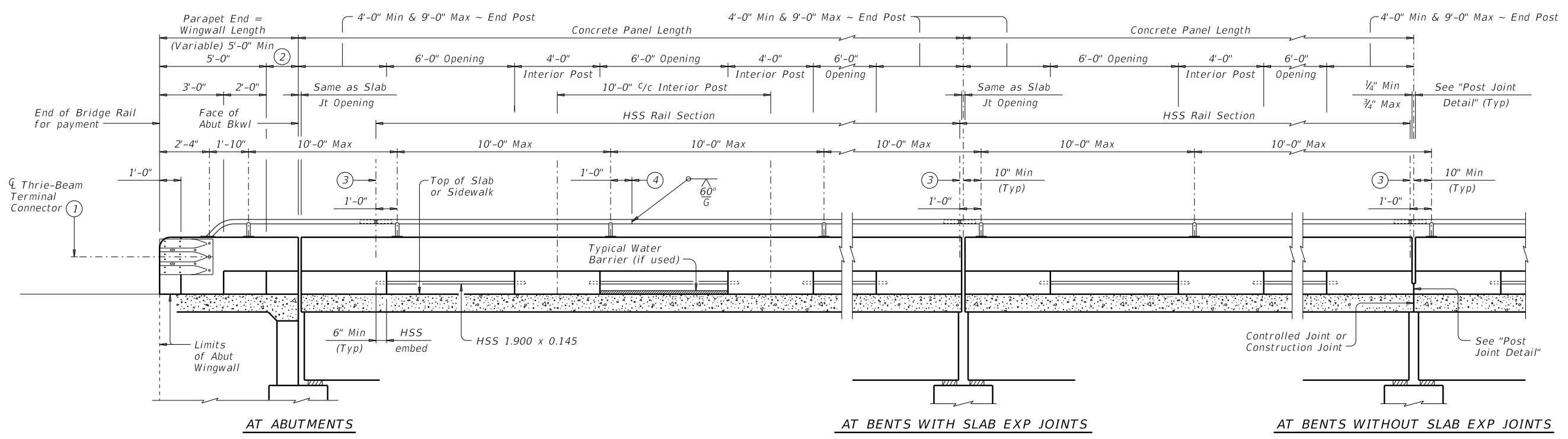
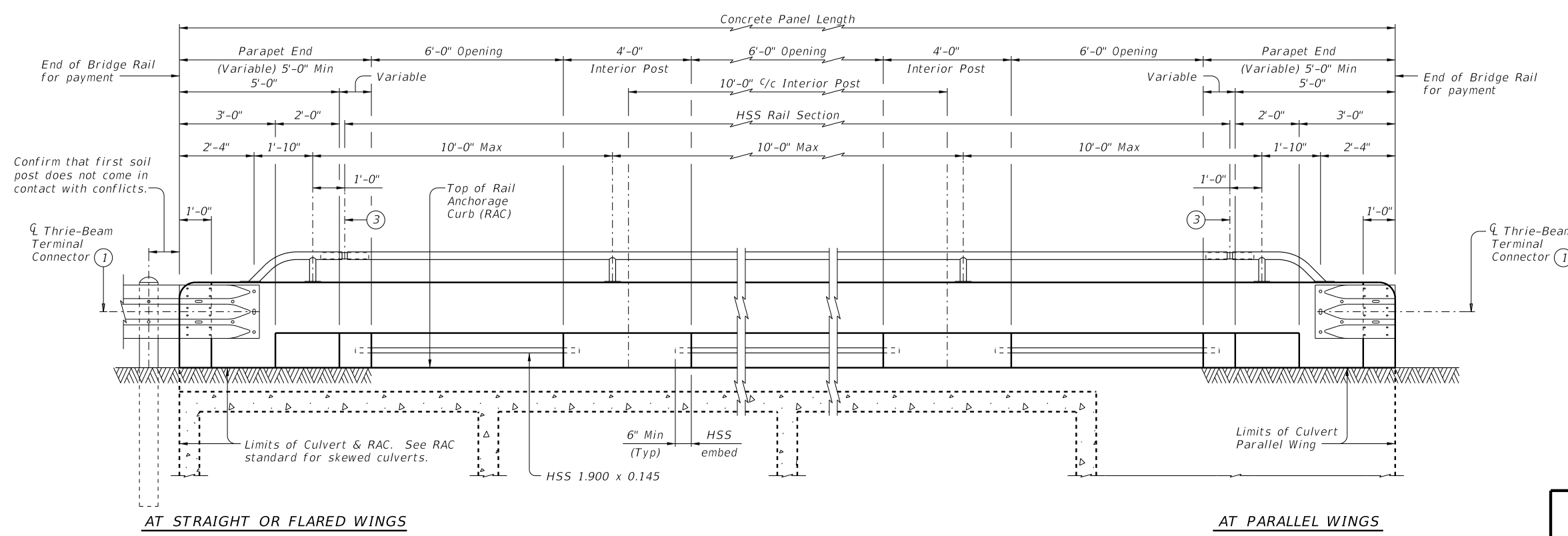


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ROADWAY ELEVATION OF RAIL ON BRIDGE
 (Showing without raised sidewalk)



ROADWAY ELEVATION OF RAIL ON BOX CULVERTS

Showing 0° skew culvert. Skewed culverts similar. See RAC standard for details not shown. Vertical joints in concrete rail are not required, unless shown elsewhere.

- ① Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.
- ② Wingwall Length minus 5'-0" (Varies)
- ③ ζ Splice Jt or Exp Jt
- ④ One shop splice per HSS rail section is permitted with minimum 85 percent penetration. The weld may be square groove or single vee groove. Grind smooth.

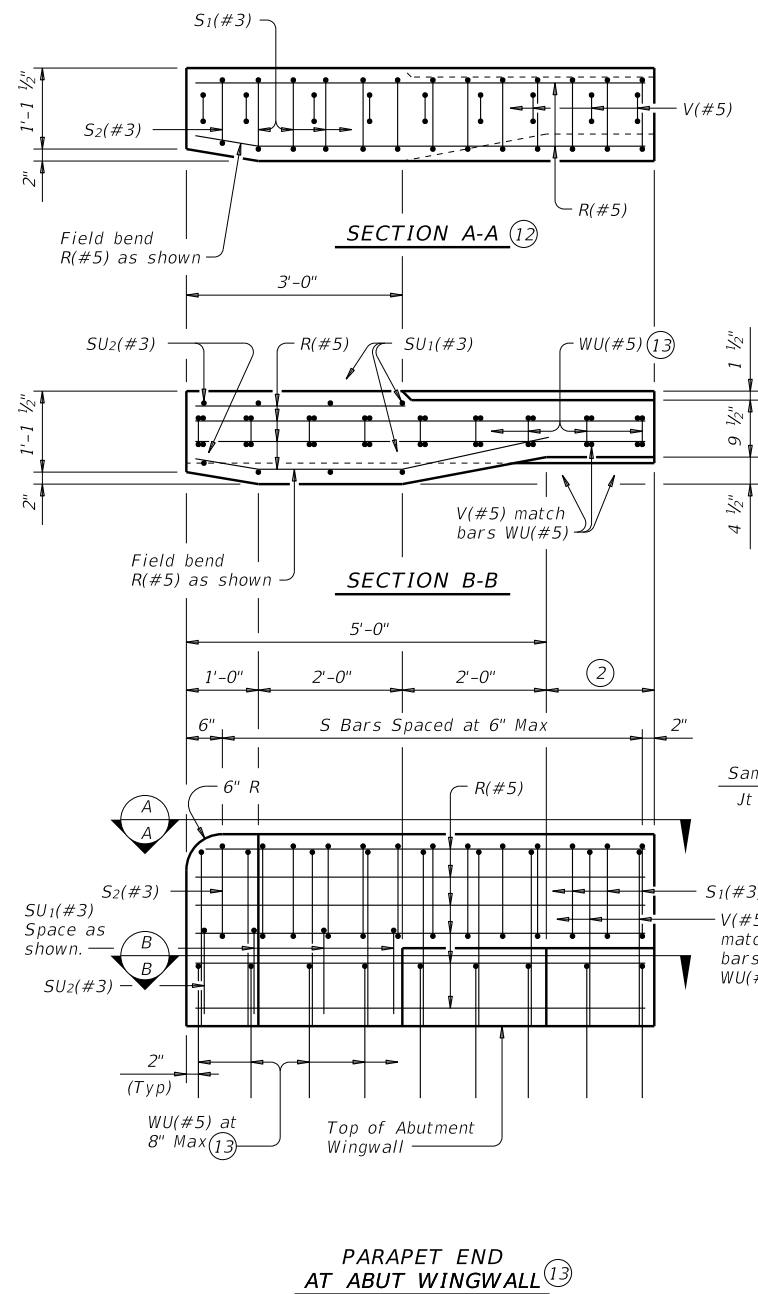
 Texas Department of Transportation	Bridge Division Standard
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COMBINATION RAIL

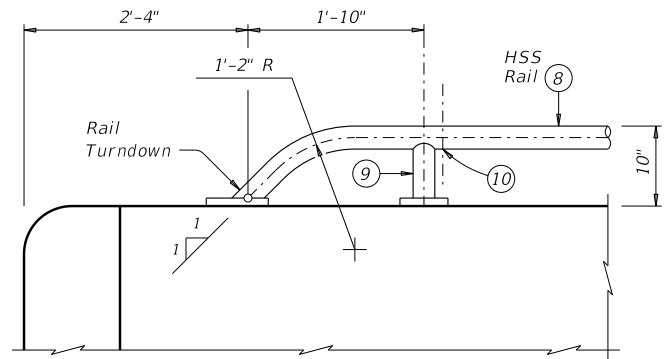
TYPE C223

FILE: r1std019.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT July 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS				
03-16: Removed shop drawing note, Added box culvert elevation. Added MASH TL-3 in General Notes. Added additional epoxy classes.	DIST	COUNTY	SHEET NO.	

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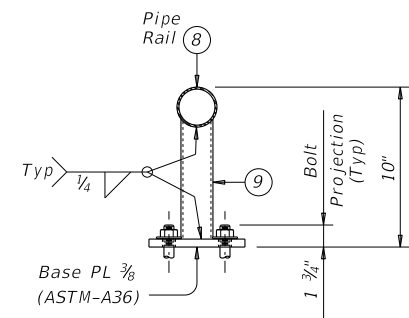


PARAPET END AT ABUT WINGWALL (13)

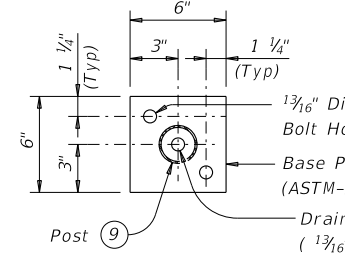


Note that at least two anchor points (as shown) are required for the Bridge Rail on the Abutment Wingwall. Longer Wingwalls may require more than two Rail anchorages.

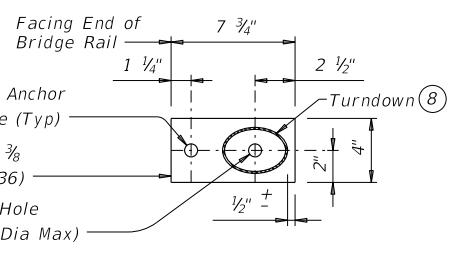
HSS RAIL TERMINAL DETAIL



TRANSVERSE SECTION

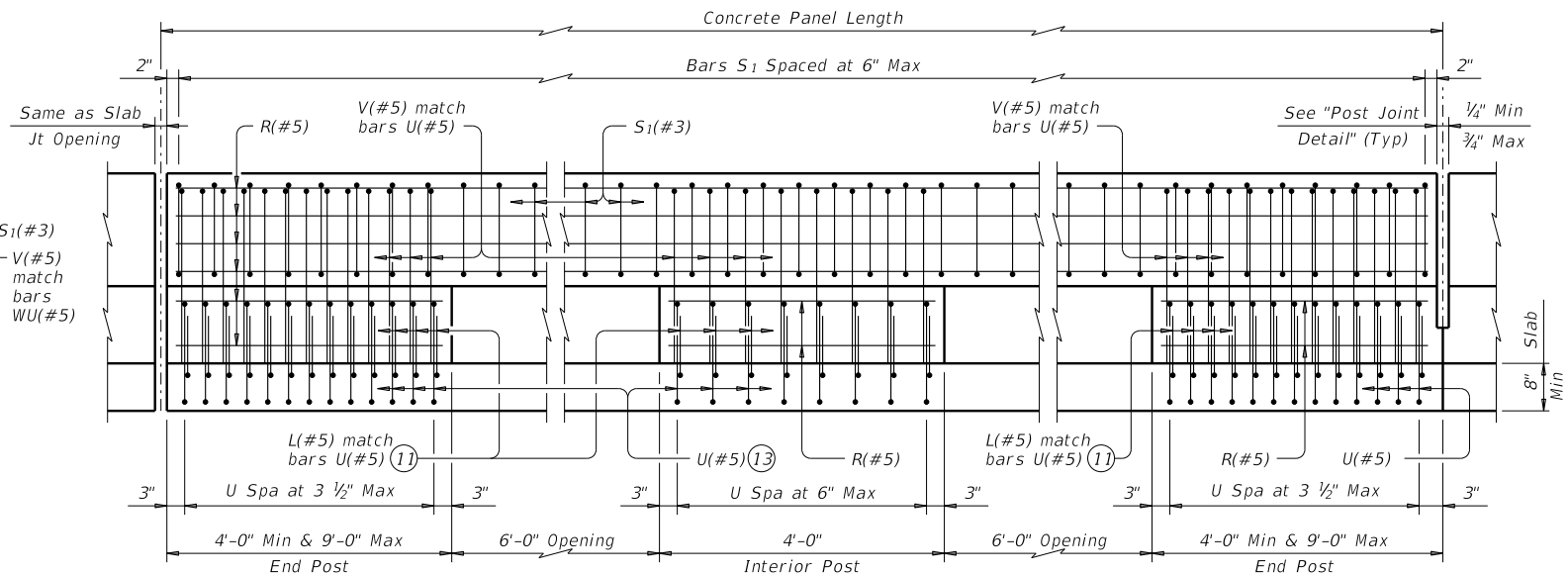


POST BASE PLATE PLAN



RAIL TURNDOWN BASE PLATE PLAN

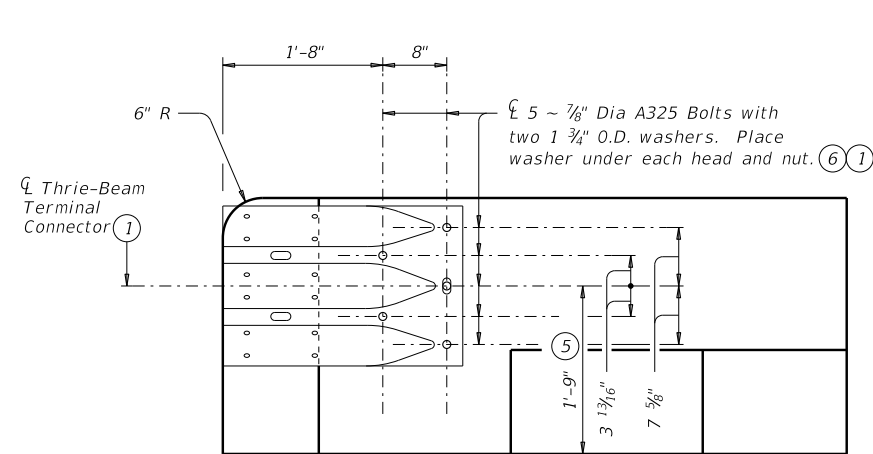
HSS RAIL DETAILS



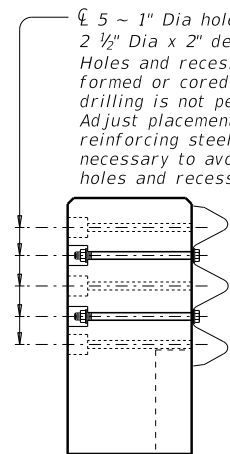
ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT

Showing rail on slab and without raised sidewalk. Rail on box culvert similar. HSS not shown for clarity.

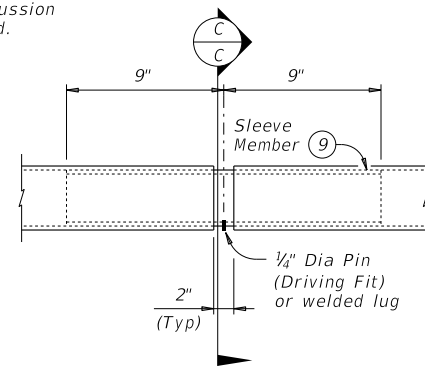
- ① Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.
- ② Wingwall Length minus 5'-0" (Varies)
- ⑤ Increase 2" for structures with overlay.
- ⑥ Provide bolts of sufficient length to extend 1/2" to 3/4" beyond nut.
- ⑦ Bolt recesses are only required when pedestrian sidewalks are adjacent to back of rail.
- ⑧ HSS 2.875 x 0.203
- ⑨ HSS 2.375 x 0.154
- ⑩ 3/8" Dia Hole in bottom of HSS rail (Minimum 1 hole between posts ~ Typ)
- ⑪ Bars L(#5) are part of rail reinforcing and are included in unit price bid for railing. Space with Bars U. Bars L match slab bar cover. Bars L may be bundled with top slab reinforcing if spacing is equivalent.
- ⑫ Bars SU1(#3), SU2(#3) and WU(#5) not shown for clarity.
- ⑬ Substitute Bars U(#5) for Bars WU(#5) when parapet end is located on anchorage curb over culvert top slab. Use Bars WU(#5) in culvert parallel wings.



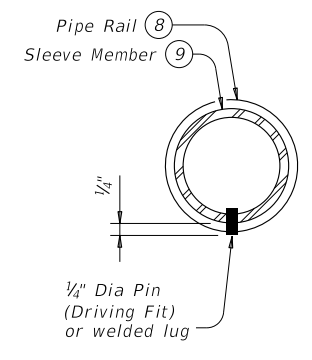
ELEVATION



SECTION



AT SPLICE OR EXP JTS



SECTION C-C

PIPE SPLICE DETAILS

TERMINAL CONNECTION DETAILS

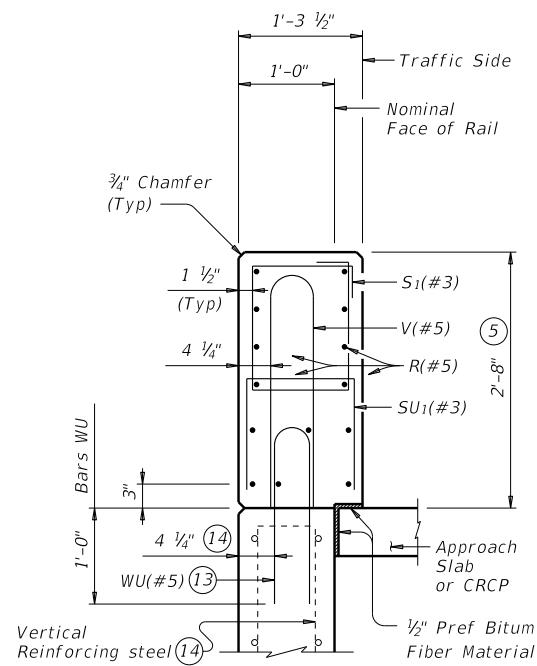
COMBINATION RAIL

TYPE C223

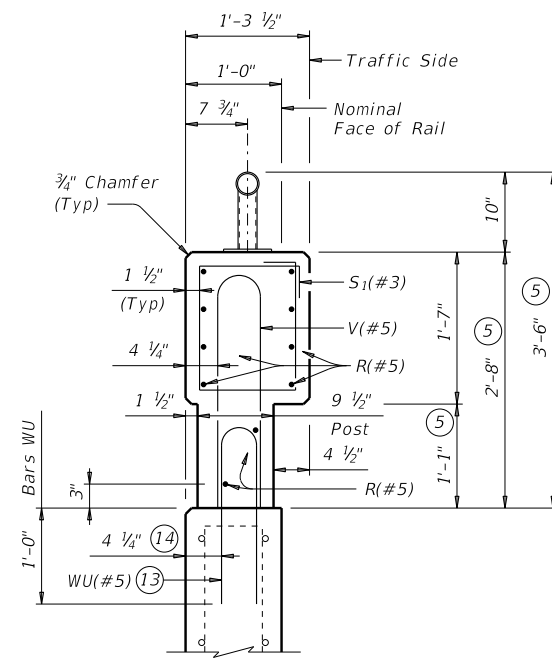
FILE: r1st0019.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT July 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS				
03-16: Removed shop drawing note, Added box culvert elevation. Added MASH TL-3 in General Notes. Added additional epoxy classes.	DIST	COUNTY	SHEET NO.	

DATE: FILE:

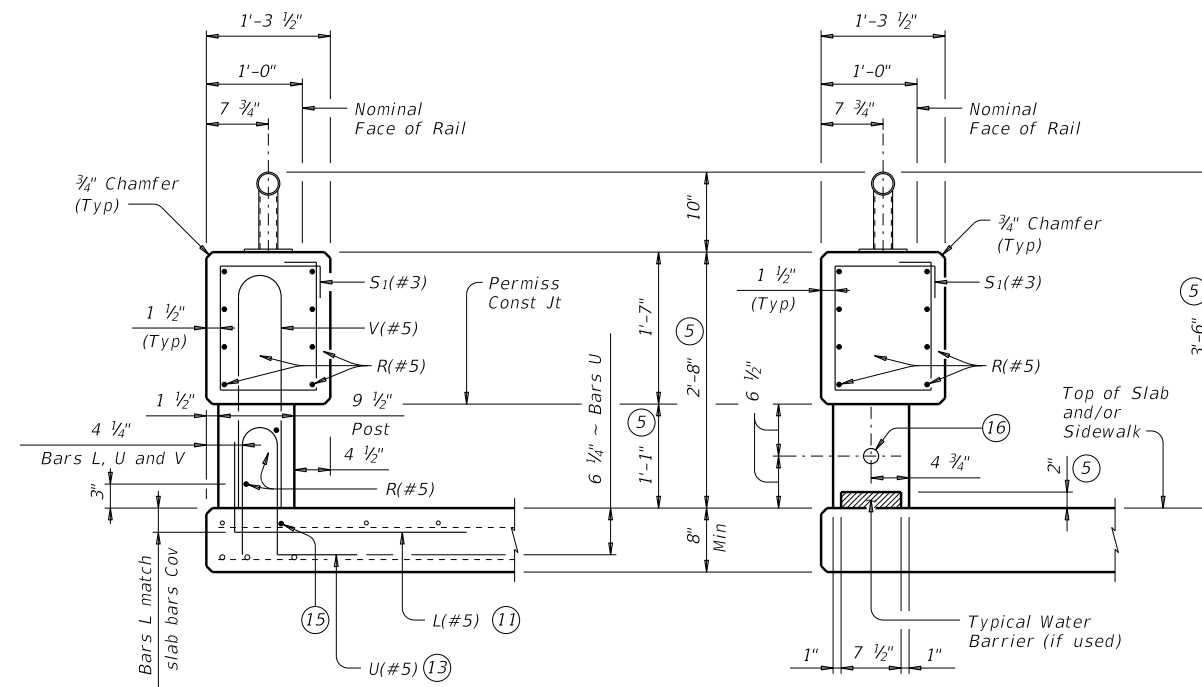
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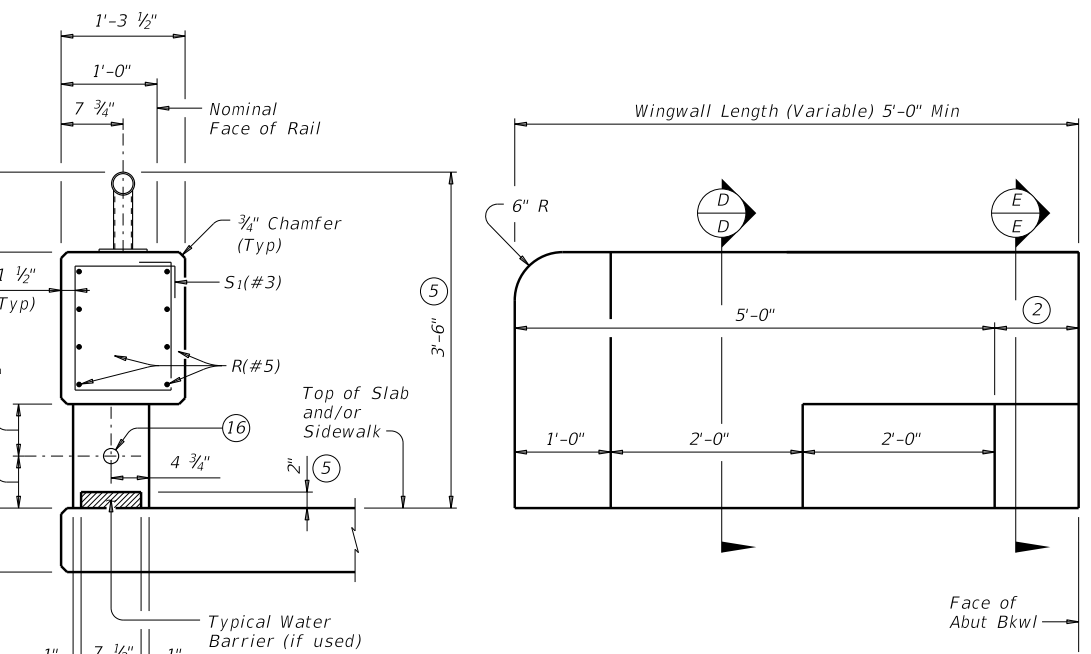
**SECTION D-D
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS**



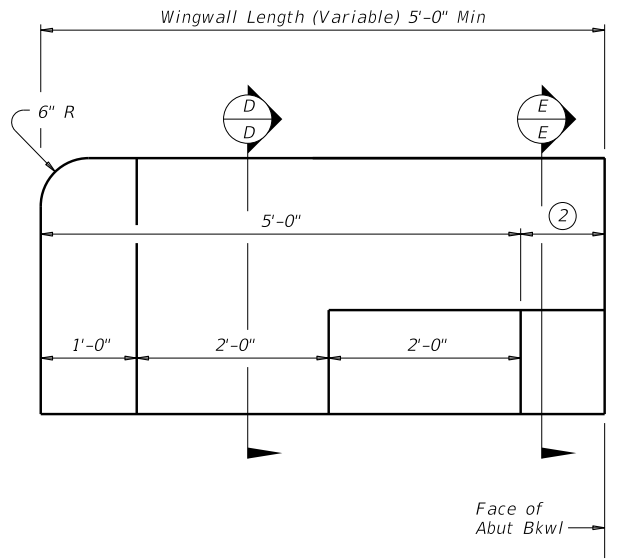
**SECTION E-E
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS**



**AT POST
ON BRIDGE SLAB**



**AT OPENING
ON BRIDGE SLAB**

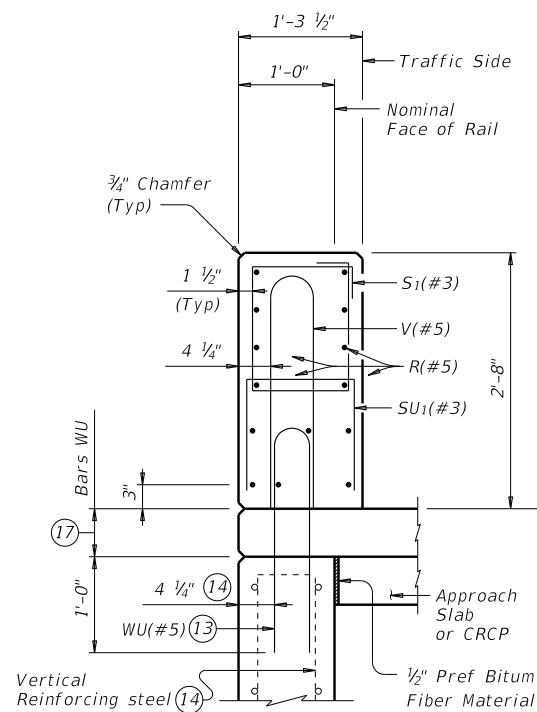


**ELEVATION AT
ABUTMENT WINGWALL**

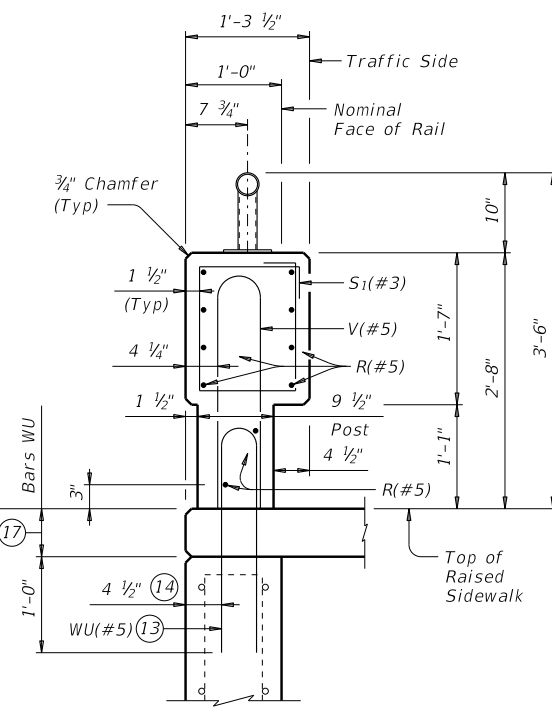
Box culvert parallel wings or rail anchorage curb similar. HSS rail not shown for clarity.

SECTIONS THRU RAIL WITHOUT RAISED SIDEWALK

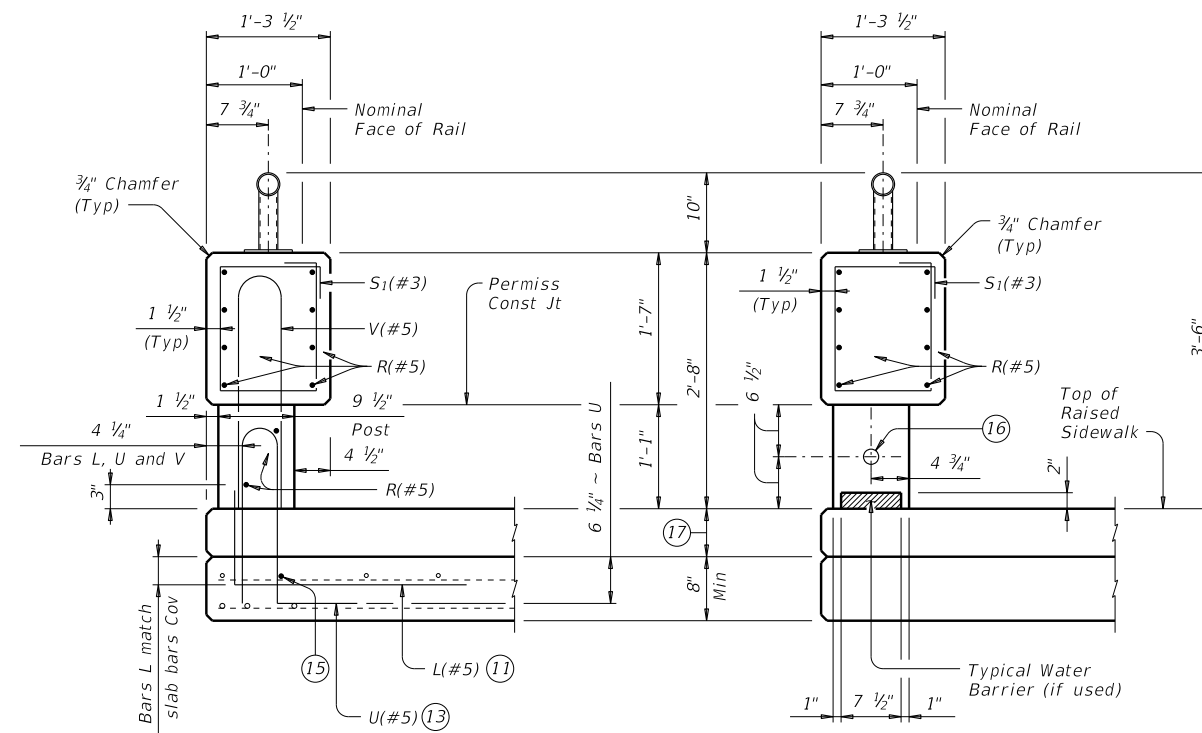
Sections on box culvert similar.



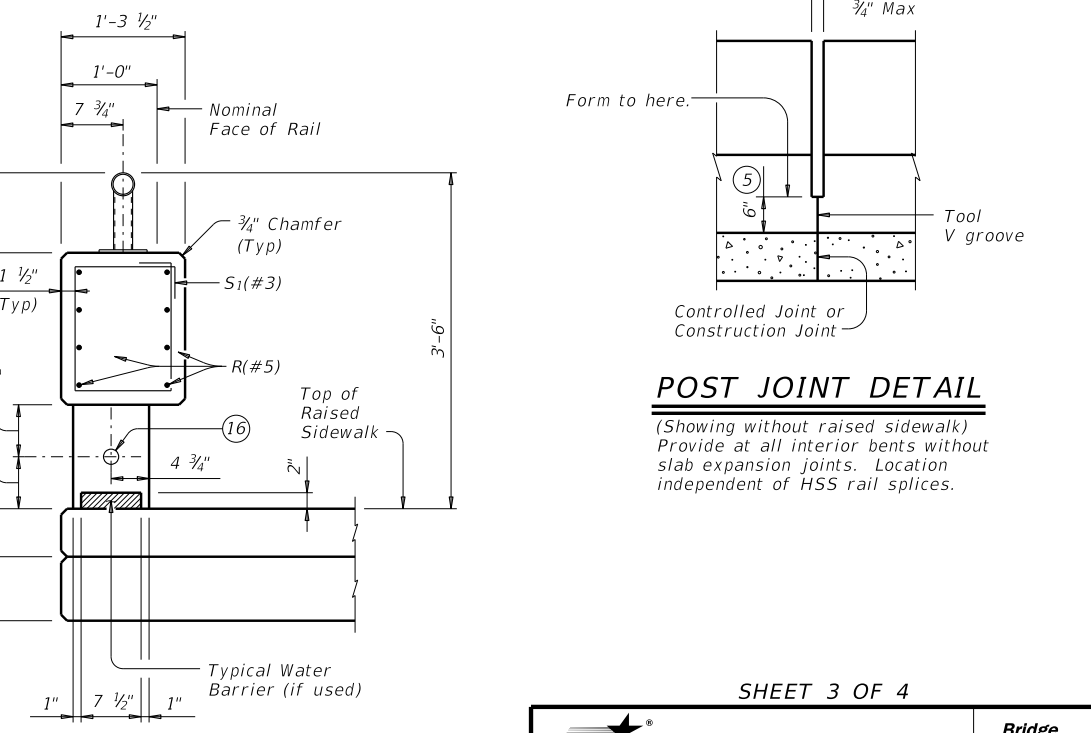
**SECTION D-D
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS**



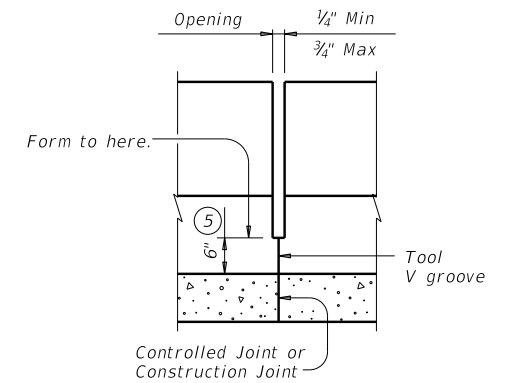
**SECTION E-E
ON ABUTMENT WINGWALLS
OR CIP RETAINING WALLS**



**AT POST
ON BRIDGE SLAB**



**AT OPENING
ON BRIDGE SLAB**



POST JOINT DETAIL

(Showing without raised sidewalk) Provide at all interior bents without slab expansion joints. Location independent of HSS rail splices.

SECTIONS THRU RAIL WITH RAISED SIDEWALK

Sections on box culvert similar.

② Wingwall Length minus 5'-0" (Varies)

⑤ Increase 2" for structures with overlay.

⑪ Bars L(#5) are part of rail reinforcing and are included in unit price bid for railing. Space with Bars U. Bars L match slab bar cover. Bars L may be bundled with top slab reinforcing if spacing is equivalent.

⑬ Substitute Bars U(#5) for Bars WU(#5) when parapet end is located on anchorage curb over culvert top slab. Use Bars WU(#5) in culvert parallel wings.

⑭ When vertical reinforcing has closer clear cover over horizontal reinforcing in abutment wingwalls on traffic side of wall, move the horizontal wingwall/retaining wall reinforcing to the inside of Bars WU where bars conflict.

⑮ Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.

⑯ HSS 1.900 x 0.145

⑰ Raised Sidewalk.

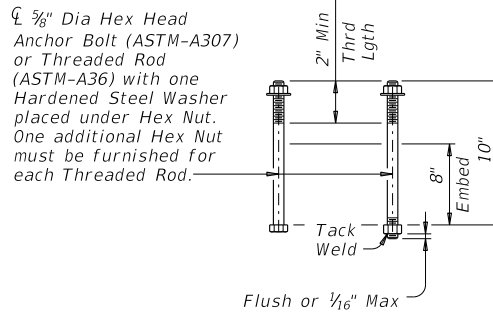
COMBINATION RAIL

TYPE C223

FILE: r1st0019.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: AES
©TxDOT July 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS				
03-16: Removed shop drawing note, Added box culvert elevation. Added MASH TL-3 in General Notes. Added additional epoxy classes.	DIST	COUNTY	SHEET NO.	

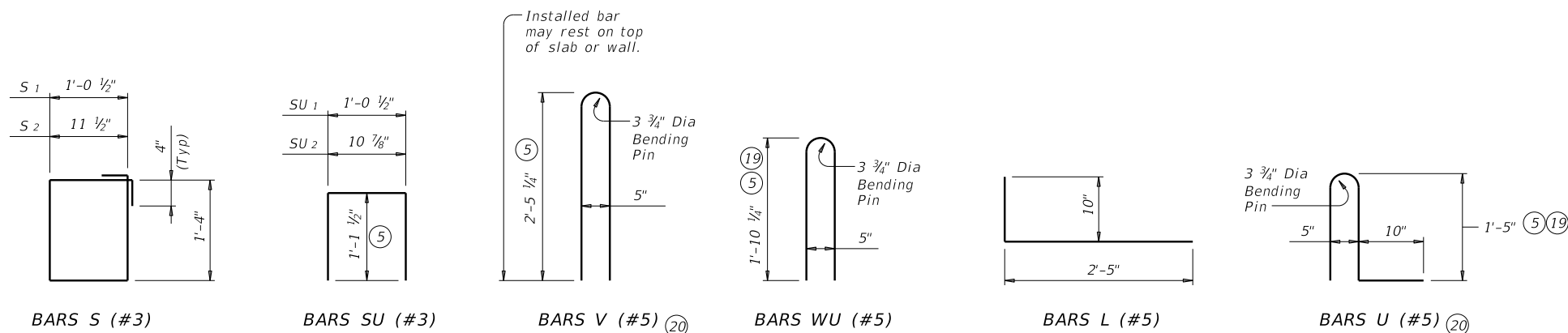
RAIL DATA FOR HORIZONTAL CURVES

	RADIUS TO FACE OF RAIL	MAX CHORD LENGTH	CONSTRUCT OR FABRICATE
HSS Rail	Over 2800'	29'-0"	Straight rail sections
	Over 1400' thru 2800'	14'-6"	To required radius or to chords shown
	Over 700' thru 1400'	7'-3"	
	Thru 700'	Zero	To required radius



CAST-IN-PLACE ANCHOR BOLT OPTIONS ⁽¹⁸⁾

- ⁽⁵⁾ Increase 2" for structures with overlay.
- ⁽¹⁸⁾ See "Material Notes" for anchor bolt information.
- ⁽¹⁹⁾ For raised sidewalks, add sidewalk height to total bar height. Use sidewalk height at rail's location.
- ⁽²⁰⁾ At the Contractor's option, Bars V may be replaced by extending Bars U to 2'-5 1/4" above the roadway/sidewalk surface without overlay.



CONSTRUCTION NOTES:

Face of rail, posts and parapet must be vertical transversely unless otherwise approved by the Engineer. HSS rail posts and opening end faces must be perpendicular to top of adjacent concrete parapet grade. Use epoxy mortar under HSS rail post base plates if gaps larger than 1/16" exist.

Provide water barriers at openings draining onto undercrossing roadways and sidewalks. They may be cast-in-place or precast in convenient lengths and bonded to the bridge deck with an approved epoxy cement.

HSS rail sections must not include less than two posts, and no more than four (except at Abutments).

Round or chamfer exposed edges of HSS rail and HSS rail posts to approximately 1/16" by grinding.

At the Contractor's option anchor bolts may be cast with the parapet (See Cast-in-Place Anchor Bolt Options).

Chamfer all exposed corners.

MATERIAL NOTES:

Galvanize all steel components except reinforcing unless otherwise shown on plans.

Provide Class "C" concrete. Provide Class "C" (HPC) if required elsewhere.

Epoxy coat all rail reinforcement if slab bars are epoxy coated. Provide Grade 60 reinforcing steel.

Anchor bolts must be 3/8" Dia ASTM A36 threaded rods with one hex nut and one hardened steel washer at each bolt. Embed threaded rods into parapet wall with a Type III, Class C, D, E, or F epoxy anchorage system. Minimum embedment depth is 3". Anchorage system chosen must be able to achieve an ultimate tensile resistance of 8.4 kips per bolt. The Contractor must provide evidence to the Engineer that this can be achieved. Evidence of adequate tensile resistance can be based on the Manufacturer's published values of ultimate tensile strength (account for anchor spacing and edge distance). Anchor installation, including hole size, drilling, and clean-out, must be in accordance with the Manufacturer's instructions.

Optional cast-in-place anchor bolts must be 3/8" Dia ASTM A307 Grade A bolts (or A36 threaded rods with one tack welded hex nut each) with one hex nut and one hardened steel washer at each bolt.

Provide ASTM-A1085, A500 Grade B or A53 Grade B for all HSS. Deformed Welded Wire Reinforcing (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U, V, and WU unless noted otherwise.

Provide bar laps, where required, as follows:

Uncoated ~ #5 = 1'-9"
Epoxy coated ~ #5 = 2'-7"

GENERAL NOTES:

This rail has been evaluated by full-scale crash test to meet MASH TL-3 criteria. This rail can be used for speeds of 50 mph and greater when a TL-3 rated guard fence transition is used. When a TL-2 rated guard fence transition is used, this rail can only be used for speeds of 45 mph and less.

Do not use this railing on bridges with expansion joints providing more than 5" movement.

Rail anchorage details shown on this standard may require modification for select structure types. See appropriate details elsewhere in plans for these modifications.

Submit erection drawings showing panel lengths, HSS rail post spacing, and anchor bolt setting to the Engineer for approval.

Average weight of railing with no overlay:

370 plf total
358 plf (Conc)
12 plf (Steel)

Cover dimensions are clear dimensions, unless noted otherwise. Reinforcing bar dimensions shown are out-to-out of bar.

SHEET 4 OF 4

Texas Department of Transportation		Bridge Division Standard
COMBINATION RAIL		
TYPE C223		
FILE: r1std0019.dgn	DN: TxDOT	CK: TxDOT
DW: JTR	CK: AES	
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JOB	HIGHWAY	
REVISIONS		
03-16: Removed shop drawing note, Added box culvert elevation. Added MASH TL-3 in General Notes. Added additional epoxy classes.	DIST	COUNTY
		SHEET NO.

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