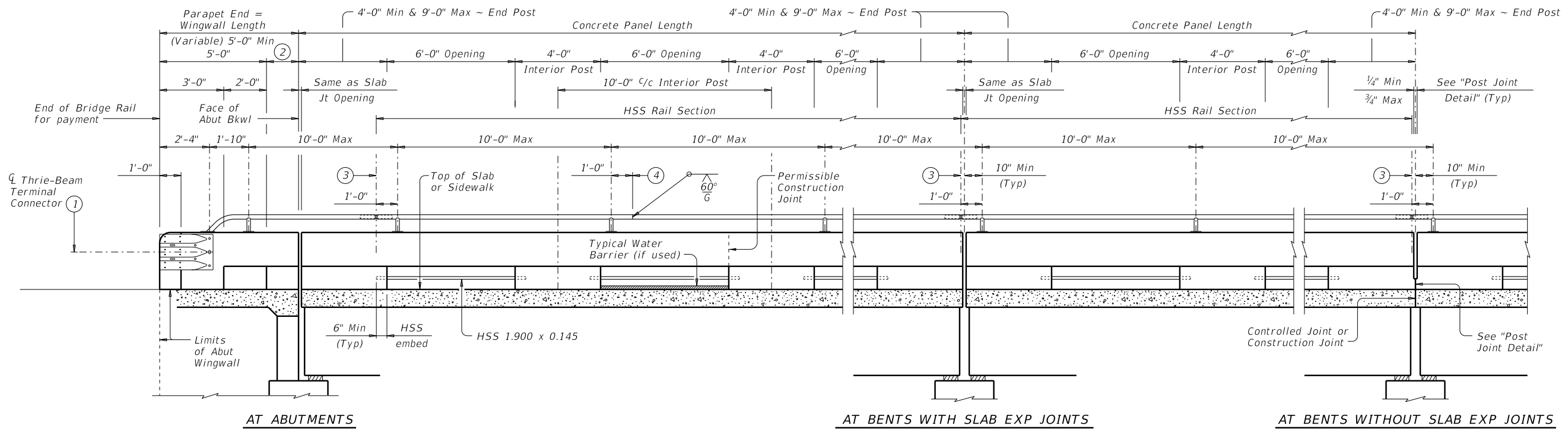


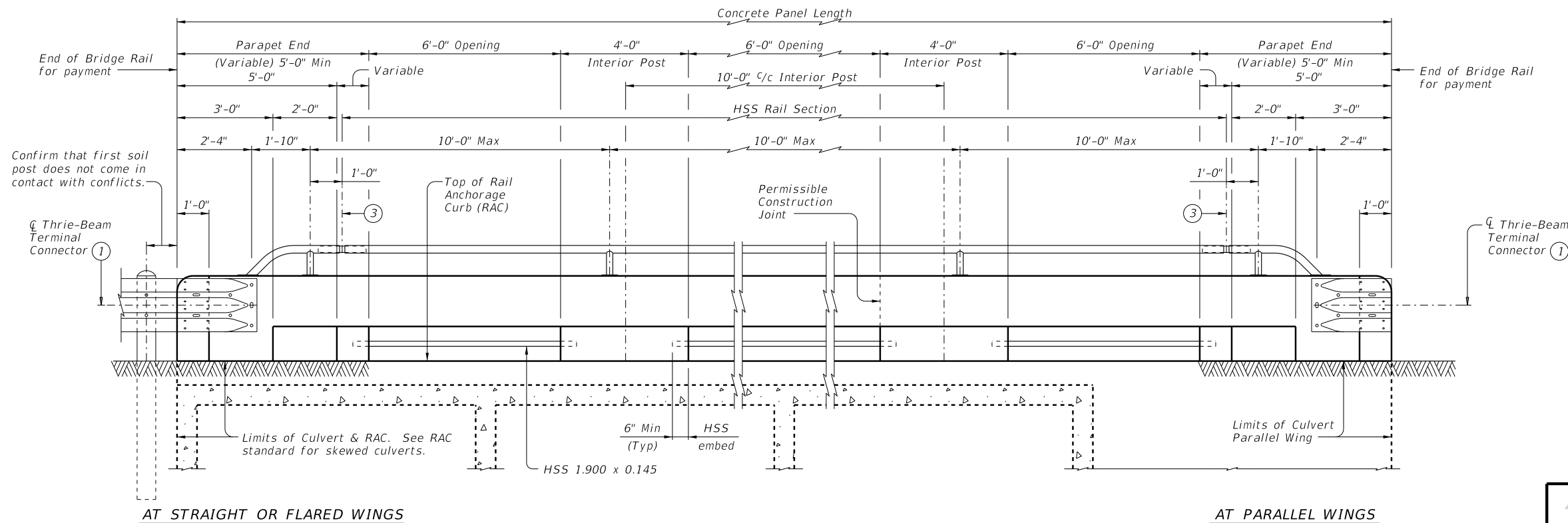
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DATE:  
FILE:



**ROADWAY ELEVATION OF RAIL ON BRIDGE**

(Showing without raised sidewalk)



**ROADWAY ELEVATION OF RAIL ON BOX CULVERTS**

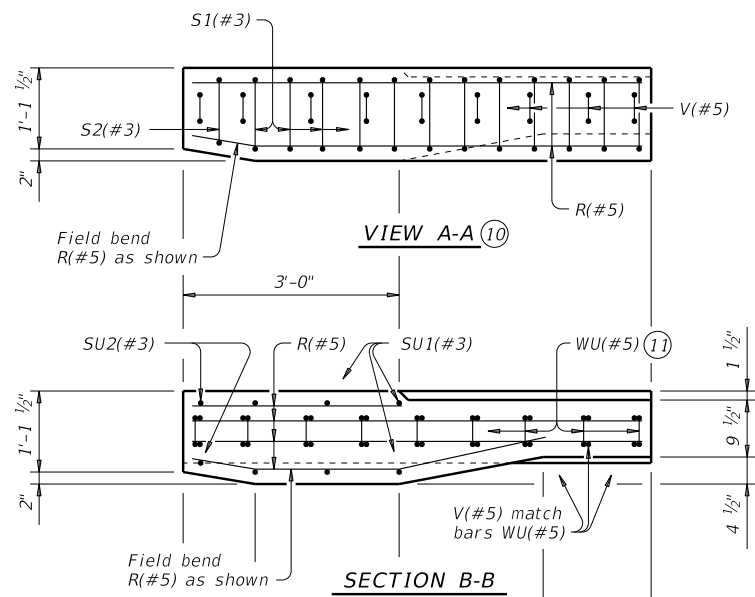
Showing 0° skew culvert. Skewed culverts similar. See RAC standard for details not shown. Vertical joints in concrete rail are not required, unless shown elsewhere.

- 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  $\zeta$  Splice joint or expansion joint
- ④ One shop splice per HSS rail section is permitted with minimum 85 percent penetration. The weld may be square groove or single V groove. Grind smooth.

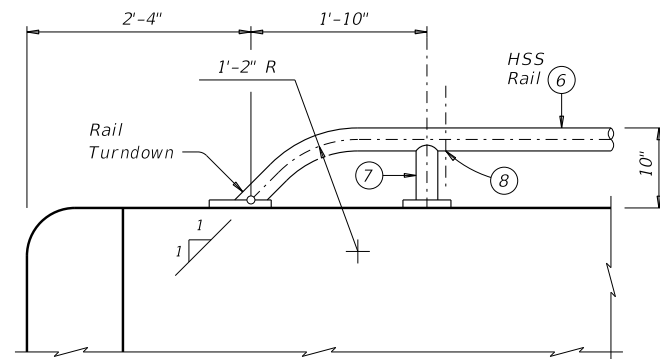
SHEET 1 OF 4

		<b>Bridge Division Standard</b>	
<h2>COMBINATION RAIL</h2>			
<h3>TYPE C223</h3>			
FILE: RL-C223-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR
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REVISIONS			
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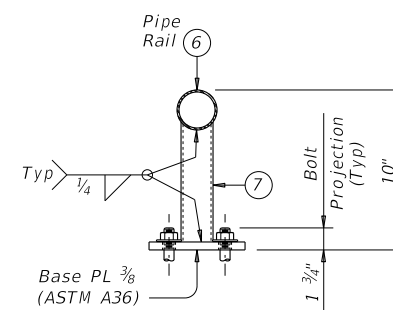


PARAPET END AT ABUT WINGWALL (1)

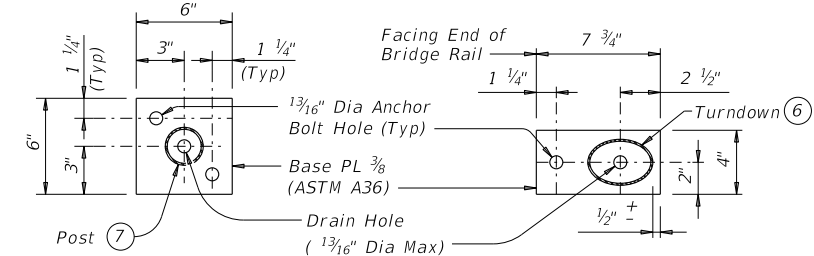


Note that at least two anchor points (as shown) are required for the Bridge Rail on the Abutment Wingwall. Longer Wingwalls may require more than two Rail anchorages.

HSS RAIL TERMINAL DETAIL



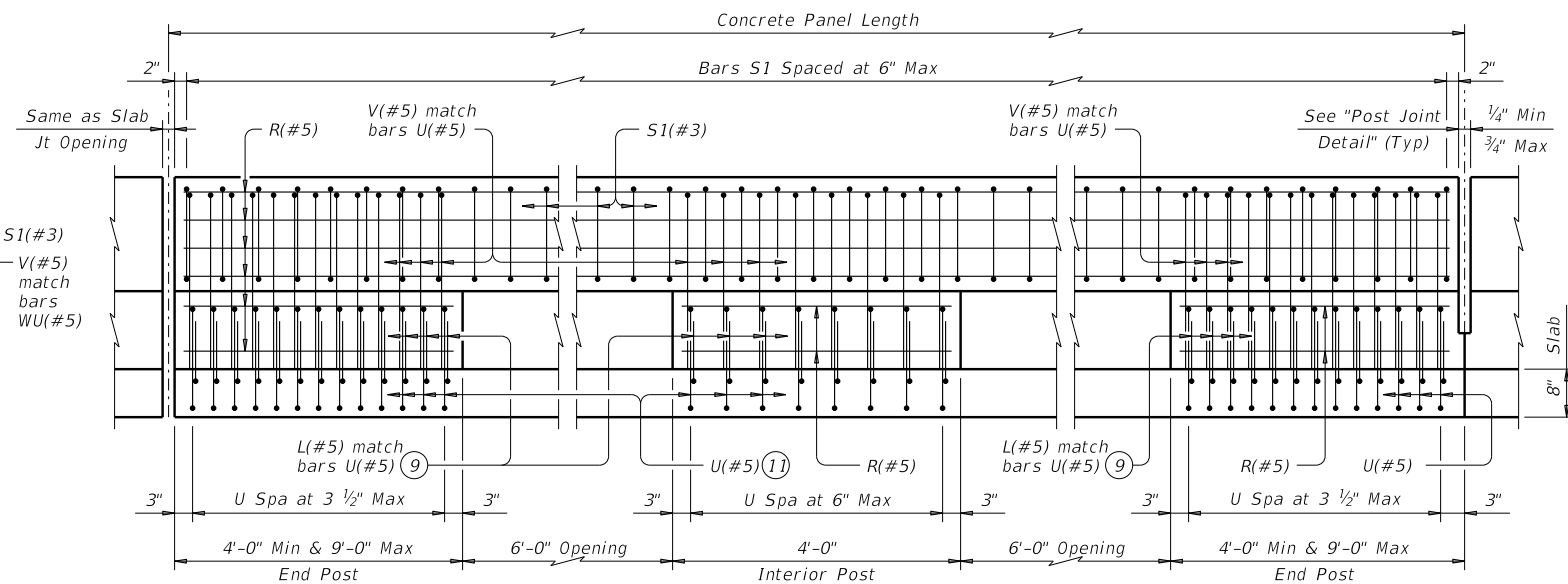
TRANSVERSE SECTION



POST BASE PLATE PLAN

RAIL TURNDOWN BASE PLATE PLAN

HSS RAIL DETAILS

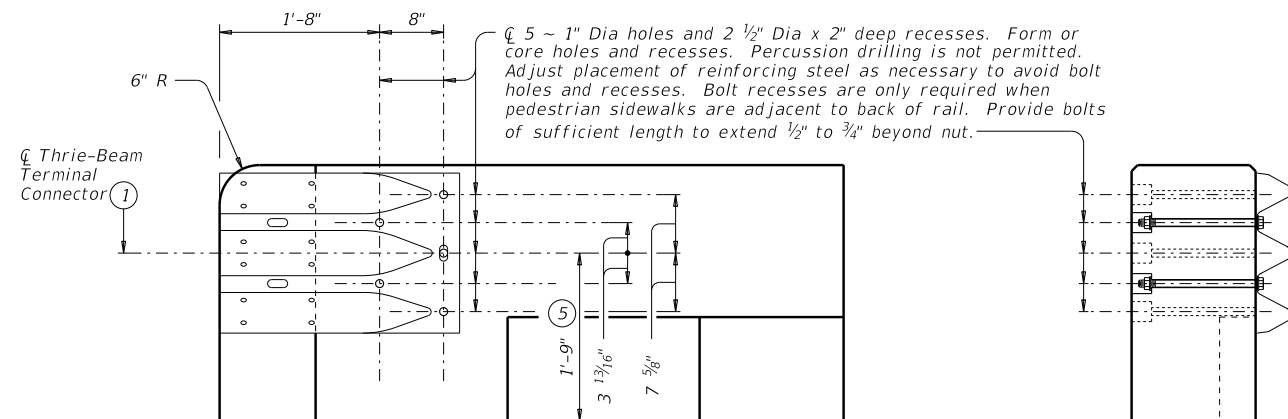


AT BENTS WITH SLAB EXP JOINTS AT 4' INTERIOR POST AT BENTS WITHOUT SLAB EXP JOINTS

ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT

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

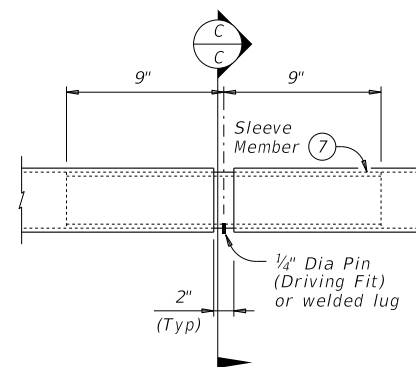
- (1) Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence." Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.
- (2) Wingwall Length minus 5'-0" (Varies)
- (5) Increase 2" for structures with overlay.
- (6) HSS 2.875 x 0.203
- (7) HSS 2.375 x 0.154
- (8) 3/8" Dia Hole in bottom of HSS rail (Minimum 1 hole between posts - Typ)
- (9) 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.
- (10) Bars SU1(#3), SU2(#3) and WU(#5) not shown for clarity.
- (11) 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

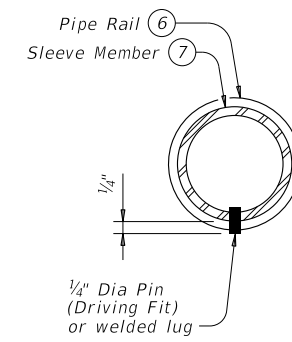
SECTION

TERMINAL CONNECTION DETAILS



AT SPLICE OR EXP JTS

PIPE SPLICE DETAILS



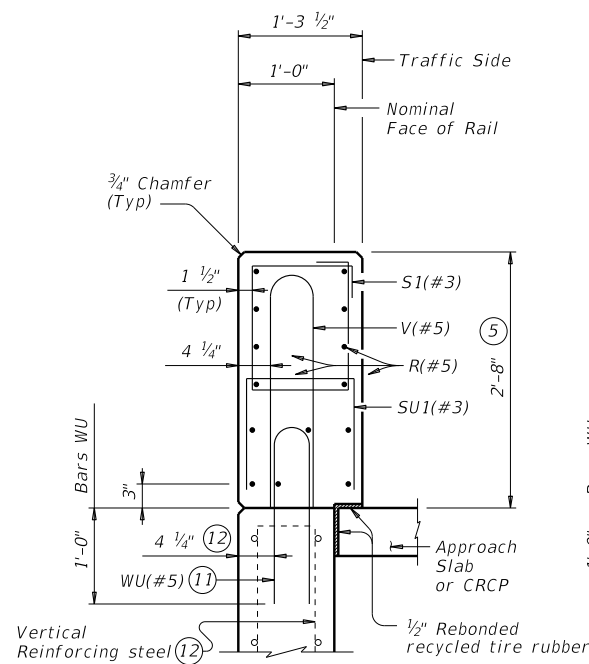
SECTION C-C

SHEET 2 OF 4

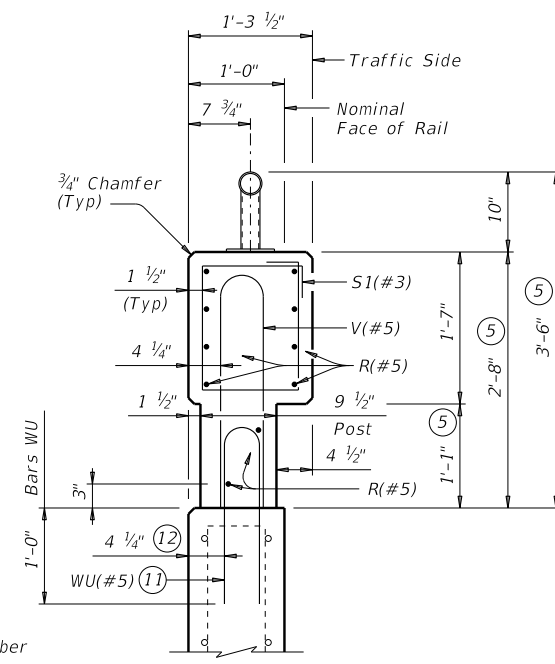
		<b>Bridge Division Standard</b>	
<h2>COMBINATION RAIL</h2>			
<h3>TYPE C223</h3>			
FILE: RL-C223-19.dgn	DN: TxDOT	CK: TxDOT	DW: JTR
REV: 01	CONT: 01	SECT: 01	JOB: 01
REVISIONS		HIGHWAY	
DIST		COUNTY	
SHEET NO.			

DATE: FILE:

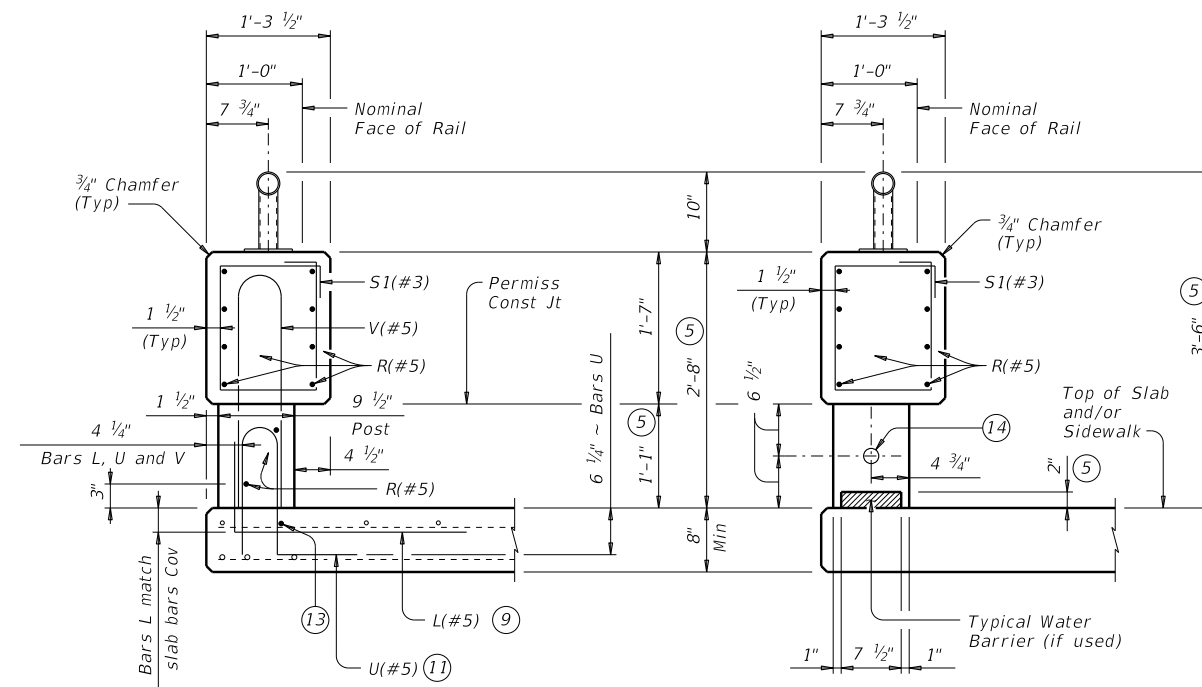
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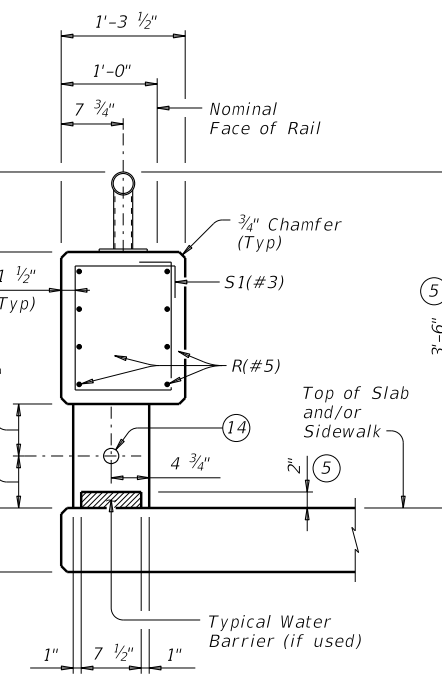
SECTION D-D  
ON ABUTMENT WINGWALLS  
OR CIP RETAINING WALLS



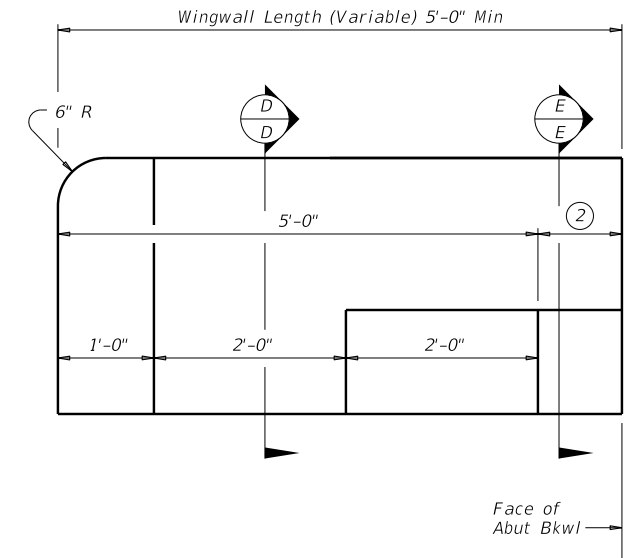
SECTION E-E  
ON ABUTMENT WINGWALLS  
OR CIP RETAINING WALLS



AT POST  
ON BRIDGE SLAB



AT OPENING  
ON BRIDGE SLAB

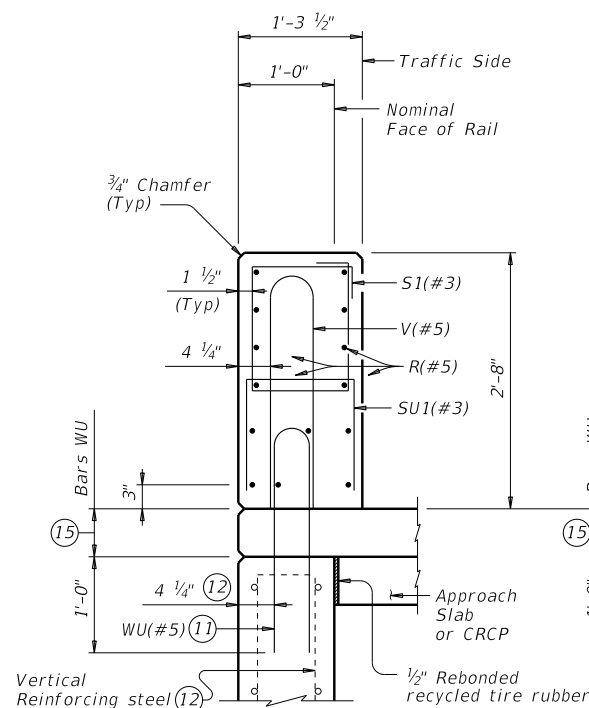


ELEVATION AT  
ABUTMENT WINGWALL

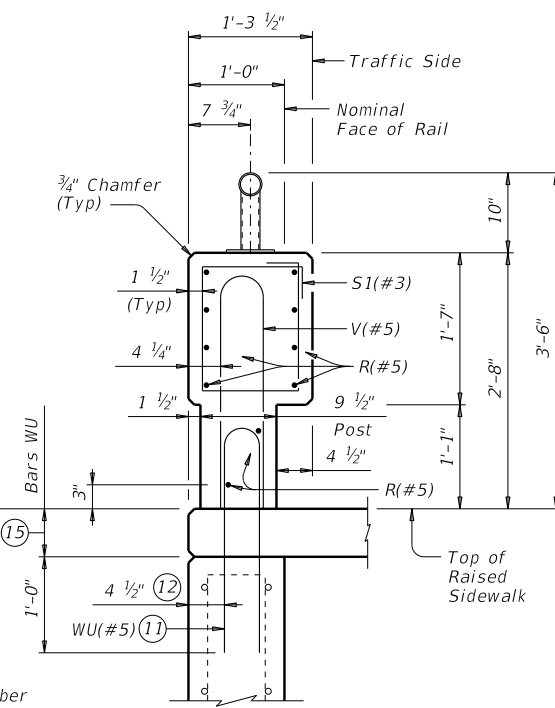
Box culvert parallel wings or rail anchorage curb similar. HSS rail not shown for clarity.

SECTIONS THRU RAIL WITHOUT RAISED SIDEWALK

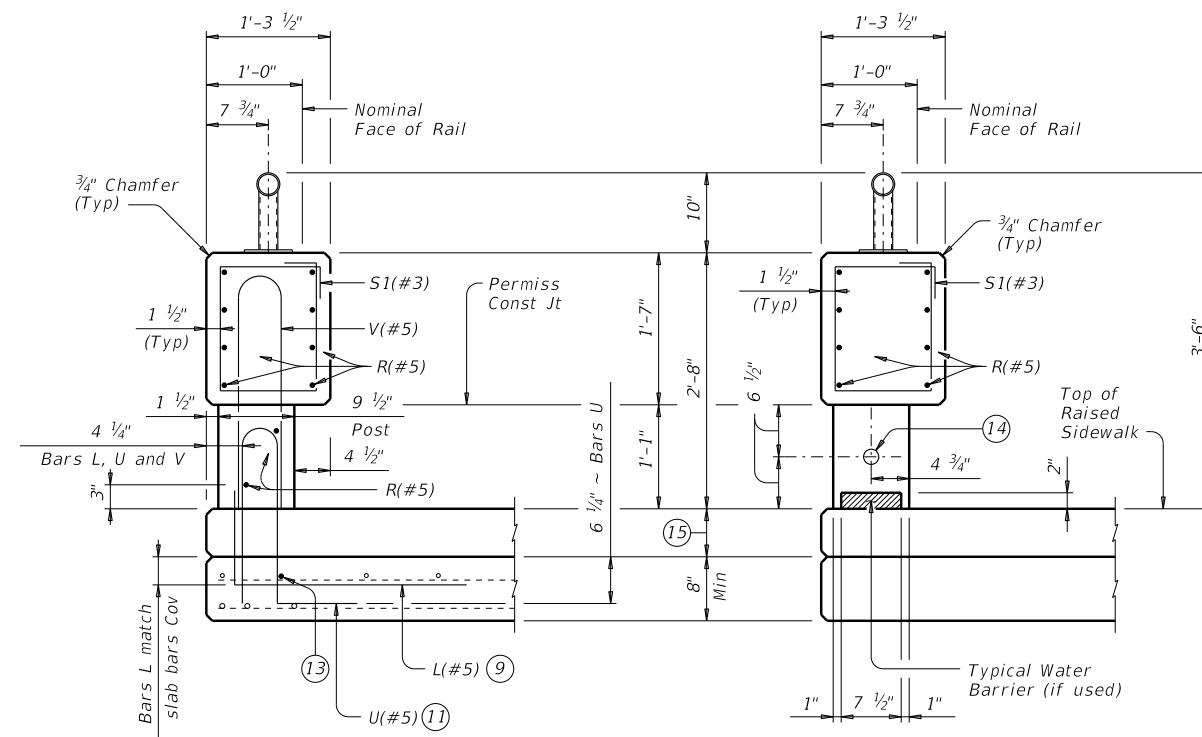
Sections on box culvert similar.



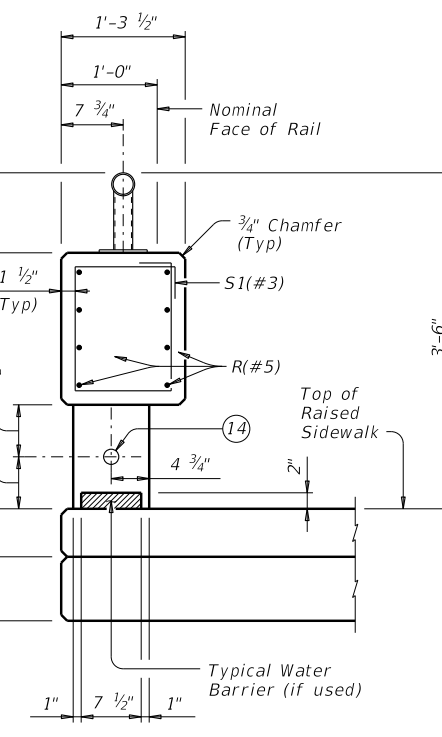
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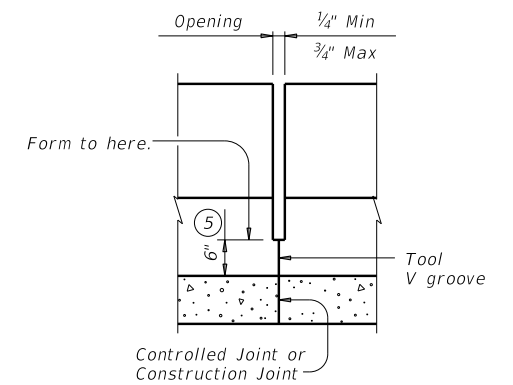
SECTION E-E  
ON ABUTMENT WINGWALLS  
OR CIP RETAINING WALLS



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.

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.
- ⑨ 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.
- ⑩ 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.
- ⑫ 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.
- ⑬ Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.
- ⑭ HSS 1.900 x 0.145
- ⑮ Raised Sidewalk.

SHEET 3 OF 4



COMBINATION RAIL

TYPE C223

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REVISIONS				
DIST	COUNTY			SHEET NO.

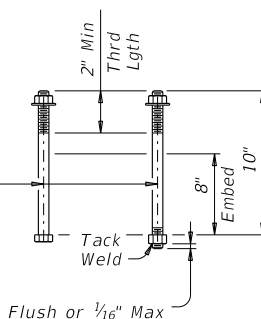
DATE: FILE:

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### RAIL DATA FOR HORIZONTAL CURVES

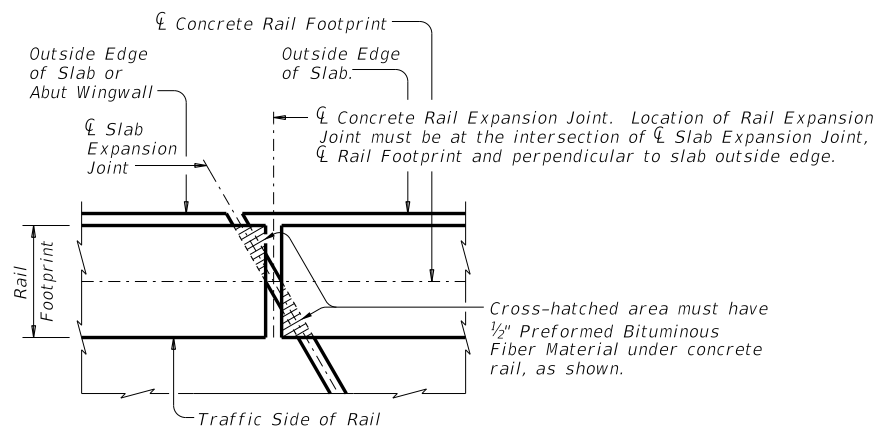
	RADIUS TO FACE OF RAIL	MAX CHORD LENGTH	CONSTRUCT OR FABRICATE
HSS Rail	Over 2800'	29'-0"	Straight rail sections
	Over 1400' thru 2800'	14'-6"	To required radius or to chords shown
	Over 700' thru 1400'	7'-3"	
	Thru 700'	Zero	To required radius

5/8" Dia hex head anchor bolt or threaded rod (ASTM A307 Gr A) with one hardened steel washer (ASTM F436) placed under each hex nut (ASTM A563). One additional hex nut must be furnished and tack welded for each threaded rod.



### CAST-IN-PLACE ANCHOR BOLT OPTIONS 16

- 5 Increase 2" for structures with overlay.
- 16 See "Material Notes" for anchor bolt information.
- 17 For raised sidewalks, add sidewalk height to total bar height. Use sidewalk height at rail's location.
- 18 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.



### PLAN OF RAIL AT EXPANSION JOINTS

Example showing Slab Expansion Joints without breakbacks.

### 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.

Test adhesive anchors in accordance with Item 450.3.3, "Tests". Test 3 anchors per 100 anchors installed. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing as directed.

At the Contractor's option anchor bolts may be cast with the parapet. See "Material Notes." Chamfer all exposed corners.

### MATERIAL NOTES:

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

Provide Grade 60 reinforcing steel.

Epoxy coat or galvanize all reinforcing steel if slab bars are epoxy coated or galvanized.

Provide ASTM A1085, A500 Gr B or A53 Gr B for all HSS.

Galvanize all metal components of steel rail system. Apply additional coatings when shown elsewhere on the plans. When plans require paint over galvanizing, follow the requirements for painting galvanized steel in Item 445, "Galvanizing" and when field painting, Item 446, "Field Cleaning and Painting Steel." Sleeve members and anchor bolts must receive galvanization prior to installation and only field paint after installation unless directed otherwise by Engineer.

Deformed Welded Wire Reinforcing (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U, V, and WU unless noted otherwise.

Anchor bolts must be 5/8" Dia ASTM A307 Gr A fully threaded rods with one hex nut and one hardened steel washer (ASTM F436) each. Nuts must conform to ASTM A563 requirements. Embed fully threaded rods into parapet wall with a Type III, Class C, D, E, or F anchor adhesive. Minimum adhesive anchor embedment depth is 3". Anchor adhesive chosen must be able to achieve a nominal bond strength in tension of a single anchor, Na, of 5 kips (edge distance must be accounted for). Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing".

Optional cast-in-place anchor bolts must be 5/8" Dia ASTM A307 Gr A bolts (or threaded rods with one tack welded hex nut each) with one hex nut and one hardened steel washer (ASTM F436) at each bolt. Nuts must conform to ASTM A563 requirements.

Provide bar laps, where required, as follows:

Uncoated or galvanized ~ #5 = 2'-0"  
Epoxy coated ~ #5 = 3'-0"

### 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.

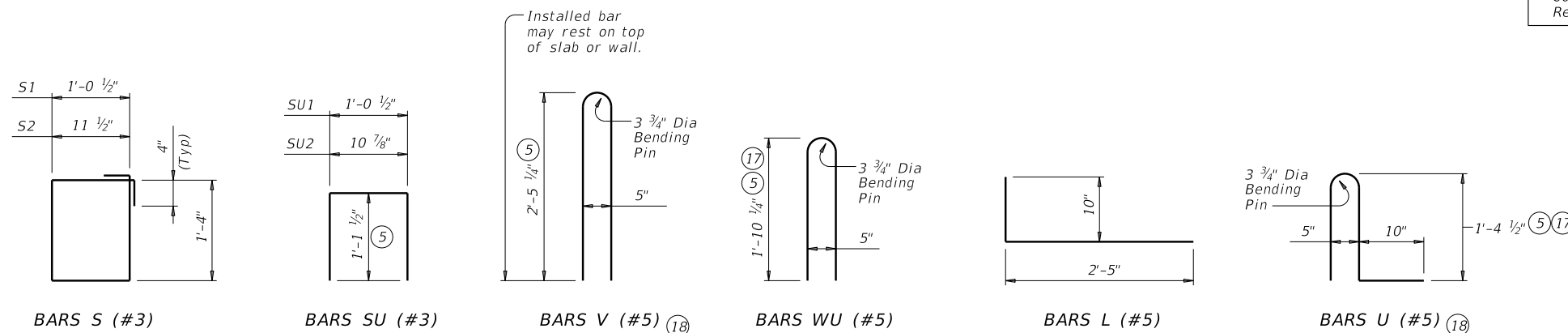
See appropriate details elsewhere in plans for these modifications.

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



## COMBINATION RAIL

### TYPE C223

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REVISIONS				
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