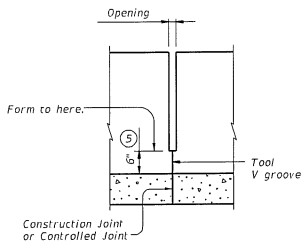
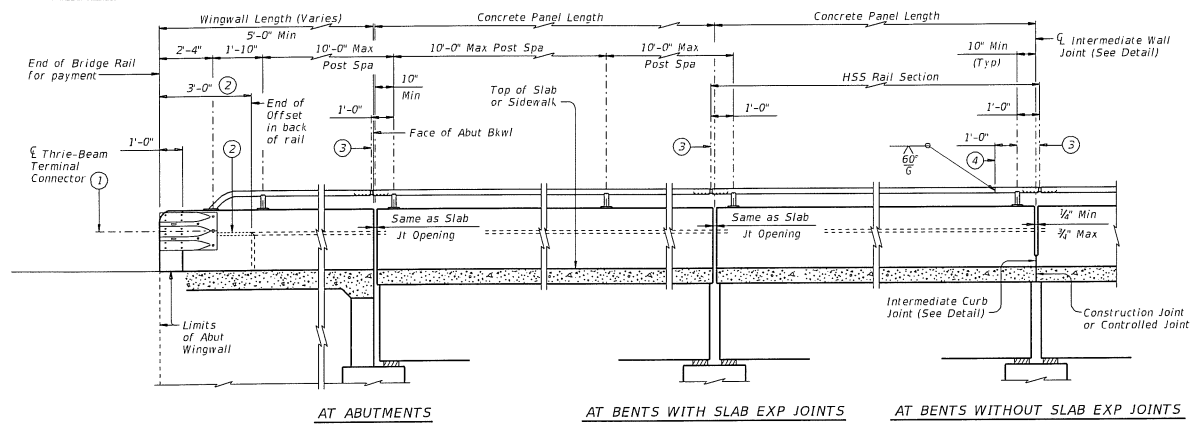
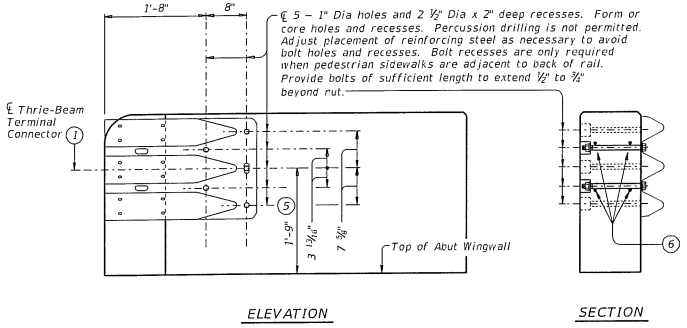


DISCLAIMER: This standard is approved by the Texas Department of Transportation for use in the State of Texas. The user of this standard assumes all responsibility for the consequences of its application to other materials or for incorrect results or damages resulting from its use.

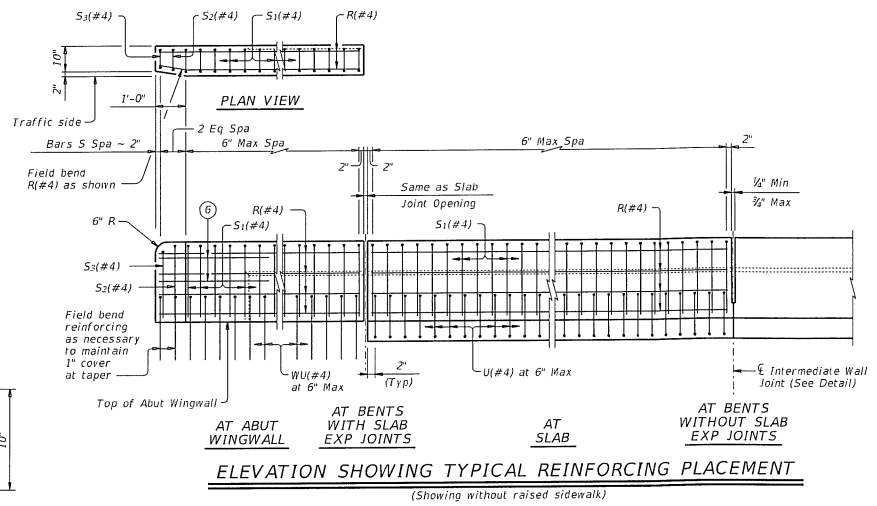


INTERMEDIATE WALL JOINT DETAIL
Provide at all interior bents without slab expansion joints. Location independent of HSS rail splices.

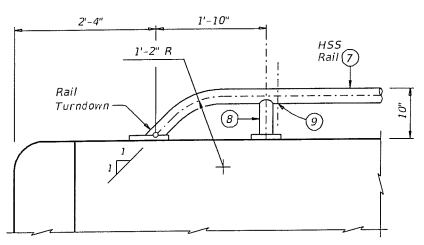
- ① Terminal Connectors and associated hardware are to be paid for under the Item "Metal Beam Guard Fence". Attach Metal Beam Guard Fence Transitions to the bridge rail and extend along the embankment unless otherwise shown in the plans.
- ② Back of rail offset may, with Engineer's approval, be continued to the end of the railing.
- ③ Exp Joint or Splice Joint as required.
- 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.
- ⑤ Increase 2" for structures with overlay.
- ⑥ Place 4 additional Bars R(#4) 3'-8" in length inside Bars S(#4) and centered 2'-0" from end of rail when Terminal Connections are required. Field bend as needed.
- ⑦ HSS 2.875 x 0.203
- ⑧ HSS 2.375 x 0.154
- ⑨ 3/8" Dia Hole in bottom of HSS rail (Minimum 1 hole between posts - Typ)



TERMINAL CONNECTION DETAILS

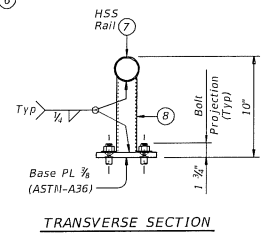


ELEVATION SHOWING TYPICAL REINFORCING PLACEMENT
(Showing without raised sidewalk)

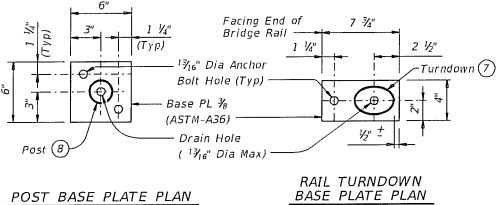


Note that at least two anchor points (as shown) are required for the Bridge Rail on the Abutment Wingwall. Longer Wingwalls may require more than two Rail anchorages.

HSS RAIL TERMINAL DETAIL



TRANSVERSE SECTION



POST BASE PLATE PLAN

HSS RAIL DETAILS

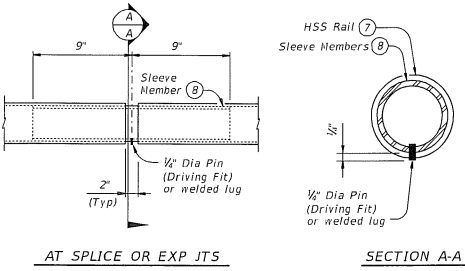
COMBINATION RAIL			
TYPE C221			
FILE: r151018-18.dgn	DATE: TxDOT	BY: TxDOT	DR: JFR
REV: 001	DATE: March 2013	DESC: SECT	NO: 100
REV: 002	DATE:	DESC:	NO:
REV: 003	DATE:	DESC:	NO:
REV: 004	DATE:	DESC:	NO:

DATE: FILE:

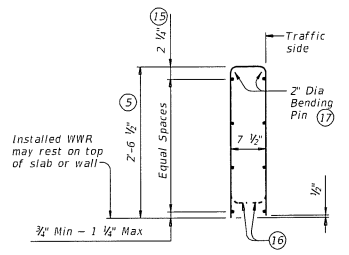
DISCLAIMER: This standard is reviewed by the Texas Engineering Practice Act. No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: FILE:

RAIL DATA FOR HORIZONTAL CURVES			
HSS Rail	RADIUS TO FACE OF RAIL	MAX CHORD LENGTH	CONSTRUCT OR FABRICATE
	Over 2800'	29'-0"	Straight rail panels
	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



PIPE SPlice DETAILS



OPTIONAL WELDED WIRE REINFORCEMENT (WWR)

DESCRIPTION	LONGITUDINAL WIRES	VERTICAL WIRES
Minimum (Cumulative Total) Wire Area	1,067 Sq In.	0.267 Sq In. per Ft
Minimum	No. of Wires	Spacing
Maximum	8	4"
	10	8"
Maximum Wire Size Differential	The smaller wire must have an area of 40% or more of the larger wire.	

CONSTRUCTION NOTES:

This railing may be constructed with slip-forms when approved by the Engineer, with equipment approved by the Engineer and when epoxy adhesive anchor bolts are used. Slip-forming parapet is not allowed if anchor bolts are cast with parapet wall. Provide sensor anchor bolts for each line and grade. Tack welding to provide bracing for slip-form operations is acceptable. Welding can be performed at a minimum spacing of 3 ft between the cage and the anchorage. It is permissible to weld to U, WU and S bars at any location on the cage. If increased bracing is needed, additional anchorage devices must be added and welding must be performed in the upper two thirds of the cage.
 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". Face of rail, parapet must be plumb unless otherwise approved by the Engineer. HSS rail posts must be square to the top of parapet. Use epoxy mortar under post base plates if gaps larger than 1/8" exist.
 Round or chamfer exposed edges of HSS rail and HSS rail posts to approximately 1/8" by grinding.
 HSS rail sections must not include less than two posts, and no more than four (except at Abutments).
 Chamfer all parapet exposed corners.

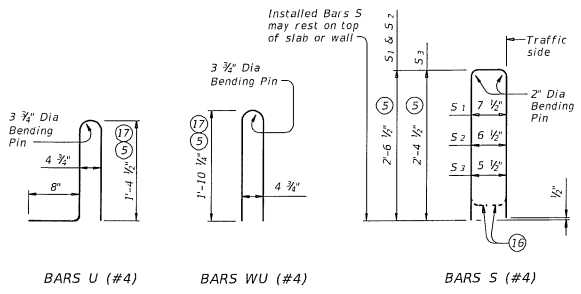
MATERIAL NOTES:

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 or 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 Reinforcement (WWR) (ASTM A1064) of equal size and spacing may be substituted for Bars U and WU unless noted otherwise. Deformed WWR (ASTM 1064) may be substituted for Bars R and S, as shown. Combinations of reinforcing steel and WWR are configurations of WWR other than shown are permitted if conditions in the table are satisfied. Provide the same laps as required for reinforcing bars.
 Anchor bolts must be 3/8" 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, f_a , 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 3/8" 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 - #4 = 1'-7" Epoxy coated - #4 = 2'-5"

GENERAL NOTES:

This rail has been evaluated and accepted to be of equal strength to railings with like geometry, which have been crash tested 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, rail post spacing, and anchor bolt setting to the Engineer for approval.
 Average weight of railing with no overlay: 380 plf (total)
 370 plf (Conc)
 10 plf (Steel)

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



CAST-IN-PLACE ANCHOR BOLT OPTIONS

- ⑤ Increase 2" for structures with overlay.
- ⑦ HSS 2.875 x 0.203
- ⑧ HSS 2.375 x 0.154
- ⑬ No longitudinal wires may be in top center of cage.
- ⑭ Bend or cut as required to clear drain slots.
- ⑰ For raised sidewalks, add sidewalk height to total bar height. Use sidewalk height at rail's location.
- ⑱ See "Material Notes" for anchor bolt information.

COMBINATION RAIL			
TYPE C221			
FILE: r1std018-16.dgn	SK: TxDOT	TX: TxDOT	DR: JTR
DATE: March 2018	CON: TxDOT	SEC: TxDOT	TOP: TxDOT
REV: 01/18	BY: TxDOT	CHECK: TxDOT	SHEET: 10