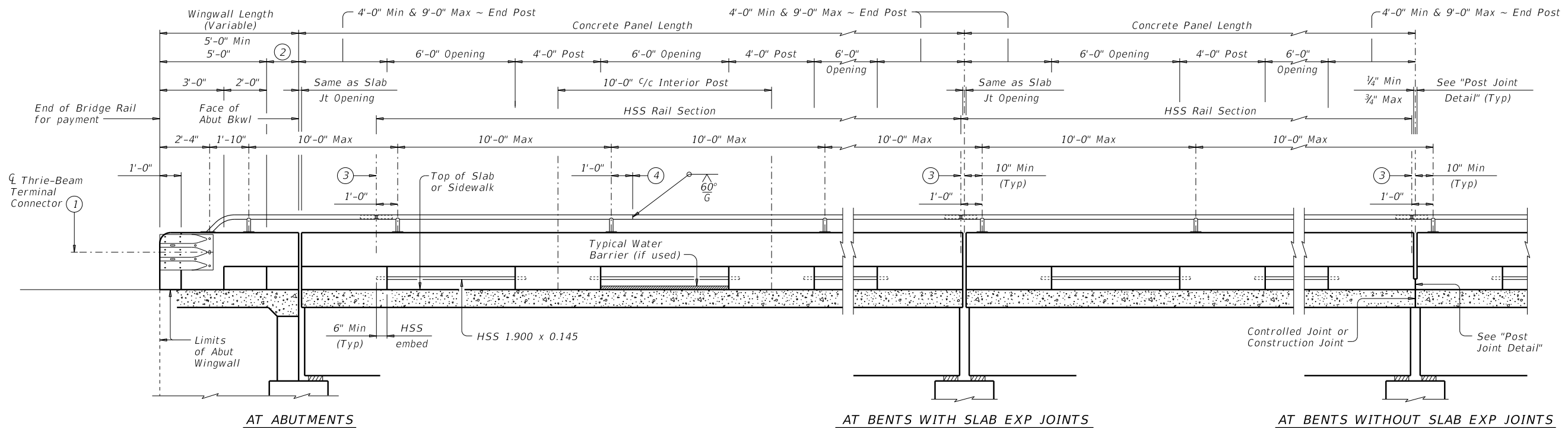


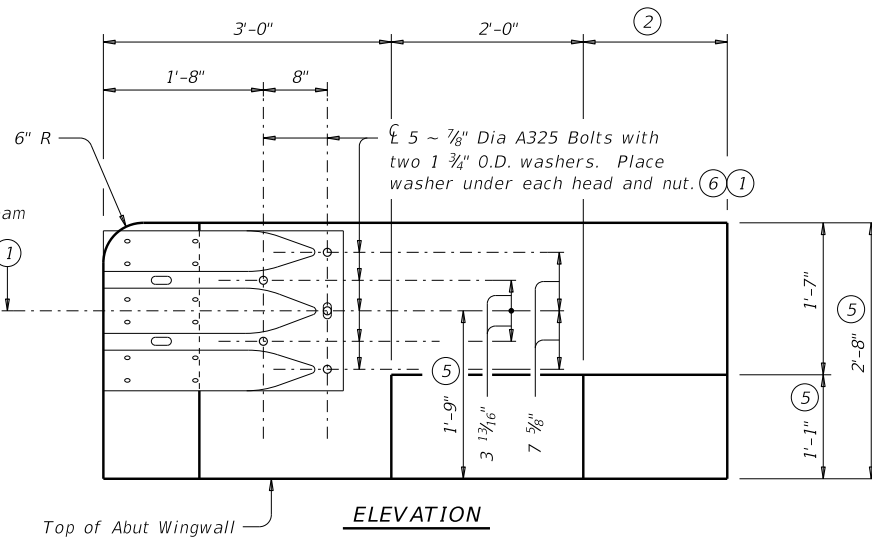
DISCLAIMER: The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE: FILE:

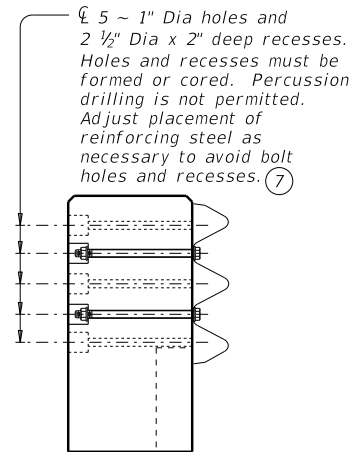


### ROADWAY ELEVATION OF RAIL

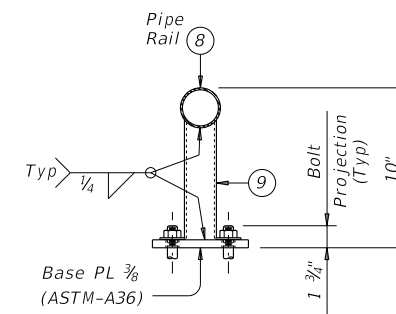
(Showing without raised sidewalk)



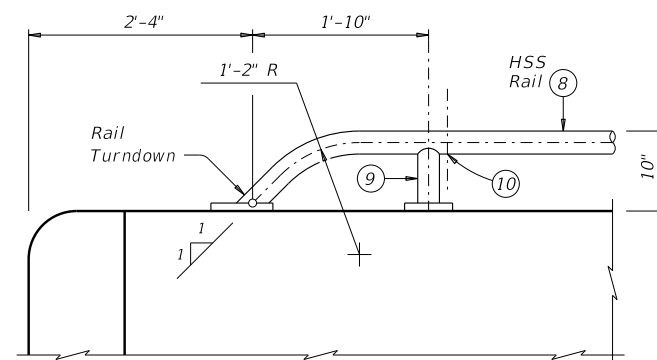
### TERMINAL CONNECTION DETAILS



### SECTION

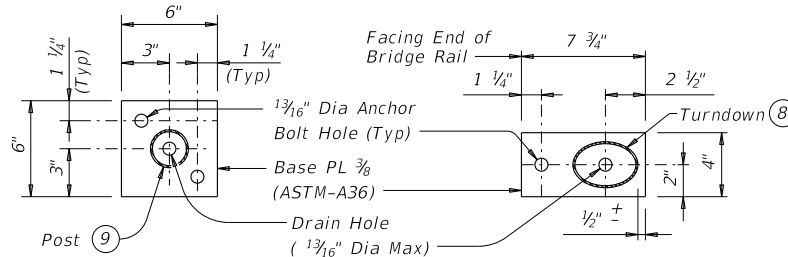


### TRANSVERSE SECTION



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



### POST BASE PLATE PLAN


### RAIL TURNDOWN BASE PLATE PLAN

### HSS RAIL DETAILS

- 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.
- Wingwall Length minus 5'-0" (Varies)
- Splice Jt or Exp Jt
- 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.
- Increase 2" for structures with overlay.
- Provide bolts of sufficient length to extend  $\frac{1}{2}$ " to  $\frac{3}{4}$ " beyond nut.
- Bolt recesses are only required when pedestrian sidewalks are adjacent to back of rail.
- HSS 2.875 x 0.203
- HSS 2.375 x 0.154
- $\frac{3}{8}$ " Dia Hole in bottom of HSS rail (Minimum 1 hole between posts ~ Typ)

The use of this railing is restricted to speeds of 45 mph or less.

SHEET 1 OF 3



Texas Department of Transportation

Bridge Division Standard

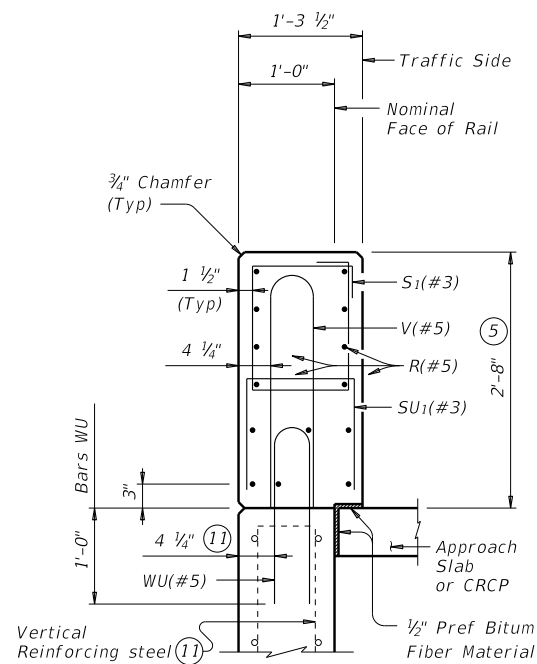
COMBINATION RAIL

TYPE C223

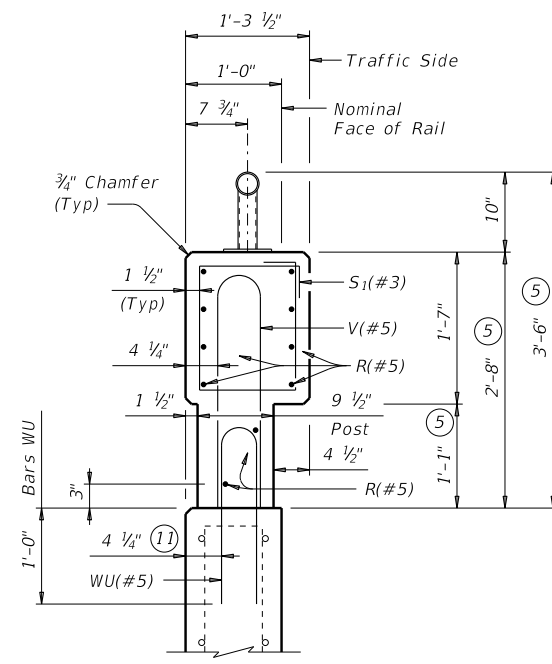
FILE: r1std019.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH
©TxDOT July 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO.

DISCLAIMER:  
The use of this standard is governed 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.

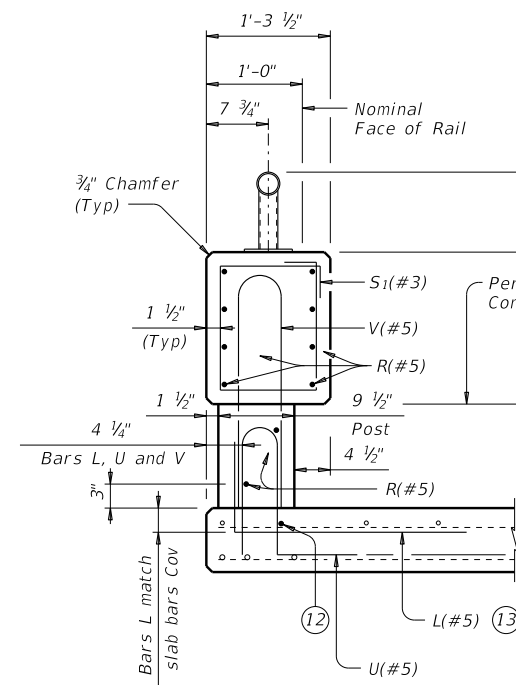
DATE:  
FILE:



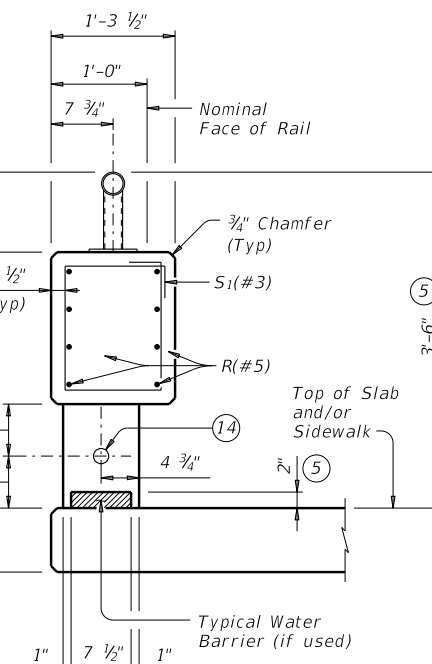
SECTION A-A  
ON ABUTMENT WINGWALLS  
OR CIP RETAINING WALLS



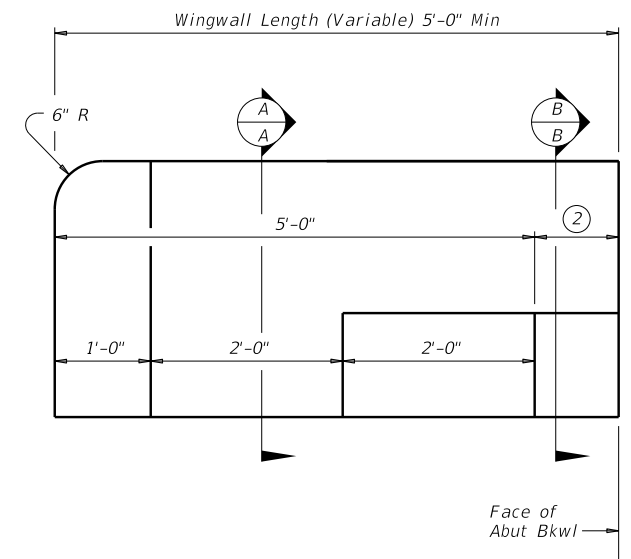
SECTION B-B  
ON ABUTMENT WINGWALLS  
OR CIP RETAINING WALLS



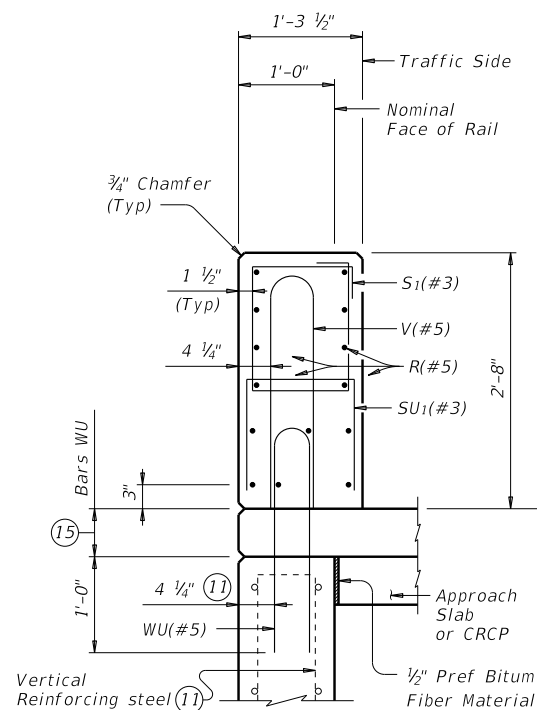
AT POST  
ON BRIDGE SLAB



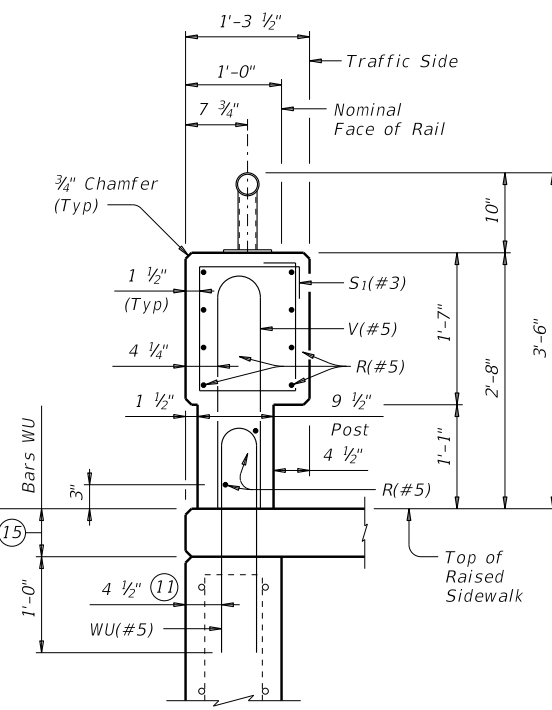
AT OPENING  
ON BRIDGE SLAB



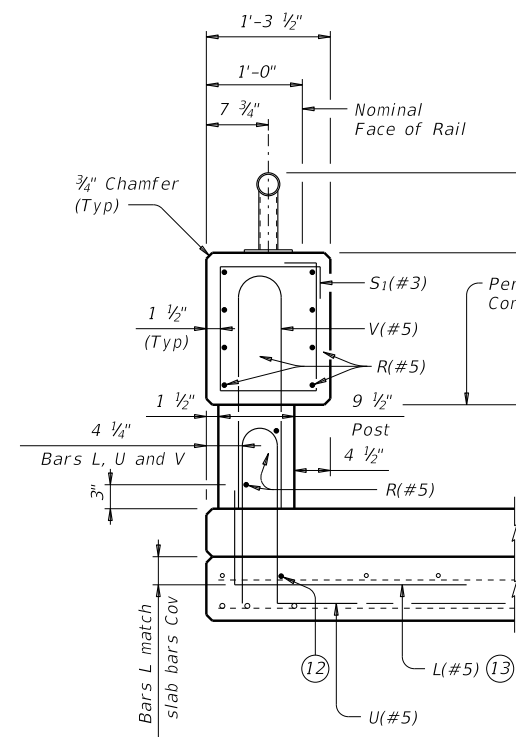
ELEVATION AT  
ABUTMENT WINGWALL  
(HSS rail not shown for clarity)



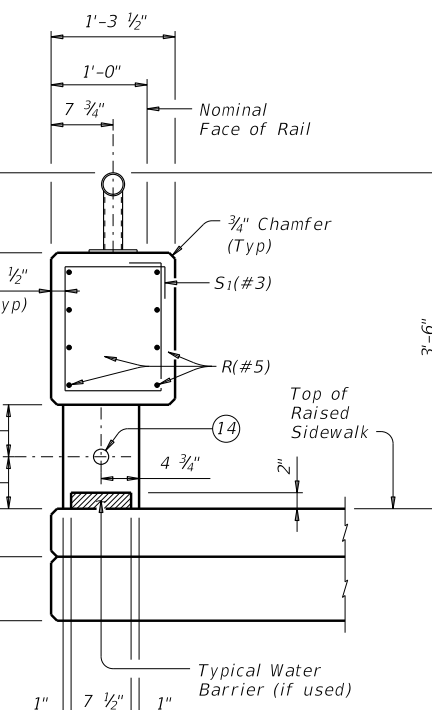
SECTION A-A  
ON ABUTMENT WINGWALLS  
OR CIP RETAINING WALLS



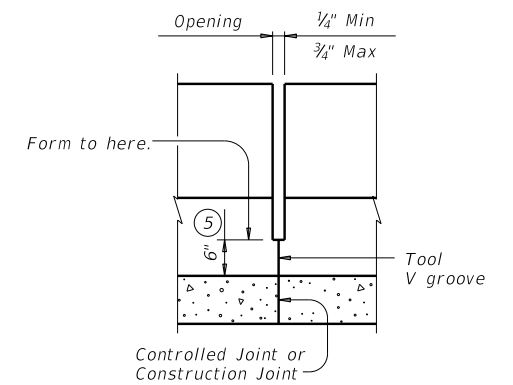
SECTION B-B  
ON ABUTMENT WINGWALLS  
OR CIP RETAINING WALLS



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 WITHOUT RAISED SIDEWALK

SECTIONS THRU RAIL WITH RAISED SIDEWALK

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

⑤ Increase 2" for structures with overlay.

⑪ 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.


⑫ Top longitudinal slab bar may be adjusted laterally 3" plus or minus to tie reinforcing.

⑬ 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.

⑭ HSS 1.900 x 0.145

⑮ Raised Sidewalk.

SHEET 2 OF 3



Texas Department of Transportation

Bridge Division Standard

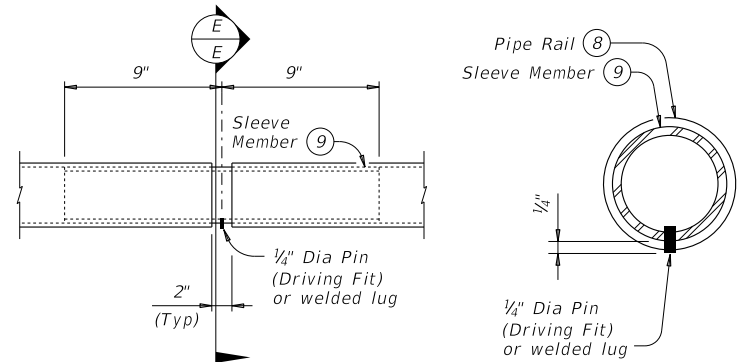
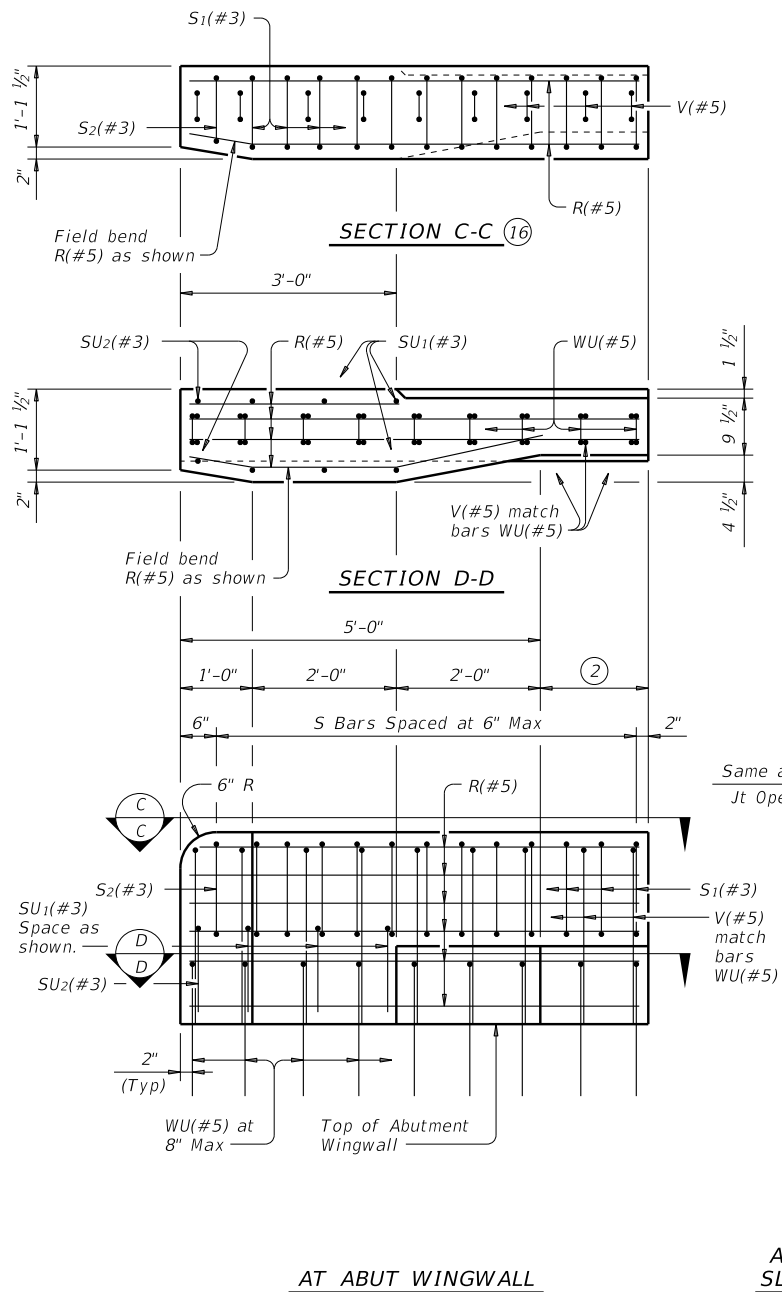
COMBINATION RAIL

TYPE C223

FILE: r1std019.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH
©TxDOT July 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO.

DISCLAIMER:  
The use of this standard is governed 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.

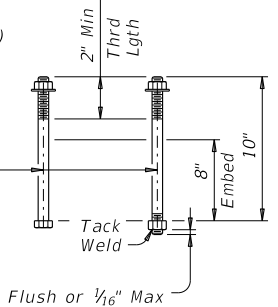
DATE:  
FILE:



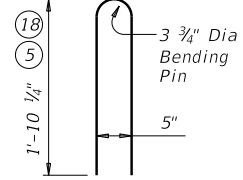
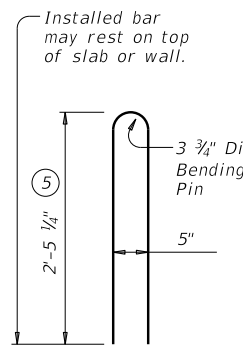
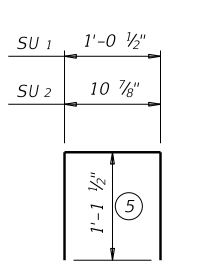
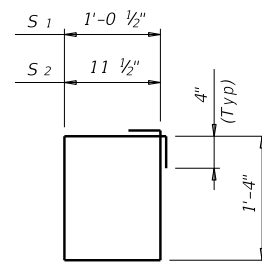
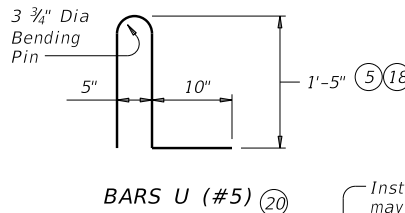
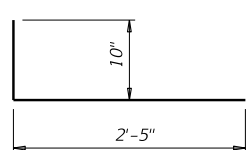
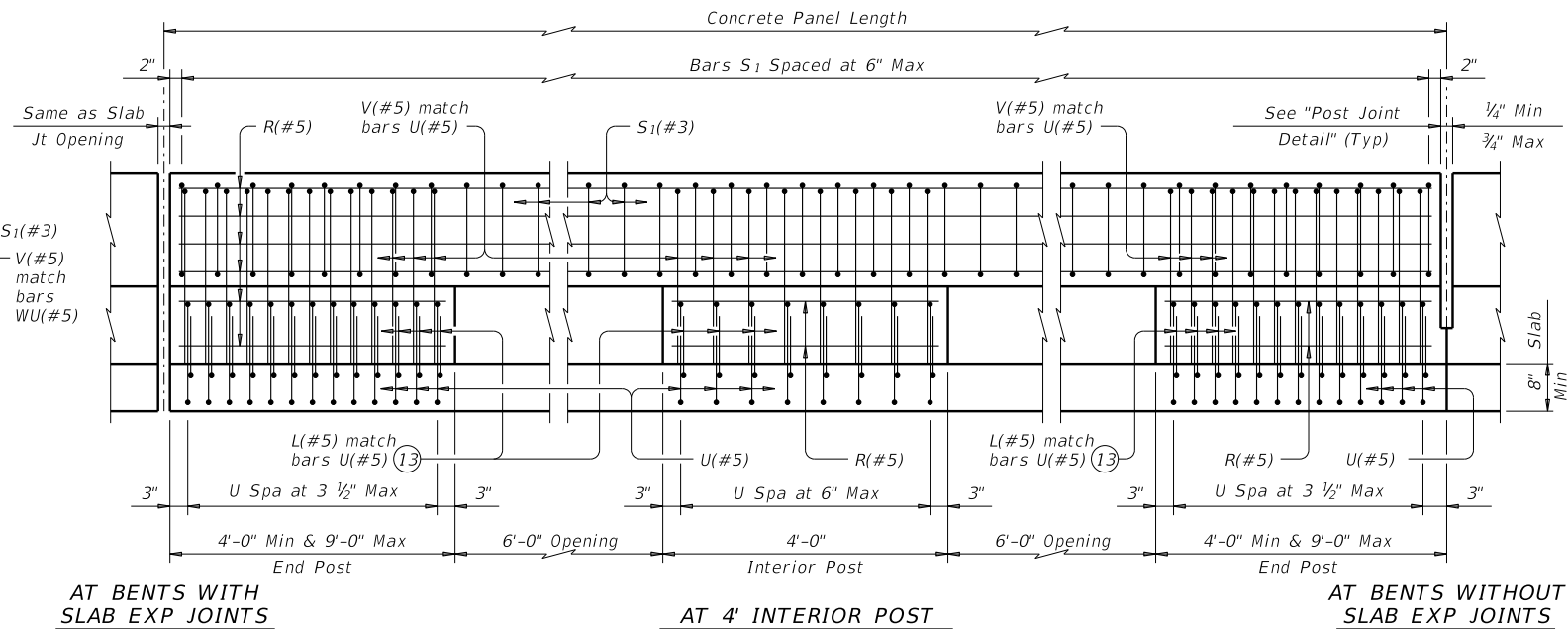
### PIPE SPLICE DETAILS

RAIL DATA FOR HORIZONTAL CURVES		
	RADIUS TO FACE OF RAIL	MAX CHORD LENGTH
HSS Rail	Over 2800'	29'-0"
	Over 1400' thru 2800'	14'-6"
	Over 700' thru 1400'	7'-3"
	Thru 700'	Zero
		CONSTRUCT OR FABRICATE
		Straight rail sections
		To required radius or to chords shown (19)
		To required radius (19)

3/8" Dia Hex Head Anchor Bolt (ASTM-A307) or Threaded Rod (ASTM-A36) with one Hardened Steel Washer placed under Hex Nut. One additional Hex Nut must be furnished for each Threaded Rod.



### CAST-IN-PLACE ANCHOR BOLT OPTIONS (17)



- (2) Wingwall Length minus 5'-0" (Varies)
- (5) Increase 2" for structures with overlay.
- (8) HSS 2.875 x 0.203
- (9) HSS 2.375 x 0.154
- (13) 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.
- (16) Bars SU1(#3), SU2(#3) and WU(#5) not shown for clarity.
- (17) See "Material Notes" for anchor bolt information.
- (18) For raised sidewalks, add sidewalk height to total bar height. Use sidewalk height at rail's location.
- (19) Shop drawings for approval required for HSS rail sections.
- (20) At the Contractor's option, Bars V may be replaced by extending Bars U to 2'-5" 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).

**MATERIAL NOTES:**  
Galvanize all steel components except reinforcing unless otherwise shown on plans.  
Provide Class "C" concrete. Provide Class "C" (HPC) if required elsewhere. Chamfer all exposed corners.  
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 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 and accepted to be of equal strength to railings with like geometry, which have been crash tested to meet NCHRP Report 350 TL-4 criteria. However, its use is limited to speeds of 45 mph or less due to the presence of the HSS rail.  
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.

Bridge Division Standard

COMBINATION RAIL

TYPE C223

FILE: r1st0019.dgn	DN: TxDOT	CK: TxDOT	DW: JTR	CK: JMH
©TxDOT July 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS				
DIST	COUNTY			SHEET NO.

SHEET 3 OF 3