



Missouri Department of Transportation

Bridge Division

Bridge Design Manual

Section 3.90

Revised 04/10/2003

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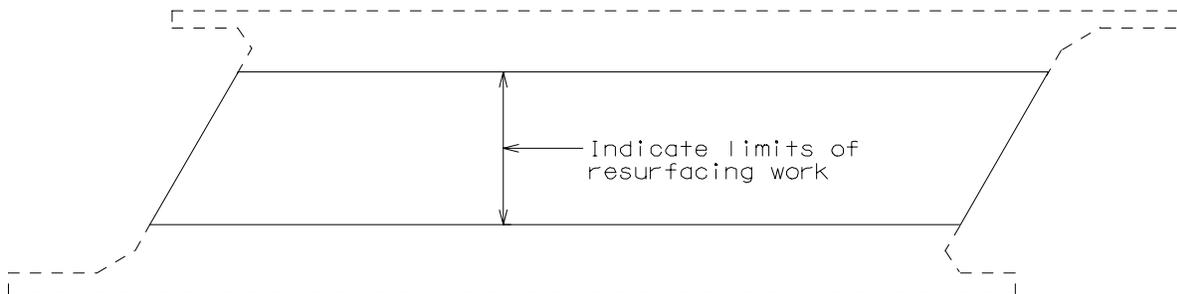
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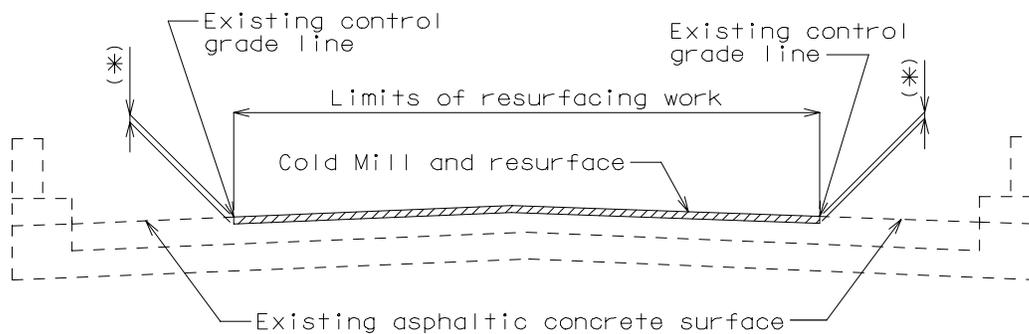
- 5.1 Closure Pour

RESURFACING
PARTIAL OVERLAY REPLACEMENT

Typical Sections of Concrete Repairs



PLAN



SECTION THRU ROADWAY

Place the following notes on plans.

The existing asphaltic concrete surface shall be removed to a uniform grade line (*) below the existing control grade line as noted.

Resurface with (*) asphaltic concrete.

(*) Depth of asphaltic concrete as specified in the Design Layout.

SPECIAL REPAIR ZONES

Typical Sections of Concrete Repairs

The following order of repair zones are to be used for the deck repair on continuous concrete structures.

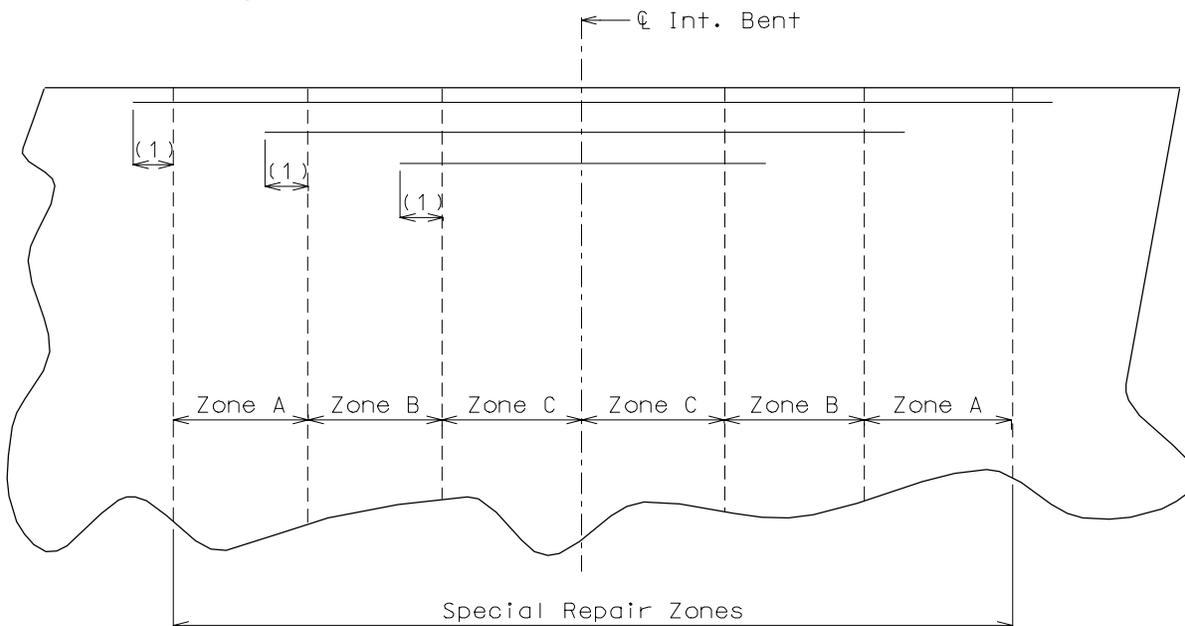
Zones with the same letter designation may be repaired at the same time. Sequence of repairs follows zone A, zone B then zone C.

Zone A is to be completed before Zone B and Zone B before Zone C, etc.

Any repair in the remainder of the bridge that is adjacent to Zone A shall be completed prior to work in Zone A.

If an excessive number of zones are required at one bent, See the Structural Project Manager.

Consider combining zones if it is $\leq 24"$.



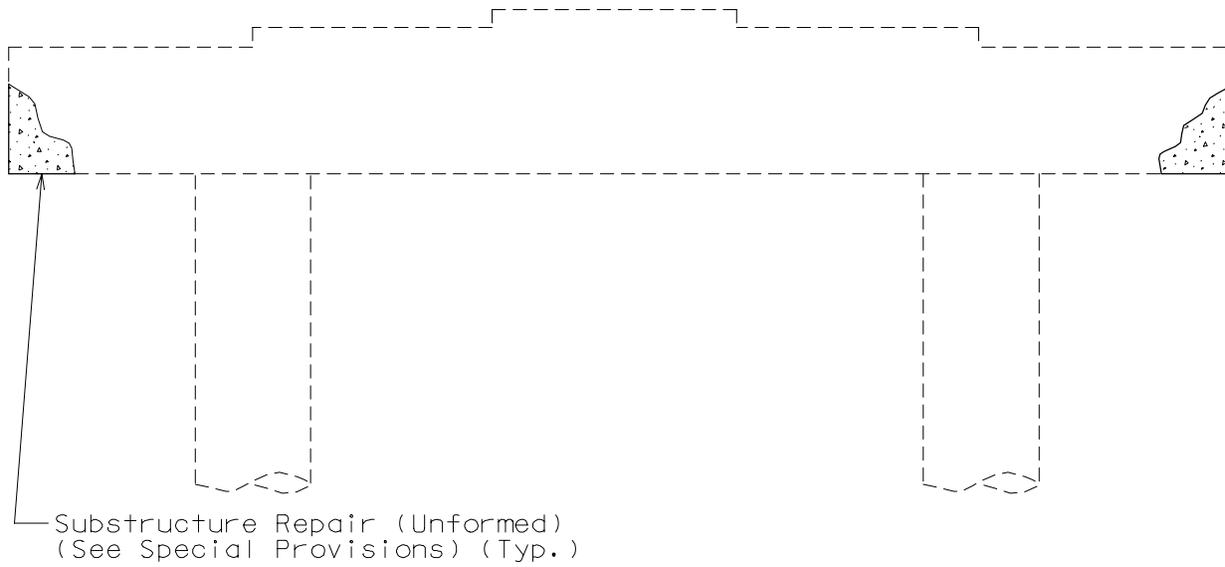
PART PLAN OF SLAB SHOWING REPAIR ZONES

(1) Development length.

See Bridge Manual Section 4 Office Notes for appropriate notes.

SUBSTRUCTURE REPAIR

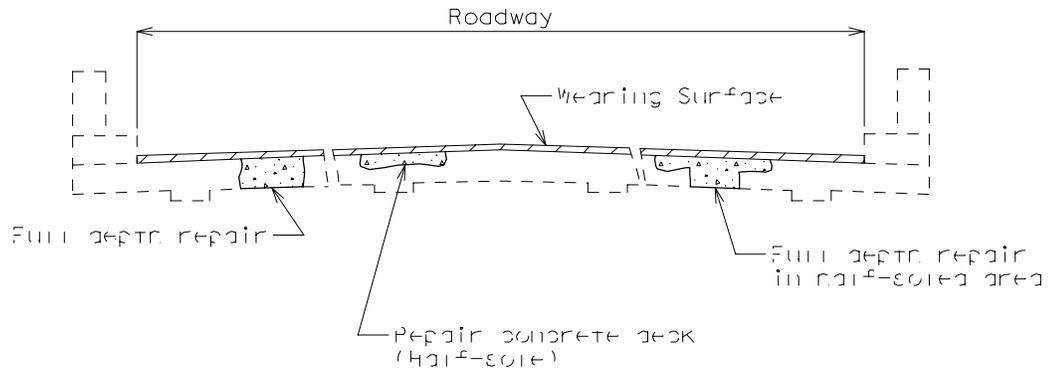
Typical Sections of Concrete Repairs



DETAILS SHOWING SUBSTRUCTURE REPAIR AREAS

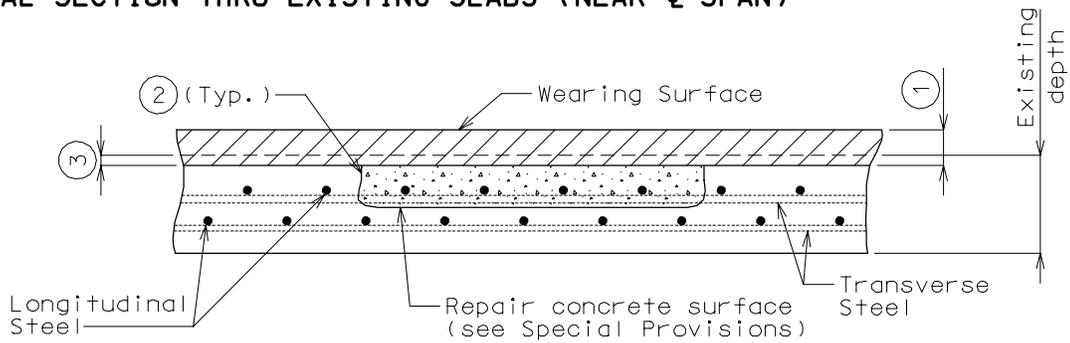
DECK REPAIR

Typical Sections of Concrete Repairs

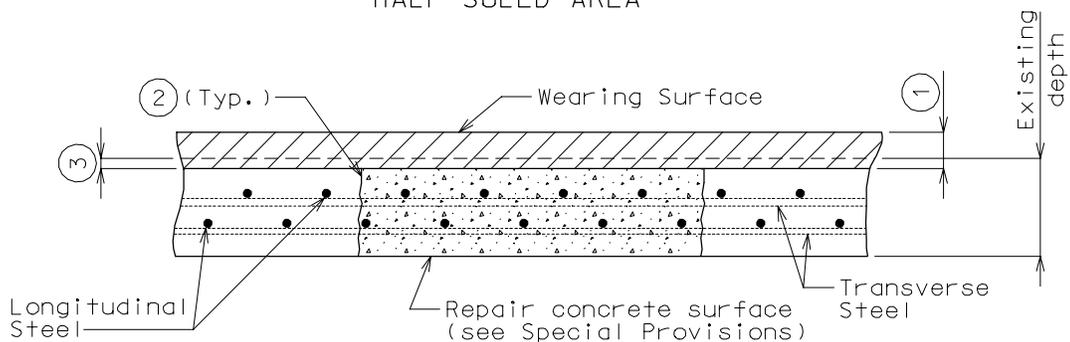


SECTION THRU ROADWAY

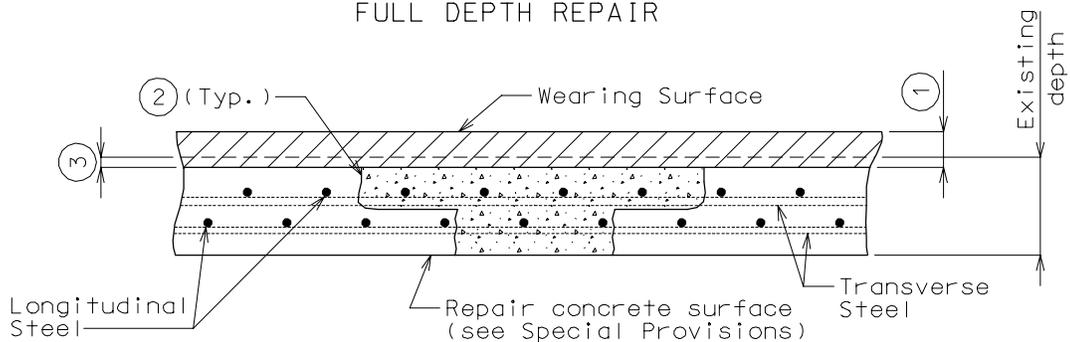
TYPICAL SECTION THRU EXISTING SLABS (NEAR $\frac{1}{2}$ SPAN)



HALF-SOLED AREA



FULL DEPTH REPAIR

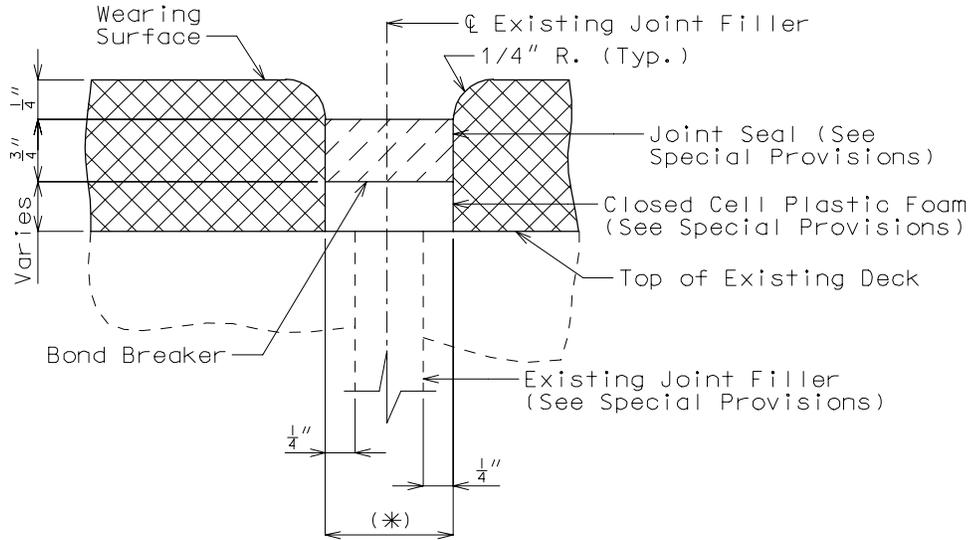


FULL DEPTH REPAIR IN HALF-SOLED AREA

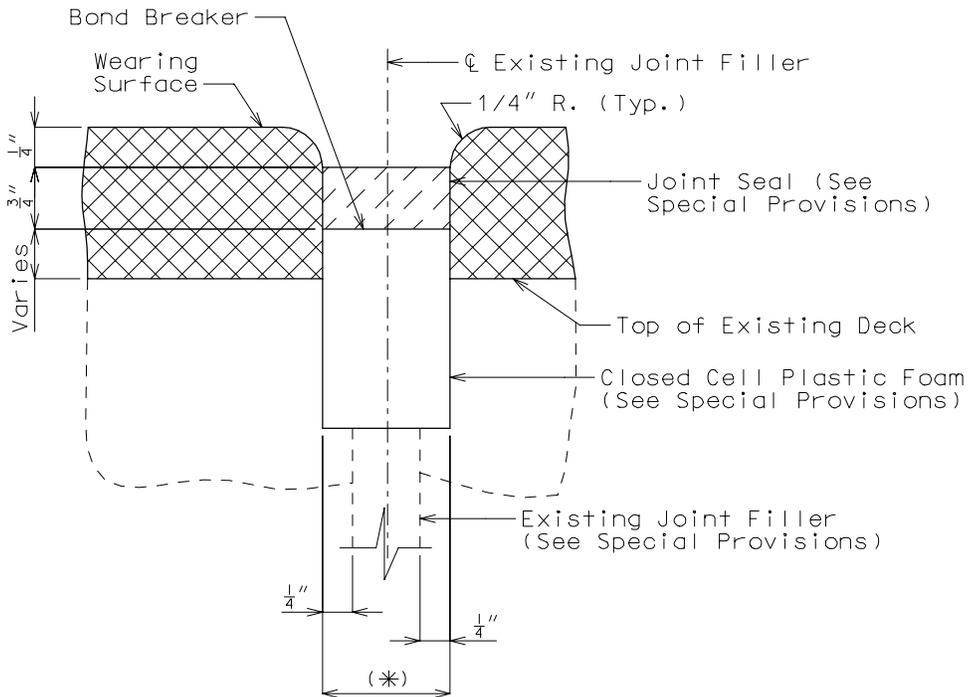
- ① 1/4" (min.) for Epoxy Polymer Concrete Overlay.
1-3/4" (min.) for Latex Modified Concrete.
2-1/4" (min.) for Low Slump Concrete or Silica Fume Concrete.
- ② Saw cut or chip vertically first 1/2" of all deck repair.
(Hydroblasting allowed by Special Provisions.)
- ③ Scarify existing slab (1/4" min.). See the Design Layout for the minimum depth of scarification for the Concrete Wearing Surface. Scarification not required for Asphaltic Concrete Wearing Surface and Epoxy Polymer Concrete Overlay.

FILLED JOINTS
LATEX, LOW SLUMP OR SILICA FUME

Typical Sections of Concrete Repairs



SECTION THRU JOINT

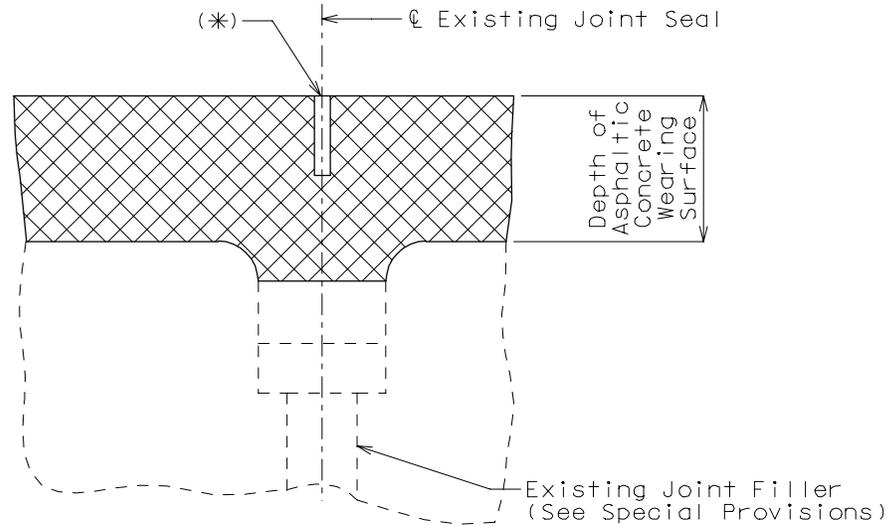


SECTION THRU JOINT

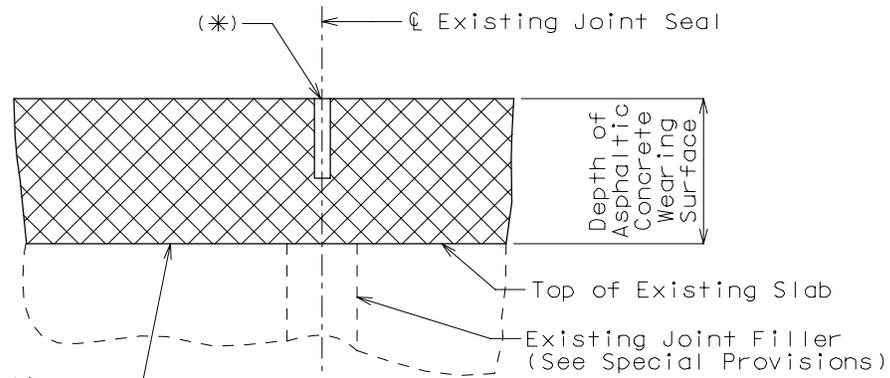
(*) Width of joint seal to be not less than the depth and not more than twice the depth of the joint seal.

Typical Sections of Concrete Repairs

FILLED JOINTS (CONT.)
 ASPHALTIC CONCRETE OVERLAY



SECTION THRU JOINT



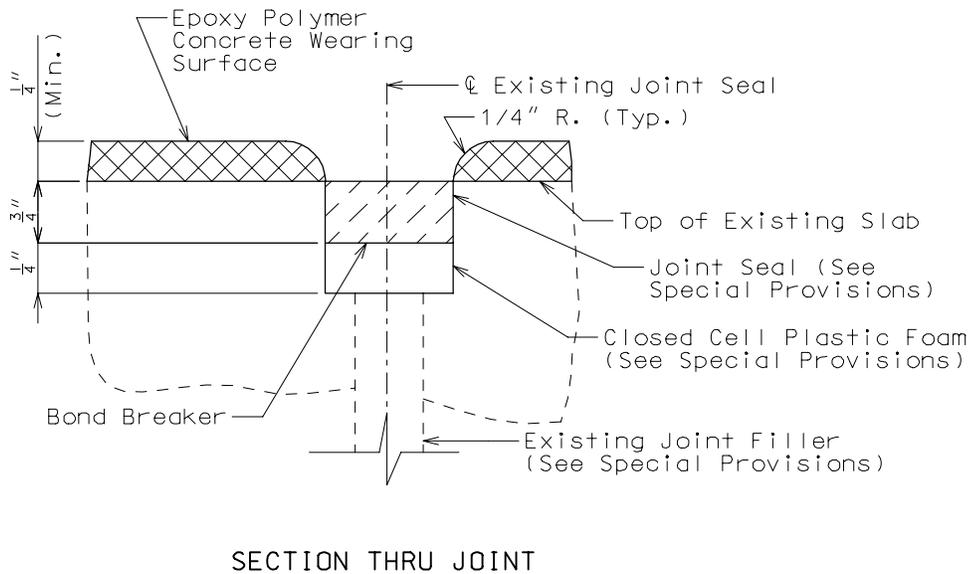
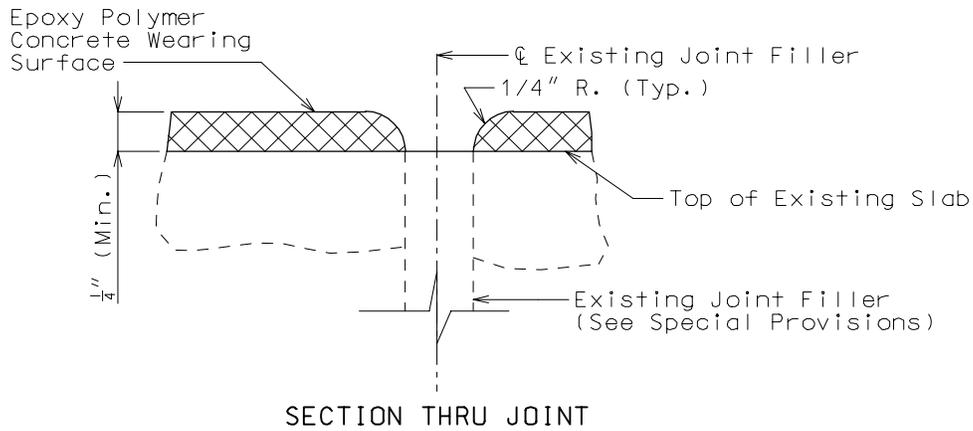
SECTION THRU JOINT

Seal Coat (See Section 409 of Missouri Standard Specifications.)

(*) Saw cut 1" deep and fill with liquid joint sealant in accordance with Section 1057.1.3 of Missouri Standard Specifications.

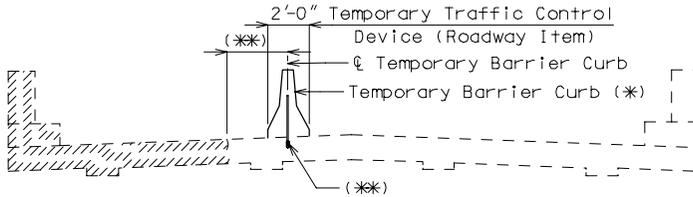
Typical Sections of Concrete Repairs

FILLED JOINTS (CONT.)
EPOXY POLYMER CONCRETE OVERLAY



TEMPORARY TRAFFIC CONTROL DEVICE

Typical Sections of Concrete Repairs

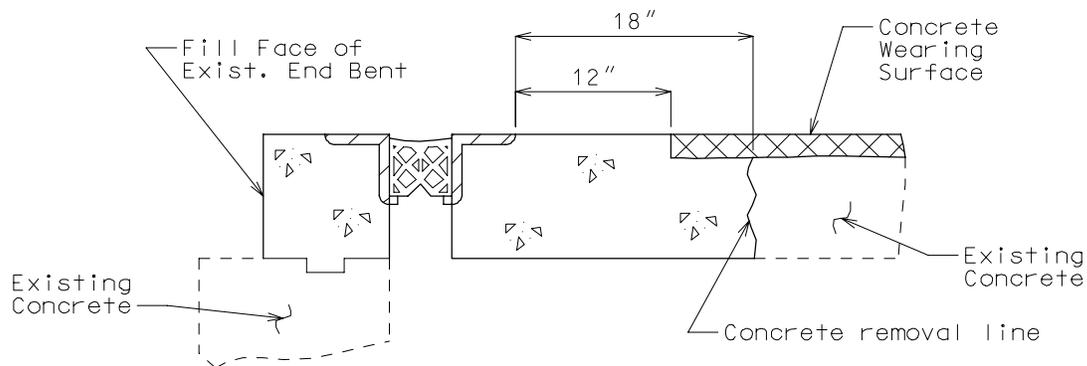


- (*) Show Barrier Curb as per District recommendation. Typically Barrier Curb is shown when structure is on interstate and/or the rail is being removed. Otherwise, show the dimension lines with 2'-0" dimension.
- (**) If this dimension is less than 41", the temporary curb may have to be dowelled in, check with Structural Project Manager.

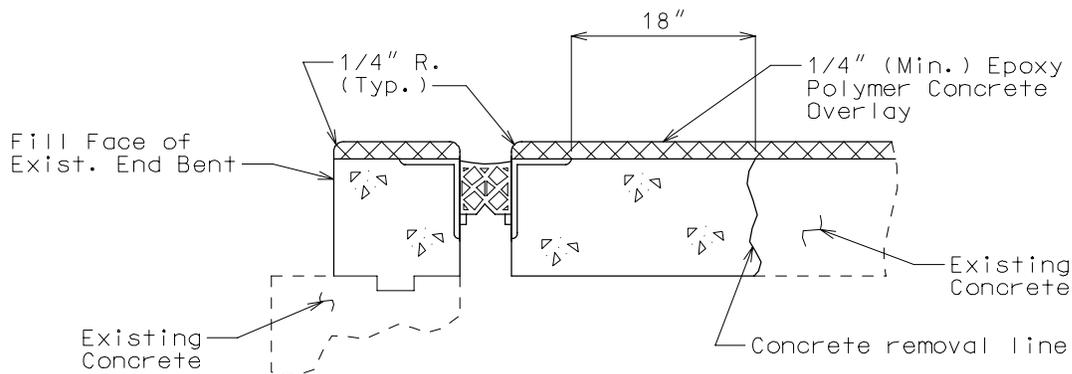
SECTION THRU ROADWAY

**CONCRETE WEARING SURFACE
REPLACEMENT OF EXISTING EXPANSION DEVICE
PREFORMED COMPRESSION JOINT SEAL
(STRIP SEAL DETAILS ARE SIMILAR)**

Dimensions



LOW SLUMP, SILICA FUME, LATEX OR ASPHALTIC CONCRETE WEARING SURFACE



Note:

The contractor shall exercise care to ensure that spillage over joint edges is prevented and that a neat line is obtained along any terminating edge of the epoxy polymer concrete.

EPOXY POLYMER CONCRETE WEARING SURFACE

Note:

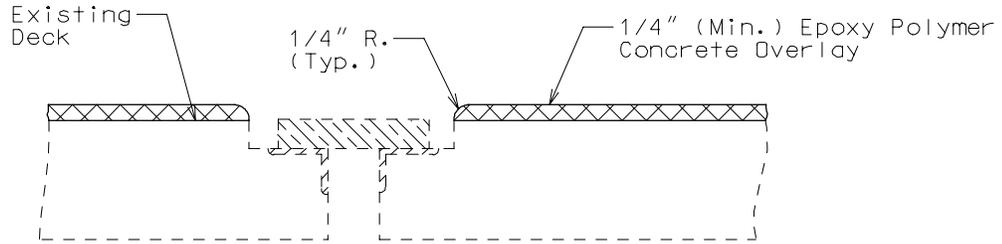
Concrete overlay shall be forced into the cavity under the armor angle. Proper consolidation of the concrete shall be achieved by localized internal vibration.

When concrete is removed and expansion device armor is replaced, see Section 3.35 of this manual for the appropriate expansion device.

CONCRETE WEARING SURFACE (CONT.)
TYPICAL SECTION OF ELASTOMERIC EXPANSION DEVICE

Dimensions

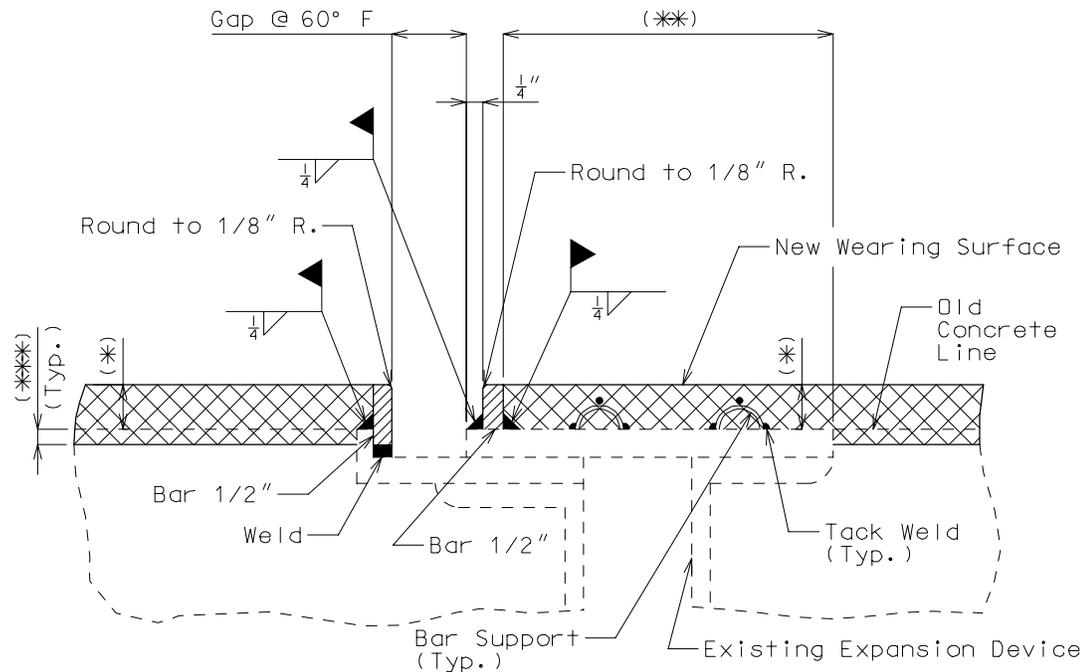
When Low Slump, Silica Fume, Latex or Asphaltic Concrete wearing surface is used, the elastomeric joint must be replaced by another type of expansion device.



EPOXY POLYMER CONCRETE WEARING SURFACE

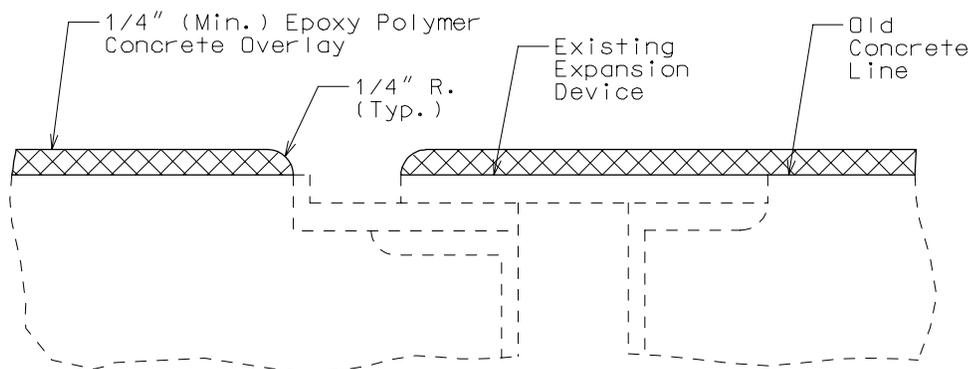
CONCRETE WEARING SURFACE (CONT.)
TYPICAL SECTIONS OF FLAT PLATE EXPANSION DEVICE

Dimensions



LOW SLUMP, SILICA FUME, LATEX OR ASPHALTIC CONCRETE WEARING SURFACE

- (*) Latex Concrete Wearing Surface = 1-3/4".
Low Slump or Silica Fume Concrete Wearing Surface = 2-1/4".
 - (**) When this dimension exceeds 3" and a Concrete Wearing Surface is used, tack weld a one inch bar chair to the plate for each 3" of plate to be covered by the Wearing Surface.
 - (***) Scarify existing slab (1/4" min.). See the Design Layout for the minimum depth of scarification. Scarification not required for Asphalt Concrete Wearing Surface.
- Note: See Standard Plans Drawing 712.40 (Steel Dams at Expansion Devices for Resurfacing Bridge Floors).

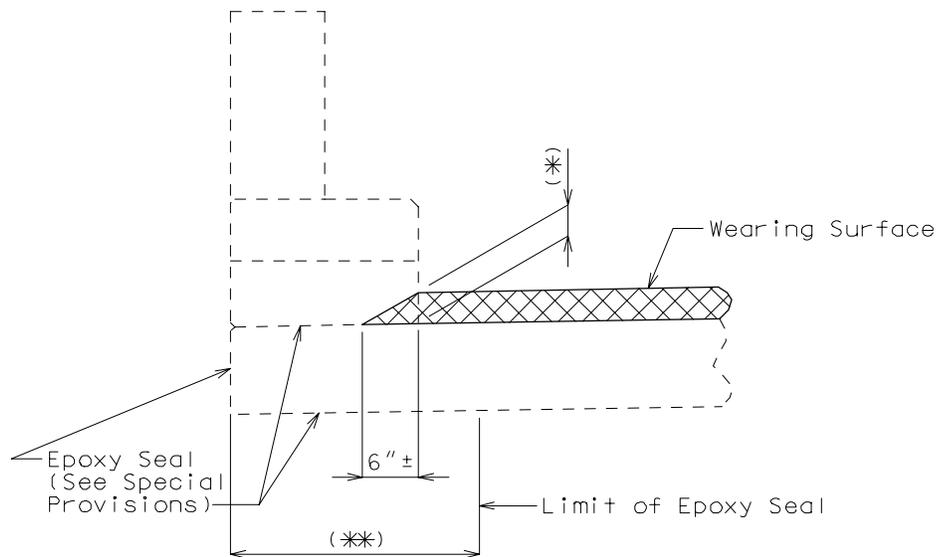


EPOXY POLYMER CONCRETE WEARING SURFACE

CONCRETE WEARING SURFACE (CONT.)

Dimensions

LATEX, LOW SLUMP, SILICA FUME OR ASPHALTIC



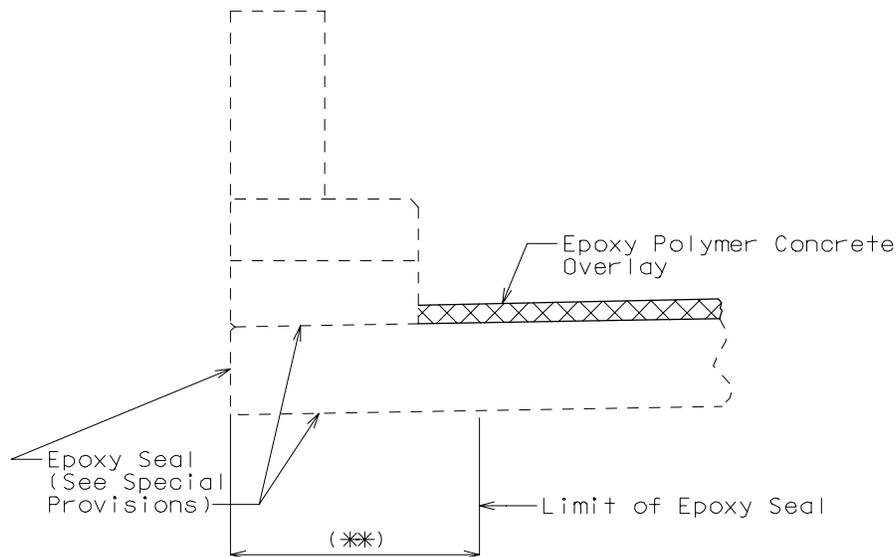
TYPICAL SECTION OF EXISTING CURB SHOWING OUTLET

Note:

(*) Latex Concrete Wearing Surface = 1-3/4"

Low Slump and Silica Fume Concrete Wearing Surface = 2-1/4"

EPOXY POLYMER CONCRETE



TYPICAL SECTION OF EXISTING CURB SHOWING OUTLET

Note:

(**) 18" or overhang width except when thrie beam rail is used,

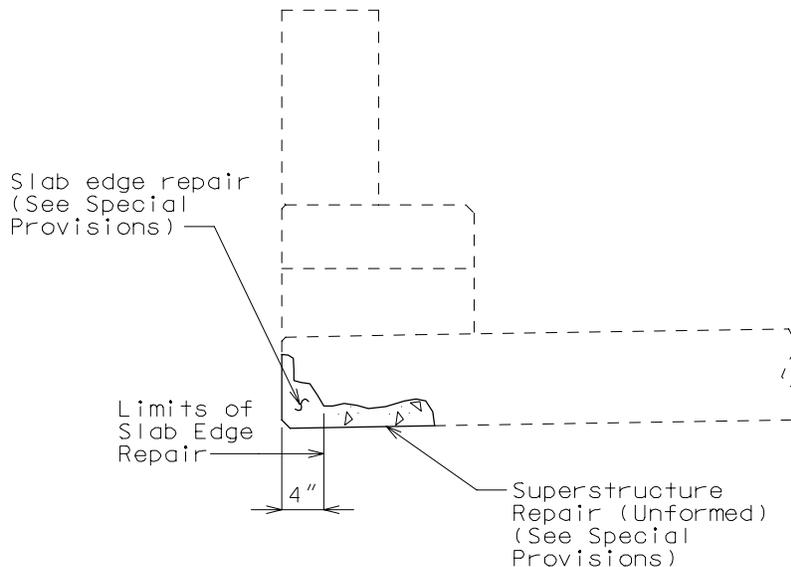
4'-0" or overhang width when thrie beam rail is used.

Do not use Epoxy Seal with Asphalt Overlays unless specified on the Design Layout.

**CONCRETE WEARING SURFACE (CONT.)
SLAB EDGE REPAIR**

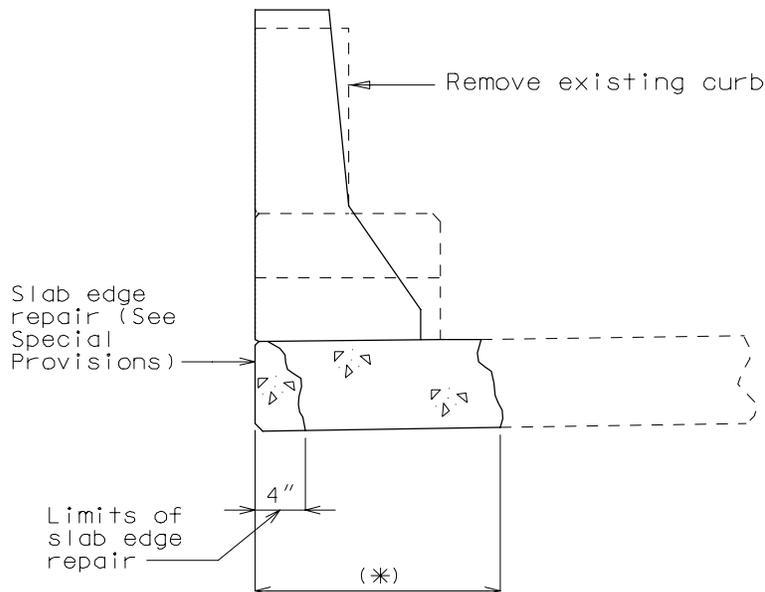
Dimensions

If slab edge repair is specified on the Design Layout when the barrier curb is not removed or when full depth repair is not a pay item, the following detail shall be provided.



CONCRETE EDGE REPAIR

If the barrier curb is removed when full depth repair and slab edge repair are pay items, the following detail shall be provided.



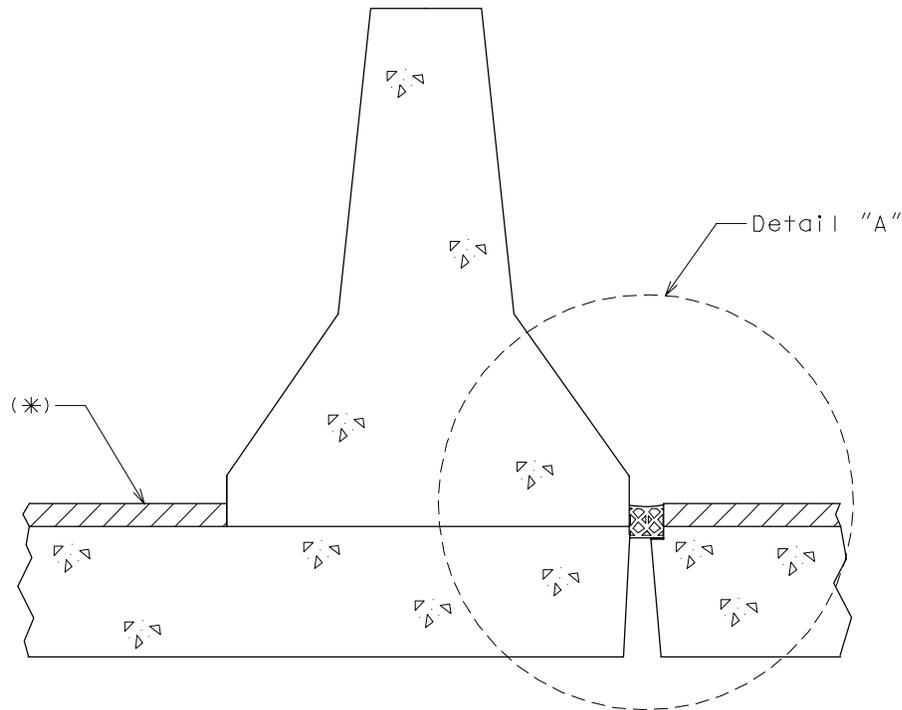
CONCRETE EDGE REPAIR

(*) If the dimension exceeds 4", the repair extending to the edge of slab shall be made and paid for as "Full Depth Repair" per sq. ft. (See Special Provisions).

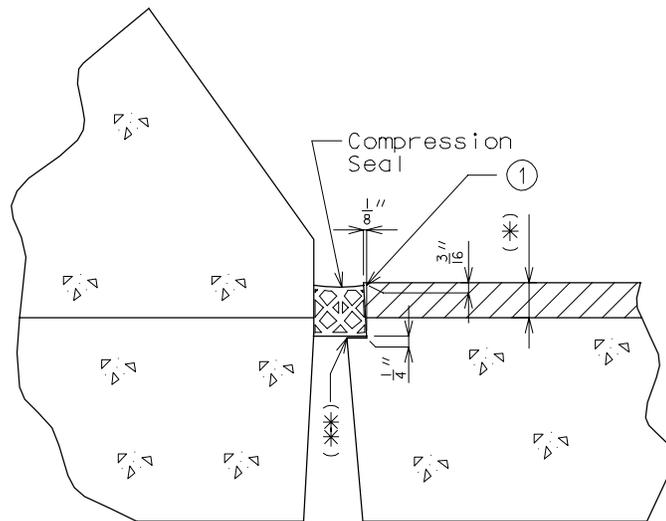
LONGITUDINAL JOINT DETAILS
REPLACEMENT OF EXISTING EXPANSION DEVICE

Dimensions

MEDIAN BARRIER CURB



SECTION THRU DOUBLE FACED MEDIAN BARRIER CURB

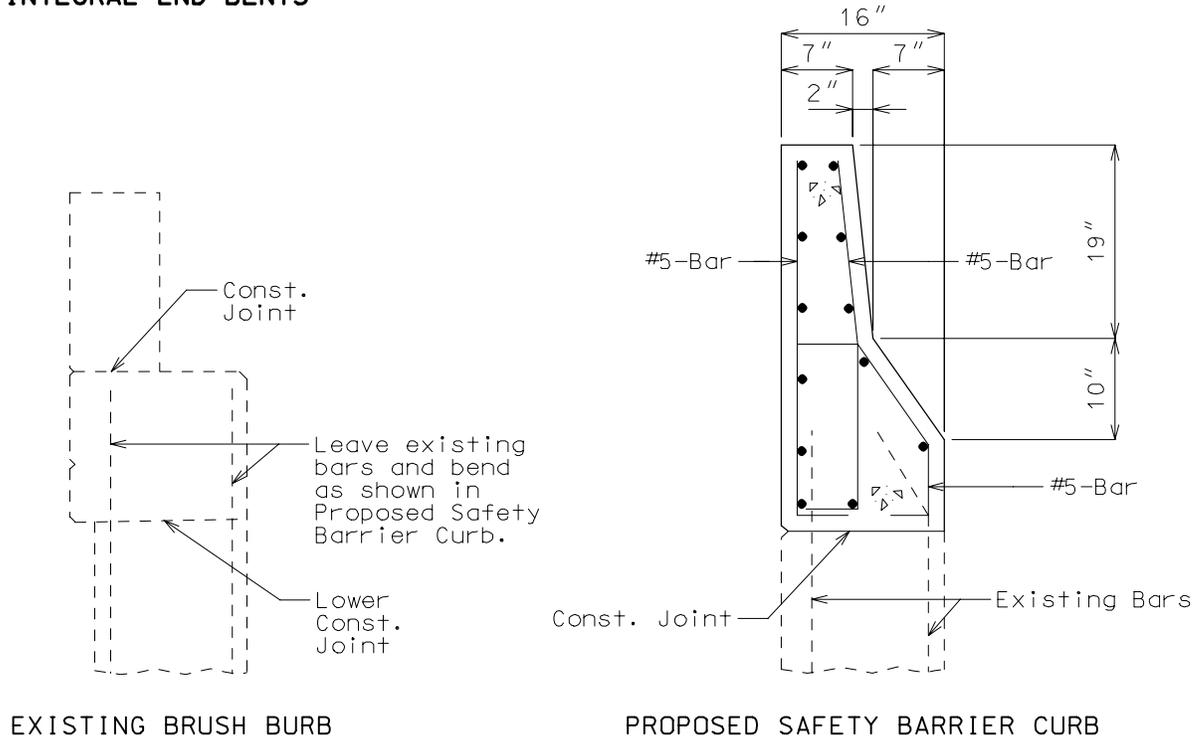


DETAIL "A"

- ① May be cast vertical and saw cut to slant.
- (*) Latex Concrete Wearing Surface = 1-3/4".
Low Slump Concrete Wearing Surface = 2-1/4".
- (**) Cut minimum 1/2" support notch (rough finish). Remove any existing compression seal.

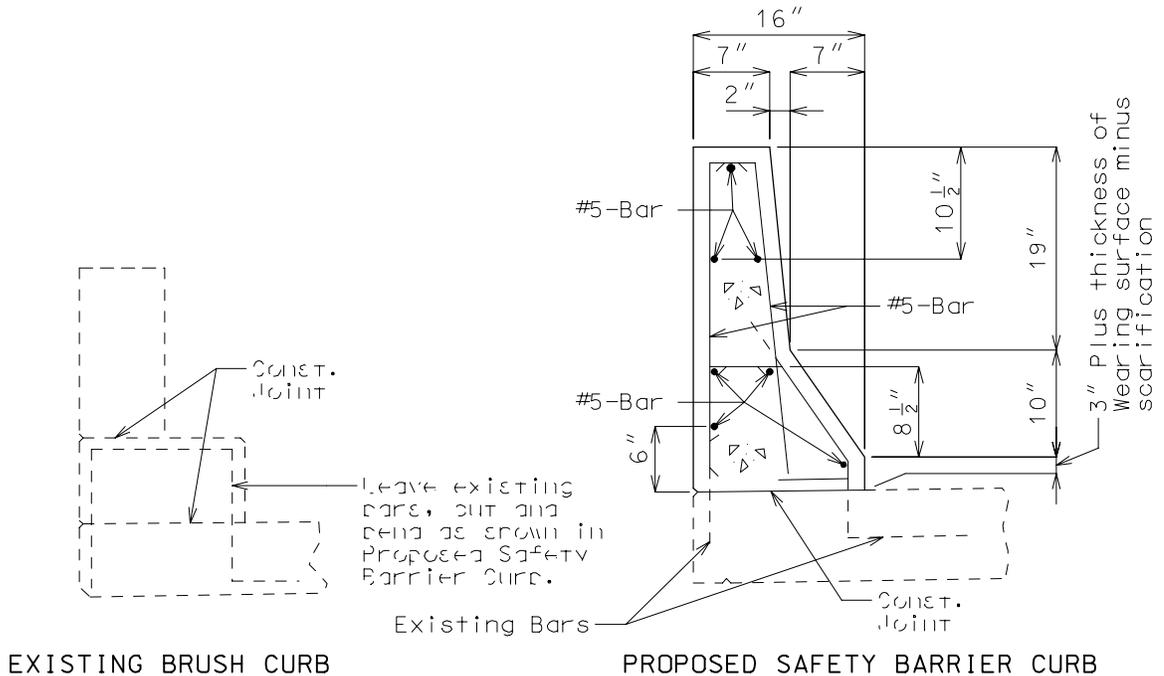
REPLACEMENT OF BRUSH CURB WITH SAFETY BARRIER CURB
NON-INTEGRAL END BENTS

Curb Treatments



SECTIONS THRU WING

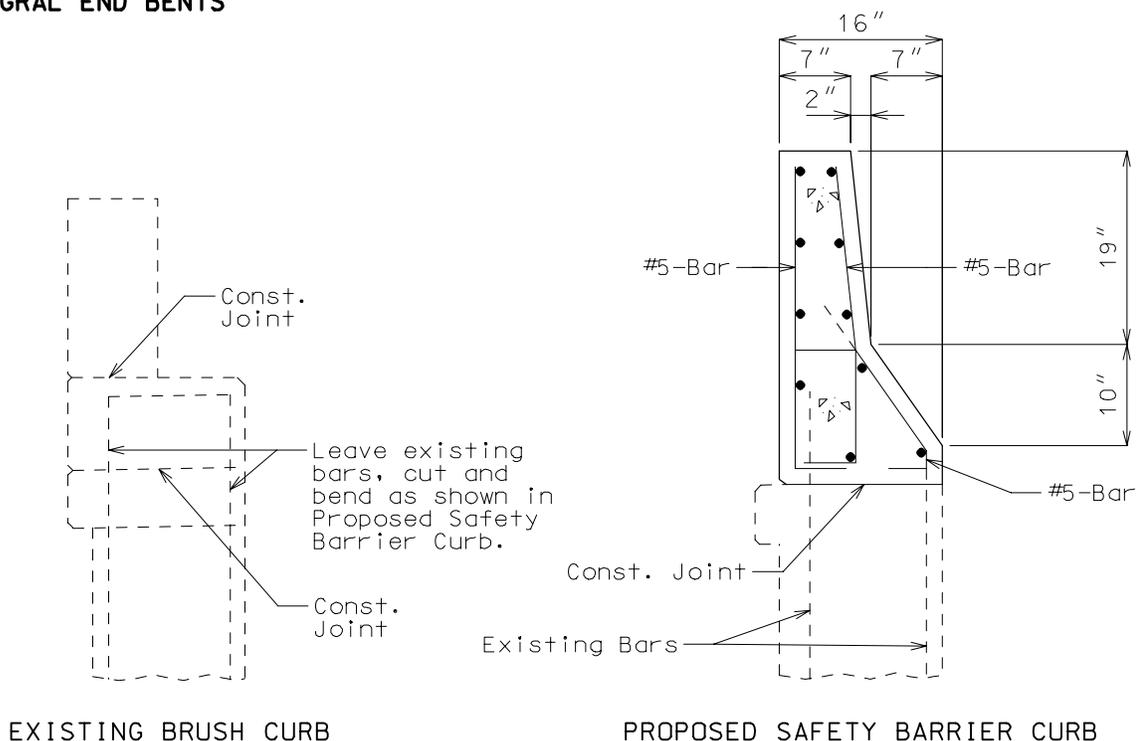
Note: Remove existing Brush Curb above lower Const. Joint.
For details not shown, see Section 3.30 of this manual.



SECTIONS THRU SLAB

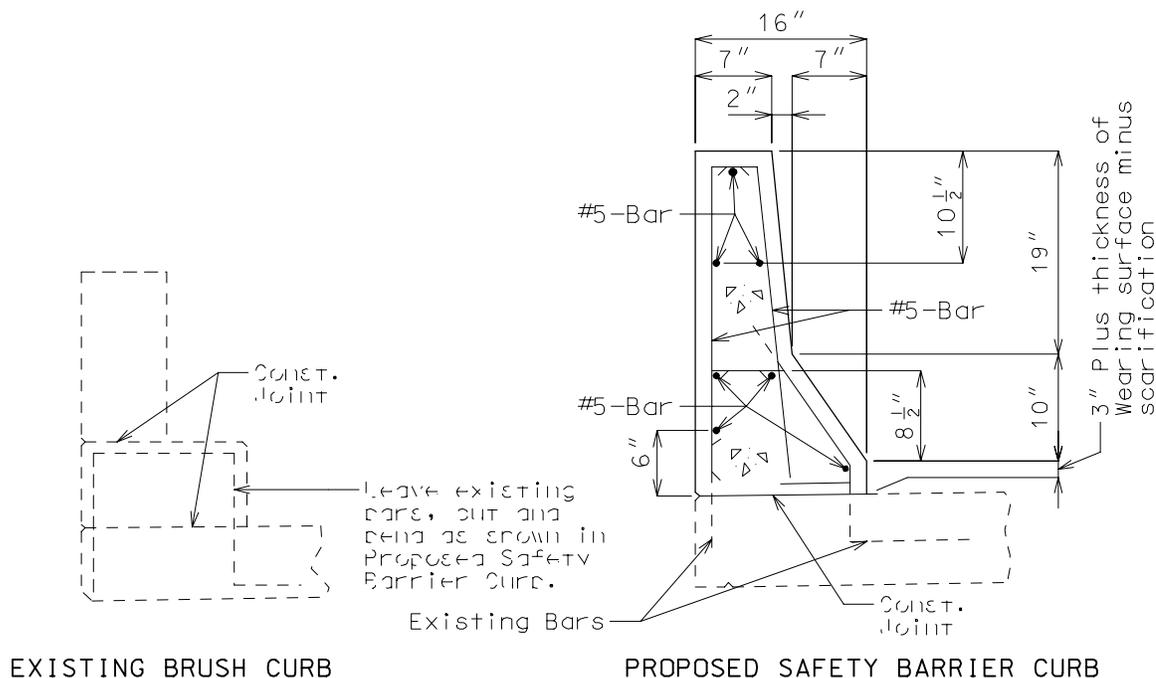
REPLACEMENT OF BRUSH CURB WITH SAFETY BARRIER CURB (CONT.)
INTEGRAL END BENTS

Curb Treatments



SECTIONS THRU WING

Note: Remove existing Brush Curb above lower Const. Joint.
For details not shown, see section 3.30 of this manual.

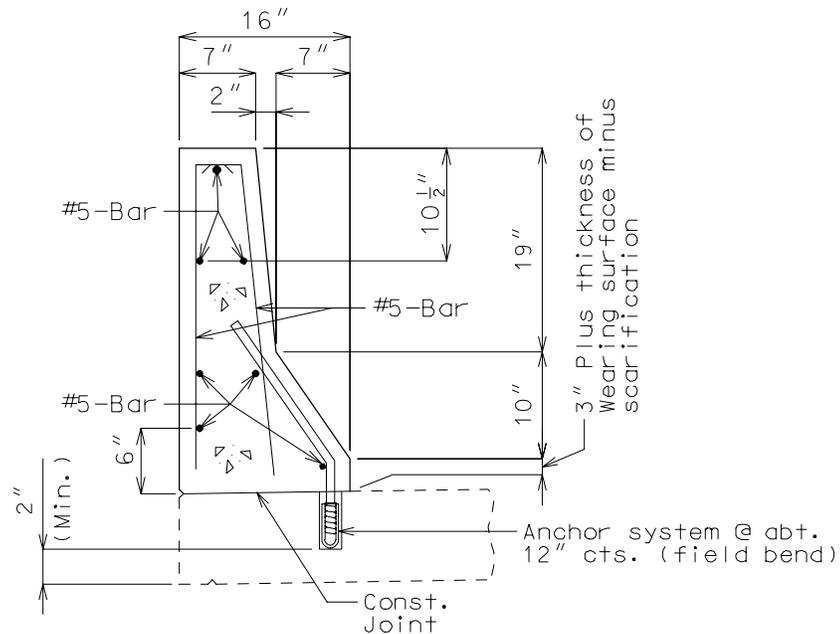


SECTIONS THRU SLAB

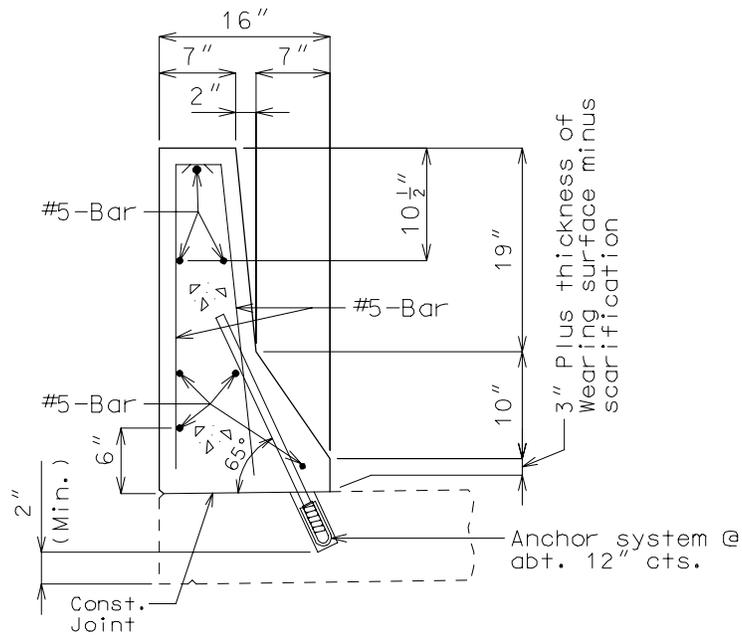
REPLACEMENT OF EXISTING CURB
(USING ANCHOR SYSTEMS)

Curb Treatments

SAFETY BARRIER CURB ON SLAB



SECTION THRU CURB



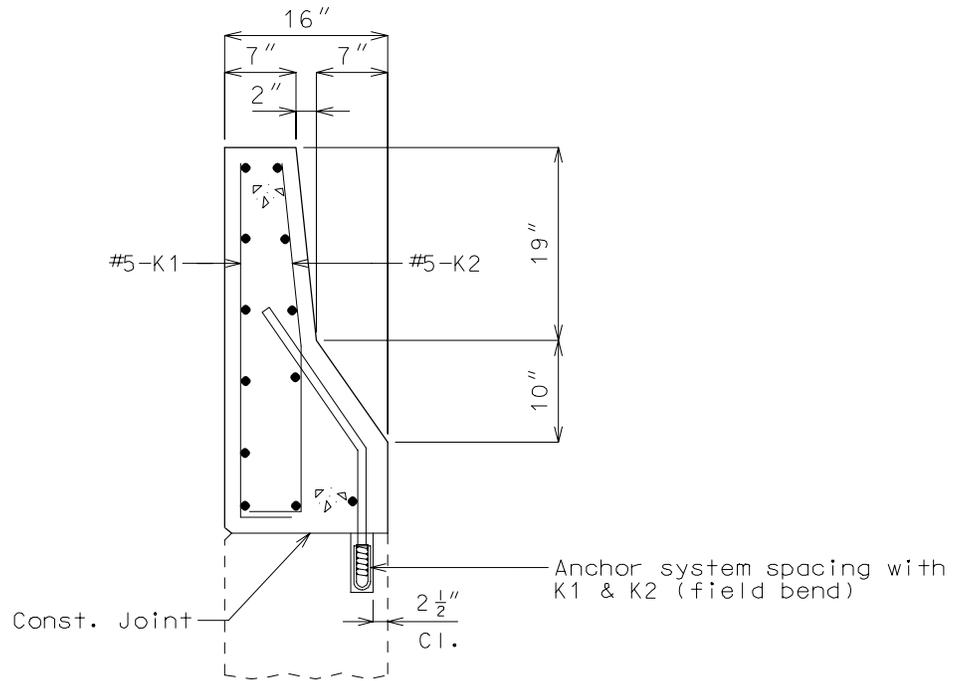
SECTION THRU CURB
(OPTIONAL ANCHORING SYSTEM)

Note: See Bridge Manual Section 4, page I1-A1 thru I2-B for appropriate notes.

REPLACEMENT OF EXISTING CURB (CONT.)
(USING ANCHOR SYSTEMS)

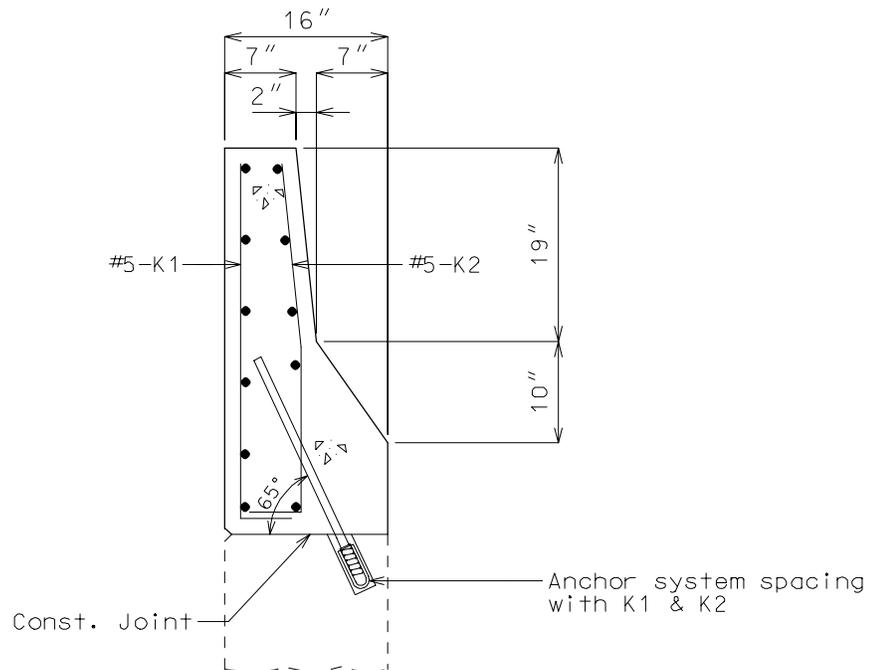
Curb Treatments

SAFETY BARRIER CURB ON WING



SECTION THRU CURB (*)

(*) Non-Integral End Bent shown, Integral End Bents similar.



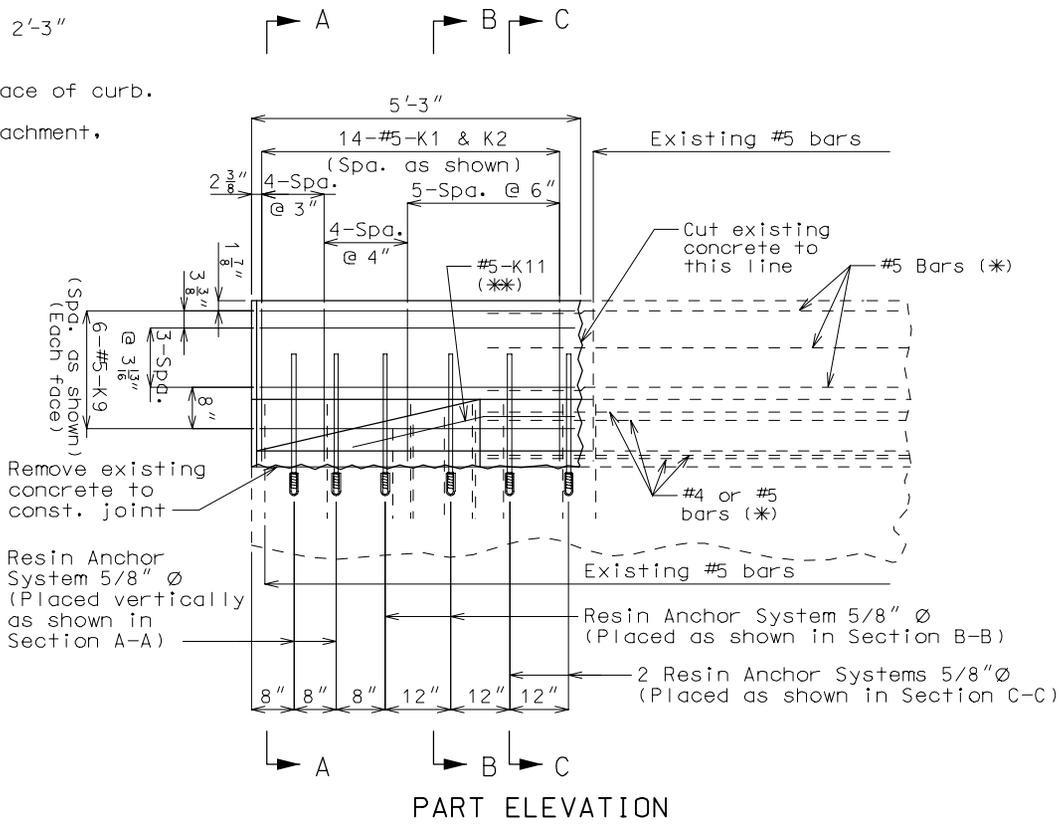
SECTION THRU CURB (*)
(OPTIONAL ANCHORING SYSTEM)

Note: See Bridge Manual Section 4, pages I1-A1 thru I2-B for appropriate notes.
For details not shown, see section 3.30 of this manual.

REPLACEMENT OF EXISTING CURB AT END OF WING
(USING ANCHOR SYSTEMS)

Curb Treatments

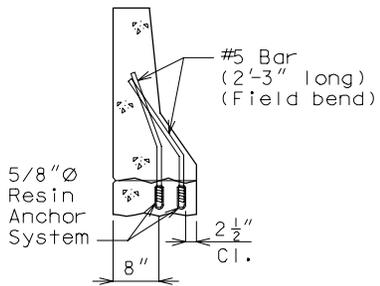
INTEGRAL END BENTS



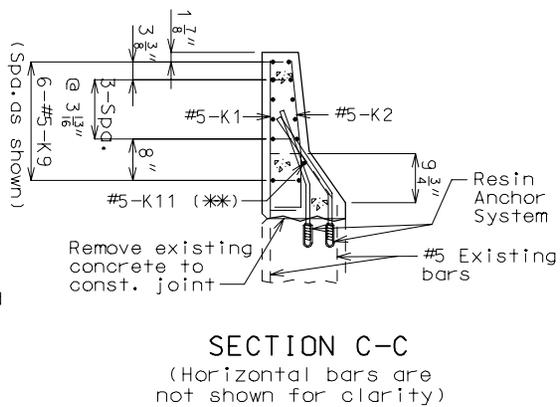
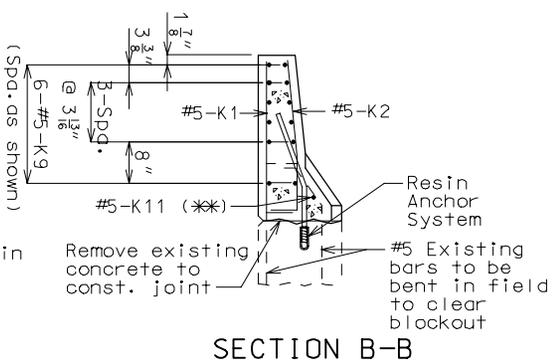
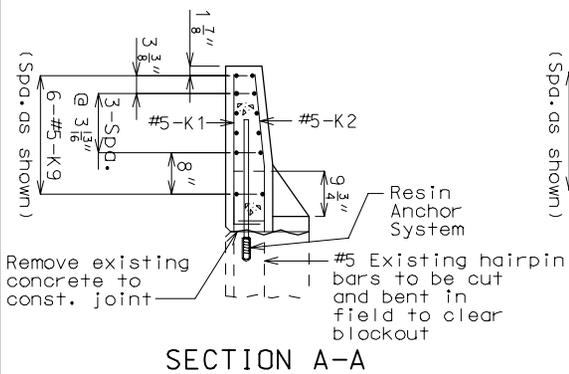
(*) Extend existing horizontal bars 2'-3" into new concrete.

(**) Fit bar to follow transition face of curb.

Note: For details of Guard Rail Attachment, see Sec. 3.30 page 4.6A-1.

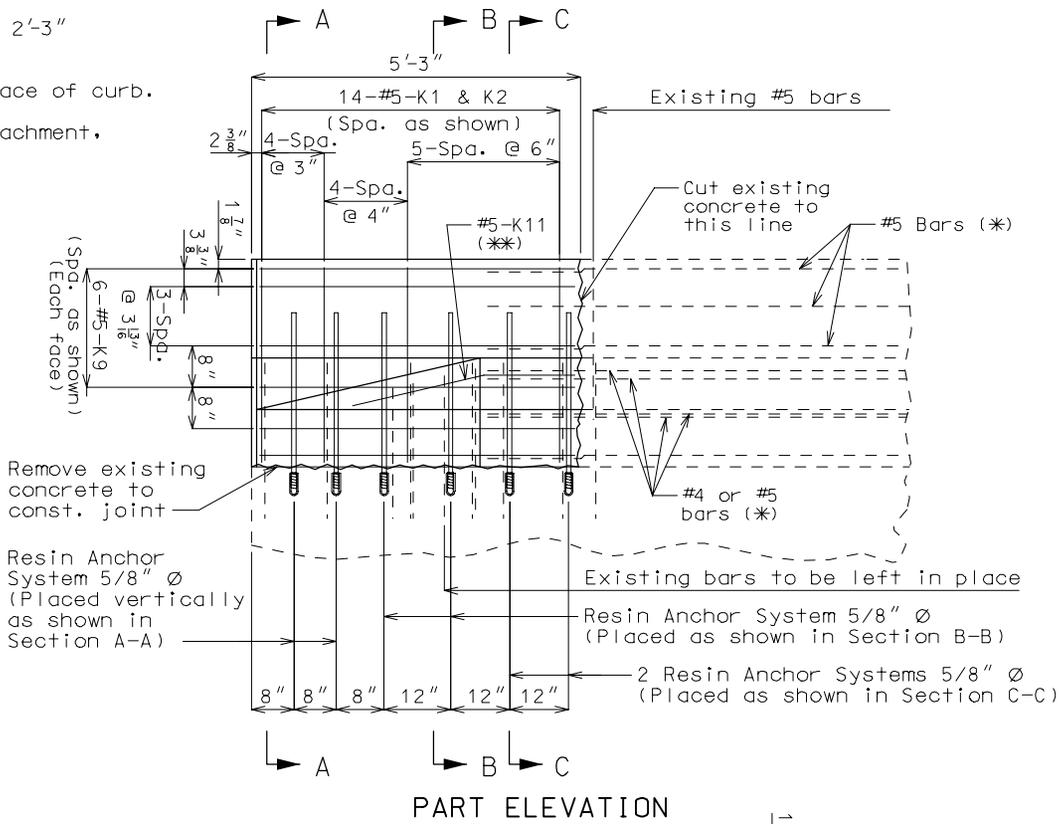


ANCHOR SYSTEMS AT SECTION C-C



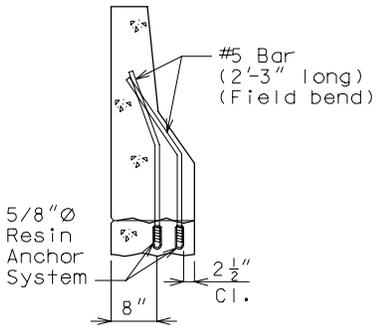
REPLACEMENT OF EXISTING CURB AT END OF WING
(USING ANCHOR SYSTEMS)
NON-INTEGRAL END BENTS

Curb Treatments

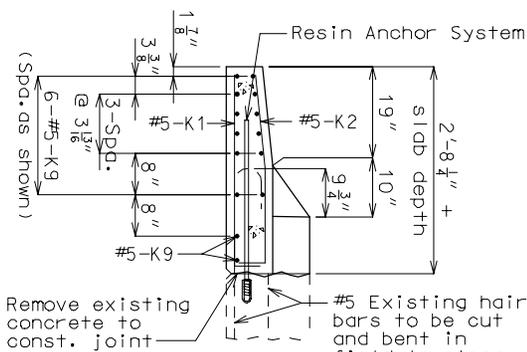


PART ELEVATION

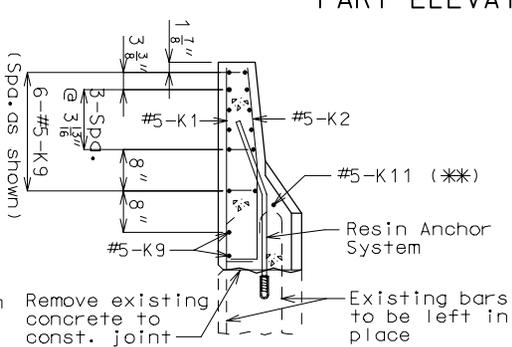
(*) Extend existing horizontal bars 2'-3" into new concrete.
 (**) Fit bar to follow transition face of curb.
 Note: For details of Guard Rail Attachment, see Sec. 3.30 page 4.6A-1.



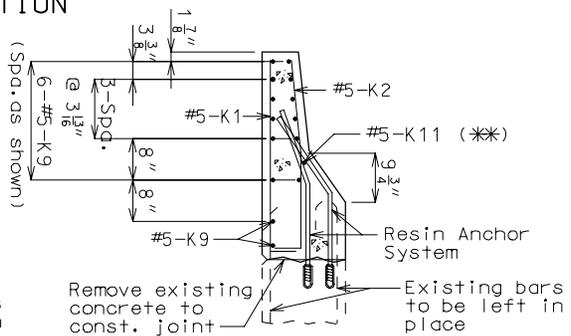
ANCHOR SYSTEMS AT SECTION C-C



SECTION A-A



SECTION B-B

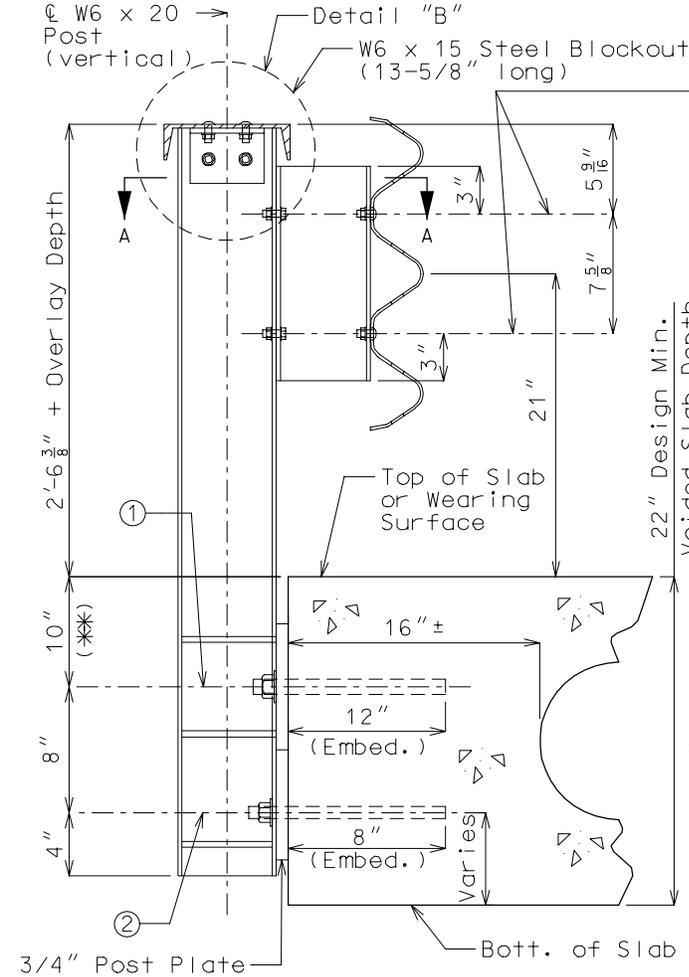


SECTION C-C
(Horizontal bars are not shown for clarity)

Curb Treatments

**SYSTEM 2: REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL
TYPICAL CONNECTION**

System 2: Applicable for rehabs only with slab depths 22" or greater. These are typically voided slabs. Connection design load is 1.5 times plastic moment capacity (Mp) of W6 x 20 Post.

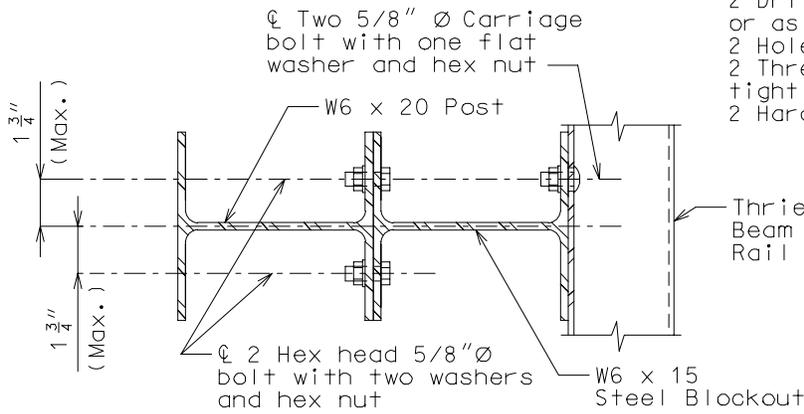


PART SECTION AT RAIL POST

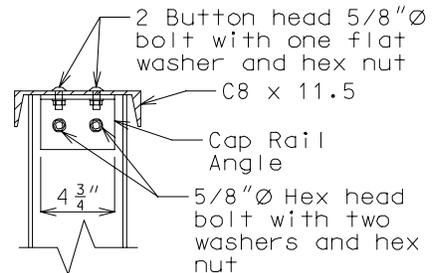
- Blockout-to-Post Conn.
 2 Holes 13/16" Ø in
 W6 x 20 Post flange and
 W6 x 15 Blockout flange
 2 Hex head bolt 5/8" Ø with
 two washers and hex nut in
 W6 x 20 Post flange
- Thrie Beam-to-Blockout Conn.
 13/16" x 2-1/2" Vertical
 slotted hole in W6 x 15
 Blockout flange (*)
 5/8" Ø Carriage bolt with
 one flat washer and hex nut

- (*) Required on one side of web only, but may be provided on both sides of web at the contractor's option.
- (**) Use 10" from top of original slab (before any future wearing surface). For 20" voided slabs reduce to 8", see Structural Project Manager.

- ① 2 Resin Anchor Systems that shall have a minimum ultimate pullout strength (each) of 72 kip in concrete with f'c = 4,000 psi to include:
 2 Drilled holes 1-1/8" Ø (min.) in slab or as recommended by manufacturer
 2 Holes 1-1/4" Ø in post plate
 2 Threaded rod 1" Ø A449 H.S. snug tight 12" embedment in slab.
 2 Hardened locking washers 2-1/2" Ø
- ② 2 Resin Anchor Systems that shall have a minimum ultimate pullout strength (each) of 20.4 kip in concrete with f'c = 4,000 psi to include:
 2 Drilled holes 7/8" Ø (min.) in slab or as recommended by manufacturer
 2 Holes 1" Ø in post and post plate
 2 Threaded rod 3/4" Ø A449 H.S. snug tight 8" embedment in slab.
 2 Hardened locking washers



SECTION A-A

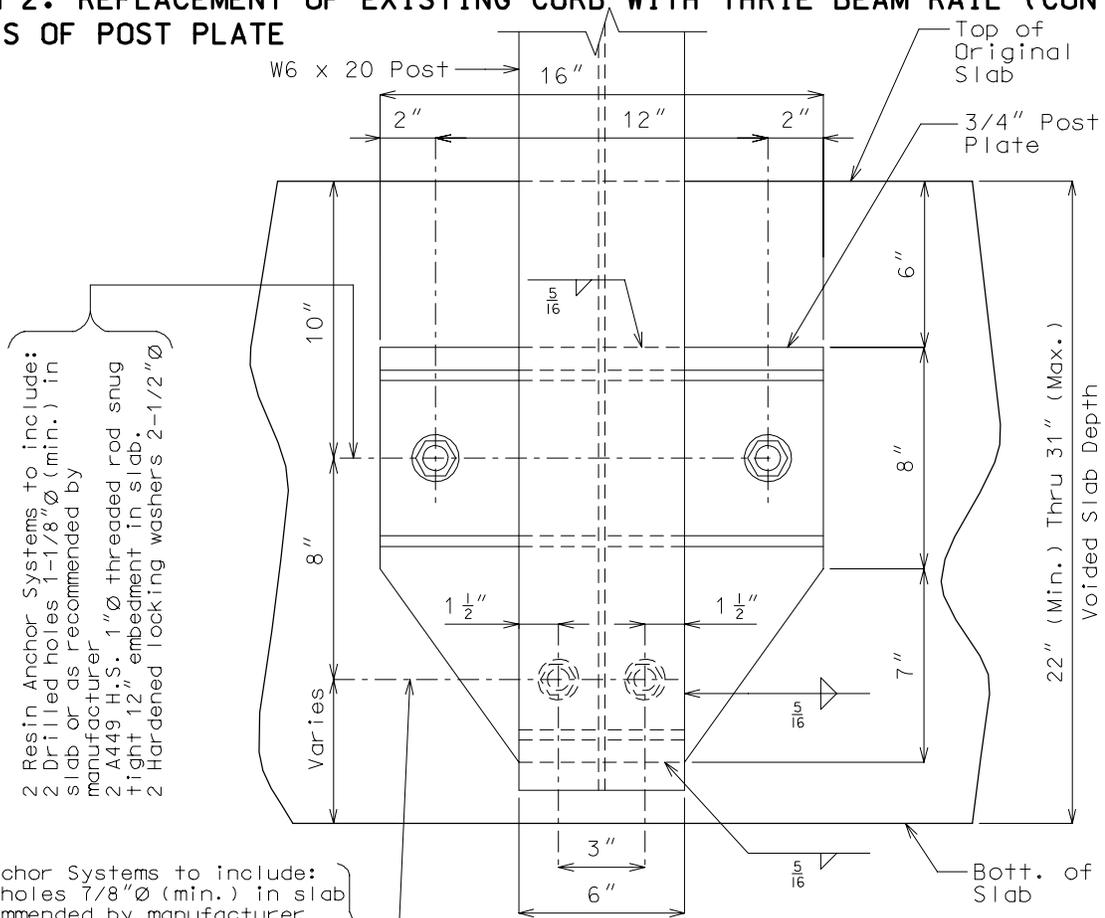


DETAIL "B"

Note: Design weight of (12 gage) Thrie Beam Bridge Rail = 35#/lin. ft.

Curb Treatments

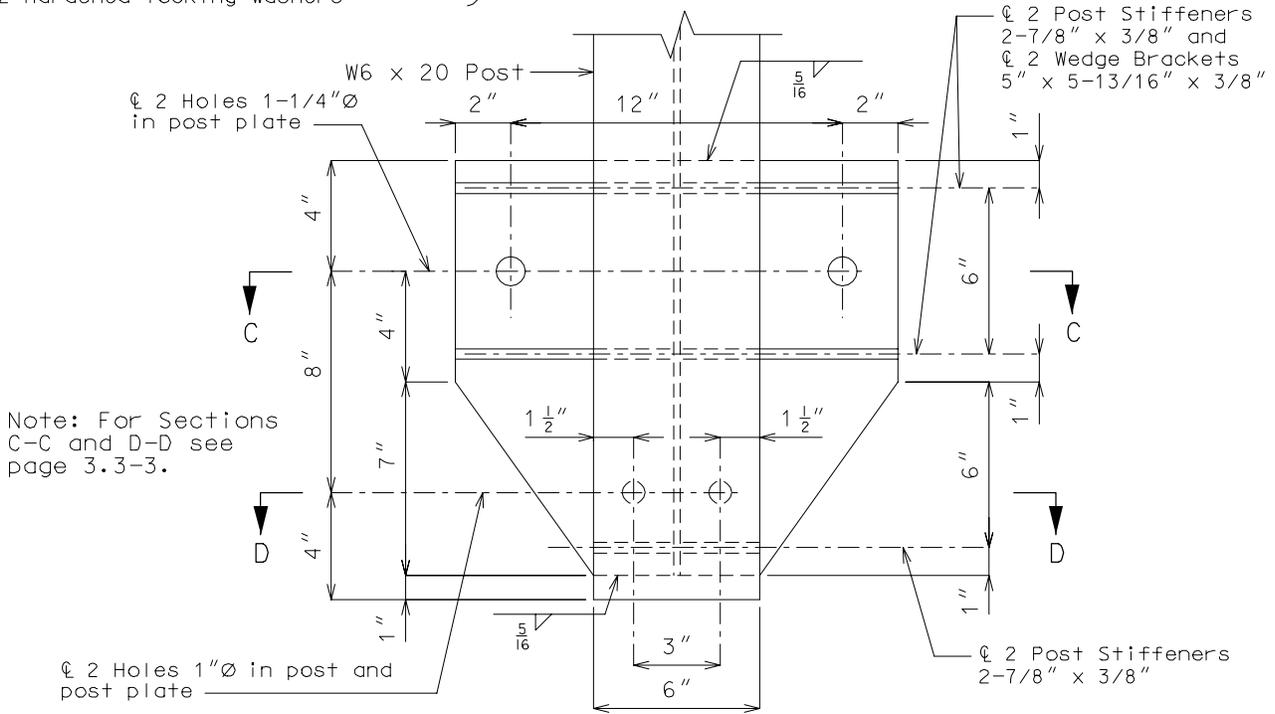
SYSTEM 2: REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL (CONT.)
 DETAILS OF POST PLATE



- 2 Resin Anchor Systems to include:
- 2 Drilled holes 1-1/8"Ø (min.) in slab or as recommended by manufacturer
- 2 A449 H.S. 1"Ø threaded rod snug tight 12" embedment in slab.
- 2 Hardened locking washers 2-1/2"Ø

- 2 Resin Anchor Systems to include:
- 2 Drilled holes 7/8"Ø (min.) in slab or as recommended by manufacturer
- 2 A449 H.S. 3/4"Ø threaded rod snug tight 8" embedment in slab.
- 2 Hardened locking washers

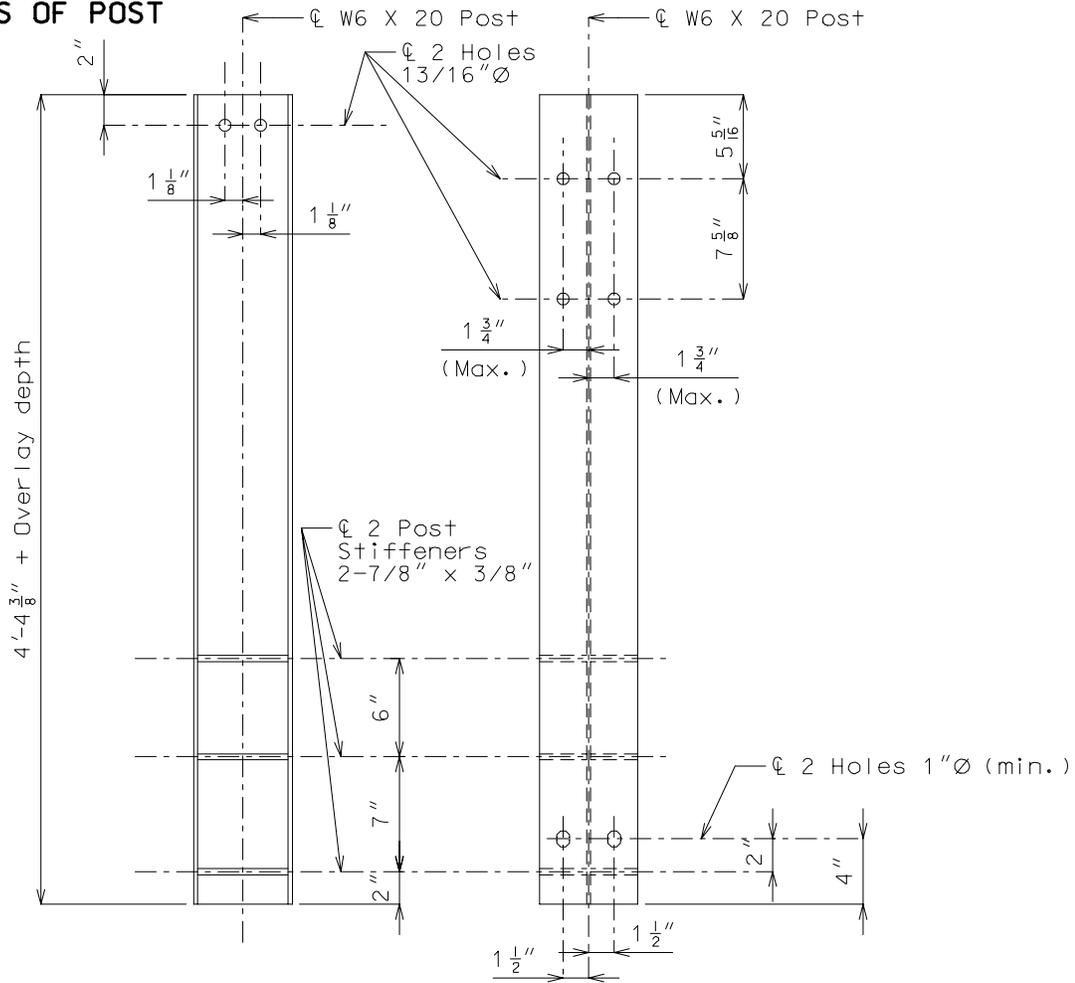
PART ELEVATION



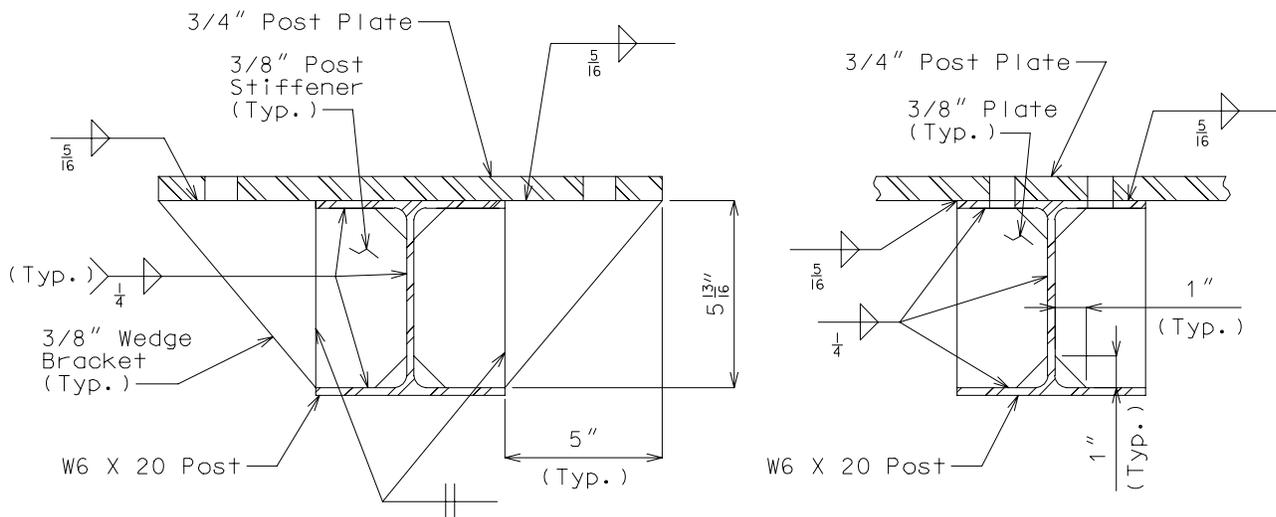
Note: For Sections C-C and D-D see page 3.3-3.

PART ELEVATION

SYSTEM 2: REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL (CONT.)
 DETAILS OF POST



DETAILS OF POST



SECTION C-C

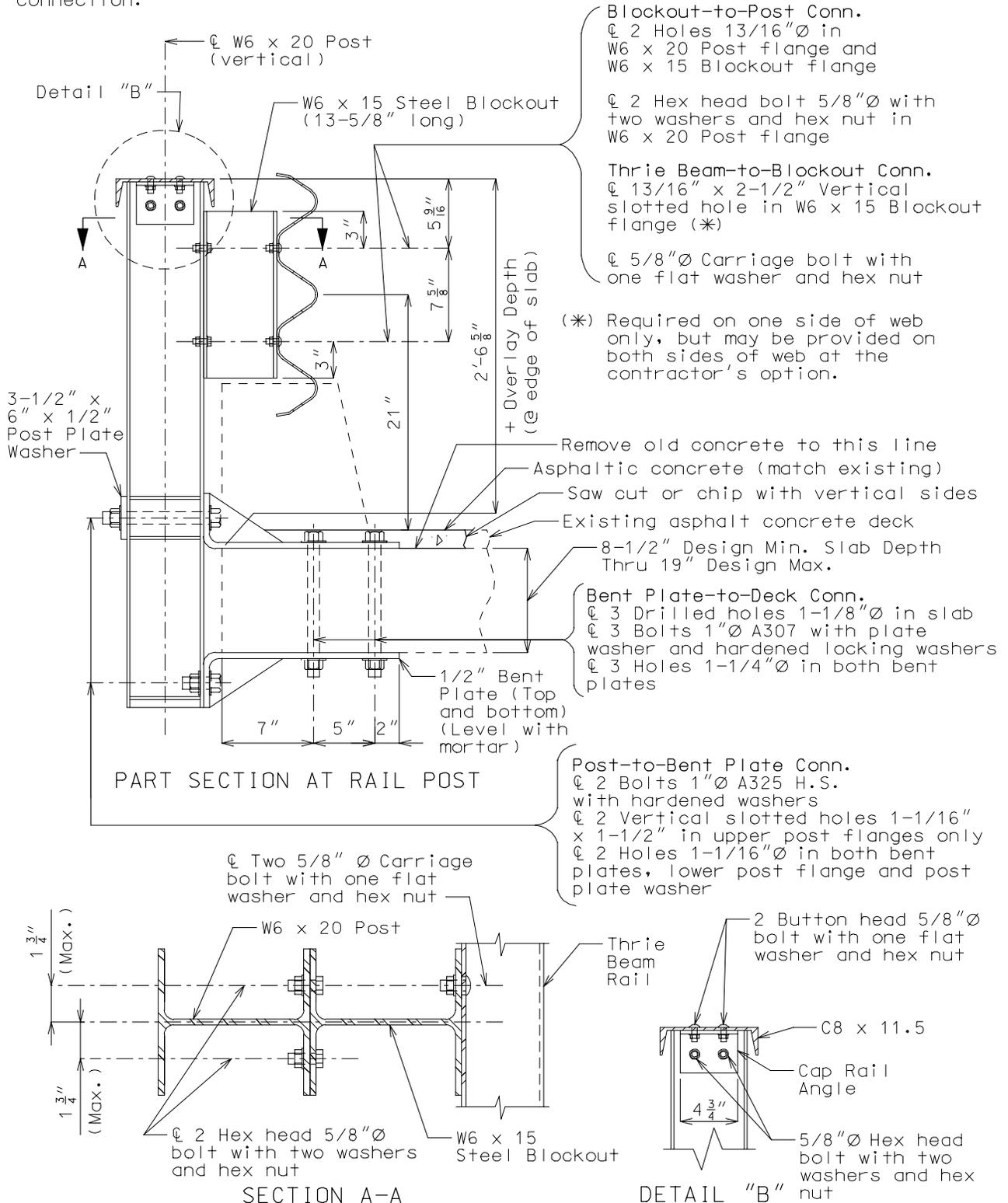
Note: For location of Sections C-C and D-D see page 3.3-2.

SECTION D-D

Curb Treatments

**SYSTEM 3: REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL
TYPICAL CONNECTION**

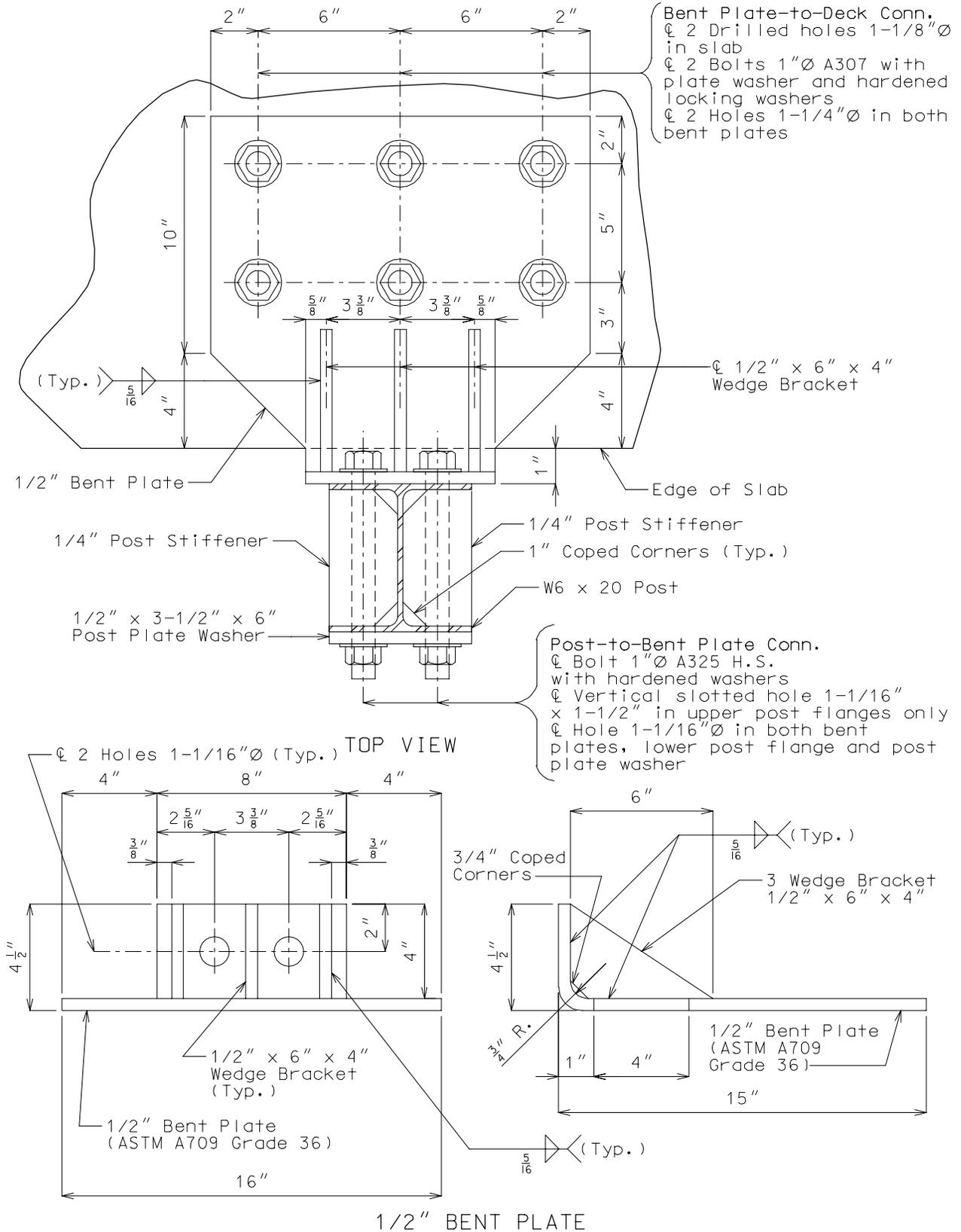
System 3: Applicable for rehab and widenings with slab depths between 8-1/2" and 19" inclusive. Connection design load is 1.5 times plastic moment capacity (Mp) of W6 x 20 Post. Vertical clearance must be checked due to obtruding lower connection.



Note: Design weight of (12 gage) Thrie Beam Bridge Rail = 35#/lin. ft.

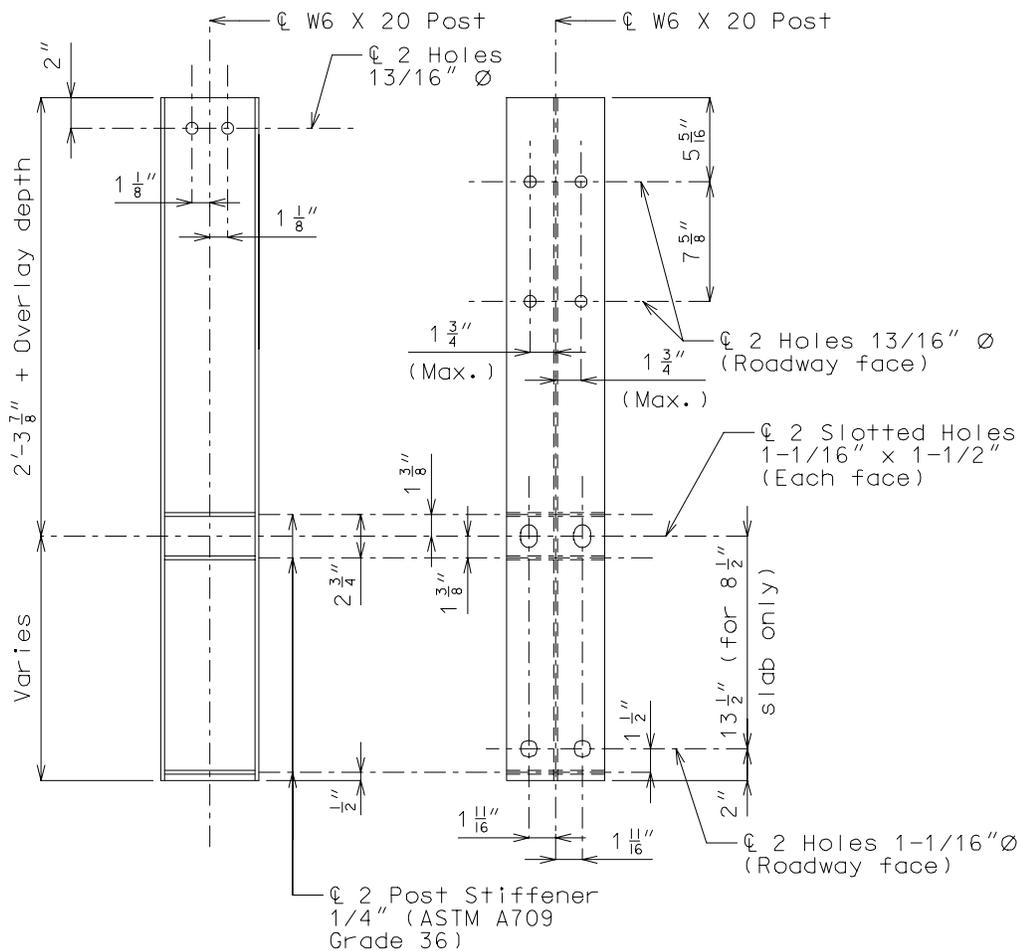
Curb Treatments

SYSTEM 3: REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL (CONT.)
 DETAILS OF BENT PLATE

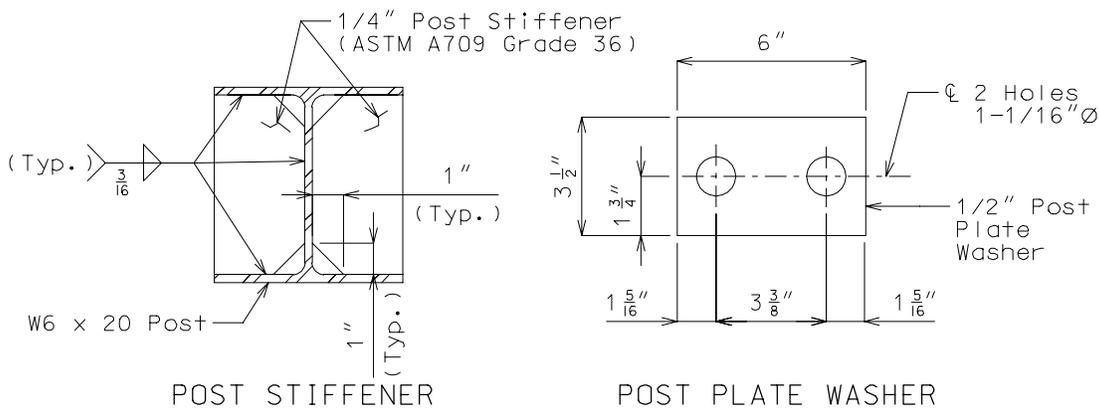


Curb Treatments

SYSTEM 3: REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL (CONT.)
 DETAILS OF POST



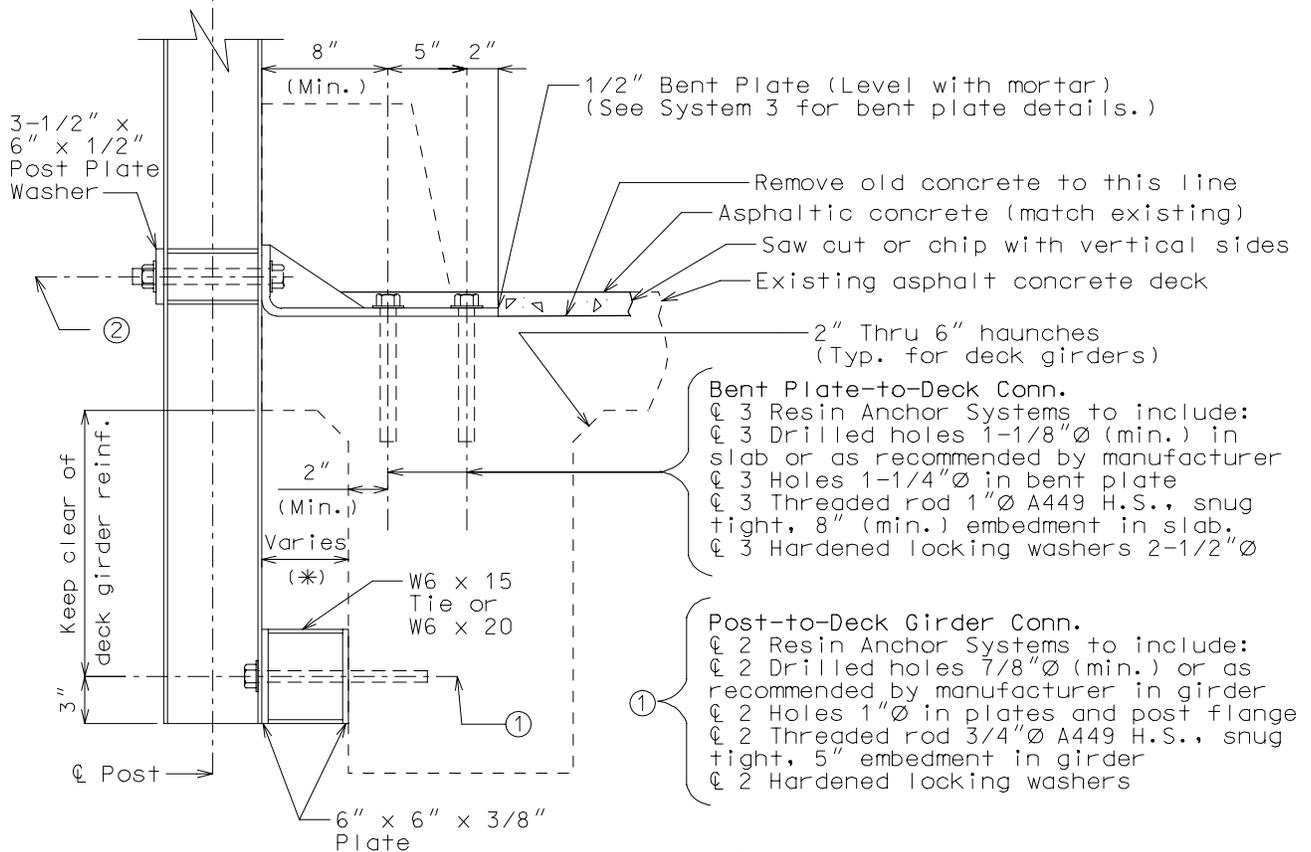
DETAILS OF POST



Curb Treatments

**SYSTEM 4: REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL
TYPICAL CONNECTION**

System 4: Applicable for rehabs on Deck Girder, Box Girder and similar structures.



PART SECTION AT RAIL POST

- Post-to-Bent Plate Conn.
 2 Bolts 1"Ø A325 H.S. with hardened washers
 2 Vertical slotted holes 1-1/16" x 1-1/2" in post flanges
 2 Holes 1-1/16"Ø in bent plate and post plate washer

- Post-to-Tie Conn.
 2 Bolts 3/4"Ø A325 H.S. with hardened washers
 2 Holes 15/16"Ø in post flange and plate

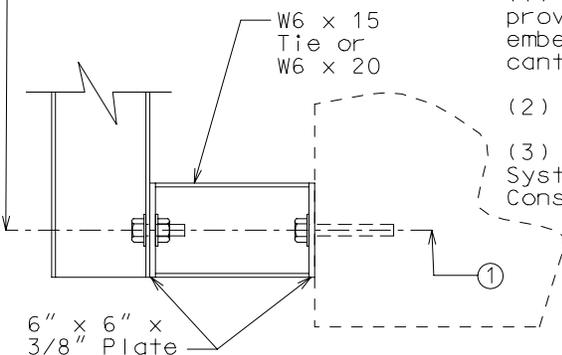
Notes:

(*) CANTILEVER MAY VARY. IF SLAB CANTILEVER LENGTH EXCEEDS 6", CONSIDERATION SHALL BE GIVEN TO: (WITH THE RESULT THAT ANCHORAGE INTO SLAB LIES IN THE CANTILEVER PART OF SLAB)

(1) Anchorage into cantilever portion of slab provided original slab thickness allows for min. embedment and 1" cover (check negative moment in cantilever).

(2) Extending bent plate (within reason).

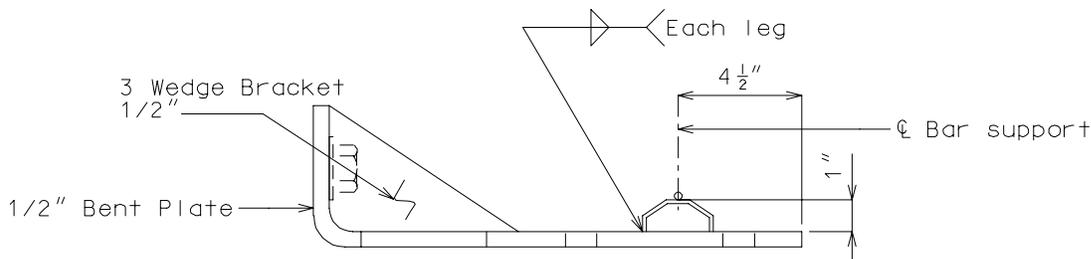
(3) Alternative method of attachment, i.e. System 1 or System 3 types and variations thereof. Consult Structural Project Manager.



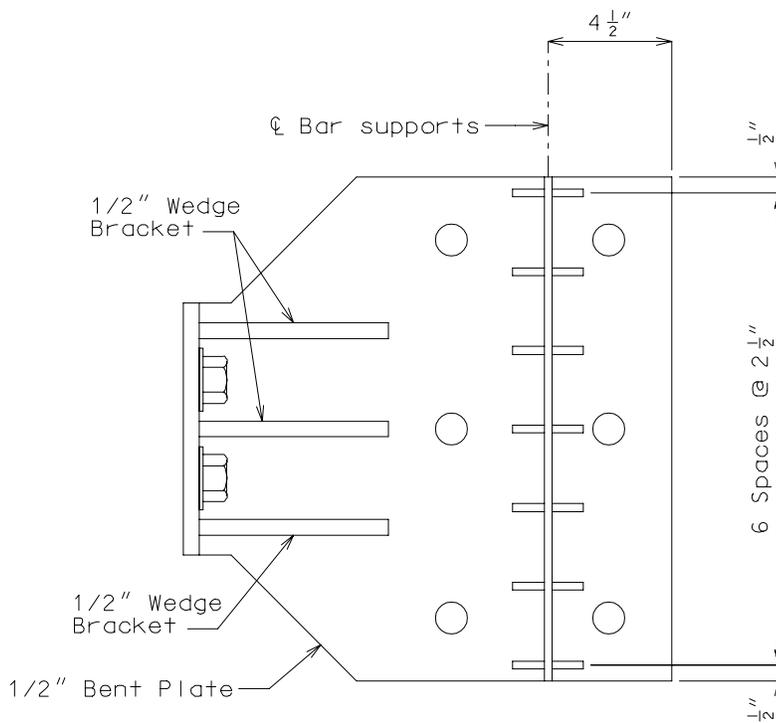
OPTIONAL TIE CONNECTION

**SYSTEM 4 AND OPTIONAL SYSTEM 4:
REPLACEMENT OF EXISTING CURB WITH THREE BEAM RAIL (CONT.)
DETAILS OF BENT PLATE**

When a latex, a low slump or a silica fume concrete overlay is used, add the following details:



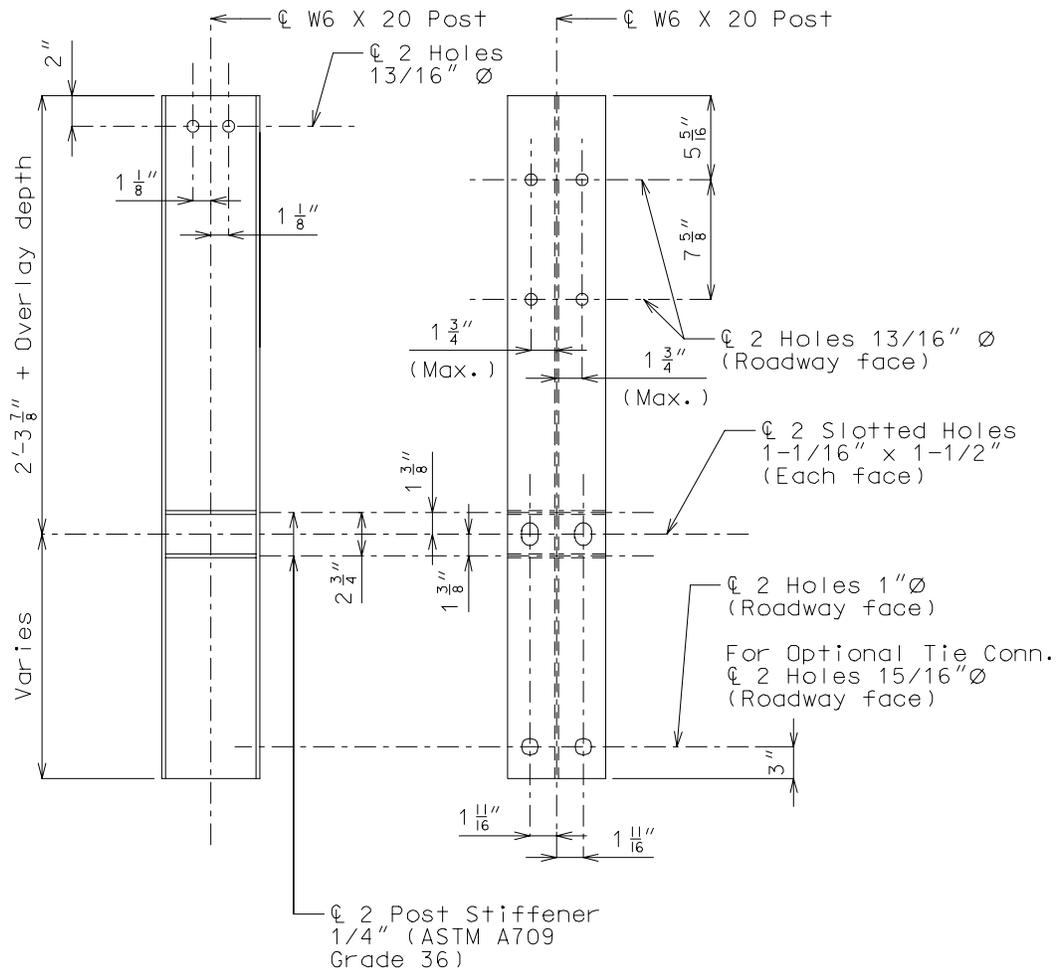
PART SECTION THRU PLATE



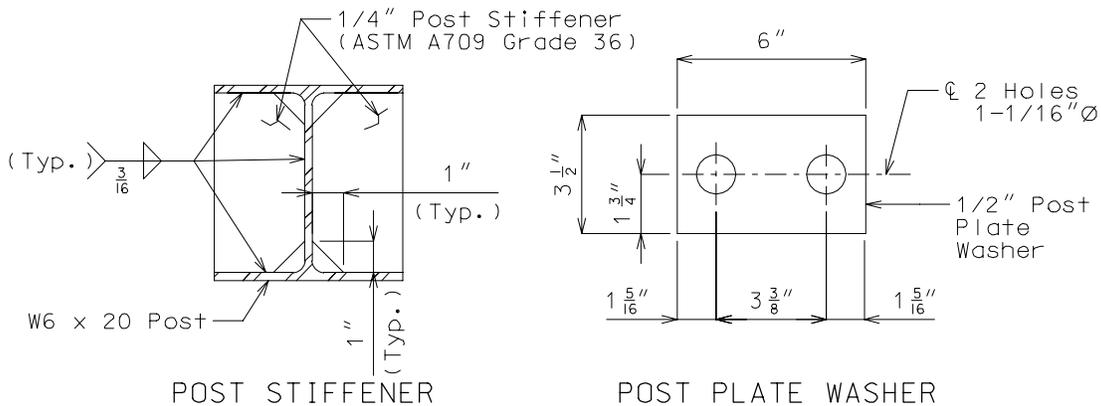
PLAN OF BENT PLATE

Note: Bar supports shall be Beam Bolsters (BB - ref. CRSI) and shall be galvanized. See Section 706.3.1 of Missouri Standard Specifications.

**SYSTEM 4 AND OPTIONAL SYSTEM 4:
REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL
DETAILS OF POST**



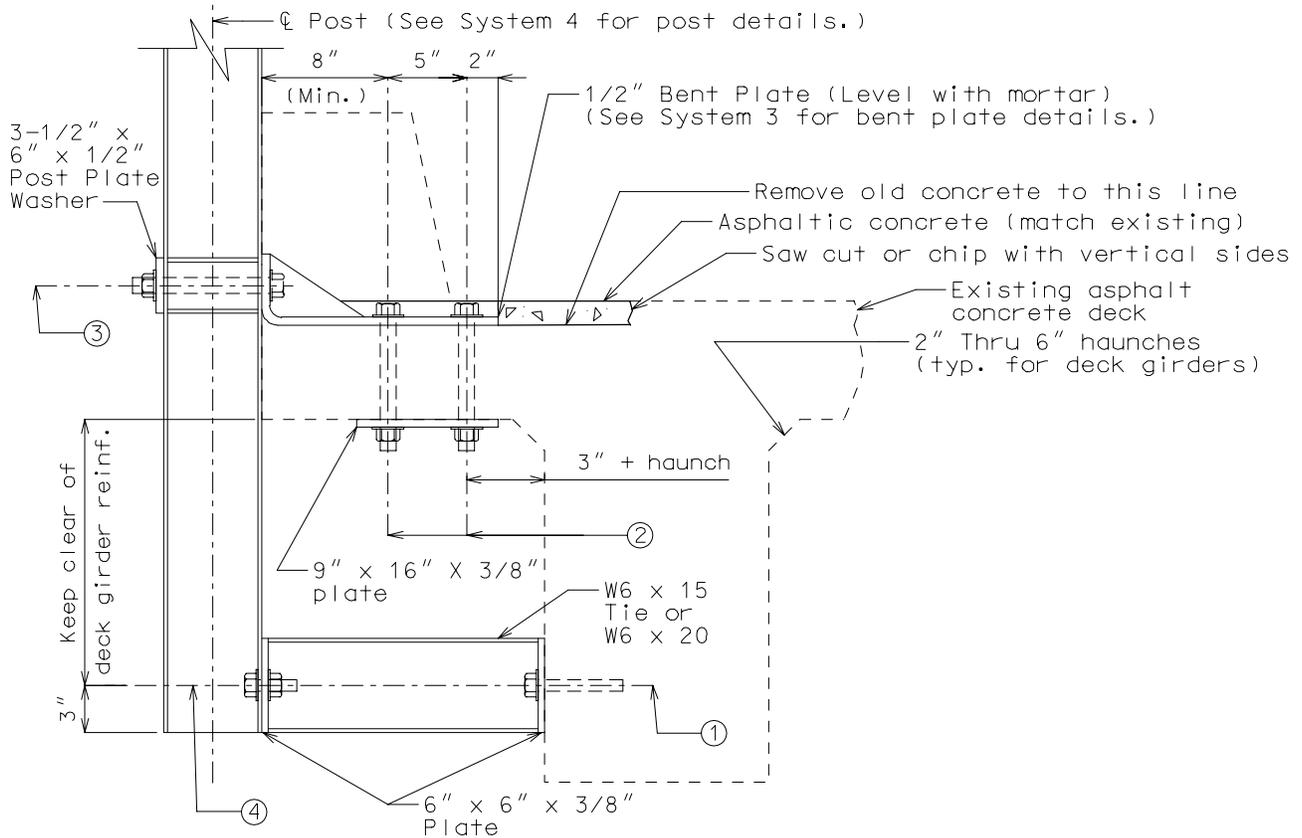
DETAILS OF POST



**OPTIONAL SYSTEM 4:
REPLACEMENT OF EXISTING CURB WITH THRIE BEAM RAIL
TYPICAL CONNECTION**

Curb Treatments

Optional system 4: Applicable for rehabs on Deck Girder and Box Girder with large cantilevers.

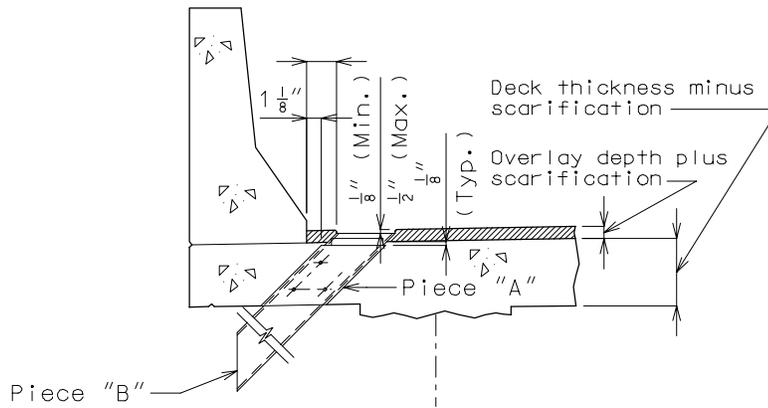


PART SECTION AT RAIL POST

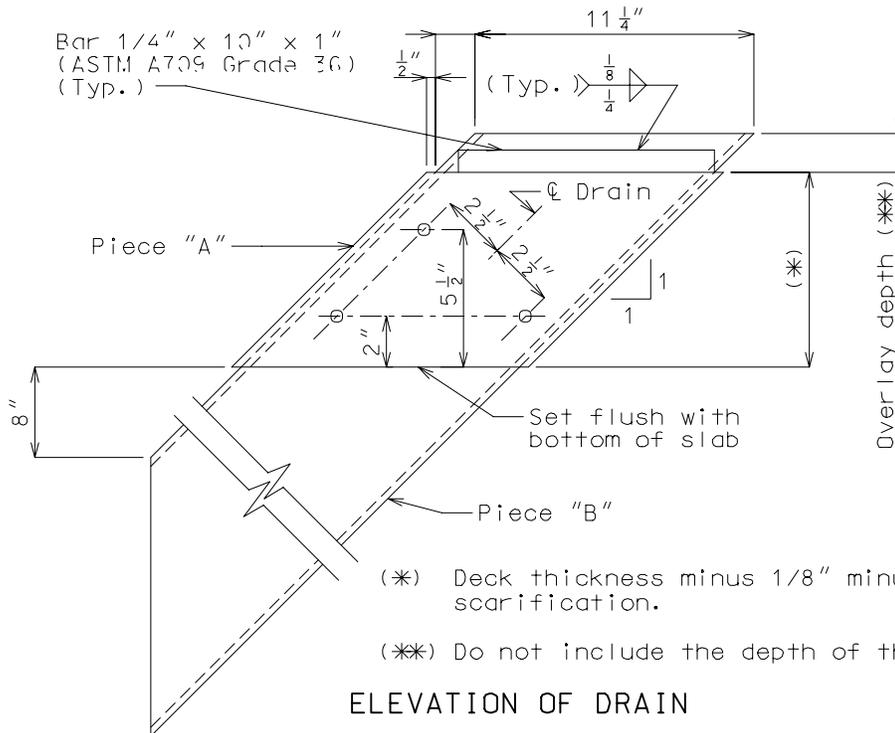
- ① Tie-to-Deck Girder Conn.
 ☐ 2 Resin Anchor Systems to include:
 ☐ 2 Drilled holes 7/8"Ø (min.) or as recommended by manufacturer in girder
 ☐ 2 Holes 1"Ø in 6" X 6" X 3/8" plate
 ☐ 2 Threaded rod 3/4"Ø A449 H.S., snug tight, 5" embedment in girder
 ☐ 2 Hardened locking washers
- ② Bent Plate-to-Deck Conn.
 ☐ 3 Bolts 1" Ø A325 H.S. snug tight, with hardened washers
 ☐ 3 Drilled holes 1-1/8"Ø (min.) in old concrete or as recommended by manufacturer
 ☐ 3 Holes 1-1/4"Ø in bent plate and 9" X 16" X 3/8" plate
- ③ Post-to-Bent Plate Conn.
 ☐ 2 Bolts 1"Ø A325 H.S. with hardened washers
 ☐ 2 Vertical slotted holes 1-1/16" x 1-1/2" in post flanges
 ☐ 2 Holes 1-1/16"Ø in bent plate and post plate washer
- ④ Post-to-Tie Conn.
 ☐ 2 Bolts 3/4"Ø A325 H.S. with hardened washers
 ☐ 2 Holes 15/16"Ø in post flange and 6" X 6" X 3/8" plate

SLAB DRAIN DETAILS
FOR STRUCTURES WITH OVERLAYS
(GIRDER DEPTH LESS THAN 48")

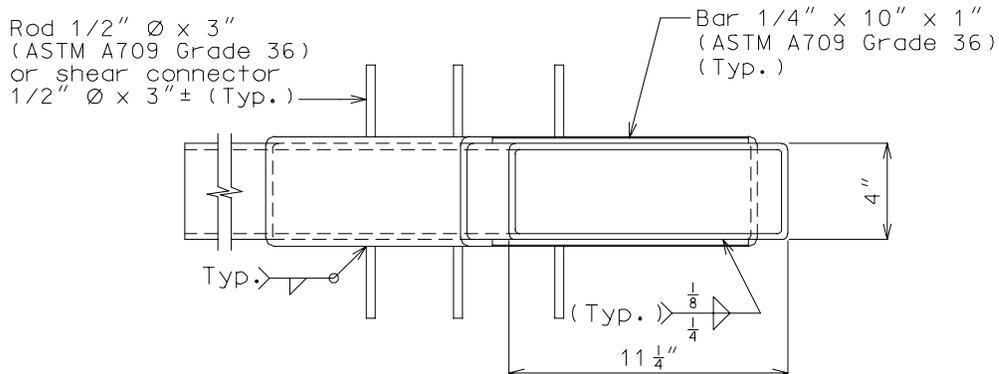
Drainage



PART ELEVATION OF SLAB AT DRAIN

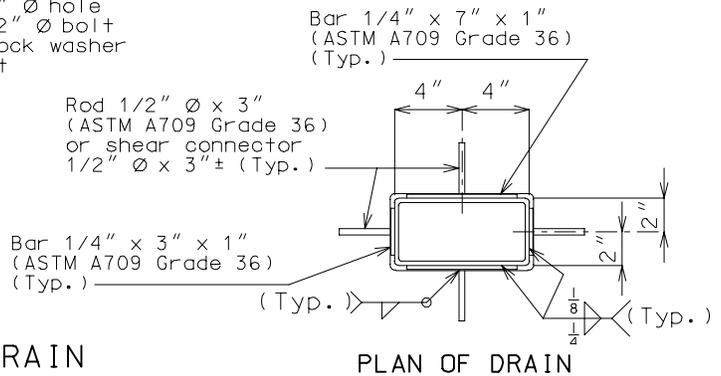
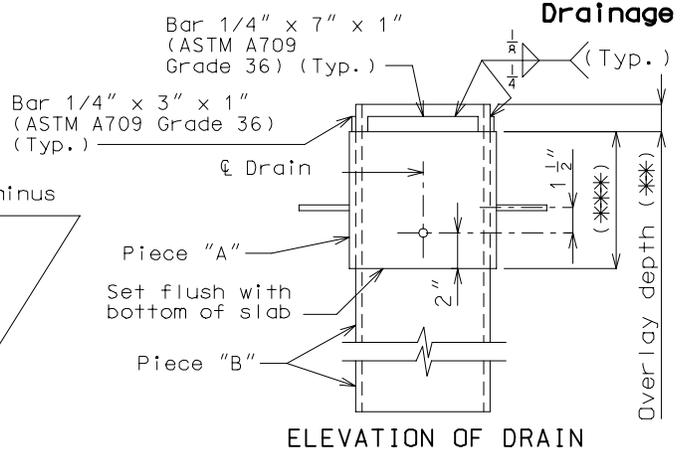
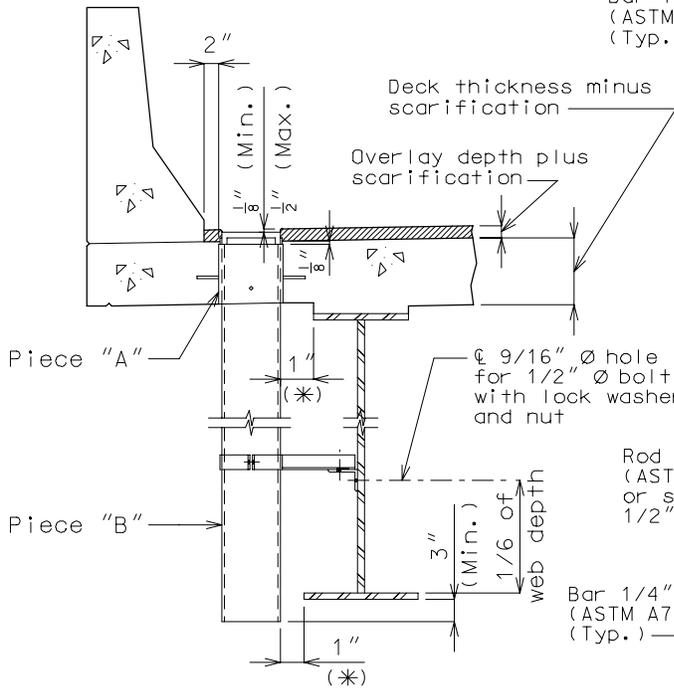


ELEVATION OF DRAIN



PLAN OF DRAIN

**SLAB DRAIN DETAILS (CONT.)
FOR STRUCTURES WITH OVERLAYS
(GIRDER DEPTH 48" AND OVER)**



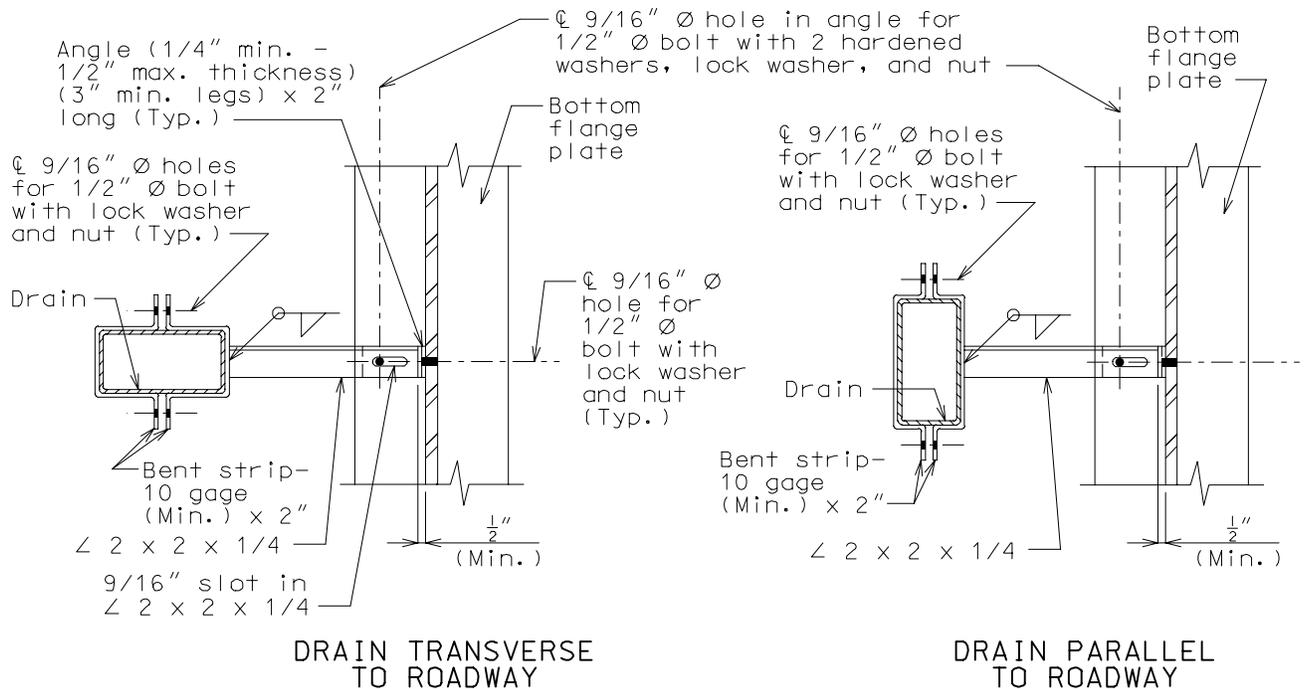
PART ELEVATION OF SLAB AT DRAIN

PLAN OF DRAIN

(*) If dimension is less than 1", drains shall be placed parallel to roadway. Otherwise, place drains transverse to roadway.

(**) Do not include the depth of the scarification.

(***) Deck thickness minus 1/8" minus the depth of the scarification.



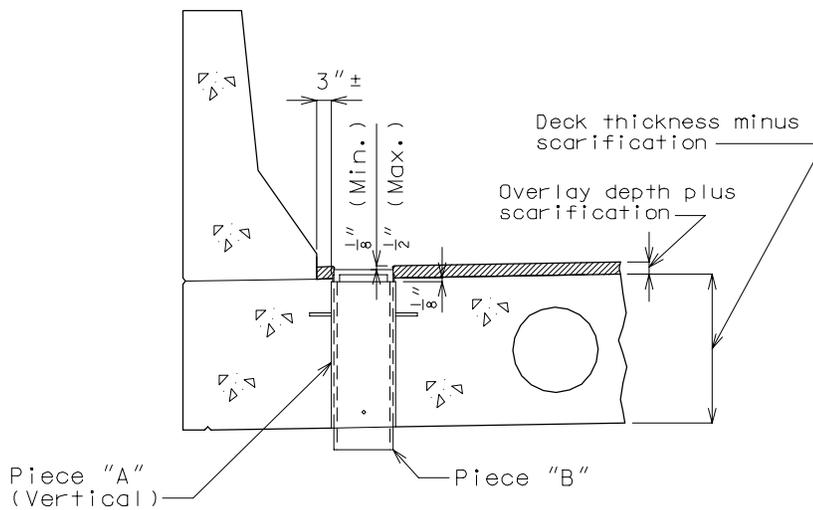
DRAIN TRANSVERSE TO ROADWAY

DRAIN PARALLEL TO ROADWAY

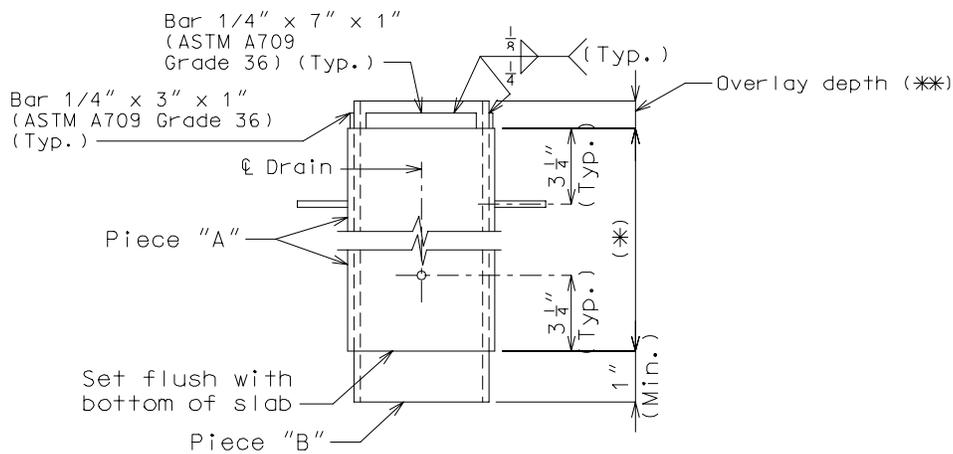
PART PLANS SHOWING BRACKET ASSEMBLY

SLAB DRAIN DETAILS (CONT.)
FOR STRUCTURES WITH OVERLAYS
(CONTINUOUS CONCRETE STRUCTURES)

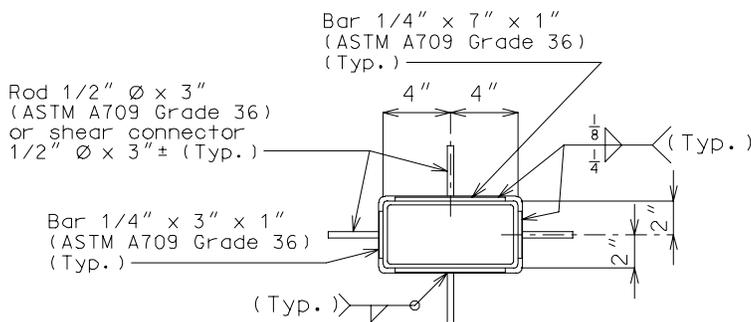
Drainage



PART SECTION NEAR DRAIN



ELEVATION OF DRAIN

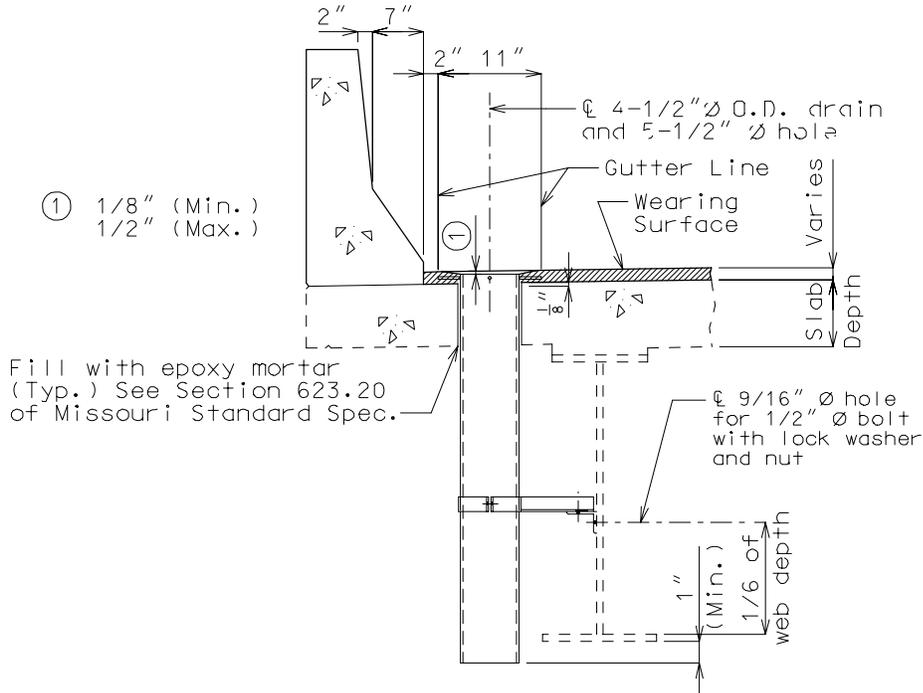


PLAN OF DRAIN

(*) Deck thickness minus 1/8" the depth of the scarification.
(**) Do not include the depth of scarification.

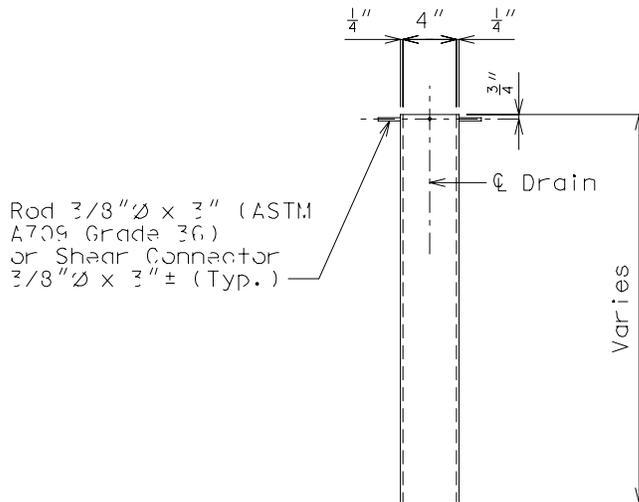
SLAB DRAIN DETAILS (CONT.)
FOR STRUCTURES WITH OVERLAYS
(VARIABLE DEPTH GIRDERS)

Drainage



PART ELEVATION OF SLAB AT DRAIN

Note: For variable depth girders with drains in deeper section, let the deeper section control and use throughout the structure.

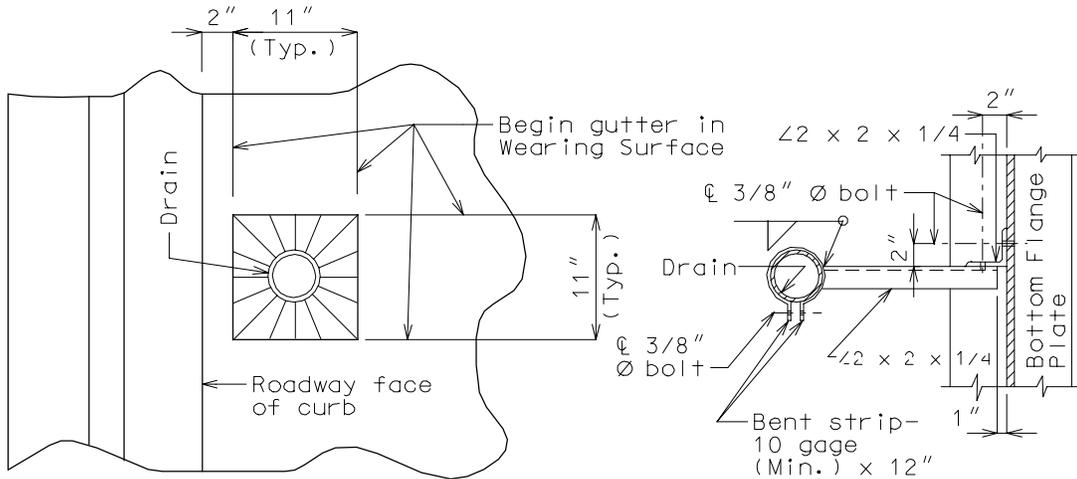


TYPICAL SECTION STRAIGHT DRAIN

SLAB DRAIN DETAILS (CONT.)
 FOR STRUCTURES WITH OVERLAYS
 MISCELLANEOUS DETAILS - ROUND DRAINS

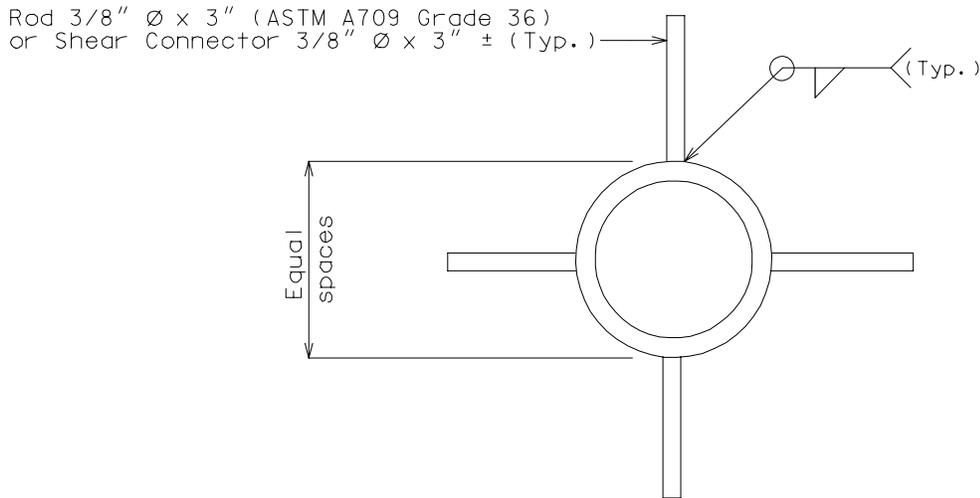
Drainage

Note: See Manual Section 3.30 for slab drain spacing.



TYPICAL PART PLAN

PART SECTION SHOWING
 BRACKET ASSEMBLY

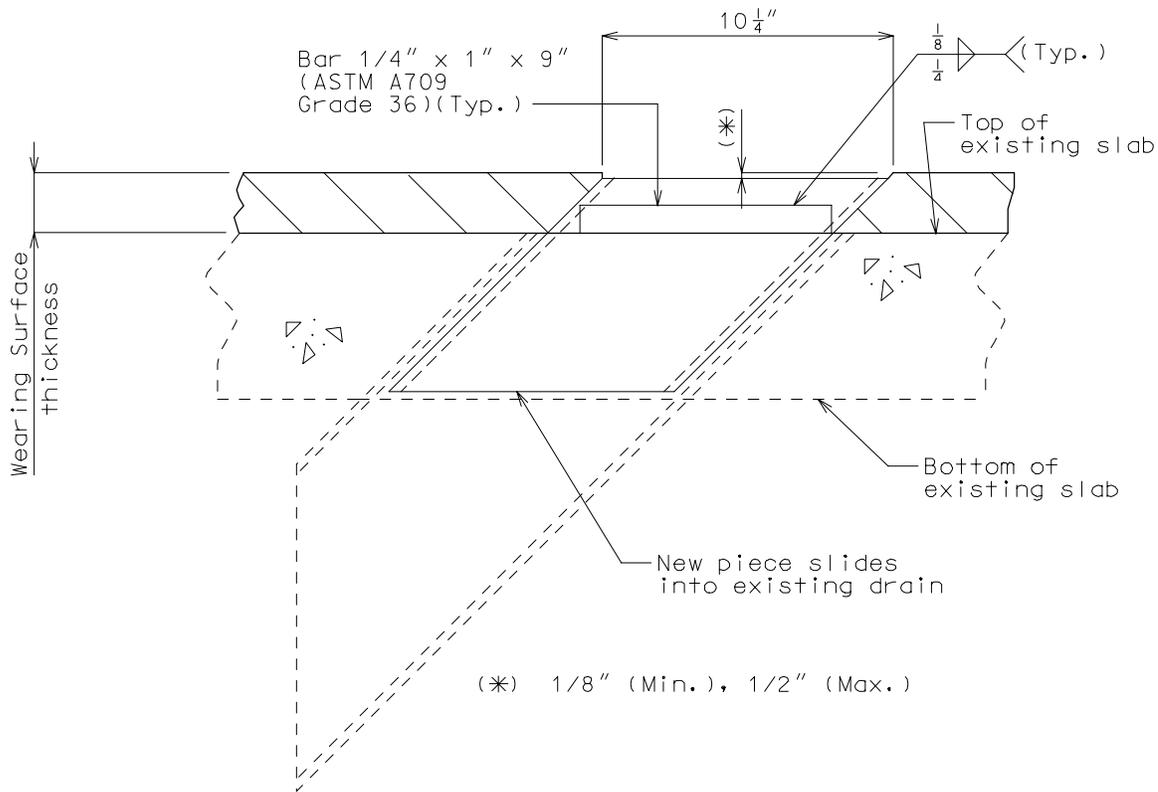


TYPICAL PART PLAN OF DRAIN

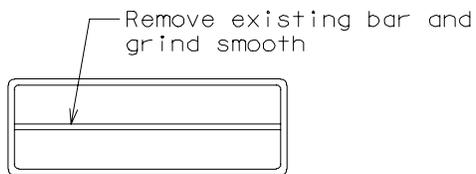
Note: See manual Section 4 for appropriate notes.

SLAB DRAIN DETAILS (CONT.)
FOR STRUCTURES WITH OVERLAYS
RAISING STANDARD SLAB DRAINS

Drainage



PART SECTION OF DRAIN

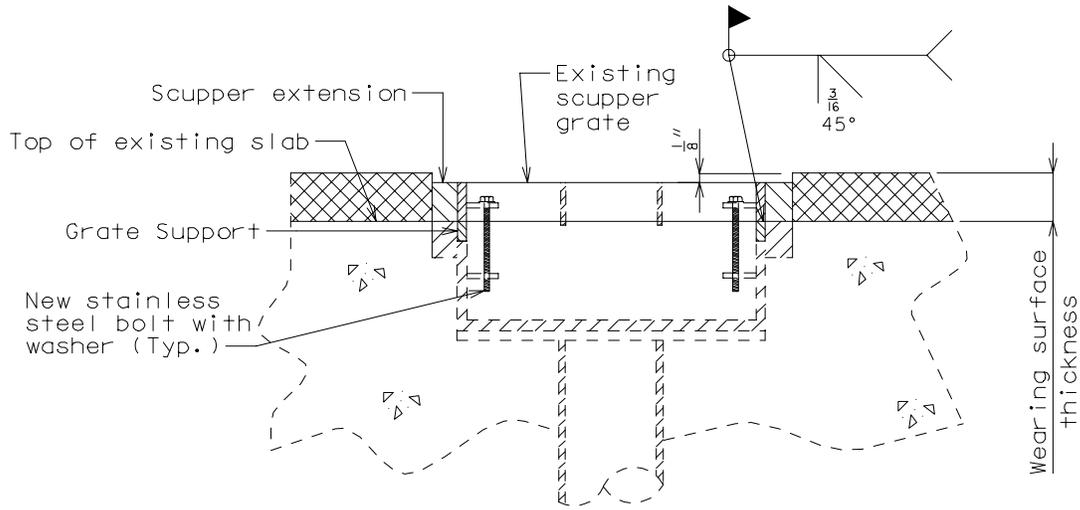


PART PLAN OF EXISTING DRAIN

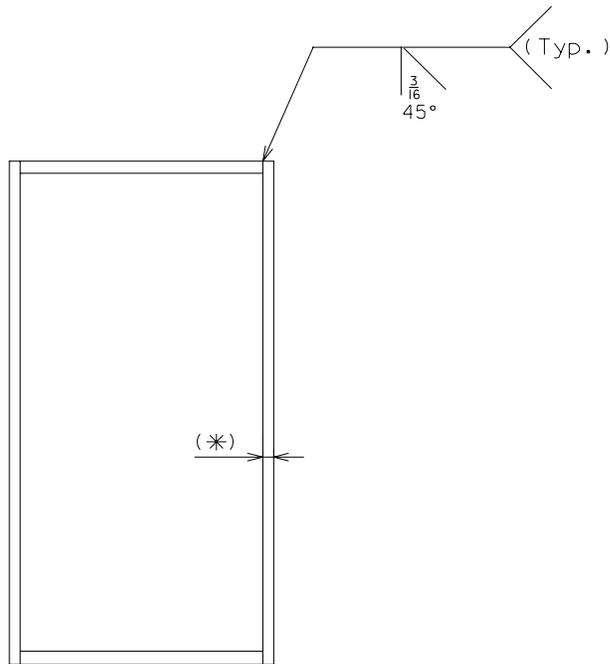
Note:
Outside dimensions of drain extension are 7-1/4" x 3-1/4",
and drain extension shall be galvanized in accordance with ASTM A123.

SLAB DRAIN DETAILS (CONT.)
FOR STRUCTURES WITH OVERLAYS
DETAILS FOR RAISING SCUPPERS

Drainage



TYPICAL SECTION THRU SCUPPER



PLAN OF GRATE SUPPORT
AND
PLAN OF SCUPPER EXTENSION

(*) Plate thicknesses should match those of existing scupper and existing grate.

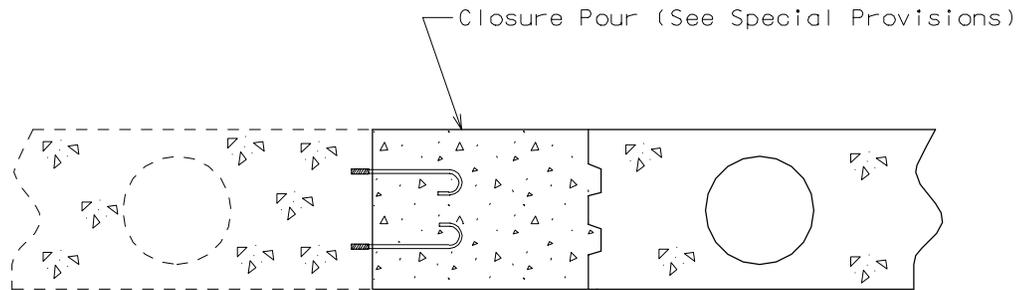
CLOSURE POUR

Widening

Note:

For closure pour on solid slab or voided slab bridges, use expansive concrete (See Special Provisions).

Release the forms before the closure pour is placed.



PART SECTION THRU ROADWAY