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ACKNOWLEDGEMENTS:

The steel details shown herein are a compilation of examples taken from actual Florida projects as well as industry preferences as published by the National Steel Bridge Alliance. The National Steel Bridge Alliance is made up of designers, detailers, fabricators, contractors and owners. A special thanks is extended to the Florida consultants and the National Steel Bridge Alliance members and cosponsors whose work contributed greatly to the details shown herein.

STRUCTURAL STEEL:

All structural steel shall be in accordance with ASTM A709, Grade 50, except that stiffeners, internal and external cross frames and lateral bracing shall be grade 36 unless shown otherwise.

STAY -IN- PLACE METAL FORMS:

Design includes allowance for 20 lb/sq.ft. over the projected plan area of the metal forms for the unit weight of metal forms and concrete required to fill the form flutes. Stay-in-place metal forms to be detailed to clear top lateral bracing of box girder.

CHARPY V-NOTCH:

All ASTM A709 structural steel as designated on the plans shall receive Charpy V-Notch testing in accordance with ASTM A709:

- a. Non-Fracture Critical members, as designated on the plans, shall be tested in accordance with ASTM A709, Table 9.
- b. Fracture Critical members, as designated on the plans, shall be tested in accordance with ASTM A709, Table 10.

All other structural steel that are main load carrying components subject to tensile stress shall meet the Charpy V-Notch test requirements specified in Section 962, of FDOT Standard Specifications.

STEEL FABRICATION:

Structural steel for girders and girder framing, including box girders, diaphragms, cross bracing, etc., shall be ASTM A709. Fabrication shall be performed in accordance with the current applicable edition of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code. Fabricators of structural steel girders and girder framing shall have the AISC Quality Certification for Major Steel Bridges. The fabricator shall also have the AISC Fracture Critical Members endorsement.

WELDING:

1. Welding details and the welding operations shall be in accordance with the current edition of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code. Welding procedures shall be submitted and approved prior to welding on project. Welds requiring non-destructive testing shall be radiographically inspected, except where the geometry of the region of the weld will not permit satisfactory information to be secured for verification of the weld quality. When such geometrical conditions exist, other inspection procedures or combinations of procedures such as Ultrasonic Inspection, Dye Penetrant Inspection and/or Magnetic Particle Inspection, shall be used. Non-destructive Testing shall be performed as required by the current edition of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

2. Field or shop welding to any Structural Steel for the purpose of attaching erection hardware, or for anchoring conduits for box lighting shall not be permitted. Proposed method of anchoring conduits/boxes for box lighting shall be formally submitted to the Engineer for approval. Shear Connector Installation is governed by OSHA Steel Erection Rule.

3. The following members are classified as ancillary members in accordance with the current edition of the ANSI/AWS D1.5 Bridge Welding Code:

- a. Expansion Joint Welds
- b. Drainage System Welds

FRACTURE CRITICAL MEMBERS:

See framing plans for designation of Fracture Critical Members. Structural components designated on the plans or in the special provisions as "Fracture Critical" shall conform to the provisions of Chapter 12 of the current ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

FIELD CONNECTIONS:

All field connections shall be made with 7/8" diameter high strength slip critical type bolts in accordance with ASTM A325 unless otherwise noted.

PAINTING:

All structural steel shall be painted in accordance with Sections 560 and 975 of the specifications. Paint all structural steel with a high performance topcoat system. The color of the finish coat shall conform to Federal Standard No. 595B, Color No. XXXXX.

[Add the following note for bridges with Steel Box Girders]:

Paint the inside surface of steel box girders with one shop applied coat of approved primer and a compatible finish coat pigmented to Federal Standard 595B, Color No. 37925 (white). Any other color used for the interior finish coat must be pre-approved by the District Structures Maintenance Engineer. The finish coat of the interior surface is not required to be UV resistant and does not have to be the same product as the finish coat of the exterior surface of the box girder.

LADDERS AND PLATFORMS:

Structural steel for ladders and platforms shall conform with ASTM A36 and shall be hot-dip galvanized in accordance with ASTM A123. Welding shall conform to ANSI/AWS D1.

UTILITIES:

The utilities including under deck lighting shown in the bridge plans are at approximate locations. For additional information refer to the utilities plans.

See Page 108
TYPICAL CROSSFRAME DETAILS "X" TYPE

of the

GUIDELINES FOR DESIGN DETAILS (G 1.4 - 2006)
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(Click here for G 1.4 - 2006)

See Page 108
TYPICAL CROSSFRAME DETAILS "X" TYPE
&
Page 110
END CROSSFRAMES

of the

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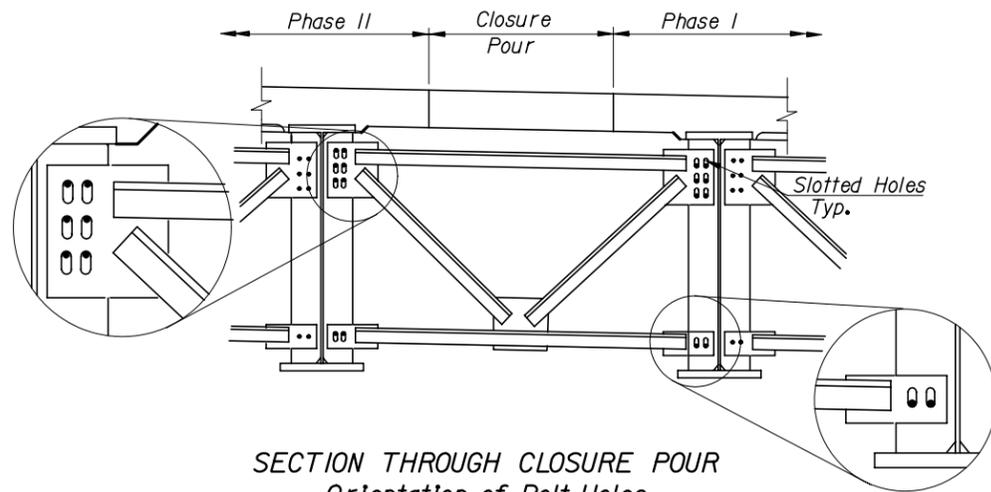
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See Page 104
TYPICAL GIRDER DETAILS - II
& FLANGE SLABBING AND STIPPING DETAILS

of the

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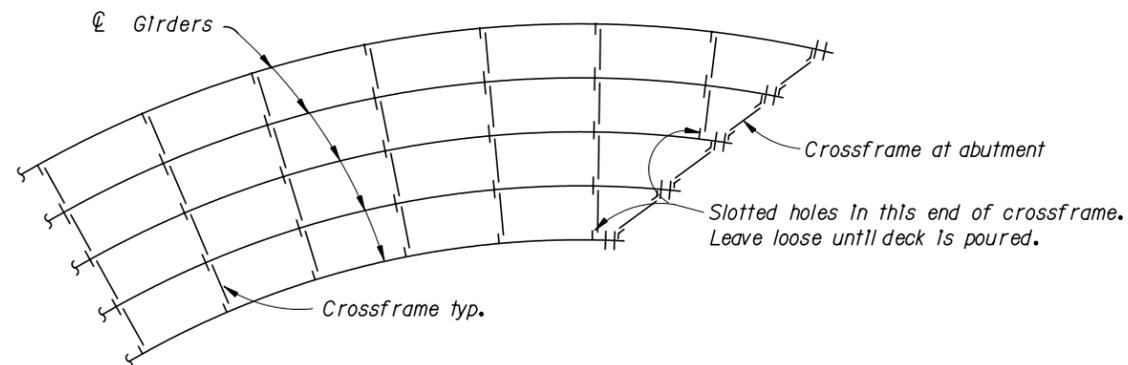


SECTION THROUGH CLOSURE POUR
Orientation of Bolt Holes
Before Phase II Slab Is Cast

PHASED CONSTRUCTION STEEL DETAIL

PHASED CONSTRUCTION STEEL DETAIL

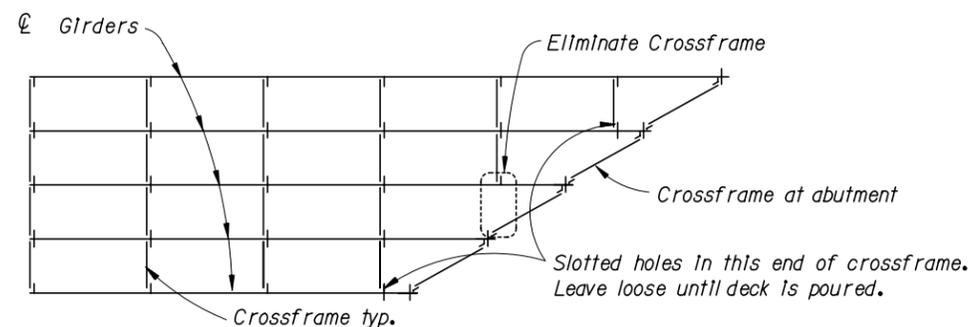
Differential dead load deflections normally necessitate the need for a longitudinal closure pours on steel bridges built in phases. Deck overhangs are recommended in the phased pours to reduce girder rotations. The deck closure pour width should be sized for deck reinforcement splice requirements. It is also recommended that the holes in the closure pour crossframes be slotted to facilitate differential dead load deflections and fit-up.



PLAN VIEW - FRAMING PLAN

FRAMING PLAN DETAILS - LARGE SKEWS

The effects of differential deflections across intermediate crossframes near the bearing locations need to be considered for steel bridges with large skew. Differential deflections across crossframes near bearing locations can result in bearing seat rotations and end unit distortions. In the case of large skewed curved bridges, uplift can result. Intermediate crossframes should be eliminated or moved away from bearing points where possible or should be slotted to accommodate differential DL deflections.



PLAN VIEW - FRAMING PLAN

GENERAL PHILOSOPHY - FRAMING PLANS FOR PLATE GIRDERS

It is normally desirable to space girders equally and to detail all intermediate crossframes normal to girders. Staggered crossframes are not recommended. A grid analysis is required for all skewed and curved girders to establish both loadings and displacements for girders and crossframes. Crossframes should be designed for the additional loads induced by differential deflections that may occur between girders. It is assumed that the girders are to be detailed in the shop drawings to "fit in the full dead load condition".

FRAMING PLAN DETAIL - LARGE SKEWS

DETAIL NAME	PHASED CONSTRUCTION STEEL DETAIL FRAMING PLAN DETAILS - LARGE SKEWS	SHEET NO.	S-6
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*See Page 103
TYPICAL GIRDER DETAILS - I*

of the

*GUIDELINES FOR DESIGN DETAILS (G 1.4 - 2006)
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(Click here for G 1.4 - 2006)

See Page 106
TYPICAL GIRDER DETAILS - IV

of the

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See Page 113
BASIC GEOMETRY - STEEL TUB GIRDERS

of the

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(Click here for G 1.4 - 2006)

See Page 115
TUB GIRDER CAMBER DIAGRAM

of the

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See Page 116
TYPICAL CROSSFRAME DETAILS
FOR TUB GIRDERS

of the

GUIDELINES FOR DESIGN DETAILS (G 1.4 - 2006)
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[\(Click here for G 1.4 - 2006\)](#)

See Page 117
BEARING DIAPHRAGMS - TUB GIRDER BRIDGES

of the

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See Page 118
STEEL TUB SCREENING DETAILS

of the

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See Page 103
TYPICAL GIRDER DETAILS - I
&
Page 116
TYPICAL CROSSFRAME DETAILS FOR TUB GIRDERS

of the

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Steel Shop Drawing Review Guideline Checklist

The following is a list of common items that should typically be checked on Shop Detail Drawings. Unusual designs may contain unique details that are beyond the scope of this guide and not fully covered here. The reviewer's judgment must prevail in determining the extent and depth of review on each project.

I. Principal Controlling Dimensions, Material and Connection Properties

The following principal controlling dimensions, material and connection properties shall be considered essential items for reviewing all Shop Detail Drawings:

- a. Length of span, i.e. the horizontal distance between bearings, pin centerlines or other points of support.
- b. Thickness and width of plates in primary members and splices.
- c. Primary dimensions and/or weight per foot of rolled shapes.
- d. Diameter, specification and grade of mechanical fasteners (bolts, nuts, studs, couplers, etc.), and coating if required (mechanical or hot dip galvanizing).
- e. All dimensions of machined pins, hangers and complex bearings.
- f. Specification, grade and toughness testing requirements for steel components.
- g. Elevation of seats or other supports for steel members.
- h. Size of fillet welds and partial joint penetration welds; appropriate partial and complete joint penetration weld configurations.

II. Web and flange plates of welded members and rolled beam stringers.

- a. Shop butt weld splice locations.
- b. Flange and web tapers and haunches (controlling dimensions only).
- c. Cover plate dimensions and termination details.
- d. Location of tension and compression zones in welded members.

III. Stiffener and connection plates

- a. Width, thickness, material grade and if toughness testing required (curved bridge, floor beam connection, etc.).
- b. Weld size and termination details and bolting to web and flange details.
- c. Appropriate spacing of intermediate stiffeners.
- d. Avoiding interference with shop web and flange splice locations.
- e. Fit and location of stiffeners.
- f. Bolt hole edge distances and compatibility with diaphragm/cross frame connections.

IV. Bolted Splices

- a. Length of flange splices, width and depth of web splices.
- b. Number, size and spacing of bolts and holes in splice material.
- c. Fill plates if necessary.
- d. Proper bolt hole edge distances.

V. Cross frames and diaphragms

- a. Number and spacing of connection plate bolts, and type of holes, especially for slip critical connections or details required for differential deflections.
- b. Length termination details and number of shop welds.

VI. Camber and/or mid-ordinate for cambered rolled beams or girder sections (spot check).

VII. Elevation at center of span or segment, field-splice, abutment and pier ordinates on shop assembly diagrams.

VIII. Number and spacing of bolts in floor beam and cross girder connections as well as special attachments (brackets, pot bearings, etc.).

IX. General notes and detail sheets relative to cleaning and painting.

- a. Corner preparation (if required for cut edges)
- b. Cleaning, required surface preparation (SP6, SP10, etc.) and profile depth (if specified)
- c. Shop Primer: type; manufacturer; wet or dry film thickness; verification of cure before shop application of subsequent coats (required); applicable restrictions on field contact (faying) surfaces; any requirements for pre-priming shop contact surfaces before assembly (e.g. inside boxes, shop bolted assemblies); and designation of any field weld areas to be left unprimed.
- d. Top Coat(s): shop or field; type; manufacturer; wet or dry film thickness; intermediate coat cure times and/or recoating "window" (time) if specified by the Contract documents or paint manufacturer's data sheet; any block out areas where shop topcoats are not permitted (e.g. field splices, diaphragm/cross frame connections, bearings).

X. Designation of material, tension zones and welds for Fracture Critical Members (FCM's), including applicable nondestructive testing.

**Steel Shop Drawing Review Guideline
Checklist (cont.)**

XI. Material and material testing

- a. Material specified in accordance with the Contract documents.
- b. Substitutions for material less than $\frac{3}{8}$ " thick, especially fills and shims.
- c. Substitutions for material over $\frac{3}{8}$ " thick.

XII. Incorporation of all necessary revisions into the Shop Detail Drawings

- a. Errors or discrepancies in the Contract plans discovered during Shop Detail Drawing preparation or review.
Such errors must be conveyed to the Owner and the Contractor to determine and implement appropriate corrective actions. Depending on the extent and importance, Contract plan corrections or project modifications may be distributed by the Owner as Construction Changes or notification may be verbal, followed by written documentation to all parties.
- b. All Construction Changes that affect the Shop Detail Drawings.
Recent Construction Changes not incorporated into the Shop Detail Drawings do not usually justify rejection. Unless changes will drastically alter fabrication details, a copy of the Construction Change may be returned with "approved as corrected" Shop Detail Drawings in such circumstances. Note: Corrections noted on Shop Detail Drawings do not constitute "Construction Changes" and should not be used to informally affect Construction Changes.
- c. Fabricator-proposed modifications approved by the Owner and Contractor.
These include deviations from the Contract requirements, substitutions of material or modifications to the Contract plan details, based upon the Fabricator's request (at no cost to the Owner), that have received prior approval from the Owner and Contractor.

XIII. Erection Framing Plan details

- a. Basic span lengths and, where appropriate, transverse girder spacing.
- b. Pier and abutment identifications.
- c. Orientation of structure (north arrow), skew(s), spot checks of curve or flare geometry if applicable.
- d. Adjustments for special bearings, expansion joints or other items not adequately covered by the contract plans to compensate for temperature or other variables where applicable.
- e. Piecemarks indicated for every element, and their relative location (end, side) is shown to clarify member orientation.
- f. Compare erection plan with Contractor's Traffic Control scheme. Ensure that public safety issues are addressed. Note special requirements concerning temporary shoring and equipment affecting public safety.

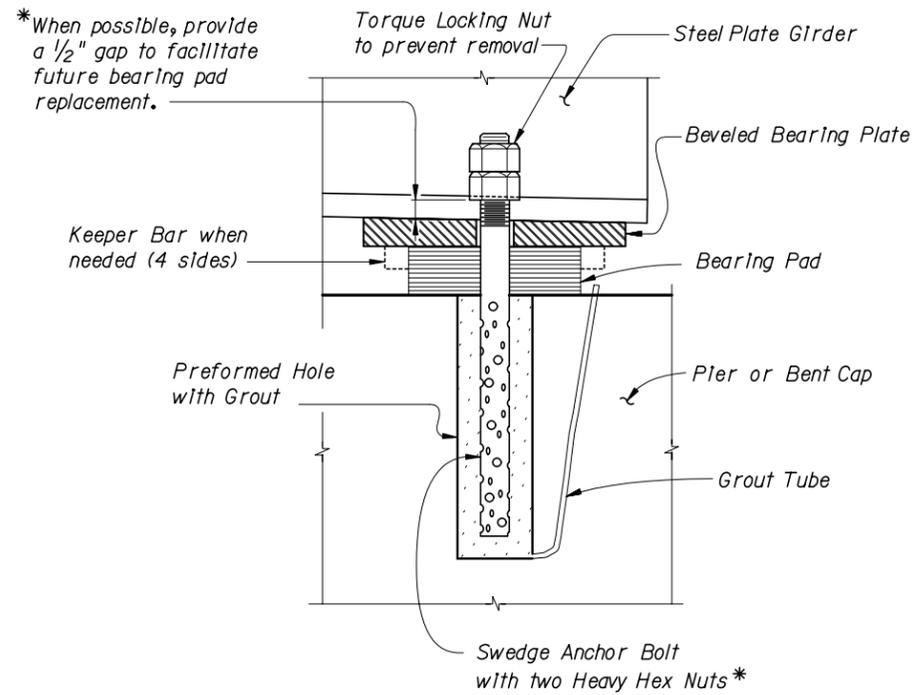
XIV. Answer or acknowledge all appropriate questions noted on Shop Detail Drawings as "Engineer verify" (does not include "Contractor verify" or "Field verify" queries that must be resolved by others before final Shop Detail Drawing approval).

XV. Compliance with Owner-specific or project-specific requirements that may supersede the requirements of this checklist.

- a. Financial Project Number, drawing title and number, title block showing Fabricator and Contractor name, initials of persons responsible for drawing, dates in which drawing was prepared including revision dates as required. Item description including Bridge Number should be clearly shown on drawing.
- b. Standard title box notes (hole diameter, welding, paint, etc.) do not conflict with Contract requirements.
- c. Proper notation of revision date(s) and number(s) on revisions after the first submission.
- d. Miscellaneous project-specific items such as utility attachments, special connections or connection materials (pins, links, cables), and stage removal and construction.
- e. Professional Engineer Seal if required.
- f. Contractor's approval stamp with date and initials.

XVI. Special needs for special structures, for example: special handling instructions or temporary fixtures for lifting, positioning and transportation; protection of critical components and connections; and dimensional controls required for shop and field assembly. "Special structures" include truss, cable stayed, suspension, tied arch and moveable (lift, swing, bascule) bridges.

XVII. Verify that Welding Procedures are submitted for all weld types within project.



ANCHOR BOLT DETAIL FOR COMPOSITE NEOPRENE BEARING PADS

DESIGNER NOTE

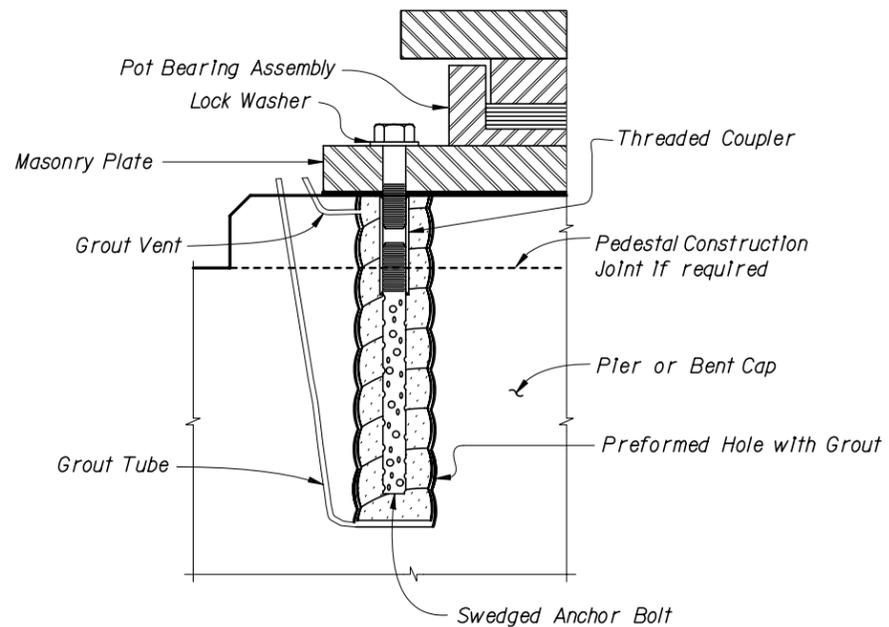
Preformed anchor bolt holes are required on all steel bridges to facilitate fit-up and to eliminate the need for field drilling.

Show all preformed holes on substructure components. The reinforcing steel shall be detailed to clear blockouts.

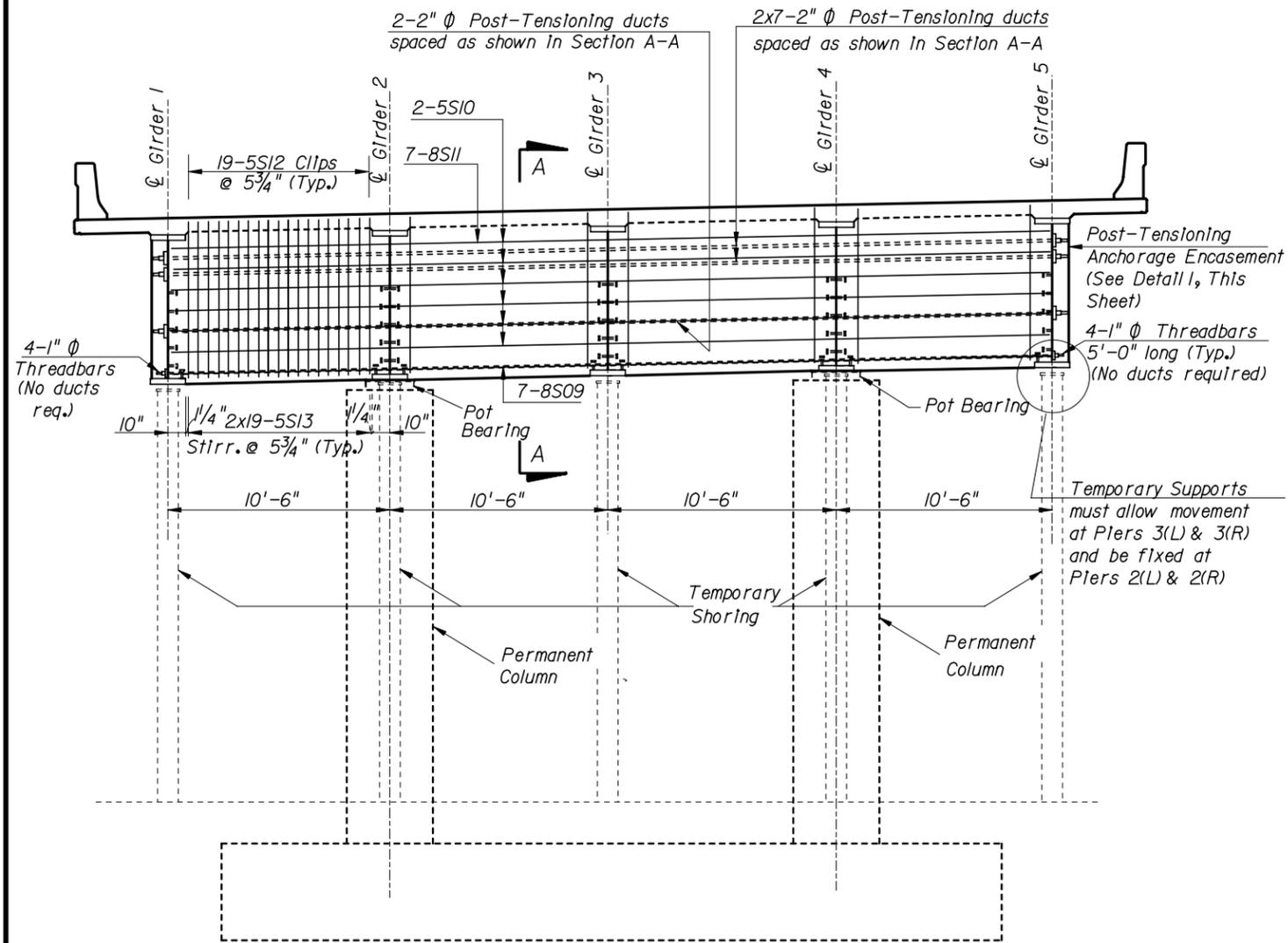
CONSTRUCTION NOTE

Blockout hole shall be free of debris prior to grouting. The blockouts shall be grouted with a non-shrink grout conforming to the Specifications and having a minimum compressive strength at 28 days of 5000 psi.

Blockout shall have a minimum diameter of 4".

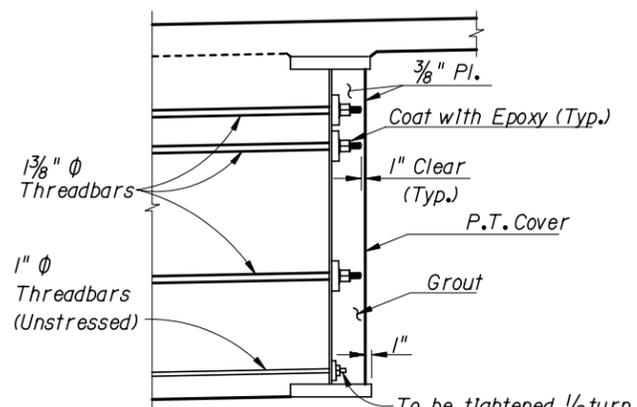


ANCHOR BOLT DETAIL FOR POT BEARINGS



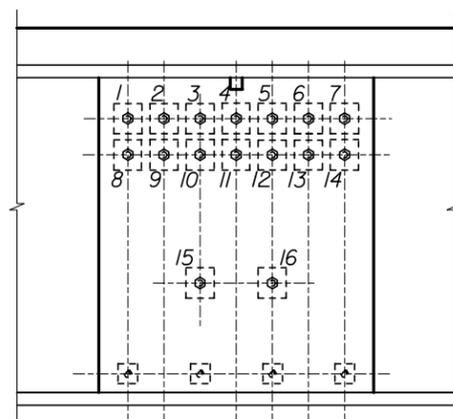
ELEVATION OF PIER CAP

NOTE: Beveled Anchor Plates to be finished straight and true to achieve full Bearing on Girder Web. Surface in contact with Girder Web to receive an ANSI 500 finish



SECTION B-B
(Studs not shown for clarity)

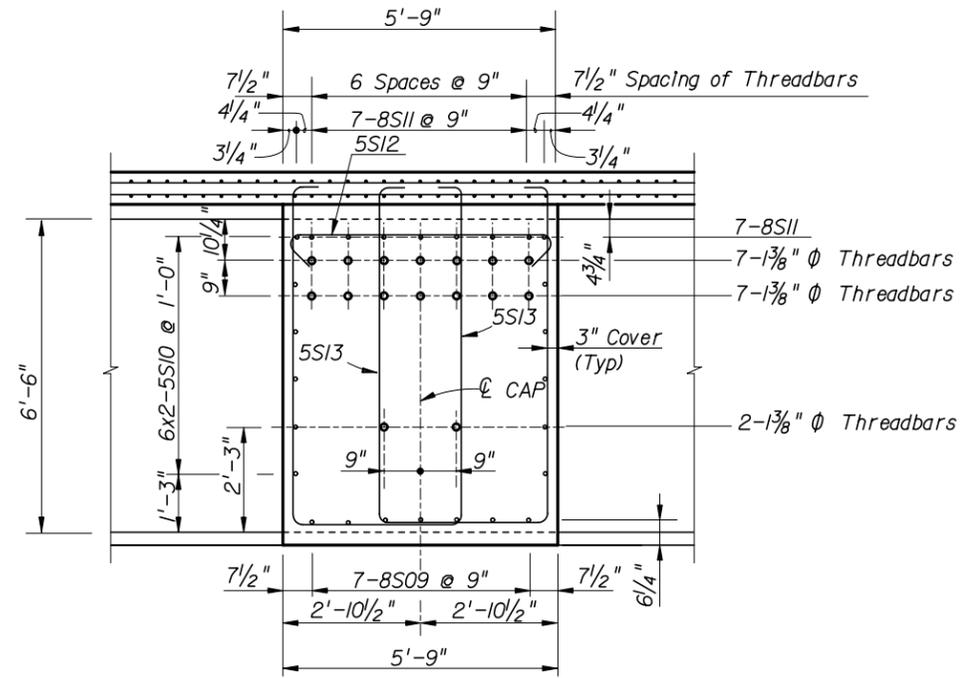
To be tightened 1/2 turn past finger-tight. Tack-Weld Nut to beveled plate.



DETAIL I

NOTES:

1. Remove temporary shoring under Girders 1 & 5 prior to removing shoring under Girder 3.
2. Threadbars shall be tensioned in the following order:
4, 11, 3, 5, 10, 12,
15, 16,
2, 6, 9, 13, 1, 7, 8, 14



SECTION A-A

GENERAL NOTES:

Bars for Post-Tensioning shall be 1 3/8" Φ uncoated, High Strength, Coarse Threadbars (Type II), conforming to ASTM Specification A-722 with latest revisions, ultimate tensile strength of bars=150,000 psi.

Jacking force required for each threadbar, after Anchor Set, is 165000 lb.

Anchorage for Threadbars shall be nuts, bearing on plate anchors, bearing on webs of exterior girders. Anchors shall be fabricated of Hot-Rolled Steel of a type and quality approved by the Engineer.

Concrete to be Class V (Special), $f'c=6000$ psi. Stressing operations shall not commence until the concrete has reached a compressive strength of 4500 psi as indicated by tests.

Duct vents are to be provided at both ends and at midspan of the ducts.

The tendon path shall be straight.

Bar reinforcement interfering with duct alignment shall be adjusted as directed by the Engineer in the field.

Anchorage details are to be determined by the Fabricator. Details shall be shown on the Shop Drawings and submitted to the Engineer for approval.

Duct placement tolerance shall be +/- 1/2" in the Horizontal direction and +/- 3/16" in the vertical direction.

Ducts to have an outside diam. of 2".

The following factors are used in the design of the Post-Tensioning Threadbars:

- Anchor Set: 0"-1/8"
- Friction Coefficient: 0.0
- Wobble Coefficient: 0.0

PROJECT NAME:

EXAMPLE OF INTEGRAL PIER CAPS

SHEET NO.

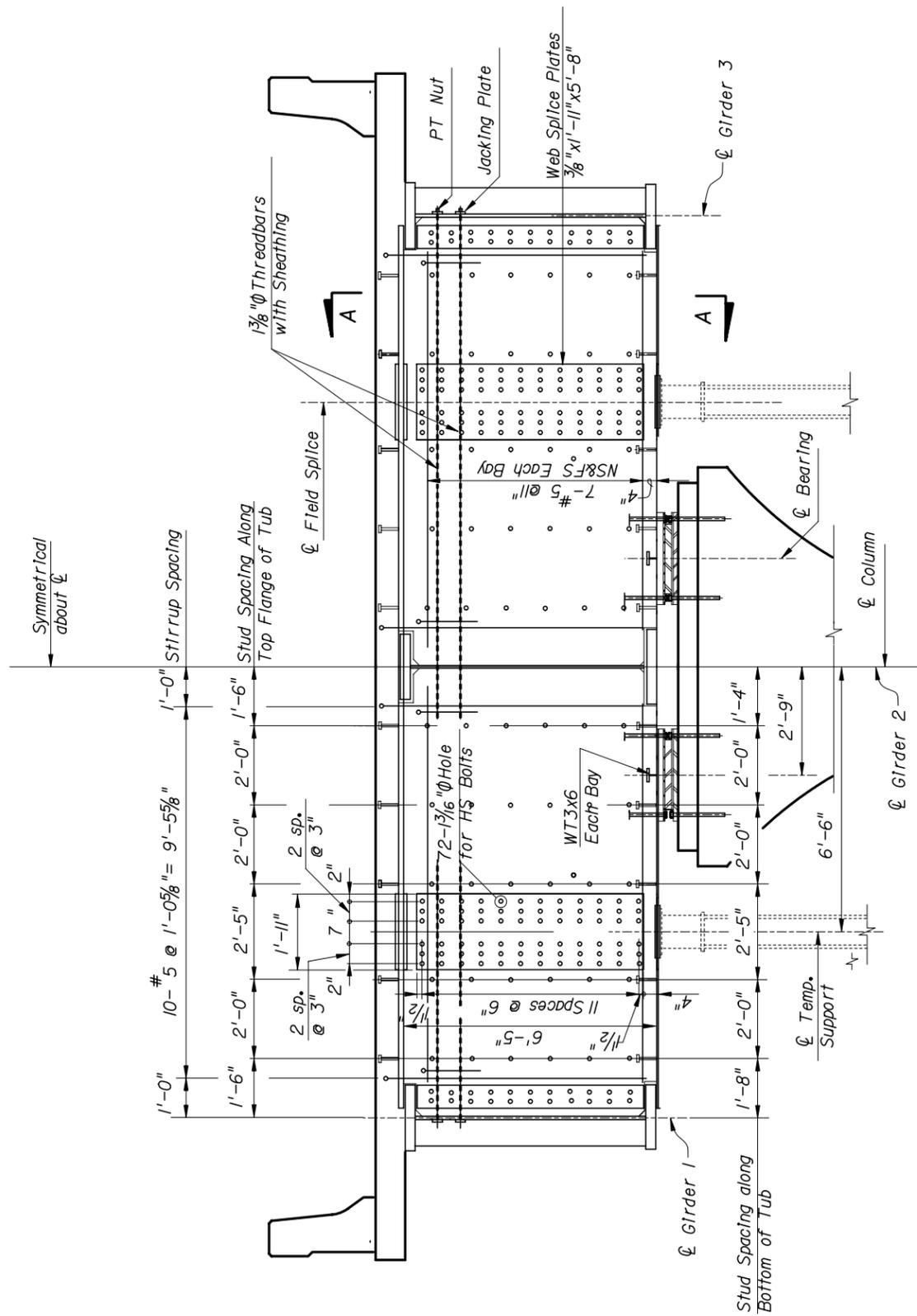
S-18

See Page 120
INTEGRAL PIER CAP STEEL BOX

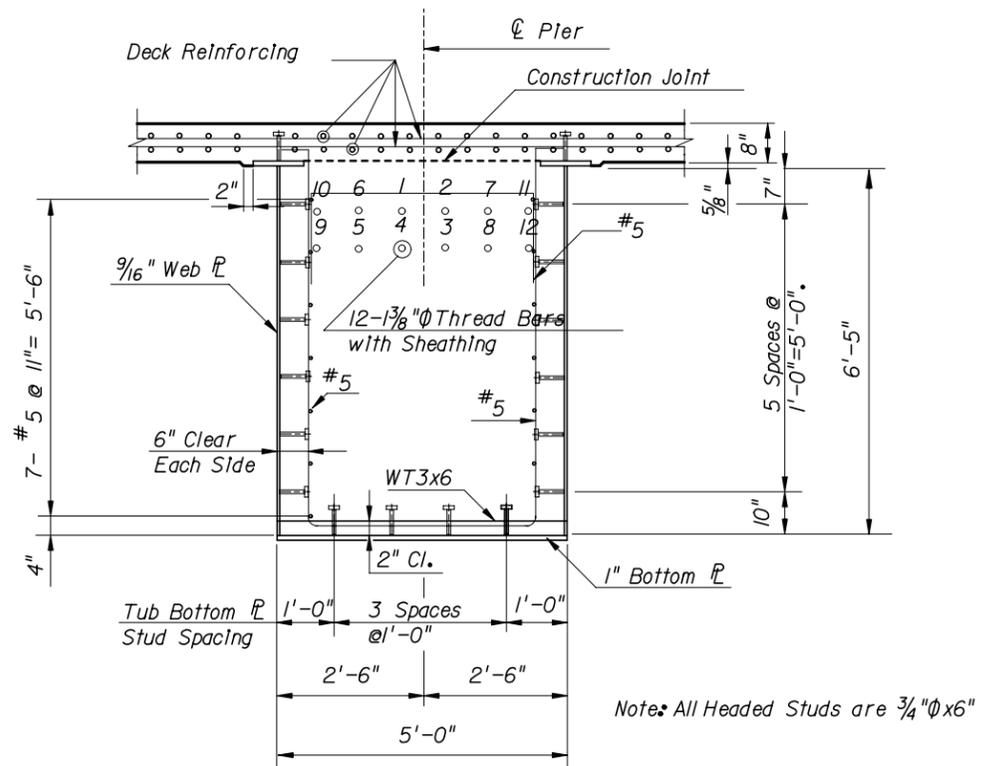
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CROSS SECTION AT INTEGRAL PIER CAP



SECTION A-A

GENERAL NOTES

P.T. Bars shall be 1 3/8" Φ Threadbars with 2" O.D. Sheathing for Grouting. Grouting for Threadbars and end covers at exterior Girders shall be Included in the Contractors bid price for Post-Tensioning Tendons (Superstructure Bars) Item No. 460-III-12.

P.T. Bars shall be uncoated 150,000 psi High Strength Coarse Thread Bar Meeting the requirements of ASTM A-722, Type II

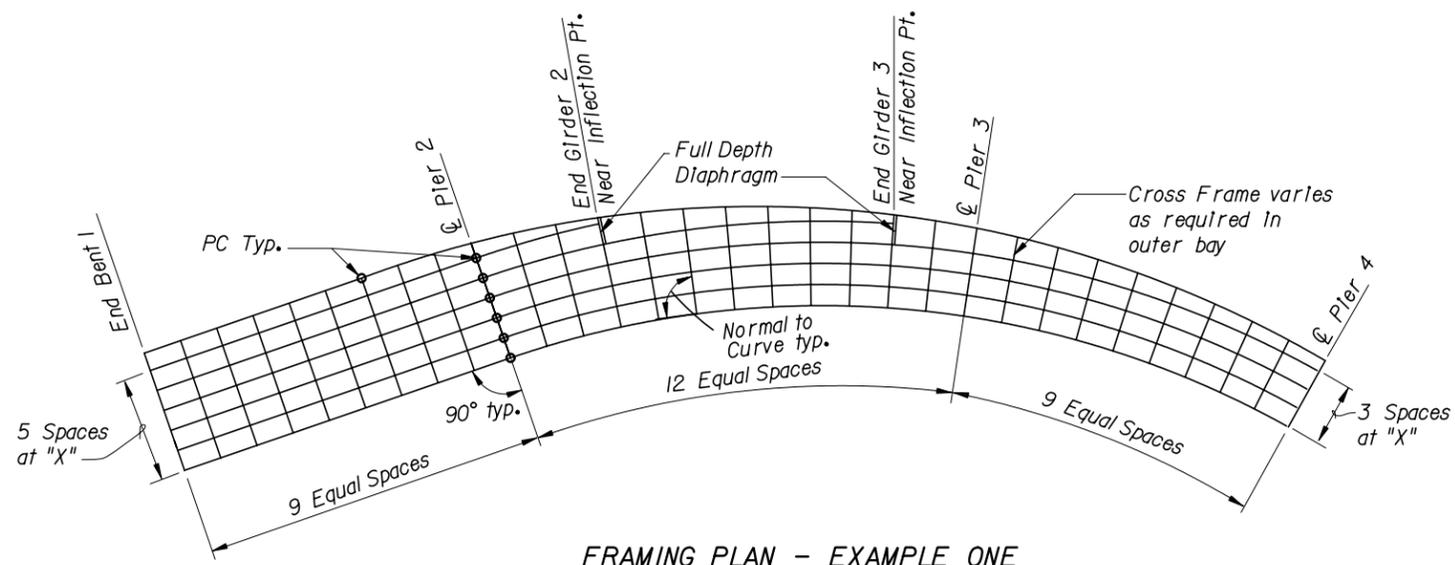
Bars shall be stressed to 165,000 lb., after anchor set, from both ends. Stressing shall proceed in the sequence shown in Section A-A at the first end and in the reverse sequence at the opposite end.

Field section of Girders 1, 2 & 3 along with the Integral Cap Tubs shall be fully shop assembled prior to field erection and disassembled prior to shipping.

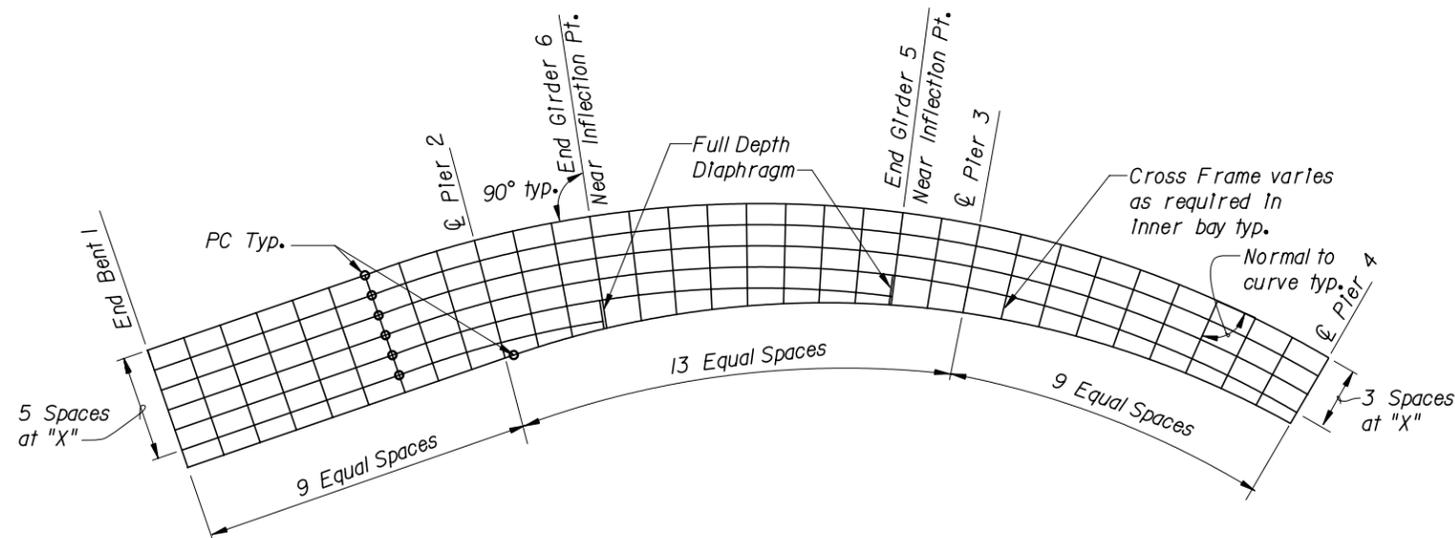
Concrete for Integral Caps shall be Class V, $f'c = 6500$ psi. Concrete shall reach a minimum compressive strength of 4000 psi prior to Post-Tensioning.

Contractor shall take care to insure proper placement of concrete under Girder and Tub Flanges. No voids will be permitted.

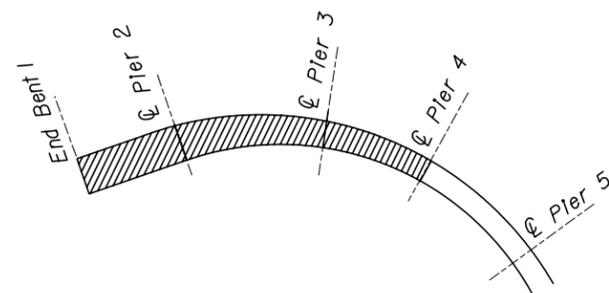
Integral Caps shall be perpendicular to Girder Flanges at Φ Bearing.



FRAMING PLAN - EXAMPLE ONE



FRAMING PLAN - EXAMPLE TWO

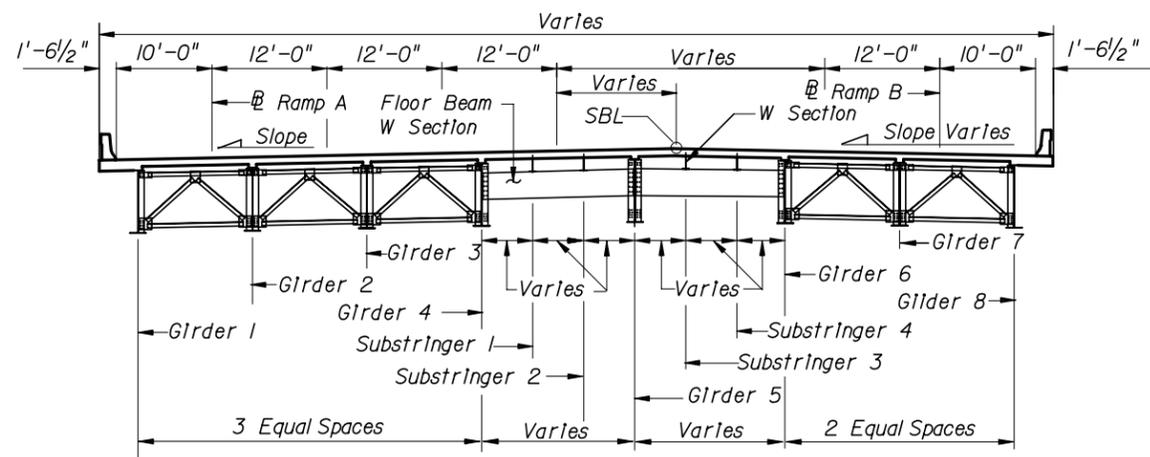


KEY PLAN

FRAMING PLAN - TAPERED RAMP:

Framing Plan - Tapered Ramp: It is desirable to utilize equally spaced beams with standard-sized crossframes where possible. For bridges with varying cross-sections, some variation in crossframes are required. When variable bridge widths are required, keep beam lines parallel and drop girder lines at or near inflection points instead of splaying girders. Under this layout only one bay varies. Although this framing scheme is more likely to require temporary support towers to facilitate fit-up it is simpler to fabricate and erect. It also saves material costs by reducing the total length of girder required.

Example One shows parallel girder lines on the inside of the curve. Example Two shows parallel girder lines on the outside of the curve. Effects of live load centrifugal forces and torsion make Example Two more desirable because all girder lines are more equally loaded.

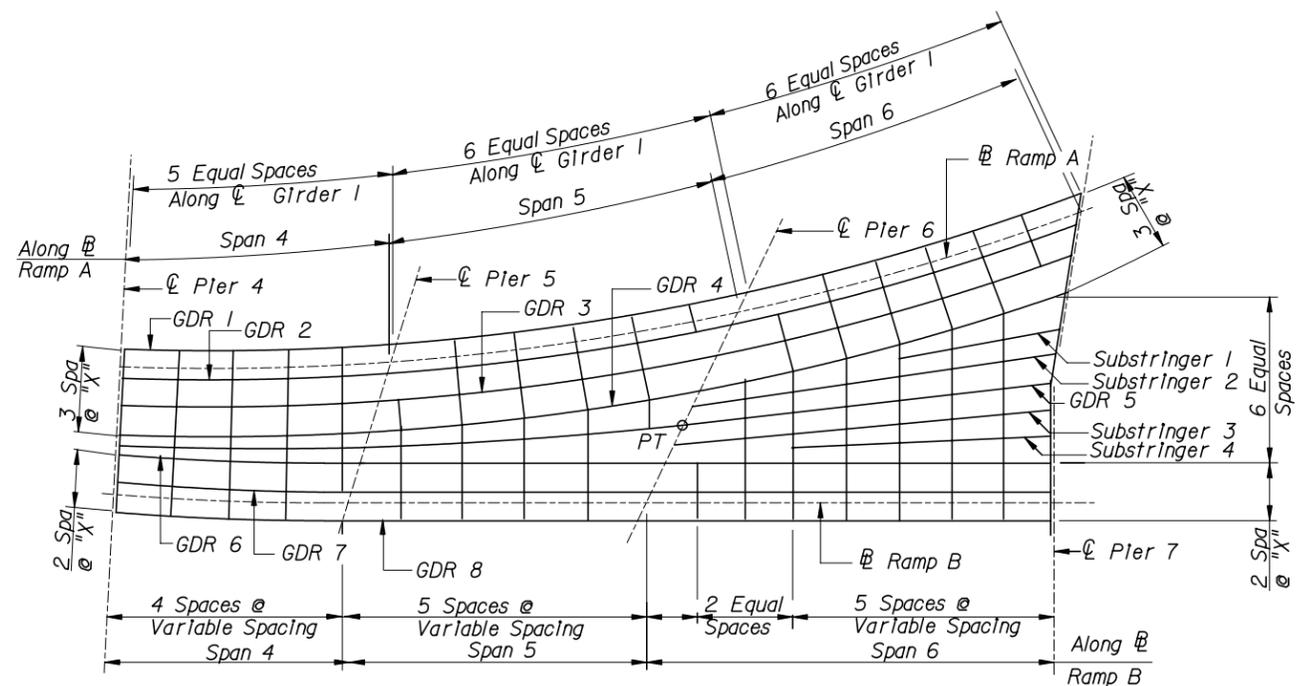


CROSS SECTION THRU GORE AREA

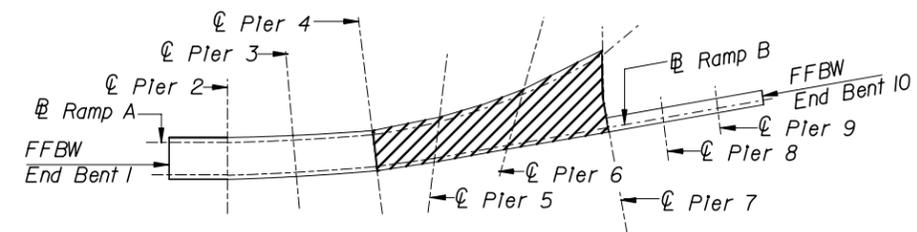
FRAMING PLAN - GORE AREA

Framing Plan - Gore Area: It is desirable to utilize equally spaced beams with standard-sized crossframes where possible. For bridges with gore areas, some variation in girder spacing is necessary. For this case, consider keeping girders equally spaced where possible and use of a floor beam-substringer system in the gore area. The substringers can be splayed on top of floor beams as required. This eliminates the need for unique diaphragms in the splayed region. Under this option, the W Section floor beams vary in length as required.

A refinement to this framing plan would be to terminate GDR 5 at an inflection point in Span 4 or 5. The end of the girder would tie into a full depth diaphragm.

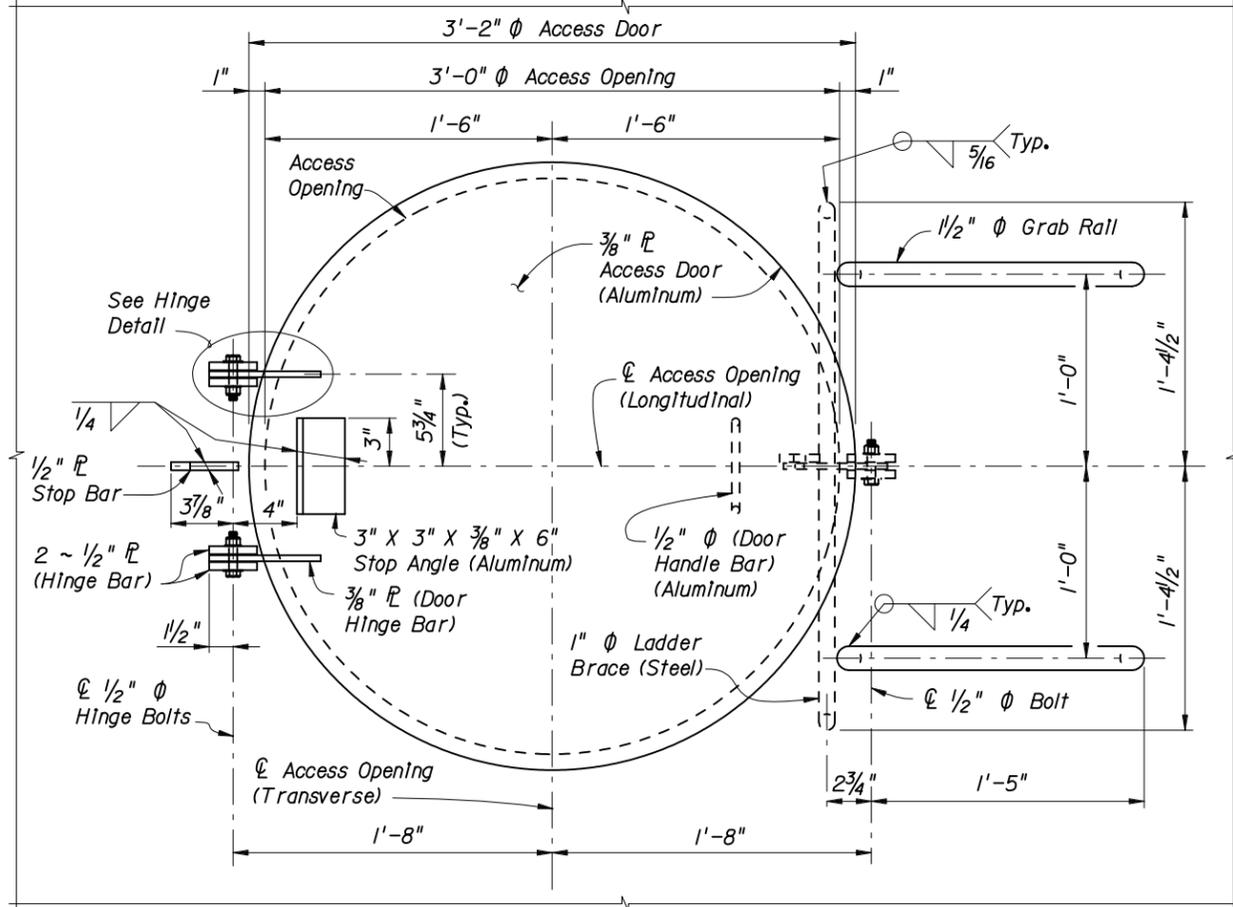


FRAMING PLAN GORE AREA

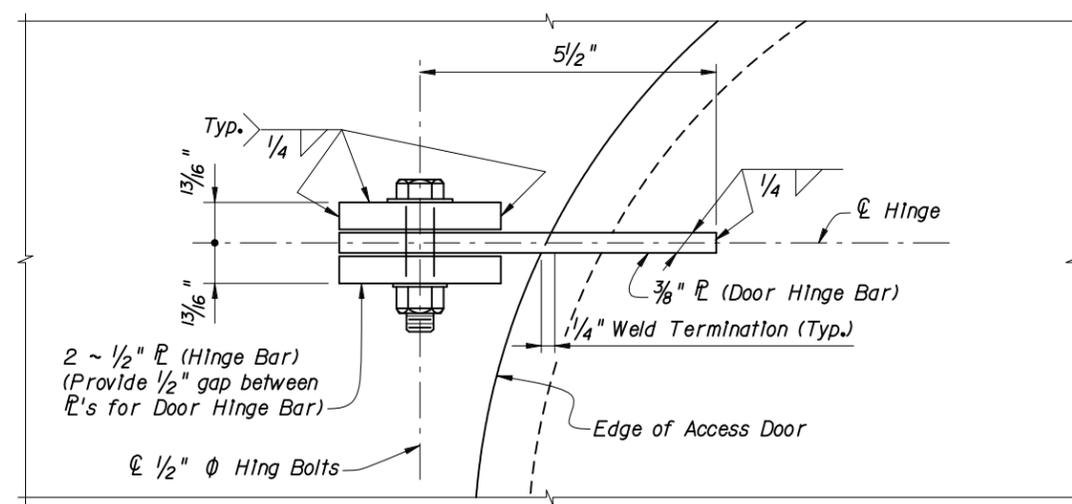


KEY PLAN

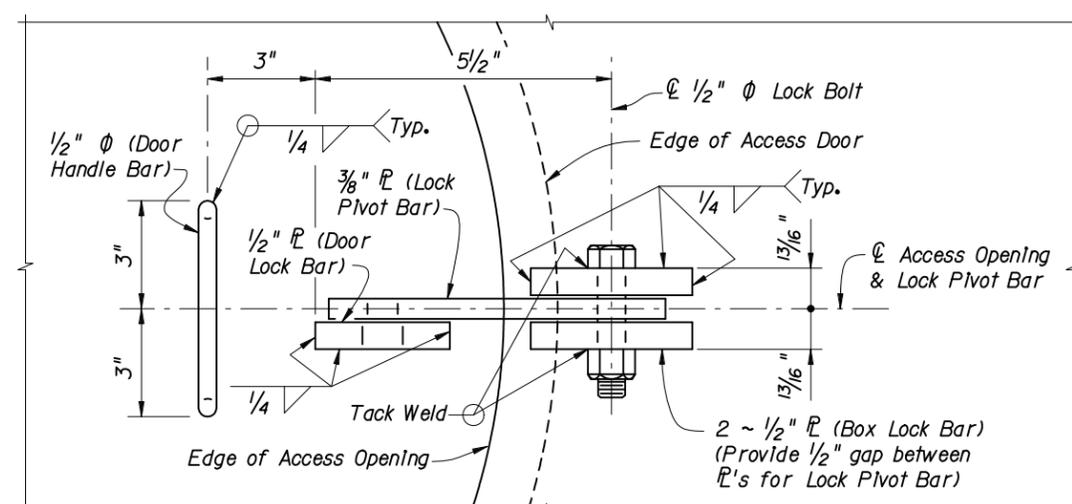
1/27/2005 1:44:54 PM \$K:\USTN\MACH\H\56\computer_support\StructuresSoftware\StructuresManual\2005-Jan\Graphics\PreferredDetails\Details\sfppre.dgn



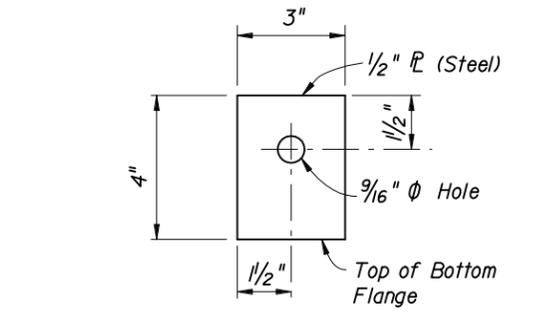
PLAN VIEW OF ACCESS DOOR



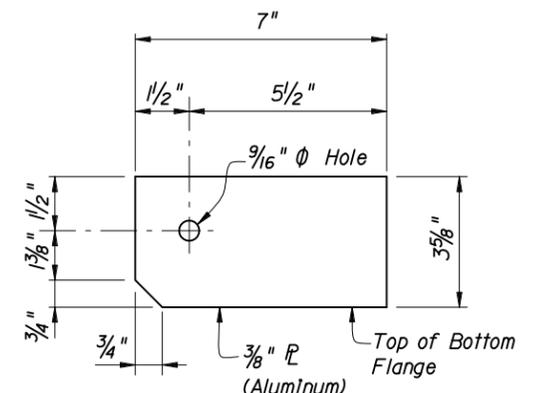
HINGE DETAIL



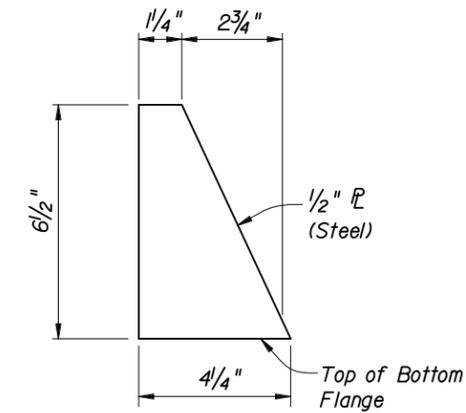
BOTTOM VIEW A-A



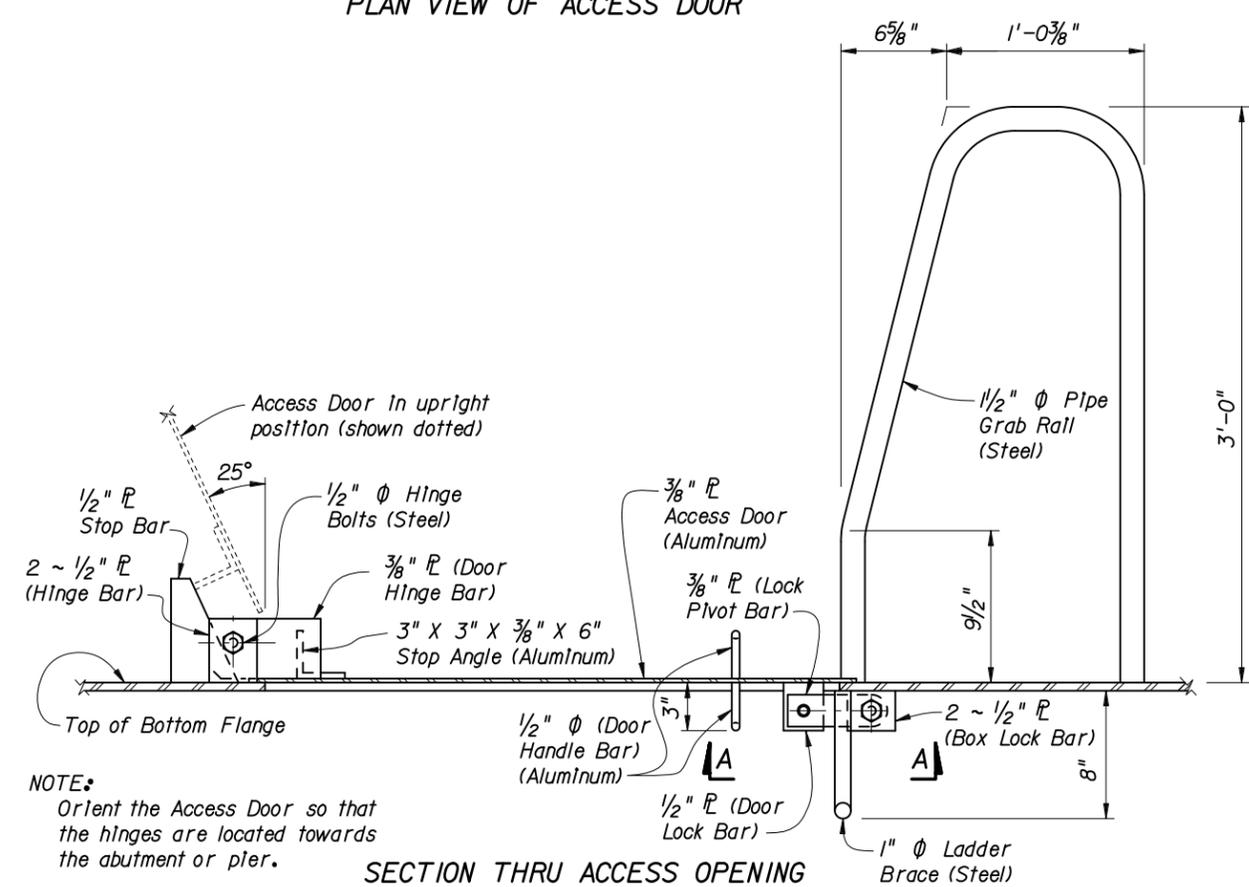
HINGE BAR DETAIL



DOOR HINGE BAR DETAIL



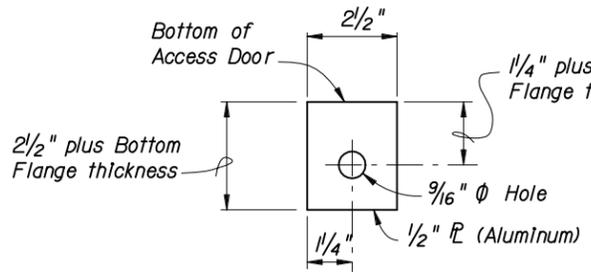
STOP BAR DETAIL



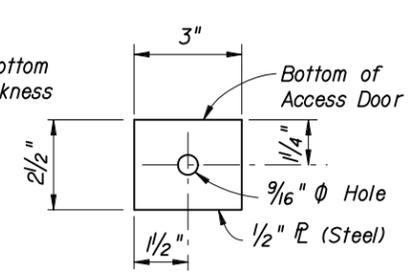
SECTION THRU ACCESS OPENING

NOTE:
 Orient the Access Door so that the hinges are located towards the abutment or pier.

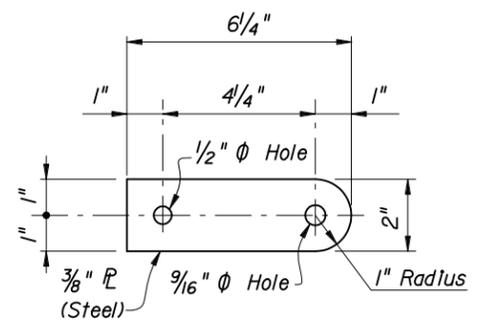
- NOTES:
- All Structural Steel material in Access Door Assemblies shall conform to ASTM A709 Grade 36. All aluminum material in Access Door Assemblies shall conform to ASTM B209, Alloy 6061-T6.
 - 1/2" ϕ Pipe Grab Rail shall be in accordance with ASTM A53 Grade B for standard weight pipe (Schedule 40).
 - All exposed edges of plates and openings shall be ground smooth.
 - See Framing Plan sheets for locations of Access Door Openings.
 - Payment for Access Door Assemblies are included in the Contract Unit Price for Structural Steel (Low Alloy). Contractor to furnish Locks, all keyed alike. Included in Door Assembly are Door, Hinges, Locking Plates, Handle Bar, Grab Rails & 1/2" ϕ Bolts, Nuts and Washers.



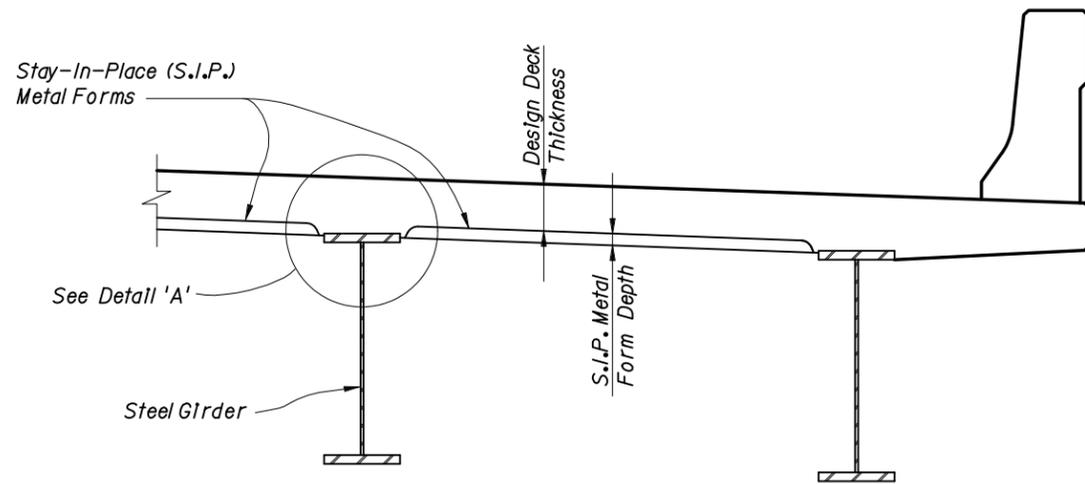
DOOR LOCK BAR DETAIL



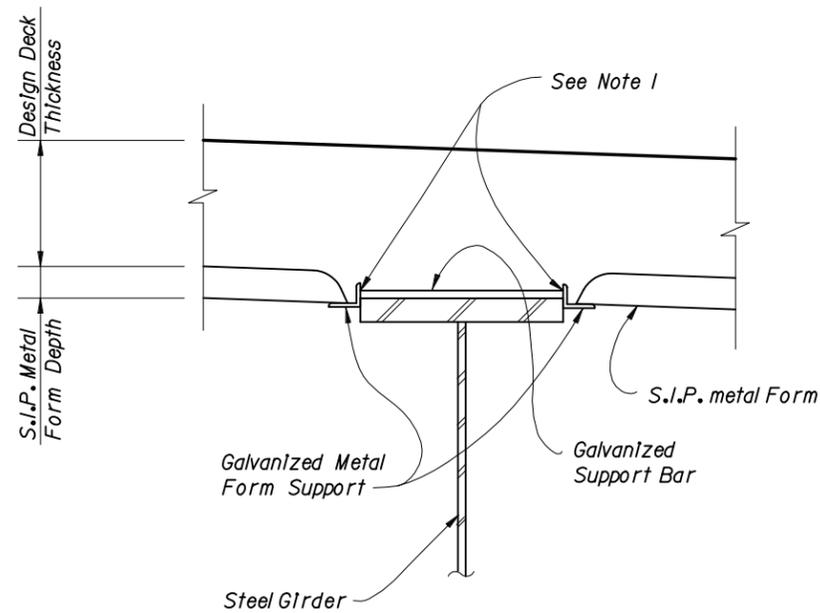
BOX LOCK BAR DETAIL



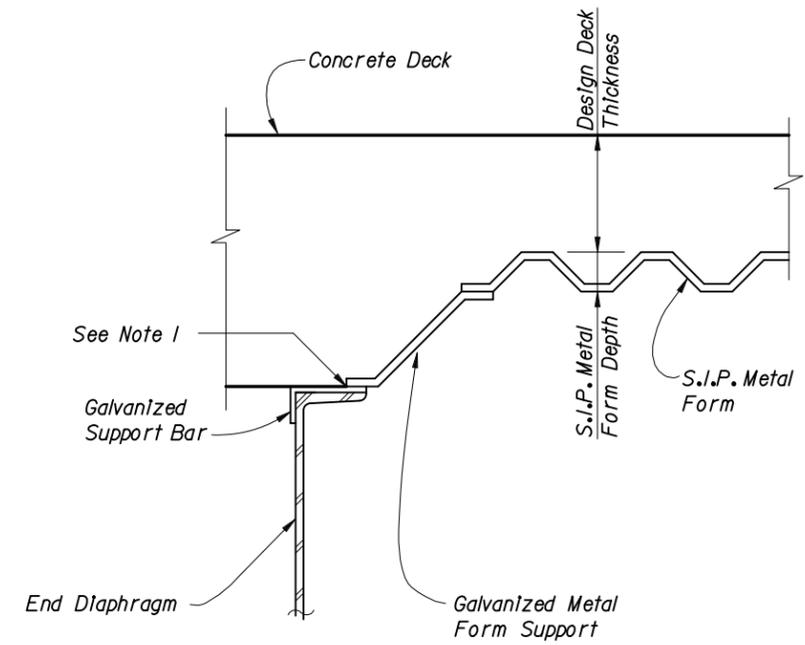
LOCK PIVOT BAR DETAIL



PARTIAL SECTION THRU SUPERSTRUCTURE
(Showing Typical Details and Notes for S.I.P. Metal Forms)



DETAIL 'A'

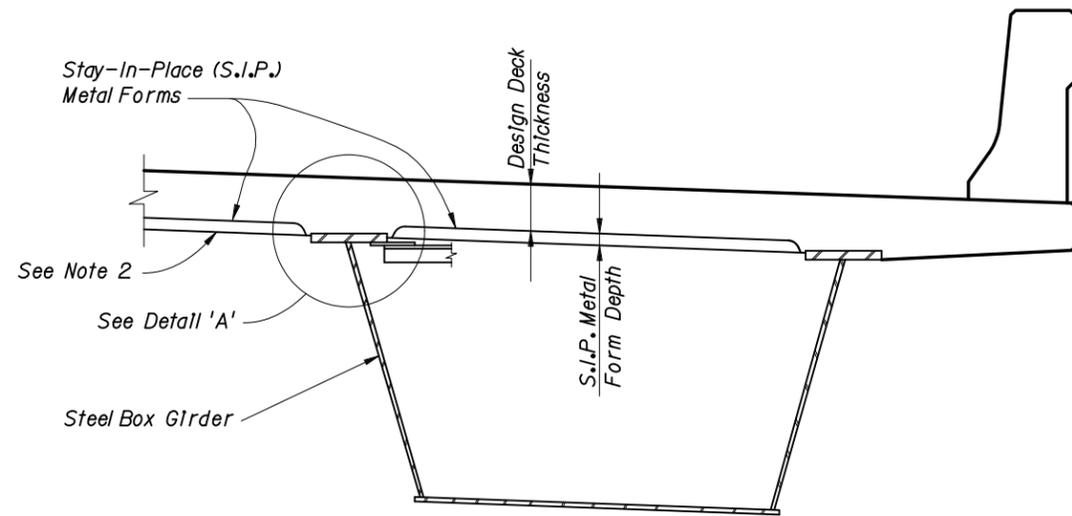


PARTIAL SECTION THRU END OF SPAN

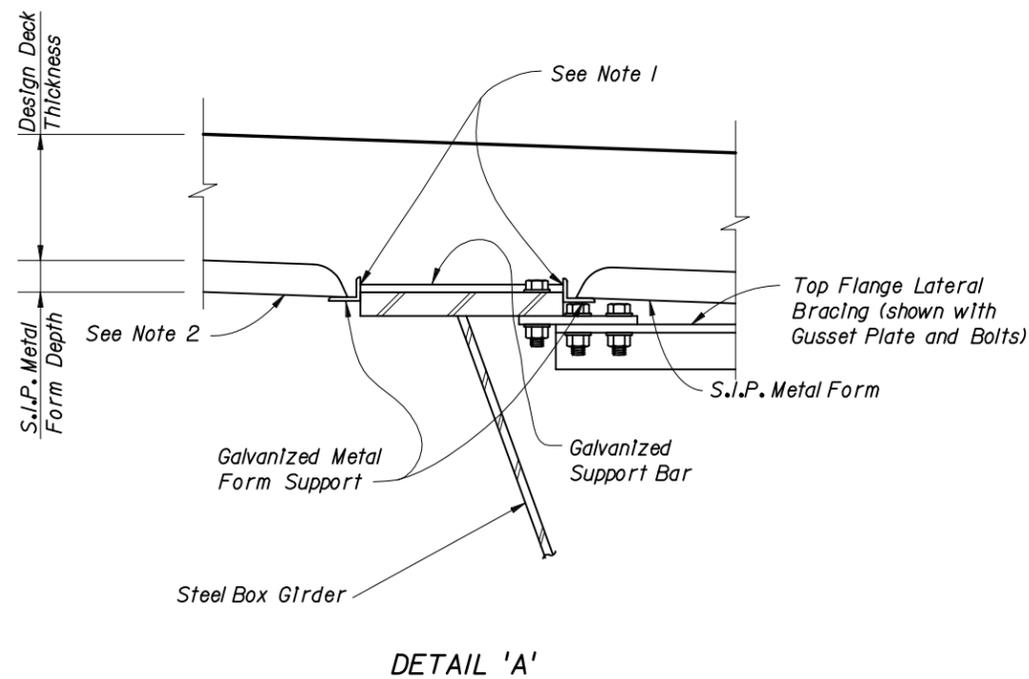
NOTE 1: See Section 400 of the Specifications for Installation requirements for S.I.P. Forms and support components. Electrical grounding to Structural Steel and Reinforcing Steel is prohibited.

Coordinate S.I.P. forms and girder framing Shop Drawings. Ensure that S.I.P. forms will not conflict with top flange lateral bracing.

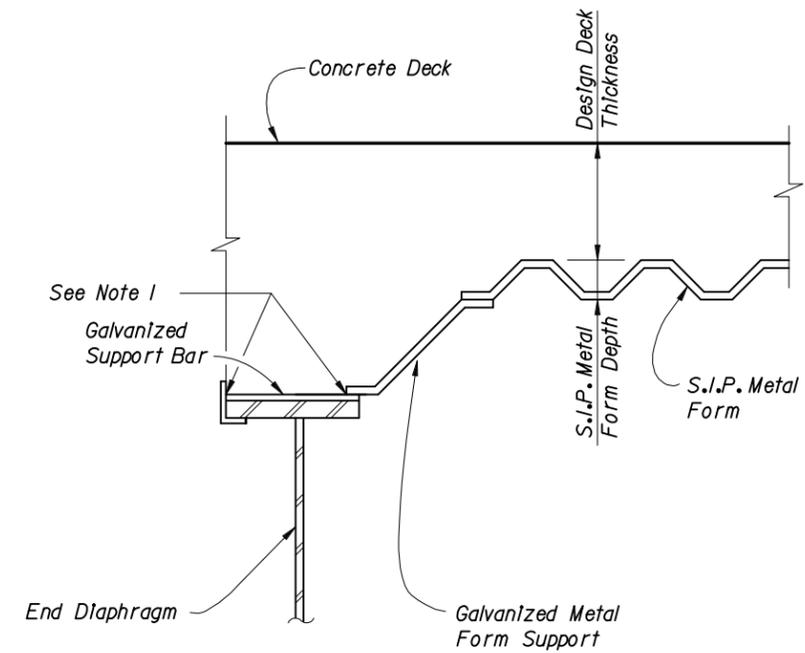
\$\$\$SYTIME\$\$\$TIME\$\$\$DONSPECIFICATION\$\$\$TIME\$\$\$



PARTIAL SECTION THRU SUPERSTRUCTURE
(Showing Typical Details and Notes for S.I.P. Metal Forms)



DETAIL 'A'

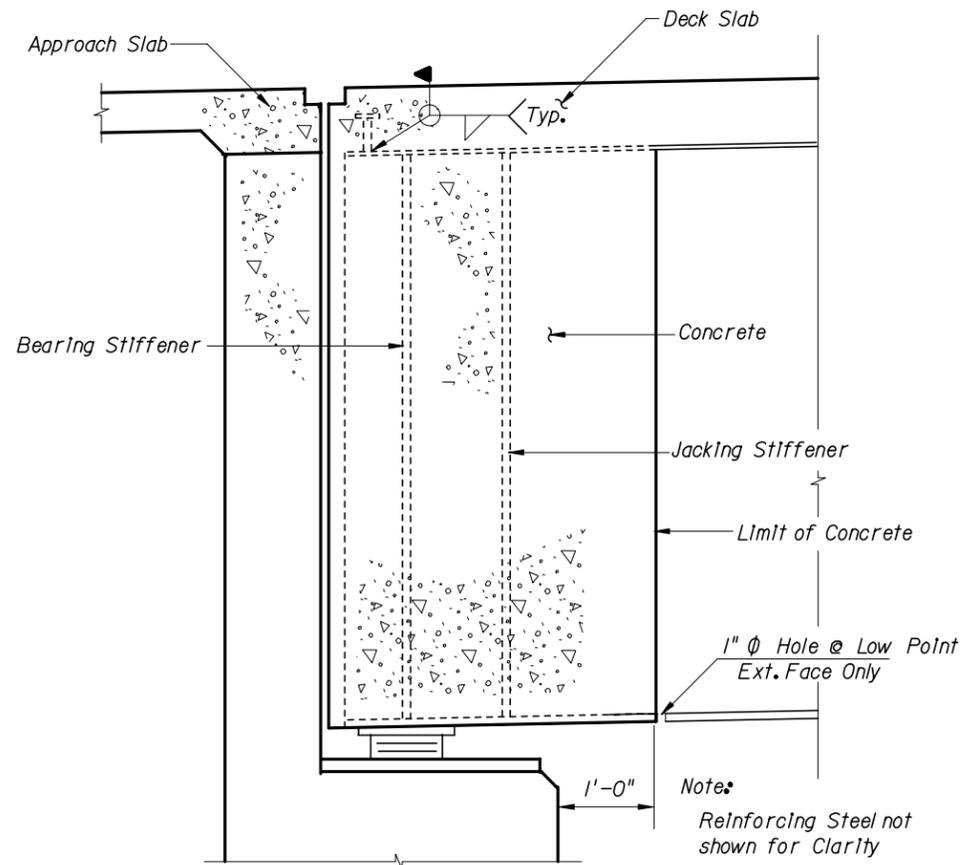


PARTIAL SECTION THRU END OF SPAN

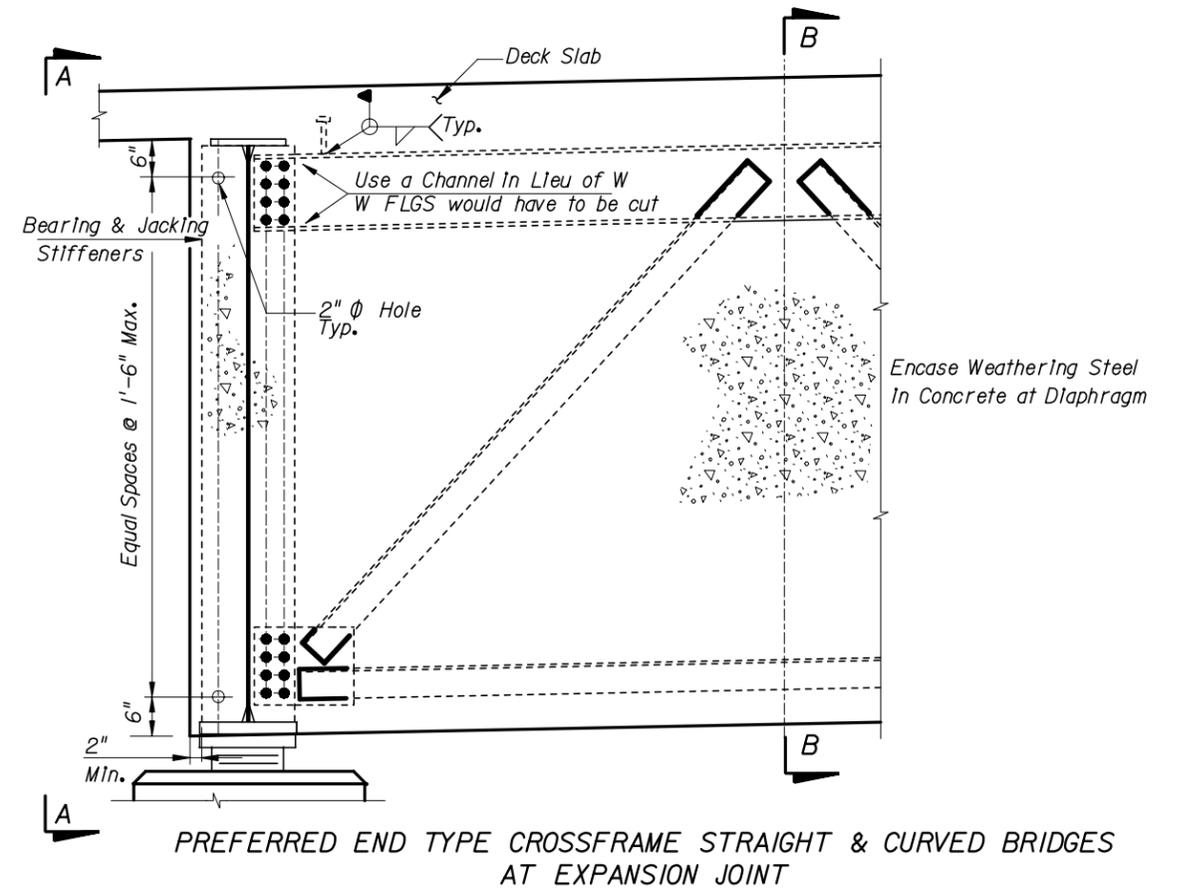
NOTE 1: See Section 400 of the Specifications for Installation requirements for S.I.P. Forms and support components. Electrical grounding to Structural Steel and Reinforcing Steel is prohibited.

NOTE 2: As required by design, either a stay-in-place corrugated galvanized metal form or a smooth removable form shall be used.

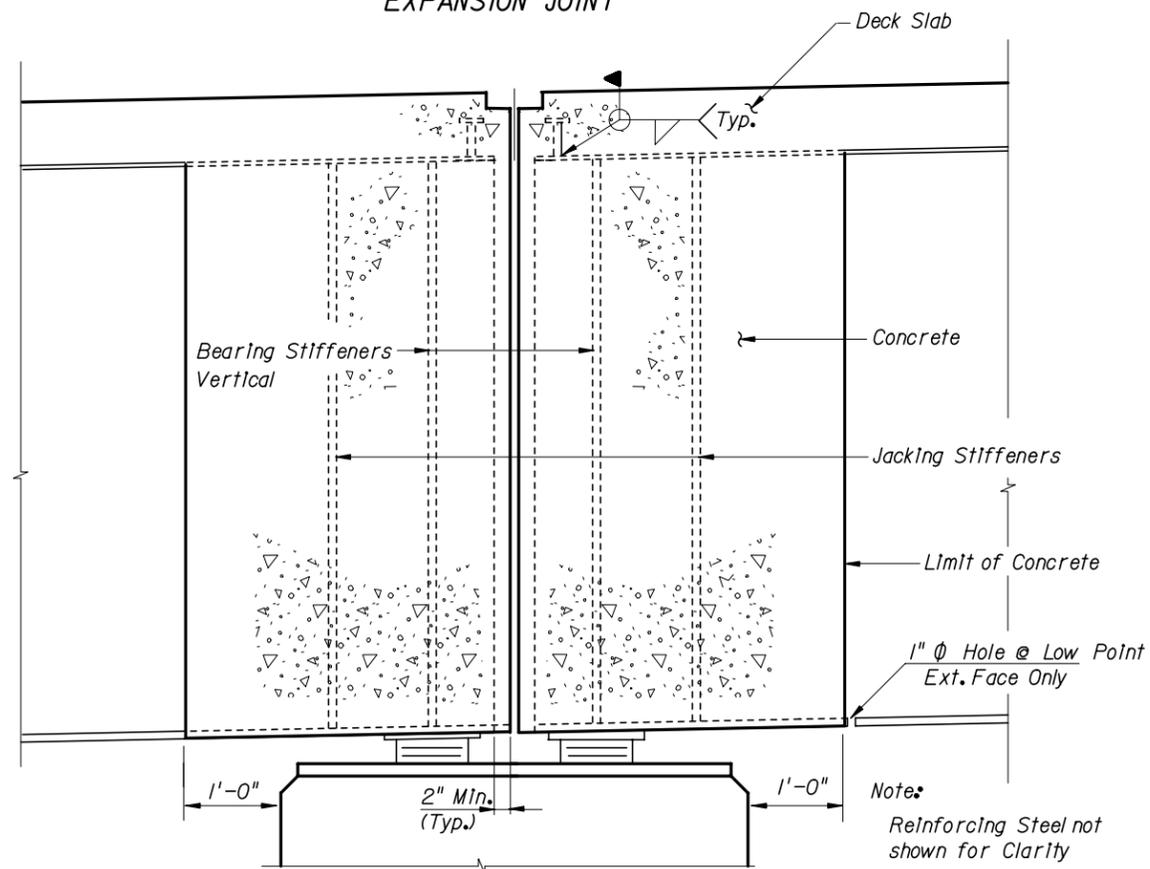
Coordinate S.I.P. forms and box framing Shop Drawings. Ensure that S.I.P. forms will not conflict with top flange lateral bracing.



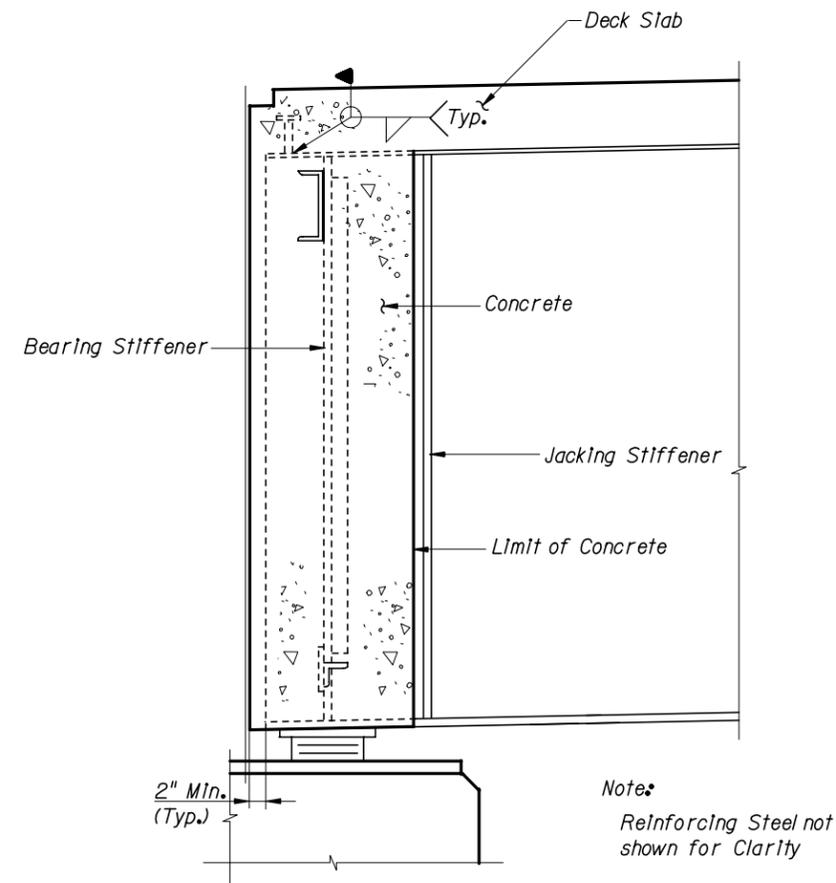
VIEW A-A AT END BENT EXPANSION JOINT



PREFERRED END TYPE CROSSFRAME STRAIGHT & CURVED BRIDGES AT EXPANSION JOINT



VIEW A-A AT PIER EXPANSION JOINT

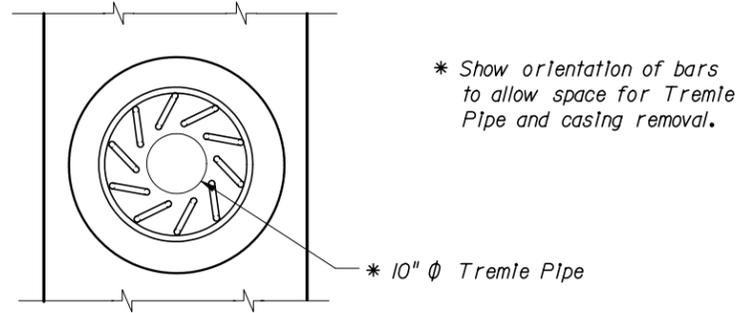


SECTION B-B

DETAIL NAME:	WEATHERING STEEL DETAILS	SHEET NO.
		S-28



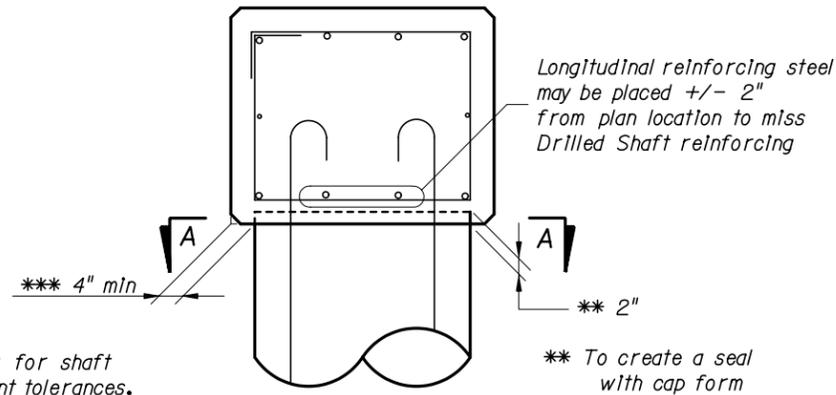
Detail Hook with proper
Minimum Pin Size



* Show orientation of bars
to allow space for Tremie
Pipe and casing removal.

* 10" \varnothing Tremie Pipe

SECTION A-A



Longitudinal reinforcing steel
may be placed +/- 2"
from plan location to miss
Drilled Shaft reinforcing

*** To allow for shaft
placement tolerances.

** To create a seal
with cap form

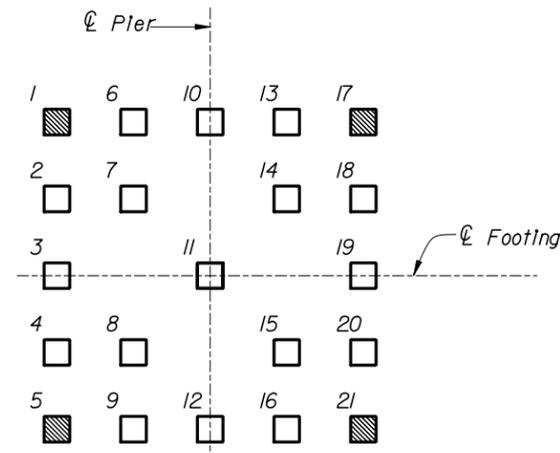
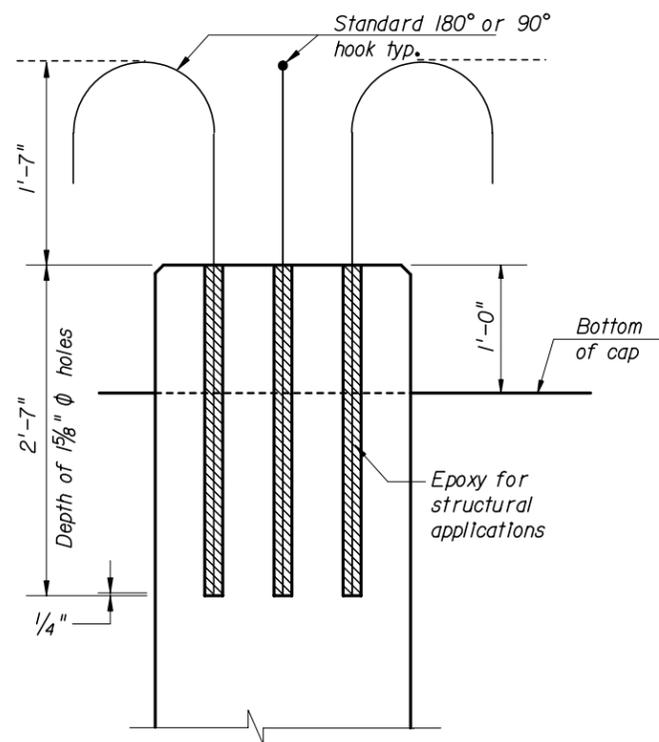
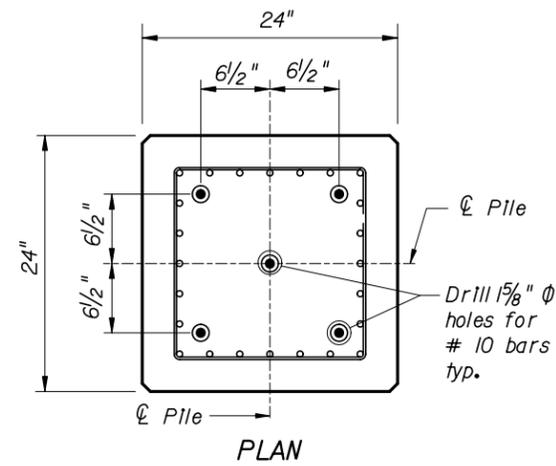
CROSS SECTION AT INTERMEDIATE BENTS

DESIGNERS NOTE:

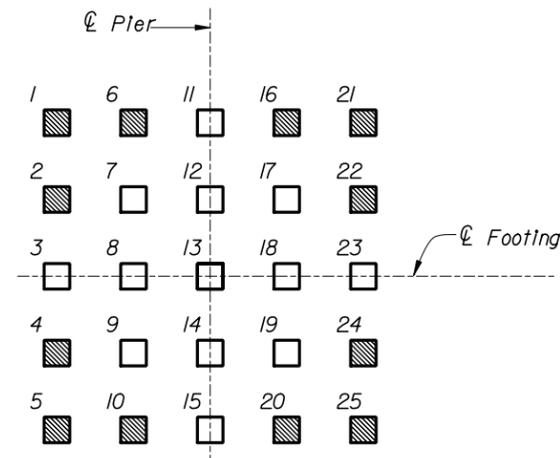
Shaft-Column Details: Whereas columns are to be placed with zero tolerances, shafts can be built up to a +/- 3" out of place in accordance with the Standard Specifications. Plan details should accommodate worst-case tolerances. When caps are used, the caps should be sized accordingly. For single columns founded on single shafts, one solution may be to oversize the shaft size relative to the column size. Another solution may be to relax the column tolerance so that the drilled shaft and column can be built concentric. In the second case, the design should assume a worst-case placement.

Reinforcing Conflicts: Conflicts between the shaft steel and cap steel can sometimes be a problem during construction. It is recommended that a note be added to the plans, where possible, to allow the cap steel to be adjusted in the field where necessary.

Tremie Pipe Access and Casing Extraction: Reinforcing steel at the top of drilled shafts should be hooked only when necessary. Hooks, when required, should be oriented inward to facilitate casing removal. The hooks should also be detailed to allow for concrete placement. For smaller shafts, this may require rotating the hooks to allow tremie access.



FOOTING TYPE I
PLAN VIEW



FOOTING TYPE II
PLAN VIEW

LEGEND

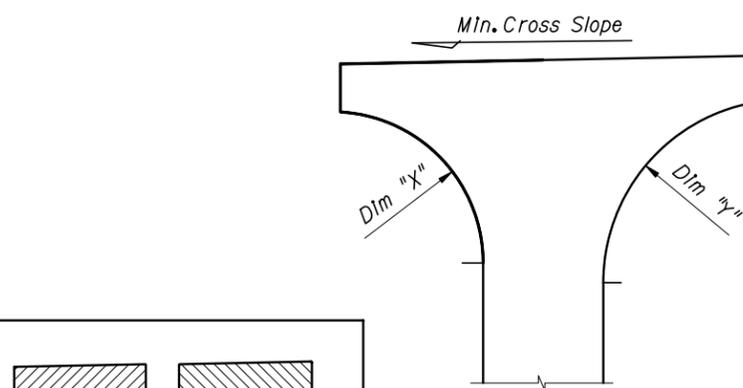
-  24" TENSION PILE
-  24" PILE
-  24" TEST PILE

All piles are plumb

FOOTING DETAILS

Tension Piles: For bridges with large lateral loads, it may be beneficial to utilize the tension capacity of the soil. This approach can serve to reduce the size of the footings. For land piers, when a 1'-0" pile embedment is utilized, a mechanical connection between the pile and cap is required to transmit tension loads. The Mechanical connection should be designed based on project requirements. The detail shown is for example only.

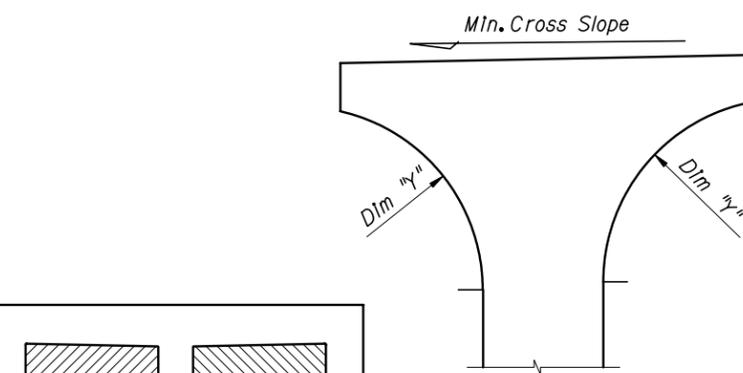
Group Footings: It is also useful to group pier footings within a project, when possible, to maximize the reuse of reinforcing jigs, formwork and driving templates. Pulling piles from a standard pile grid is one way to achieve this. Least materials is not always least cost. Labor costs and material costs need to also be considered.



SPLIT CAP FORM

DIFFERENT RADIUS - SPLIT CAP FORM

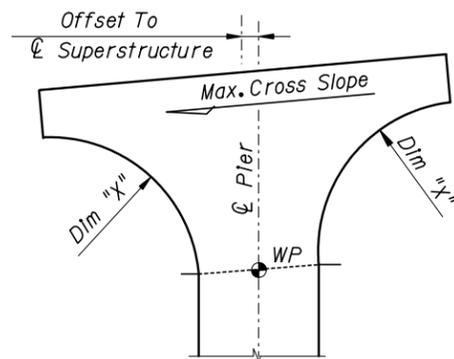
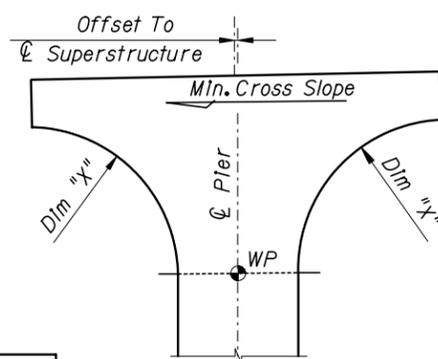
OPTION ONE



SPLIT CAP FORM

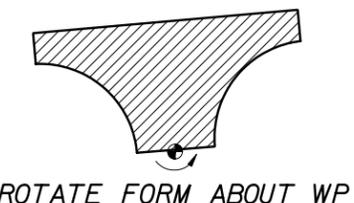
SAME RADIUS - SPLIT CAP FORM

OPTION TWO



SAME RADIUS - ROTATE SINGLE CAP FORM ABOUT WP

OPTION THREE



ROTATE FORM ABOUT WP

PIER SHAPE:

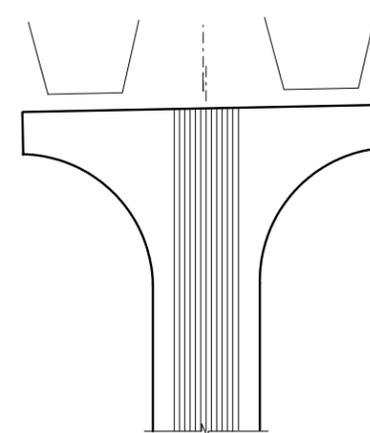
For multi-pler interchanges it is important to utilize pier shapes that make best use of formwork and reinforcing details, while balancing aesthetics. This is especially difficult when the pier cross slopes vary due to superelevated curved ramps. When curved hammerhead piers are utilized with varying cross slopes, three methods of detailing are normally employed.

Option One utilizes two split forms of differing radii. Under this option, the forms are lowered or raised to accommodate the varying cross slopes. Although many of the reinforcing cages are similar, they vary based on the cross slope. The two radii are chosen based on aesthetics and the cross slope extremes.

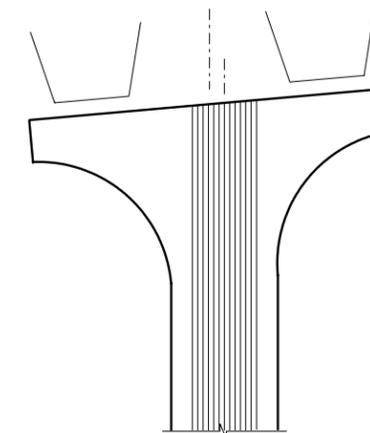
Option Two is similar to Option One except that the radii are the same. This option has the same advantages and disadvantages as option one above, however the aesthetics may not be as desirable depending on the cross slope variation.

Option Three utilizes a single cap form. Under this option, the form is rotated about a working point at its base. The cage steel for all piers is the same or similar based on the loads. This option introduces a slight P.I. at the column/radius interface and requires the superstructure and substructure to be offset slightly based on the given cross slope.

Of the three options, Option Three is preferred based on its simplicity and aesthetic value.



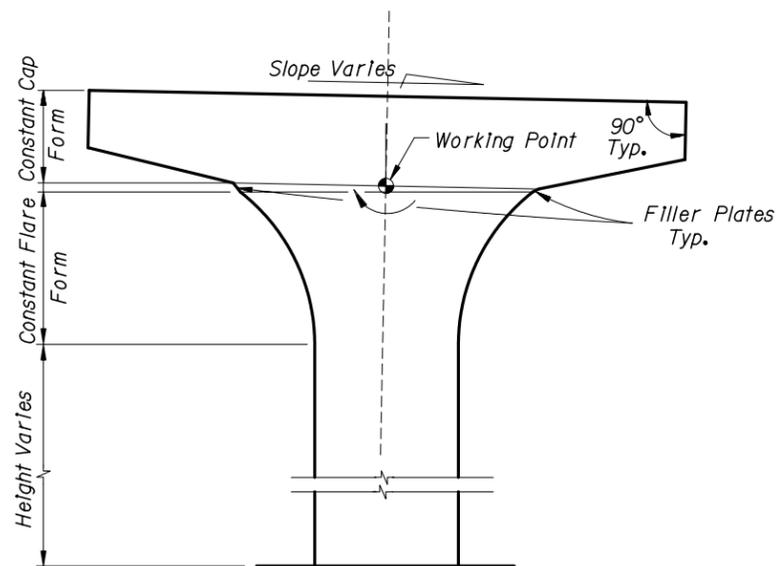
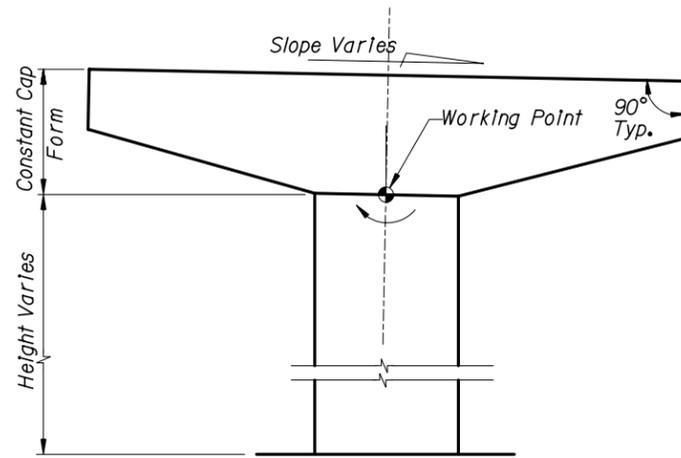
MIN. CROSS SLOPE



MAX. CROSS SLOPE

EXAMPLE OPTION THREE

(under this option the pier is rotated at a point as the cross slope changes)



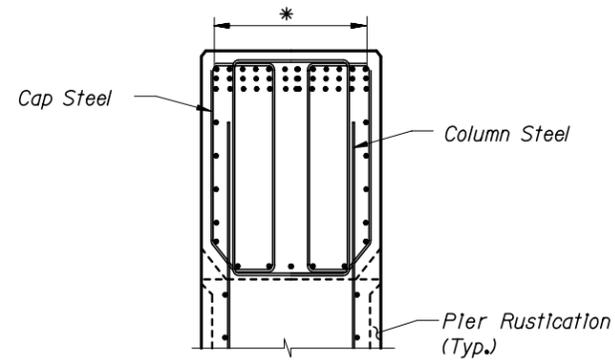
ROTATE SINGLE CAP FORM ABOUT WORKING POINT

PIER SHAPE:

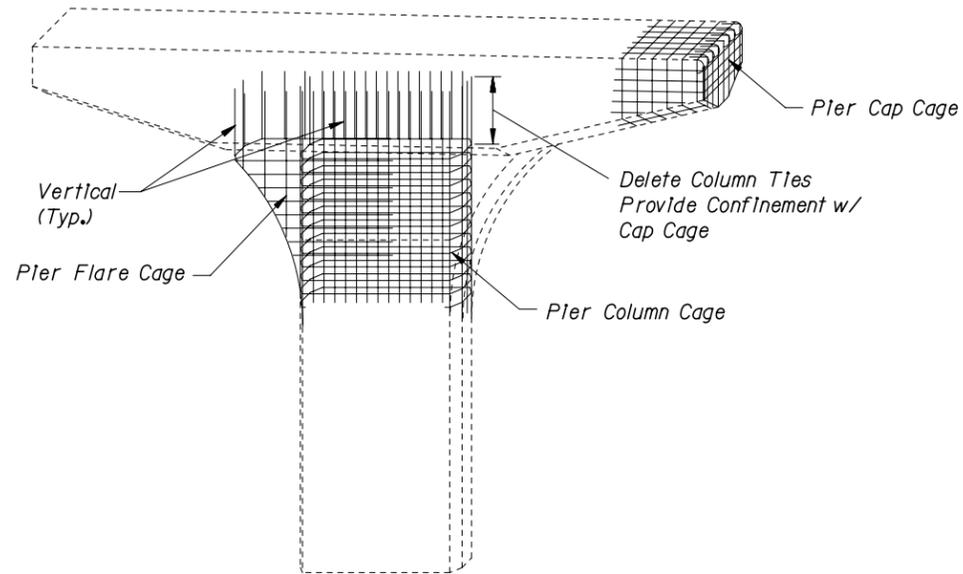
For multi-pler interchanges it is important to utilize pier shapes that make best use of form work and reinforcing details, while balancing aesthetics. This is especially difficult when the pier cross slopes vary due to superelevated curved ramps. When curved hammerhead piers are utilized with varying cross slopes.

The two examples shown utilize a single cap form rotated about a working point at its base. In either case, the cage steel for all piers is the same or similar based on the loads. The cap should be sized based on the largest cross slope with the pedestal locations adjusted as required.

* Space cap reinforcing to miss preformed anchor bolt holes, drainage pipes, and to allow for concrete placement.

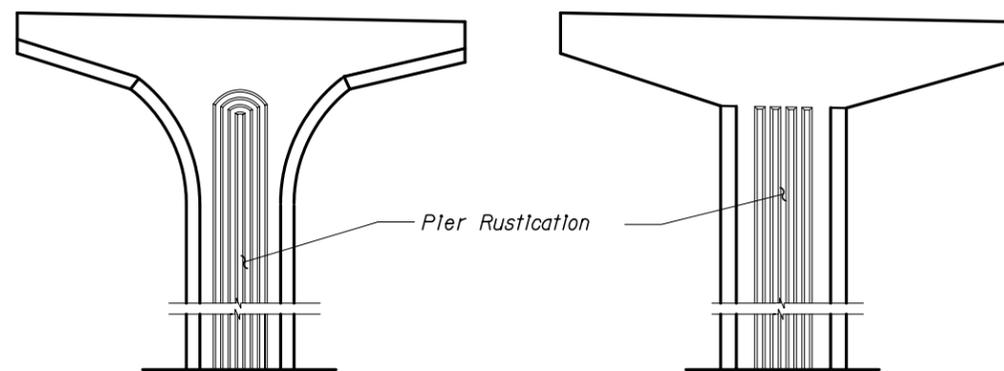


SECTION THROUGH CAP
Case Showing Flush Pier Face w/ Rustication



REINFORCING STEEL - PICTORIAL VIEW

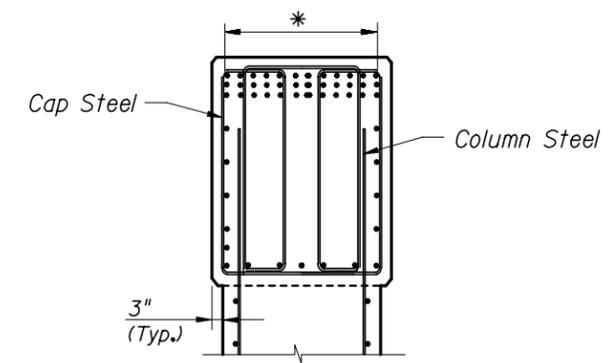
REINFORCING DETAILS - HAMMERHEAD PIERS
Case Showing Flush Pier Face w/ Rustication



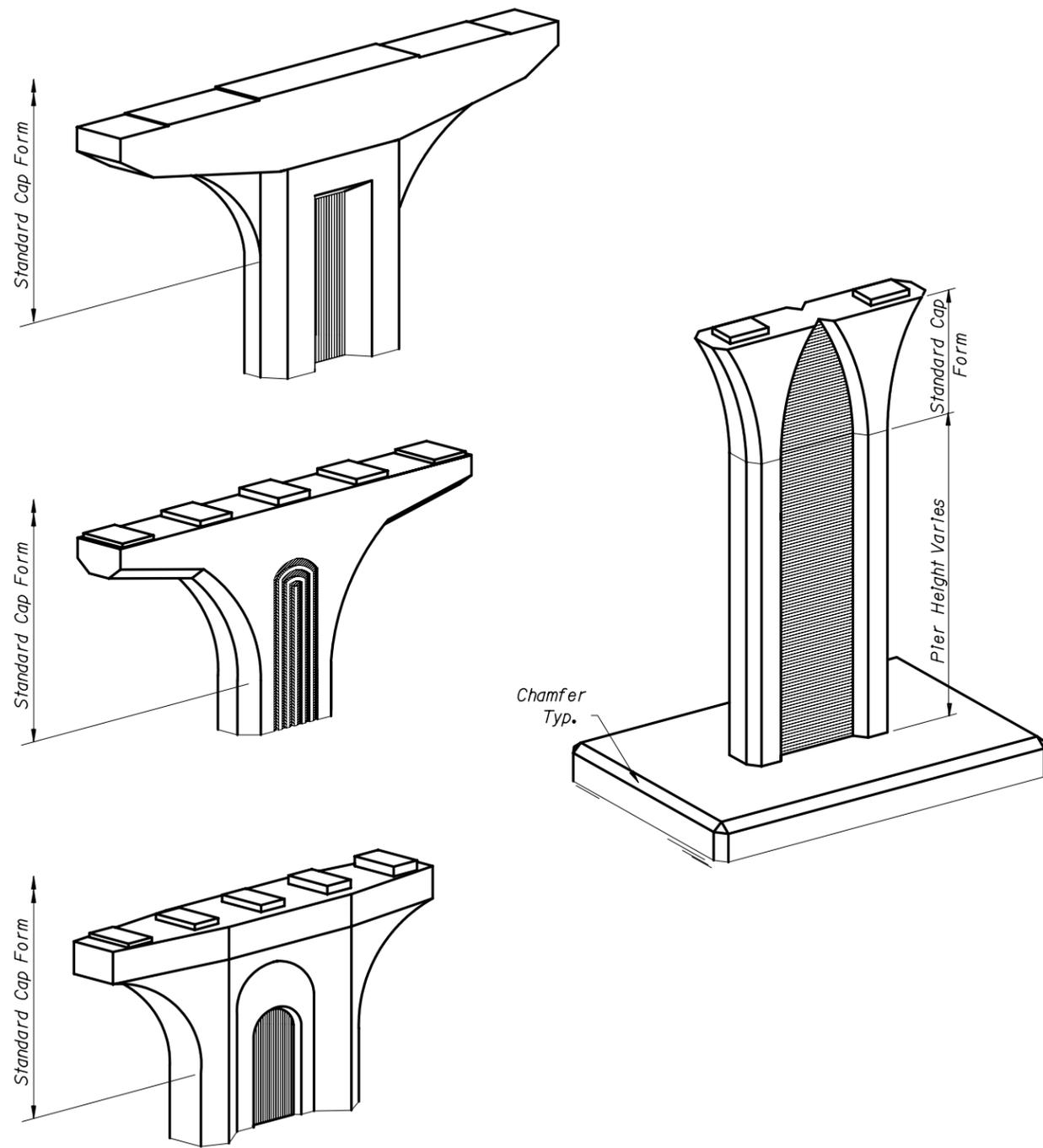
ELEVATION VIEW - HAMMERHEAD PIERS
Case Showing Flush Pier Face w/ Rustication

PREFABRICATION OF STEEL CAGES FOR HAMMERHEAD PIERS

It is desirable to standardize pier reinforcing where possible for the maximum reuse of reinforcing jigs. Details which allow the steel cages to be tied on the ground and lifted into the form by crane are preferred. This requires that the pier cap be six inches wider than the column so that the column steel can extend inside the cap steel. Another method is to allow the column rustication to terminate at the column/cap interface. As a general rule all pier lap reinforcing should be vertical where possible to facilitate lowering adjoining cage.



SECTION THROUGH CAP
Case Showing Cap 6" Wider than Column

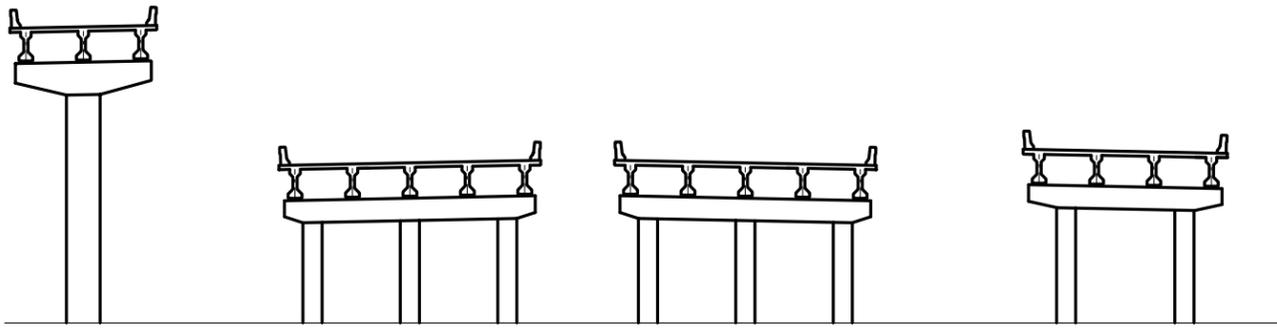


PIER AESTHETICS

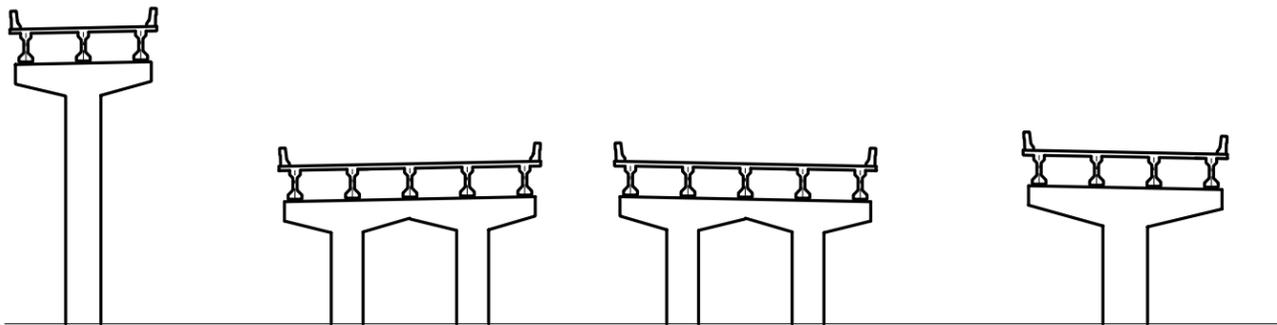
On bridges requiring many piers, it is desirable to standardize the piers throughout so that the formwork can be reused. Generally bridge aesthetics can best be achieved through pier shapes. If pier forms can be reused on a project, the cost of an aesthetic form is normally a small percentage of the overall cost. The best approach is to utilize a constant column section which varies in height as required.

It is important to look at both the tallest pier and the shortest pier before selecting a pier shape.

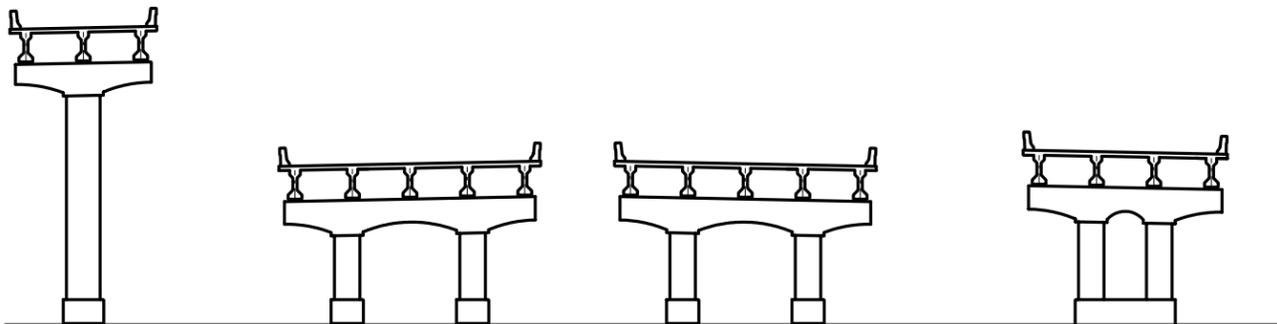
Consideration should be given to increasing the chamfer sizes on large concrete elements to improve on the large blocky appearance. Examples include exposed pile caps and large bridge pier columns and caps.



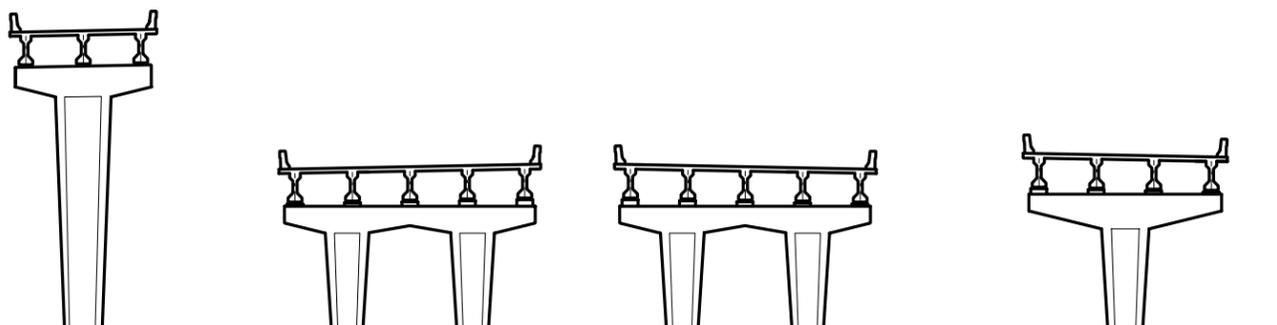
PIER ALTERNATE 1



PIER ALTERNATE 2



PIER ALTERNATE 3



PIER ALTERNATE 4

FAMILY OF PIERS

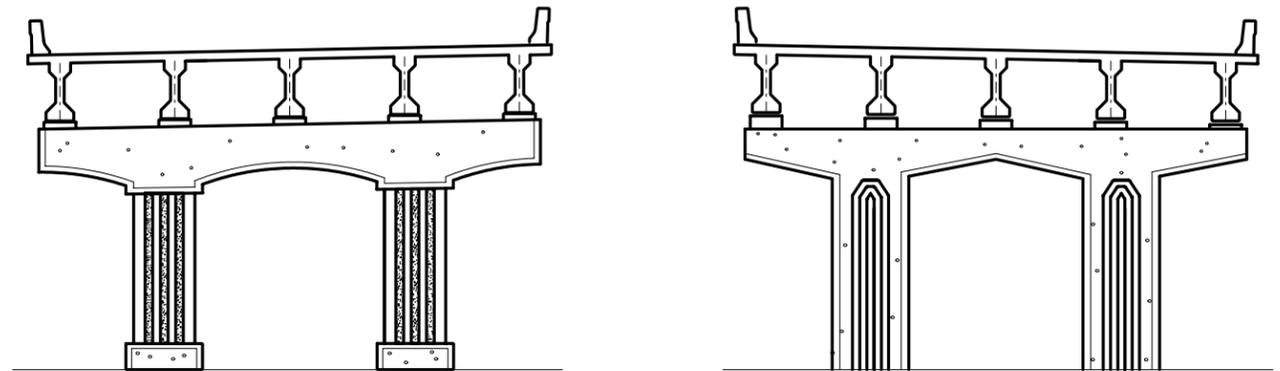
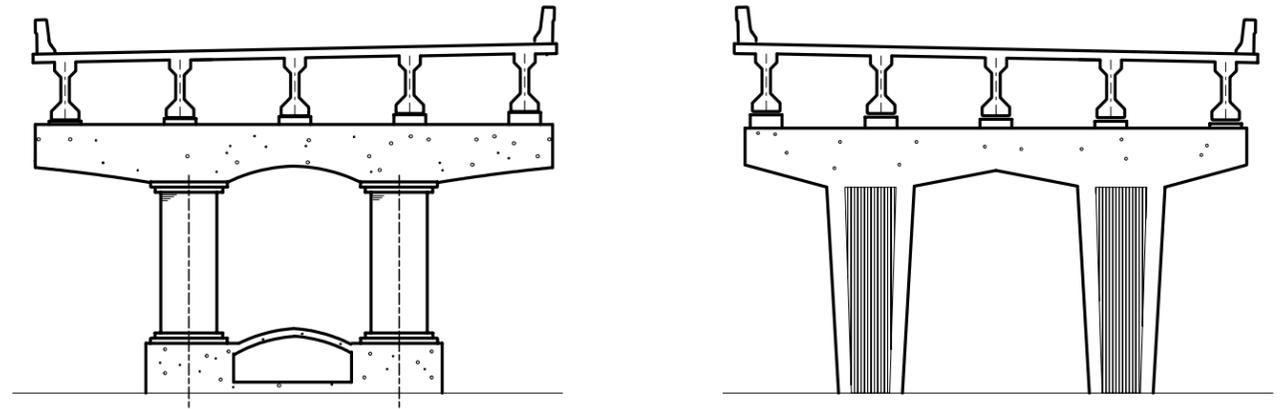
PIER AESTHETICS

Uniformity of pier shapes within a project is preferred due to constructibility as well as aesthetic reasons. This can be a difficult task on projects with variable pier heights and widths. Pier Alternates 1 through 4 are examples of how uniformity within a project can be achieved when pier heights and widths vary. Projects with multiple structural types also introduce design challenges from an aesthetic point of view.

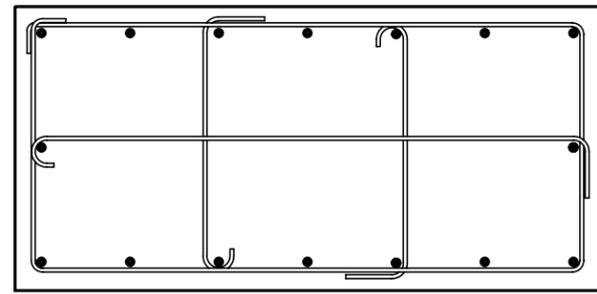
The best approach is to first determine the various substructure arrangements required, then determine the other factors which will affect the selection of the substructure details. Site specific issues also have to be considered. Are the bridges to be viewed at 65 miles per hour or 35 miles per hour. Is there high pedestrian traffic at the site. Are the bridges to be viewed from far away or up close. These are key questions to be asked when determining the detail required in the pier design. Cost effective solutions dictate that the level of detail and aesthetic treatment utilized be commensurate with the site requirements.

Costs associated with pier construction is often related to the Contractor's ability to reuse formwork, reinforcing jigs and utilize assembly line construction techniques. The pier details need to be consistent with this approach when possible. Grouping of piers within a large project is also beneficial.

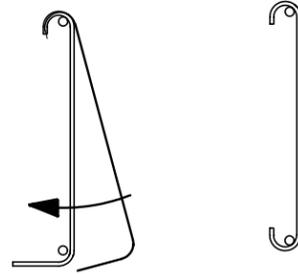
DESIGNERS NOTE: It is generally desirable to make the substructure appear slightly heavier than required and to make the superstructure appear as light and streamlined as possible.



EXAMPLE PIER SHAPES



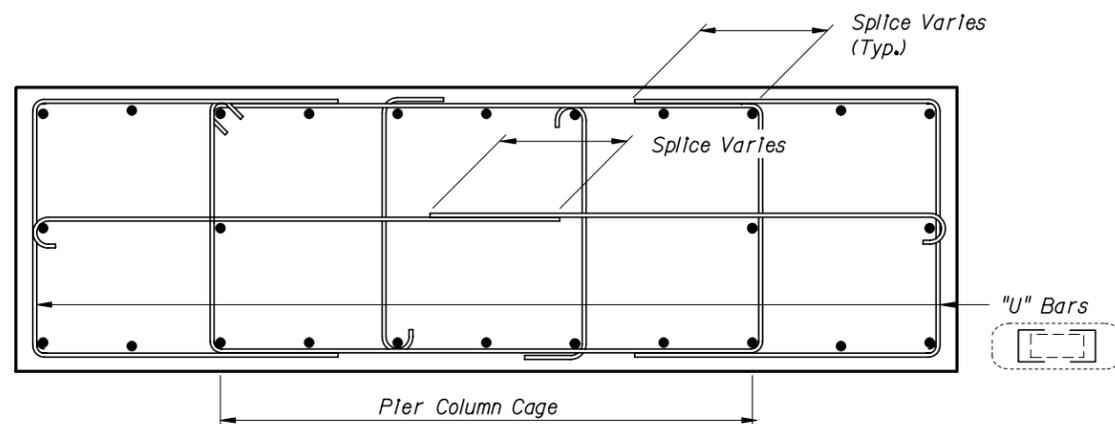
COLUMN CROSS SECTION



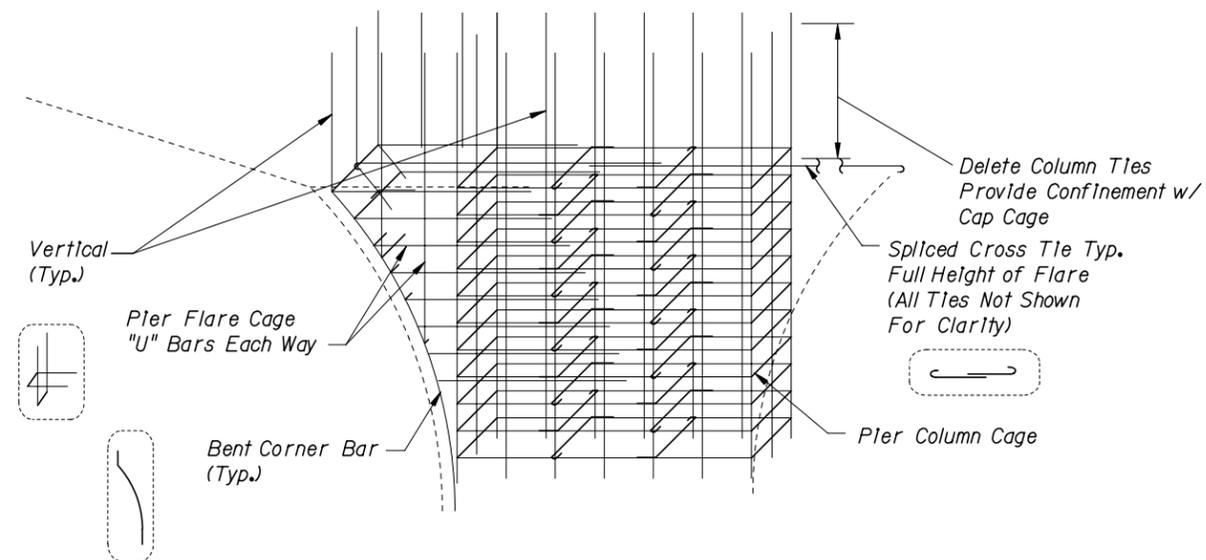
PREFERRED

AVOID

PREFERRED COLUMN TIE DETAIL



COLUMN CROSS SECTION AT FLARE



PARTIAL PICTORIAL VIEW COLUMN CAGE AT FLARE

VARIABLE CONCRETE REINFORCING DETAIL

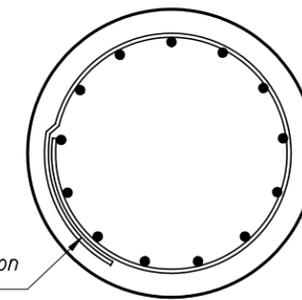
PIER REINFORCING DETAIL:

Column cross-ties with 180-degree hooks at each end of the bar are difficult to place. The preferred method is to have a 90-degree hook at one end. This allows the bar to be rotated into position making fabrication of the column cage easier.

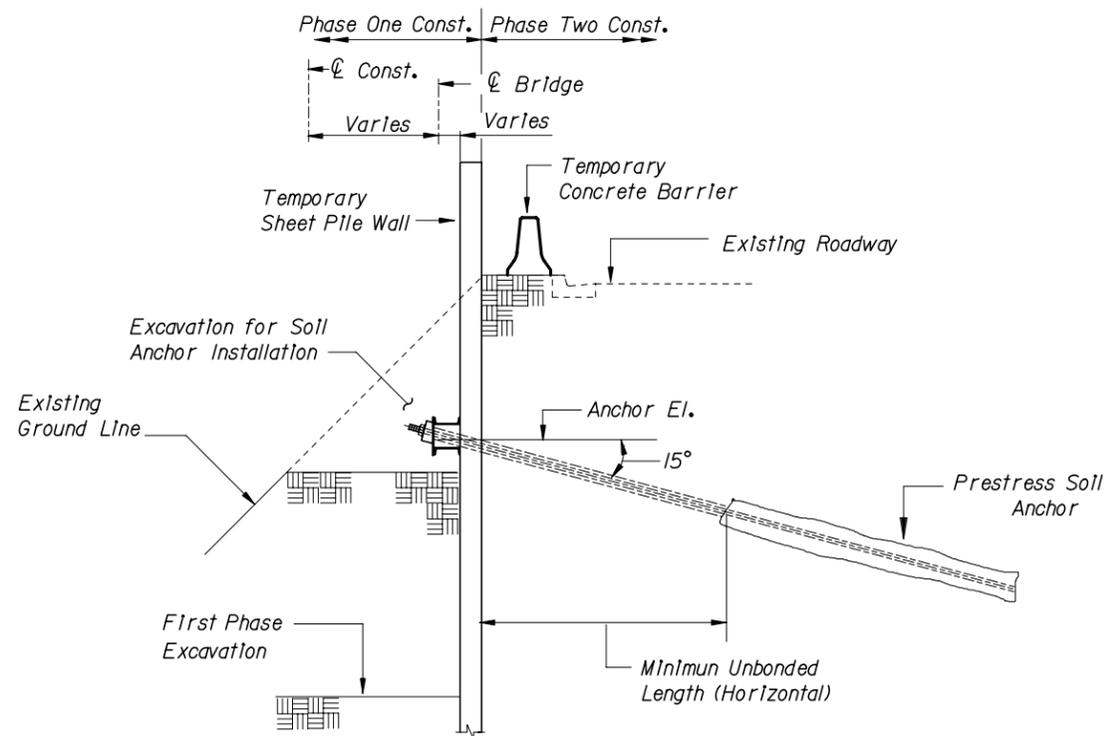
Variable width pier columns are difficult to detail. Consideration should be given to extending the typical pier column cage through the flared section and detailing the flare with "U" bars. Horizontal "U" bars may be detailed with a constant mark by varying laps.

This detail is not appropriate when plastic hinging due to ship impact or high seismic loads are anticipated because the concrete cover may spall making the standard lap of the "U" bars unacceptable.

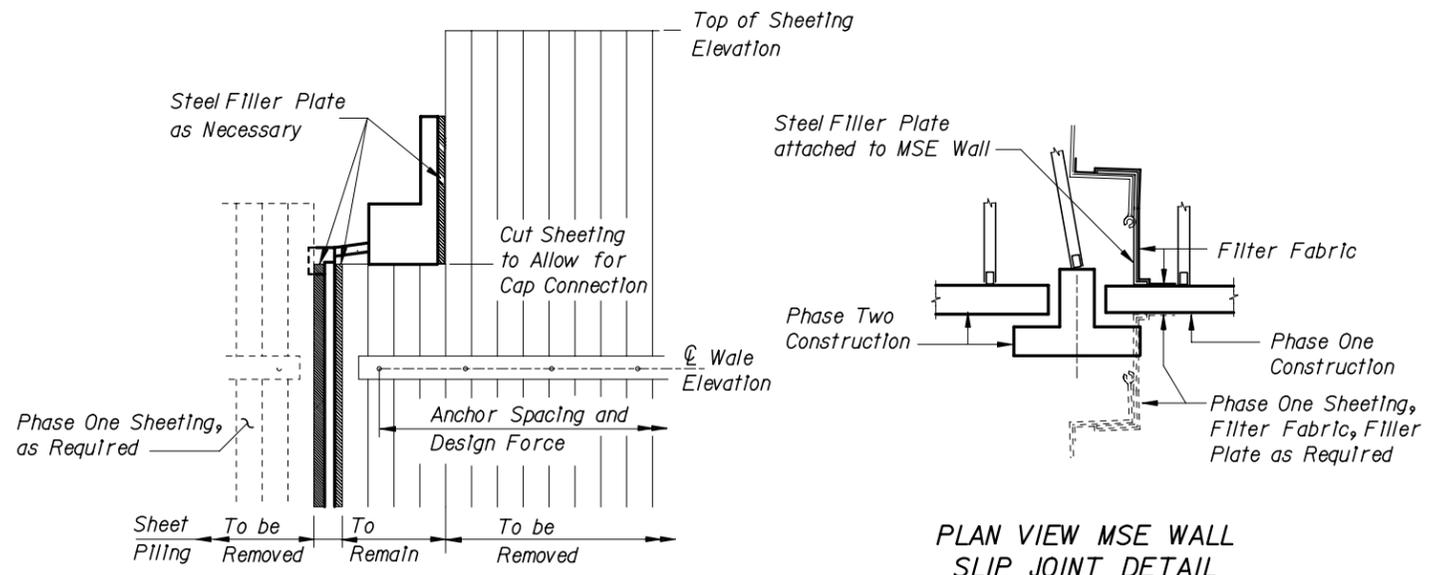
Unless plastic hinging is anticipated, standard hoops may be used on circular columns provided that the ties are rotated so the lap splice location varies throughout the length of the column.



CIRCULAR COLUMN CROSS SECTION

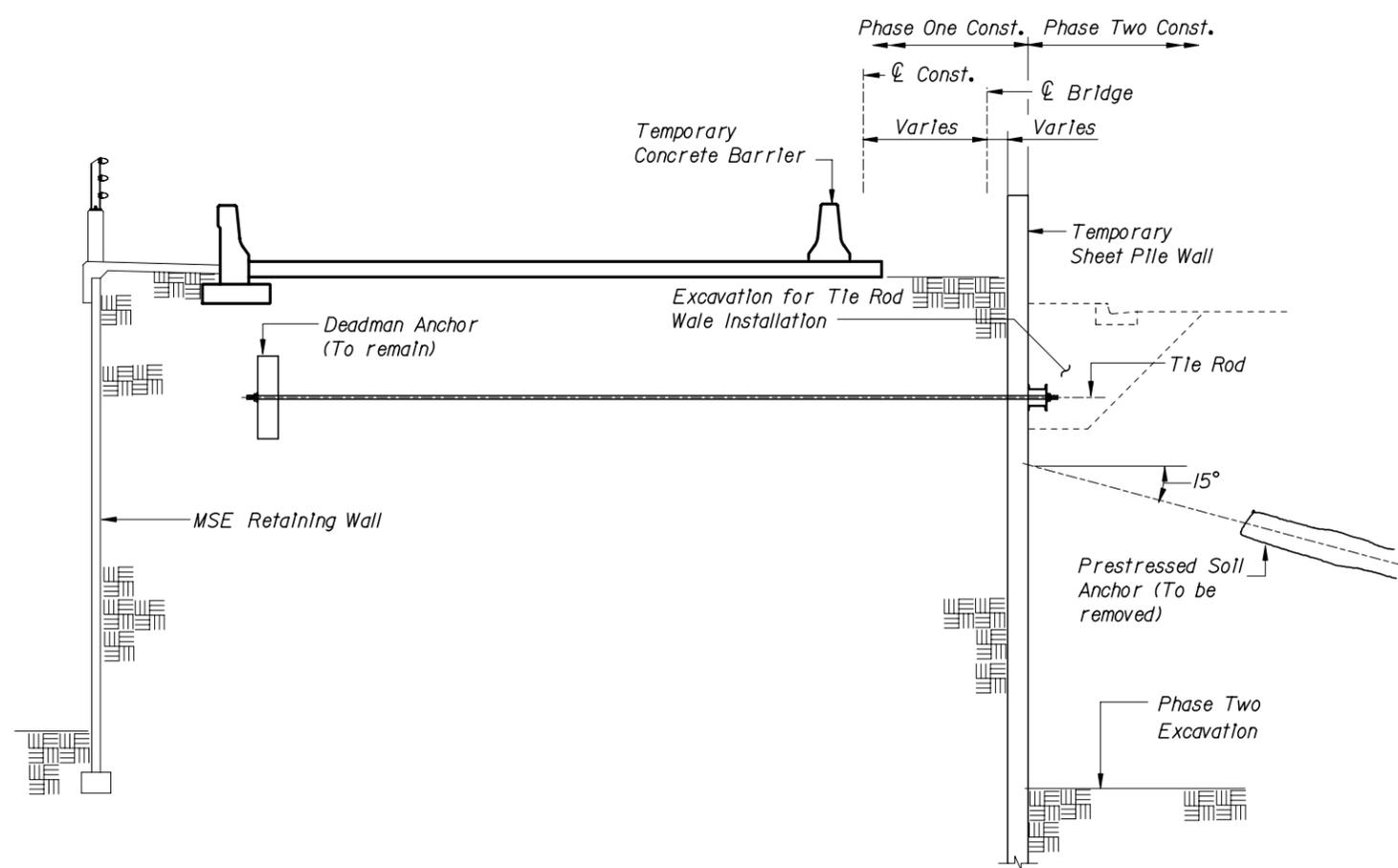


EXCAVATION AND SOIL ANCHOR INSTALLATION FOR PHASE ONE CONSTRUCTION



SECTION THROUGH BRIDGE END BENT PHASE ONE

PLAN VIEW MSE WALL SLIP JOINT DETAIL



COMPLETION OF PHASE ONE CONSTRUCTION AND EXCAVATION FOR PHASE TWO CONSTRUCTION

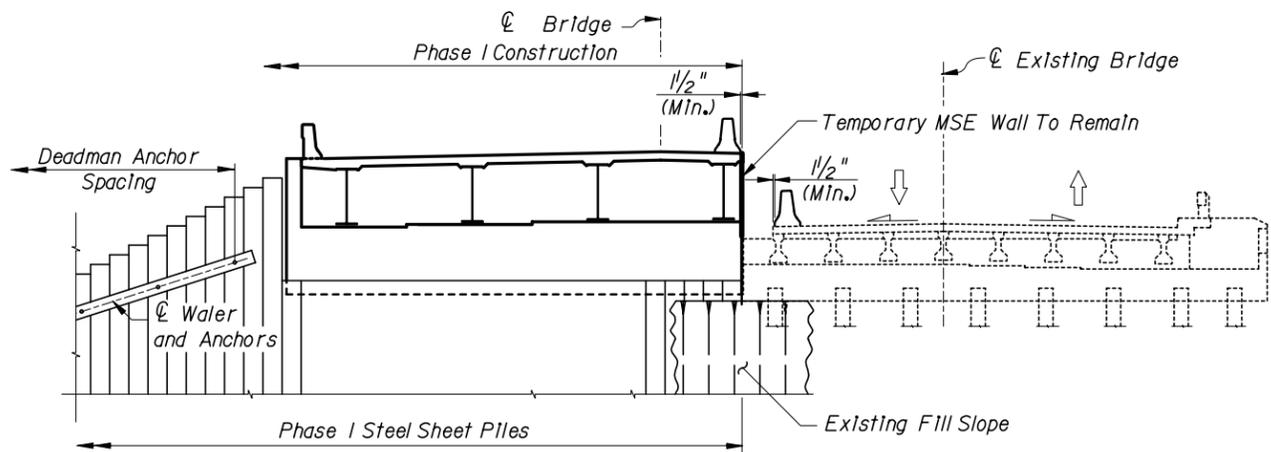
TEMPORARY WALL DETAILS TO FACILITATE PHASED CONSTRUCTION OF MSE WALLS AT BRIDGE ENDS

In many cases, maintaining traffic on bridge replacement project necessitates phasing the bridge construction. This can be especially difficult in cases where MSE walls are being proposed under the new structure. The difficulty arises because the existing fill has to be removed to the leveling pad elevation in the vicinity of the bridge so soil reinforcement can be placed. Also the temporary wall heights usually necessitates an anchored system. The details shown depict soil anchors and dead man anchors for this purpose. Soil nails can also be utilized.

CONSTRUCTION NOTES

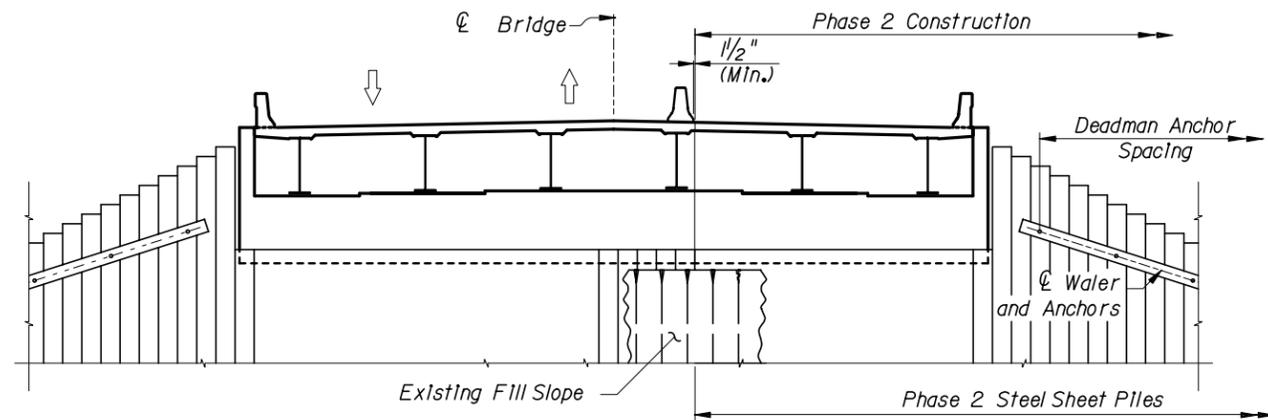
Install Sheet Piling, start sheeting installation at proposed MSE wall interface. Excavate existing fill slope to just below soil anchor wale location. Install and proof test soil anchors. Care should be taken to miss existing bridge piling. Excavate to the leveling pad elevation. Install the phase one MSE wall. Place dead man anchors and rods into MSE soil volume. Cut sheeting to bottom of end bent cap elevation to allow for cap connection. Once the phase one wall and bridge is complete, move traffic onto new structure. Excavate existing fill to the Phase Two leveling pad elevation. Install phase two MSE wall. Once wall construction proceeds to the deadman anchor elevation, remove wale and cut anchor. Complete phase two MSE Wall construction. Remove all temporary sheet piling except that the sheeting located directly under the end bent cap should remain.

1/27/2005 1:47:58 PM \$KUSTN\MACH\H456\computer\support\StructuresSoftware\StructuresManual\2005-Jan\Graphics\PreferredDetails\Details\stwalltemp.dgn



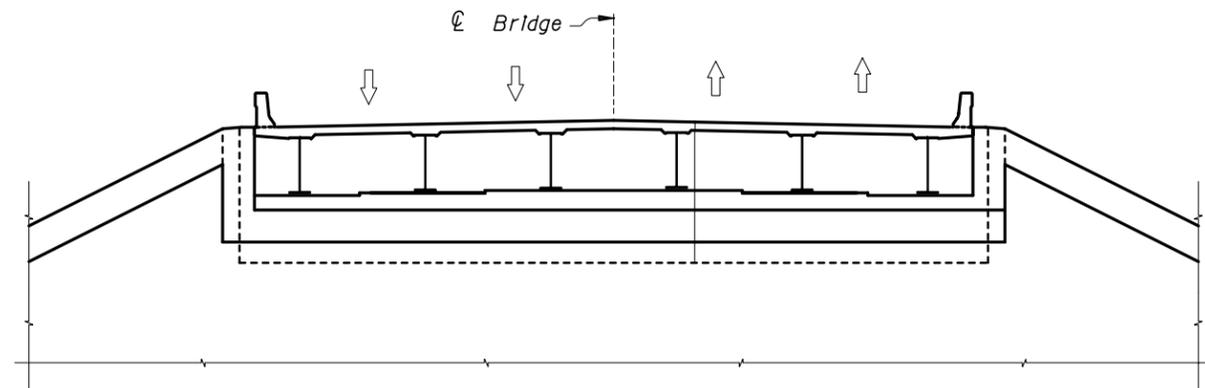
PHASE I CONSTRUCTION

1. Drive Prestressed Concrete End Bent Piles.
2. Drive Steel Sheet Piles and construct Deadman Anchors.
3. Construct Phase I portion of new Bridge and Approach Slabs and place approach fill material and temporary MSE wall.



PHASE 2 COSTRUCTION

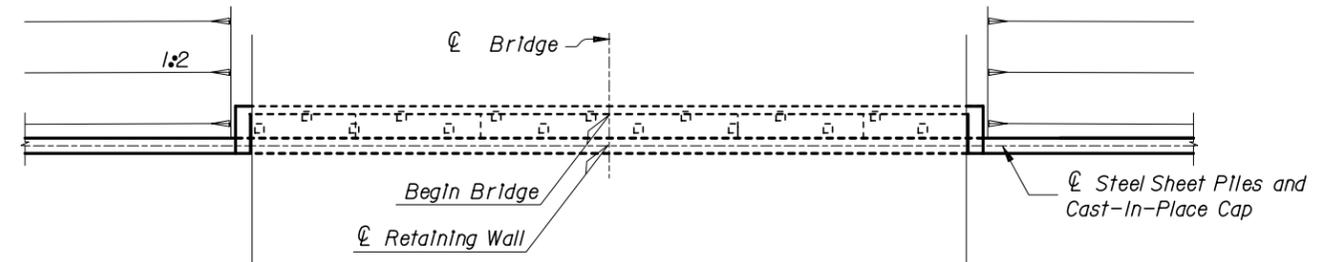
1. Move traffic onto Phase I Bridge and remove existing bridge.
2. Drive Prestressed Concrete End Bent Piles.
3. Drive Steel Sheet Piles and construct Deadman Anchors.
4. Construct Phase 2 portion of new Bridge and Approach Slabs and place approach fill material.



PHASE 3 CONSTRUCTION

1. Excavate fill slope.
2. Attach shear studs to steel sheet pile wall, and construct concrete facing and cap.

CONSTRUCTION SEQUENCE



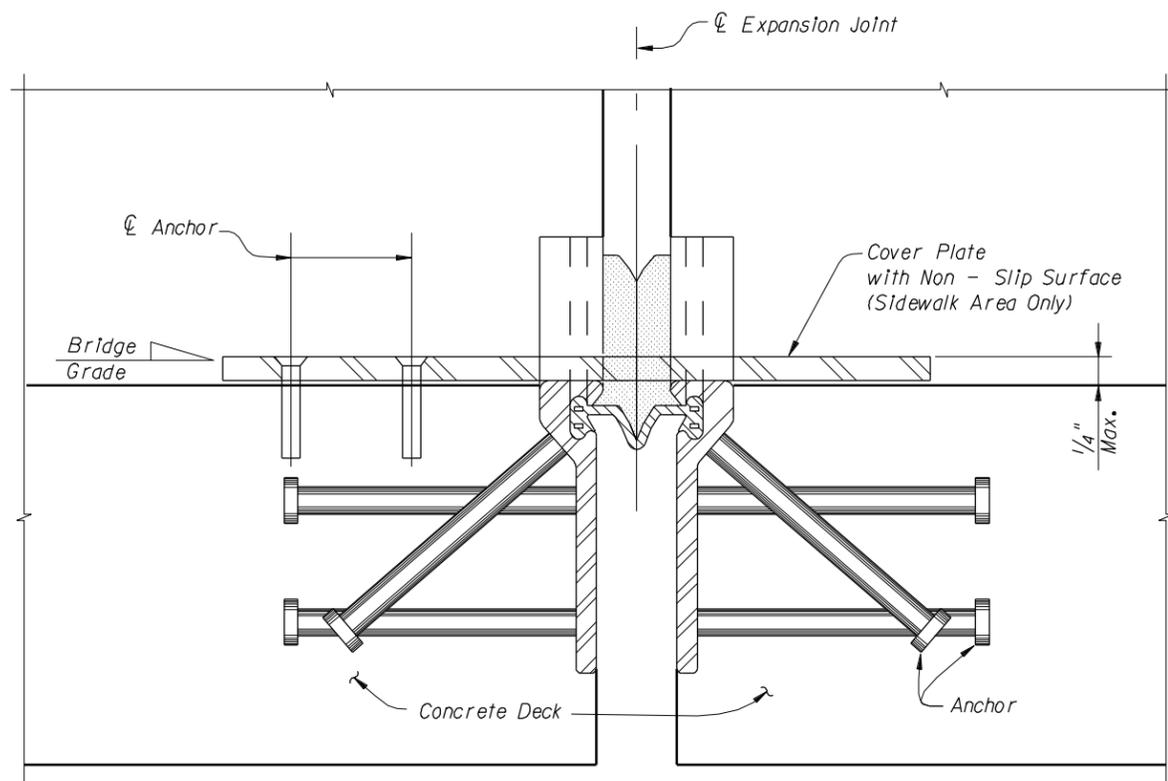
PLAN VIEW

STEEL SHEET PILE WALL WITH CIP FACING AT BRIDGE ENDS

On bridge replacement projects that require phase construction, a permanent steel sheet pile wall with a cast-in-place concrete facing may be a cost effective solution when walls are required at bridge ends, but where wrap around walls are not necessary.

Under these conditions, MSE walls may more costly to construct because of the difficulty in placing straps. Anchored temporary walls using grouted soil anchors and deadmen anchors are normally required because of the grade separations involved.

DETAIL NAME:	SHEET NO.
SHEET PILE WALL WITH CIP FACING	S-38



SECTION THRU STRIP SEAL EXPANSION JOINT
WITHIN LIMITS OF SIDEWALK
(POURED JOINT SIMILAR)

COVER PLATE NOTES

1. Cover plates are required at all bridge expansion joints for the full width of the sidewalk.
2. The cover plate must be capable of accommodating the anticipated expansion joint opening and operating ranges.

See Design Standards 21100 AND 21110.

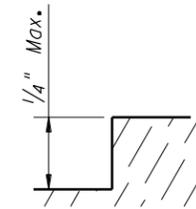
AMERICANS WITH DISABILITIES ACT:

Bridge and bridge approach sidewalk surfaces shall conform to the Americans with Disabilities Act (ADA) and Florida Accessibility Code

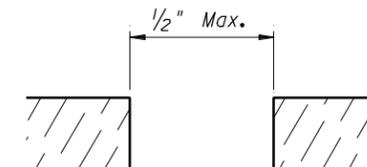
Special attention is required when:

- Bridge or bridge approach grades are greater than 5%.
- Drainage grates or scuppers are placed within the limits of the sidewalk.
- Expansion Joints are placed within the limits of the sidewalk.
- Sidewalk cross slopes exceed 2%.

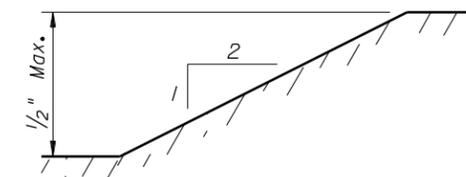
In cases where grades greater than 5%, ramps and landing shall be provided. See the ADA Requirements (3 of 5) and (4 and 5) for details. In some cases drainage within the sidewalk limits can be minimized or eliminated by addressing the roadway drainage separately and by carrying the sidewalk drainage to the end of bridge or to the touch-down point. Cover plates are required on all expansion joints with openings greater than 1/2". A strip-seal and modular joint example is shown on ADA Requirement (1 of 5) and (2 of 5), respectively. See ADA Requirement (5 of 5) for example showing how structures with sidewalks and cross slopes greater than 2% can be detailed.



VERTICAL STEP



EXPANSION JOINT OR
GRATING OPENINGS



TAPERED STEP

SIDEWALK SURFACES

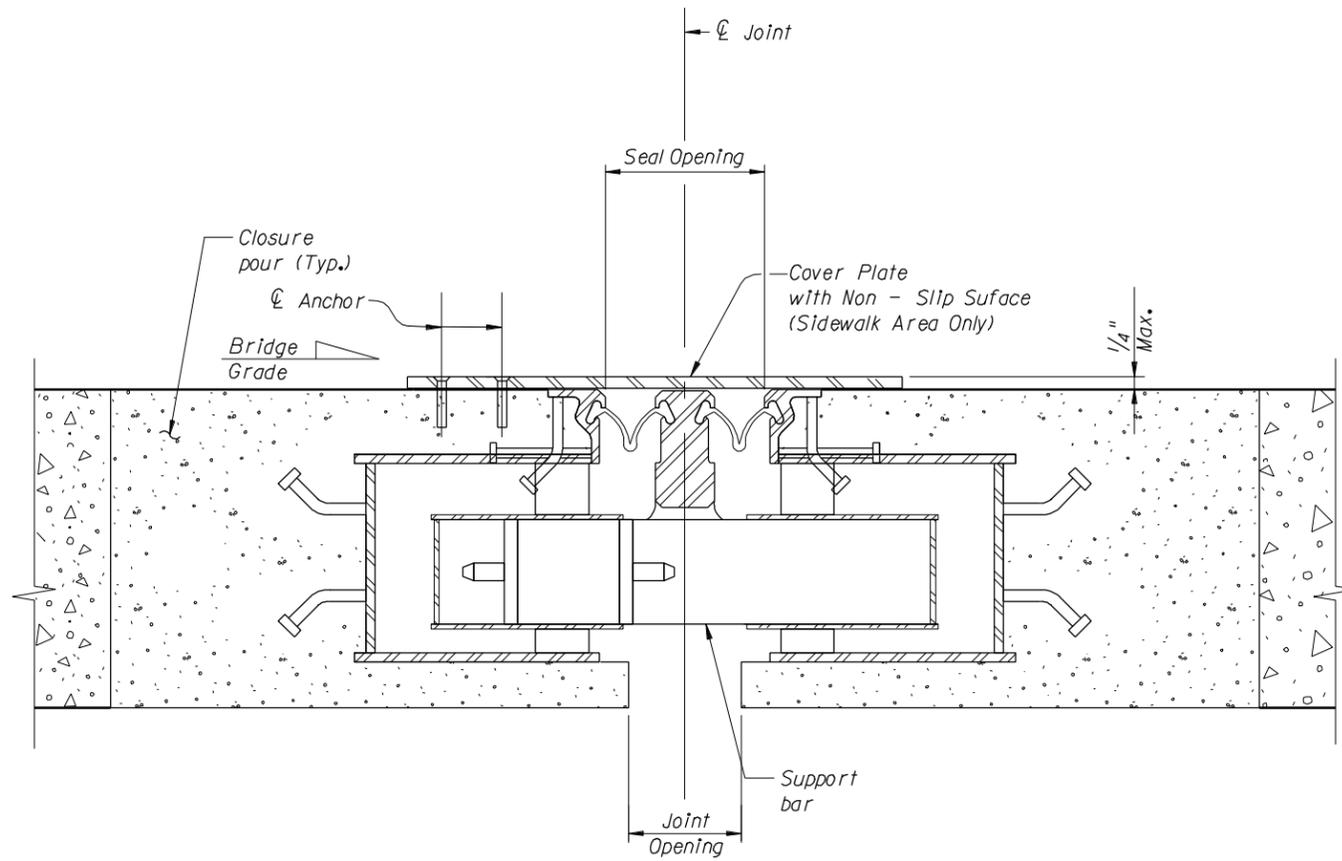
Sidewalk surfaces shall be firm, stable and slip-resistant.

Expansion joint openings or openings in drainage grates or scuppers shall not exceed 1/2".

Vertical changes in surface shall be as follows:

- Abrupt Vertical Steps shall not exceed 1/4"
- Tapered Steps shall not exceed 1/2" with a 1:2 tapered slope.
- Vertical changes from level greater than 1/2" shall have slopes not greater than 1:12 slope with landings placed at every 2'-6" of vertical rise.

ADA SURFACE REQUIREMENTS

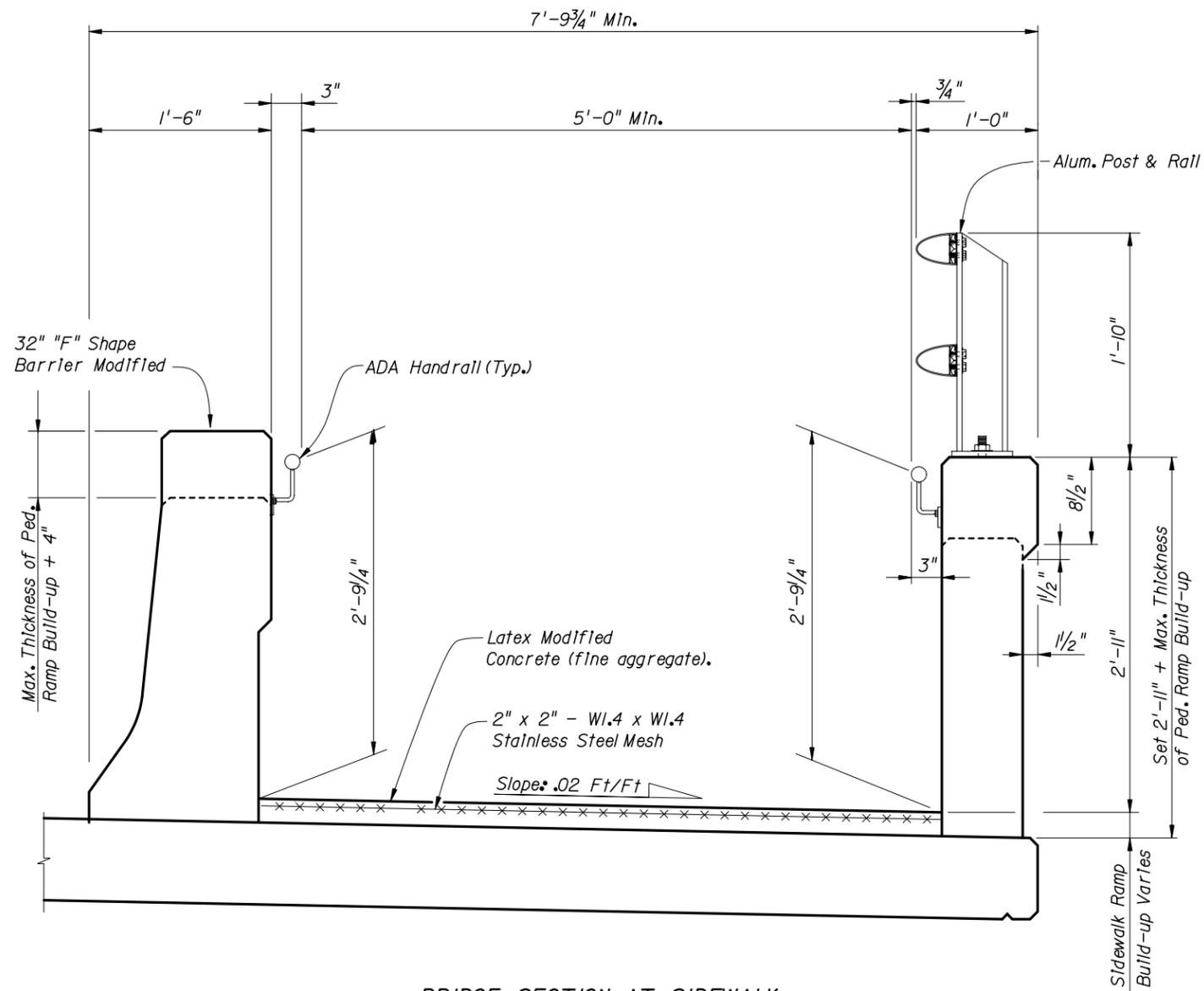


SECTION THRU EXPANSION JOINT
WITHIN LIMITS OF SIDEWALK

COVER PLATE NOTES

1. Cover plates are required at all bridge expansion joints for the full width of the sidewalk.
2. The cover plate must be capable of accommodating the anticipated expansion joint opening and operating ranges.

See Design Standards 21100 for
Cover Plate requirements and details.



BRIDGE SECTION AT SIDEWALK WITH 32" "F" SHAPE BARRIER (MODIFIED)

SIDEWALK RAMP BUILD-UP NOTES

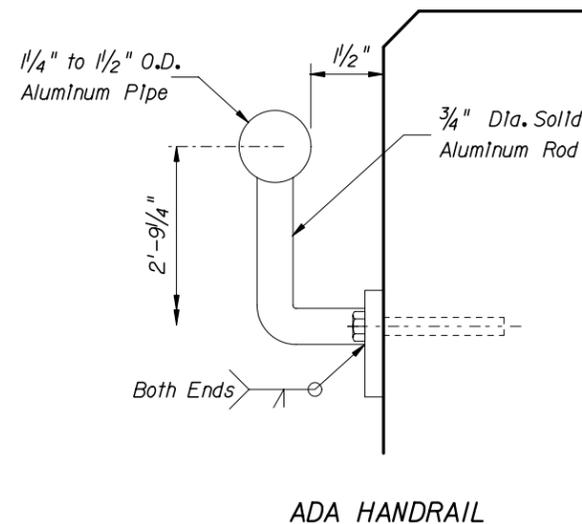
1. Sand-blast or water-blast deck surface within limits of the sidewalk.
2. Remove all loose concrete and laitance in accordance with the manufacturer's recommendations.
3. Apply an approved epoxy bonding agent to the exposed concrete surface.
4. Overlay with latex modified concrete to the dimensions indicated for the special pedestrian ramp and landings.
5. Finish deck surface in accordance with Section 522.

RAMPS

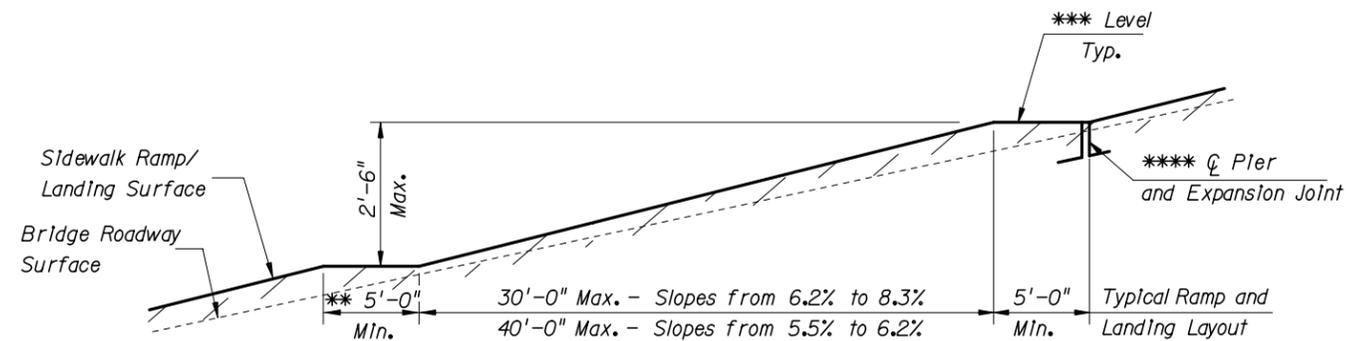
ADA ramps, landings and ADA handrails shall be provided within the sidewalk limits where bridge and bridge approaches have grades greater than 5%.

ADA handrails are required on both sides of the sidewalk in areas where ramps are required. The ADA handrails shall be placed a constant distance from the landing/ramp surface. It is aesthetically desirable to maintain a constant height pedestrian/roadway barrier for the full bridge length. The height of the pedestrian/roadway barrier should be sufficient to hide the ADA handrail.

A minimum clear distance of 5'-0" between ADA handrails shall be provided.

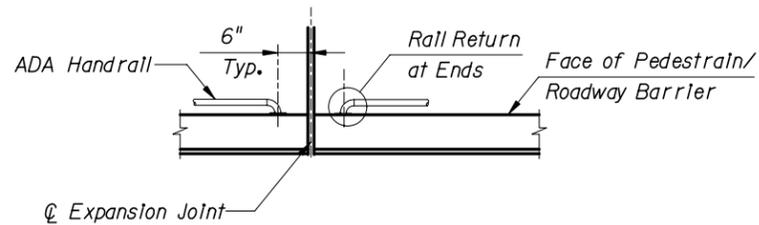


ADA HANDRAIL

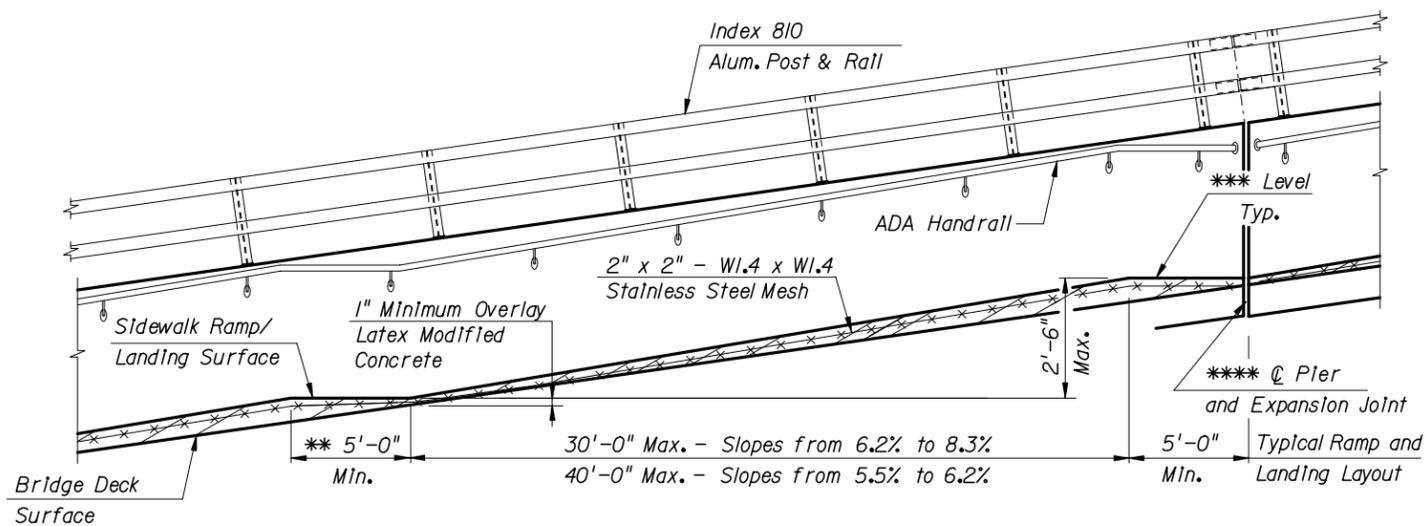


RAMPS - MAXIMUM SLOPES AND LANDING SPACING AND DIMENSIONS

- ** 6'-0" Minimum at Bottom Landing
- *** 2% or Less Slope.
- **** Vary the ramp and landing dimensions as required so that expansion joint locations are at the points of minimum build-up to simplify detailing.



PLAN VIEW AT ENDS



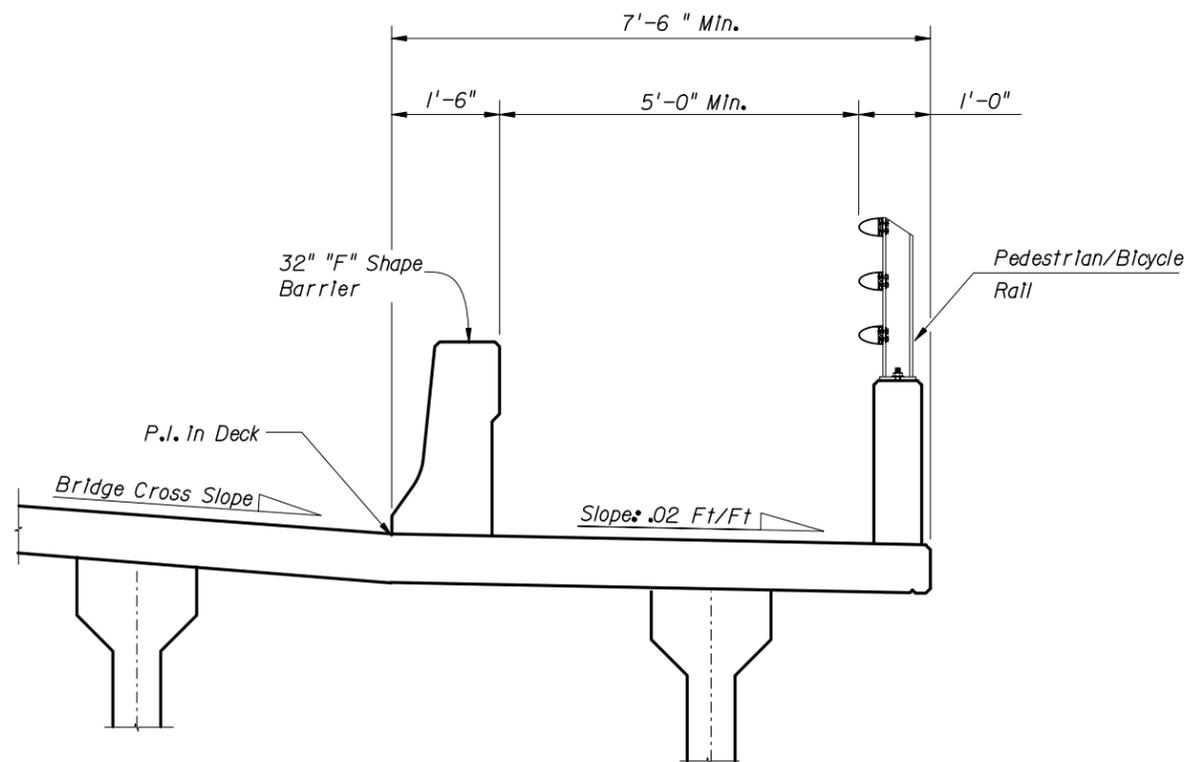
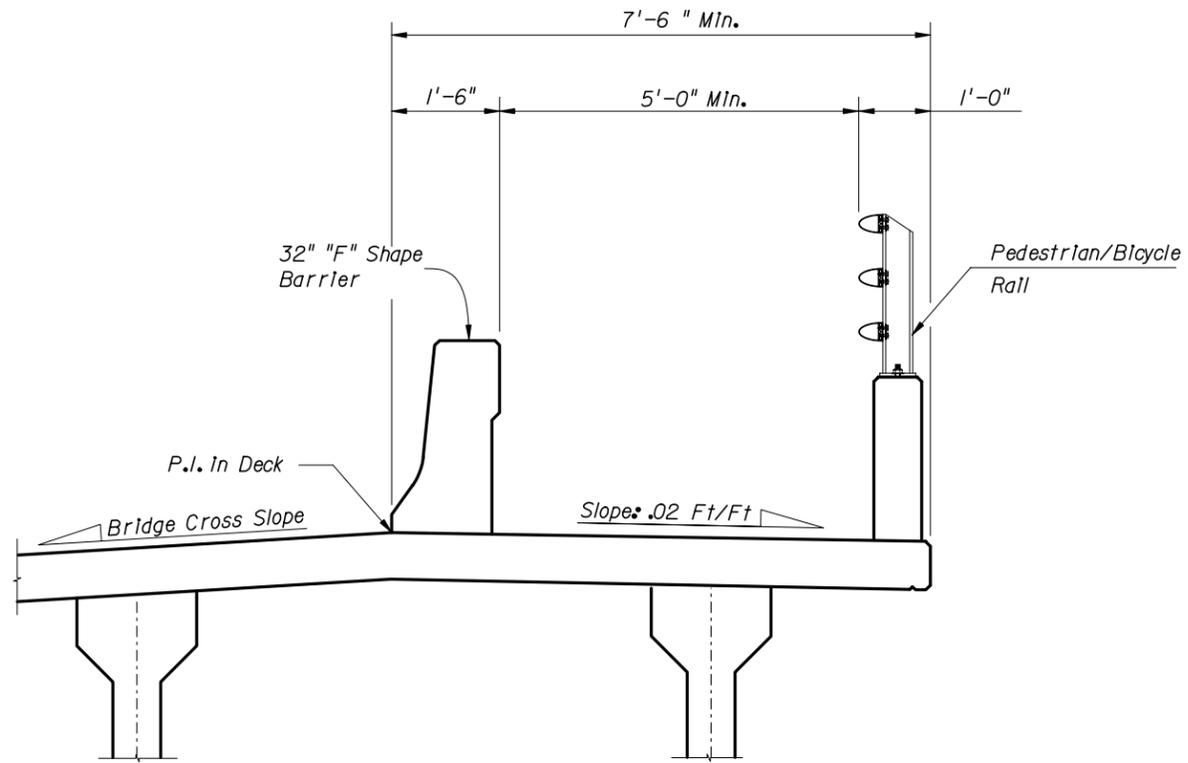
RAMPS - MAXIMUM SLOPES AND LANDING SPACING AND DIMENSIONS

- ** 6'-0" Minimum at Bottom Landing
- *** 2% or Less Slope.
- **** Vary the ramp and landing dimensions as required so that expansion joint locations are at the points of minimum build-up to simplify detailing.

ALUMINUM ADA HANDRAIL NOTES

1. Payment for the ADA handrail shall be per pay Item 515-1-2 which includes the furnishing and installation of the grab rails, rail splice assemblies, wall brackets, wall returns, anchor bolts, nuts, washers, screws, resilient pads and all incidental materials and labor required to complete the installation on the bridge and roadway barriers.
2. Structural requirements: ADA handrails, assemblies, wall brackets and attachments shall withstand a minimum uniform load of 250 pounds per foot applied vertically down and horizontally, but not simultaneously on the top of the rail. The contract shall provide the manufacturer's engineering design of the rail system, its components, bracket spacing and mechanical fasteners. - See submittals (below).
3. Regulatory requirements: The rail system, its components and installation shall be in compliance with the current ADA Standards For Accessible Design and all applicable state and local authorities.
4. Submittals: The Contractor shall submit the following for the Engineer's approval prior to fabrication.
 - a. Shop drawings with complete details including rail, bracket and expansion joint locations. Indicate component details, materials, finishes, connections and joining methods, and the relationship to adjoining work.
 - b. Summary of the materials proposed for the rail system, including mill analysis with certification by the producer that the parts are of the alloys specified and meet the specifications called for. - Per Section 965-2 of the specifications.
 - c. The manufacturer's engineering design and data for the rail system and components signed and sealed by a Professional Engineer registered in the state of Florida.
 - d. The manufacturer's installation instructions and product data.
5. Materials and finishes:
 - a. Rails and splice assemblies - extruded aluminum pipe. Alloy 6063-T52 meeting ASTM B 221. Rails shall be schedule 40 with a nominal size of 1-1/2 inches (1.900 inches outside diameter), and a 0.145 inch minimum wall thickness, with a clear anodized finish.
 - b. Wall brackets - extruded aluminum alloy 6063-T52 meeting ASTM B 221, with a clear anodized finish.
 - c. Mechanical fasteners shall be of the type and size required per the manufacturer's specification and design calculations.
 1. Anchor bolts for the brackets shall be in accordance with ASTM A36 or ASTM F1554, Grade 36. Anchor bolts, nuts and washers shall not be hot dip galvanized in accordance with Section 962 of the specifications.
 2. Fasteners and washers used at the rail splice assemblies and to mount the rails to the brackets shall be stainless steel, ASTM F-593, Alloy Group 2 (326).
6. Welding: Welding of aluminum components shall be in accordance with ANSI/AWS D1.2 "Structures Welding Code - Aluminum".
7. Installation:
 - a. Install in accordance with the approved shop drawings and manufacturer's instructions.
 - b. Erect rails parallel to and 2'-10" above the top of pedestrian ramp as indicated in these plans.
 - c. Wall brackets shall be set normal to the pedestrian ramp profile longitudinally. Wall brackets shall be seated on 1/8" thick resilient pads in accordance with Section 932 of the specifications. The dimensions of the resilient pads shall be the same as the wall bracket.
 - d. Rails shall be continuous over a minimum of 3 wall brackets. Splices shall be spaced at 40'-0" centers maximum. Locate the center of a splice near the edge wall brackets.
 - e. After installation is completed, wash all rail components thoroughly with clean water and soap; rinse with clean water. Do not use acid solution, steel wool or other harsh abrasives. If stain remains after washing, remove finish and restore in accordance with NAAMM metal finishes manual.

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BRIDGE SECTION AT SIDEWALK WITH BRIDGE CROSS SLOPE GREATER THAN 2%

ADA REQUIREMENTS FOR BRIDGES WITH CROSS SLOPE GREATER THAN 2%

Sidewalk cross slopes on bridges shall not exceed 2%.

Maintaining the same cross slope throughout the width of the bridge is generally desirable to simplify deck screeding. Maintain a constant cross slope and provide a latex modified concrete overlay as required to meet the 2% cross slope criteria. Depending on bridge cross slopes and sidewalk widths, the overlay may be too thick. In these cases, it is recommended that a change in deck cross slope (P.I.) be provided at the gutter line.

The sidewalk may slope to the outside or inside as long as the slope is 0.02 or less and as long as the drainage can be handled appropriately.

