Chapter 03 - Superstructure

SECTION 05

STRUCTURAL STEEL
(SUP-SS)
Chapter 03 - Superstructure

Section 05 – Structural Steel

SUB-SECTION 01

GENERAL

(SUP-SS(GEN))
In no case shall cover be less than 2\(\frac{1}{2}\)" (Typ).

Embedment shall be as deep as possible but shall not be less than 3\(\frac{1}{2}\)" for wood formed slabs and 3" for Steel Forms Which Remain in Place.

Bottom of slab for wood formed slabs or top of Steel Forms Which Remain in Place.

Notes:
1. For number of studs per row, and longitudinal spacing of rows see pertinent Superstructure sheets.
2. For flange widths less than 11", only two rows of studs are to be used.
3. Steel Forms Which Remain in Place not shown.
Notes:
1. Minimum stiffener thickness 1/2''.
2. On exterior girders place all intermediate stiffeners on inside of girder.
3. When longitudinal stiffeners are required, place all longitudinal stiffeners on one side of web, place transverse stiffeners on opposite side.
4. Minimum fillet weld is 3/16''.
1. Minimum stiffener thickness 1/2", on exterior girders place all intermediate stiffeners on inside of girder.
2. When longitudinal stiffeners are required, place all longitudinal stiffeners on one side of web, place transverse stiffeners on opposite side.
3. Minimum fillet weld is 3/8".

Notes:

STIFFENER ATTACHMENT DETAILS
WITH OPTIONAL RADIUS CLIPS FOR STEEL GIRDERS

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SUPERSTRUCTURE STEEL
Fascia Stringer Concrete Diaphragm with Additional Stringers adjacent thereto

AT PIERS (WHERE STRINGER IS CONTINUOUS OVER SUPPORT)

AT PIERS (WHERE STRINGER IS NOT CONTINUOUS OVER SUPPORT) AND AT ABUTMENTS

<table>
<thead>
<tr>
<th>Location</th>
<th>W Stiffener Width</th>
<th>Stiffener Thickness</th>
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Optional Seat Plate Detail

Optional 1/4" plate
Concrex Slab Cantilevered
Fascia Stringer

Concrete Diaphragm with
Additional Stringers adjacent thereto

See Detail A below

See Optional Plate Detail below

Mill to Bear
Prior to Welding
Both Sides

Bearing Shoe

AT PIERS
(WHERE STRINGER IS
CONTINUOUS OVER SUPPORT)

Scale: 1/2" = 1'-0"

Mill to Bear
Prior to Welding
Both Sides

See Detail A below

Graduate Stringer

See Optional Plate Detail below

Mill to Bear
Prior to Welding
Both Sides

Scale: 1/2" = 1'-0"

Location | W= Stiffener Width | Stiffener Thickness
---|---|---
Abutment | | |
Pier | | |
Pier | | |
Pier | | |
Abutment | | |

Detail A
Scale: 1/2" = 1'-0"

Optional Seat Plate Detail

Optional 3/16" Plate

Bearing Stiffeners for Rolled Steel Beams
Optional Radius Clip
Notes:
1. For all stiffeners (intermediate or bearing)
   top and bottom, including connection plate for channel diaphragms for all 
girders and rolled beams.
2. Welding to flange as per this detail will only be required where plans or 
other detail sheets indicate stiffener is extended and welded to flange.

1.0
PLAN VIEW OF STRINGER BELOW TOP FLANGE

Scale: 1" = 1'-0"

Notes:
1. Contractor has the option of using seat plates or seat angles, only one type shall be used per bridge.
2. Concrete diaphragm not shown.

* Seat plate width shall be increased as necessary so that plate exceeds stiffener width by at least 1/2".
**PLAN VIEW OF STRINGER BELOW TOP FLANGE**

Scale: $\frac{1}{2''} = 1' - 0''$

* Longest leg of angle shall be increased as necessary so that angle exceeds stiffener width by at least $\frac{1}{2''}$. If angle size is not available to satisfy this requirement, stiffener shall be tapered at end to meet this requirement.

Note:
Concrete diaphragm not shown.
1. All bolts to be 7/8" High Strength Bolts (5/8" open holes). 
   ASTM A 325 unless 1" High Strength Bolts are required 
   by design (5/8" open holes). Bolts to be used when 
   weathering structural steel is called for 
   shall be ASTM A 325, Type 3.

2. All splice plates to be a minimum 1/2" thick.

3. If flange widths of adjacent stringers 
   vary more than 2", then larger flange 
   shall be tapered to smaller flange width 
   in a distance of 1/2" length of cover 
   plate. This only applies to bottom flange.

4. Bolts not shown in splice.

5. Bolt heads shall be on the exterior face 
   of the fascia stringer and the bottom 
   of the fascia stringer.

Notes:

- See Note 3 below.
- Filler P (where required, 1/6" minimum thickness).
- If filler is greater than 1/4", the need for extension of 
  filler and/or additional fasteners must be evaluated 
  as per AASHTO requirements.

For composite stringers add note: "Space studs to 
miss splice bolts."
PLAN OF STRAIGHT TAPERED TRANSITION FLANGE SPLICE
Scale: None

PLAN OF RADIAL TRANSITION FLANGE SPLICE
Scale: None

Notes:
1. Butt welds of flange splice plates to be ground flush prior to attaching web plates.
2. Splice shown is for different width and different thickness flanges; if only one variation is present use pertinent portion of detail.
3. Fabricator may use either of the above transition details.
ELEVATION OF GIRDER

Scale: None

B-L2c-S for plates over 1/2" thick.

B-L1a-S for plates 1/2" thick or less.

Stiffener Plate

1'-0" Min. 6" Min. Web Splice

6" Min. 1'-0" Min.

Flange Splice

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SHOP SPlice DETAILS FOR
PLATE GIRDER STRINGERS

DETAIL NO. SUP-SSIGENI-401 SHEET 2 OF 2
Chapter 03 - Superstructure

Section 05 – Structural Steel

SUB-SECTION 02
CROSS FRAMES
(SUP-SS(CF))
This detail to be used when connection plate extend beyond edge of flange.

2-7/8" Erection Bolts in each connection to remain in place after welding.

Diaphragm level

Notes:
Angle clip shown; optional radius clip acceptable.

ELEVATION
Scale: None

T-JOINT WELD DETAIL FOR
SKEW ANGLE OVER 70° TO 90°
Scale: None

T-JOINT WELD DETAIL FOR
SKEW ANGLE 70° OR LESS
Scale: None

DIAPHRAGM SPACING
70° OR LESS SKEW
Scale: None

VIEW A
Scale: None

Notes:
1. Slant lettering indicates note "For Office Use Only".
2. Where the angle between the center line of roadway and the center line of bearing is 70° or less place diaphragms at 90 to the stringers, diaphragms shall be spaced as shown in detail this sheet and as noted below.
3. Where aforementioned angle is greater than 70°, the diaphragms shall be parallel to the center line of bearing of the stringers.
4. Space intermediate diaphragms at 20' to 25' for spans, (Non-curved bridges only).
5. All diaphragms are to be completely connected to stringers before deck slab is poured.
T-JOINT WELD DETAIL FOR
SKEW ANGLE OVER 70° TO 90°

Scale: None

Notes:
1. For notes and all details not shown see sheet 1 of 2.
2. Contractor has option to use either welded or bolted connection. However only one type of connection may be used per bridge.
3. All bolts to be ½" ASTM A325.
4. All bolts holes to be ⅝".
5. Bolt spacing applies regardless of skew.

ELEVATIONS
Scale: ½" = 1'-0"

Note: Dimensions shown are for 90° connections.

VIEW 'A'
Scale: None

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ROLLED STEEL BEAMS
INTERMEDIATE DIAPHRAGM DETAILS
BOLTED CONNECTIONS

DETAIL NO. SUP-SS(1C)-101 SHEET 2 OF 2
Note to Designer:
The skew angle shown is the compliment of the skew angle as defined in AASHTO Section 6.7.4.

FOR OFFICE USE ONLY

Note:
All cross frames are to be placed normal to girders or to the girder tangent and shall be continuous lines.

CROSS FRAMING PLAN
SKEW ANGLE IS LESS THAN 70°
Note to Designer:
The skew angle shown is the compliment of the skew angle as defined in AASHTO Section 6.7.4.

TANGENT FRAMING PLAN
Scale: None

Note:
All cross frames are to be placed parallel to abutments and pier in a continuous line.
For curved girders with radial supports cross frames shall be in continuous lines normal to girder tangents.

CURVED FRAMING PLAN
Scale: None

Note:
Skew angle is greater than or equal to 70°.
Or radial supports.
Notes:
1. Intermediate cross frames on curved girders shall be designed as main members.
2. Intermediate cross frames shall be placed as follows:
   - Curved Girders: Cross Frames shall be placed radially, and shall extend to intersection of \( \theta \) bearing and \( \theta \) girder at supports, wherever possible.
   - Additional diaphragms shall be provided at all support areas.
   - Straight Girders: Where the skew angle between the center line of roadway and center line of bearing is \( 70^\circ \) or less, place cross frames at \( 90^\circ \) to the girders. Where aforementioned angle is greater than \( 70^\circ \), the cross frames shall be parallel to the center line of bearing of the girders.
3. Maximum interior cross frame spacing shall be 25 feet.
4. The smallest angle used for bracing shall be \( 3\frac{1}{2} \times 3\frac{1}{2} \times \frac{3}{8} \) inches.
5. Weld sizes and number of \( \frac{1}{8} \) "ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is \( \frac{3}{8} \) in.
6. All cross frames are to be completely bolted and torqued before deck slab is poured.

When bearing stiffeners are greater in width than outside edge of flange miter stiffener.

Centroid of Angle. Set angles so centroids intersect at \( \psi \) of web, wherever possible.

* To match size of gusset plate.

When bearing stiffeners are parallel to outside edge of flange miter stiffener.

* To match size of gusset plate.

Intermediate cross frames on curved girders shall be designed as main members.

Intermediate cross frames shall be placed as follows:
- Curved Girders: Cross Frames shall be placed radially, and shall extend to intersection of \( \theta \) bearing and \( \theta \) girder at supports, wherever possible.
- Additional diaphragms shall be provided at all support areas.
- Straight Girders: Where the skew angle between the center line of roadway and center line of bearing is \( 70^\circ \) or less, place cross frames at \( 90^\circ \) to the girders. Where aforementioned angle is greater than \( 70^\circ \), the cross frames shall be parallel to the center line of bearing of the girders.

Maximum interior cross frame spacing shall be 25 feet.

The smallest angle used for bracing shall be \( 3\frac{1}{2} \times 3\frac{1}{2} \times \frac{3}{8} \) inches.

Weld sizes and number of \( \frac{1}{8} \) "ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is \( \frac{3}{8} \) in.

All cross frames are to be completely bolted and torqued before deck slab is poured.
Intermediate cross frames shall be designed as main members.

1. Intermediate cross frames on curved girders shall be placed as follows:
   - Curved Girders: Cross Frames shall be placed radially, and shall extend to the intersection of % of bearing and % of girder at supports, wherever possible.
   - Straight Girders: Where the skew angle between the center line of roadway and center line of bearing is 70° or less, place cross frames at 90° to the girders. Where aforementioned angle is greater than 70°, the cross frames shall be parallel to the center line of bearing of the girders.

2. Maximum interior cross frame spacing shall be 25 feet.

3. All cross frames are to be completely bolted and torqued before deck slab is poured.

4. The smallest angle used for bracing shall be $\frac{3}{2} \times \frac{3}{2} \times \frac{3}{5}$ inches

5. Weld sizes and number of % ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is 3/16 in.

6. All cross frames shall be perpendicular to web of girder.

Bolted Connection

See Note 5.

Stiffener and/or connection plates to be perpendicular to web of girder (Typ.)

Centroid of Angle

Set angles so centroids intersect at % of web, wherever possible.

When bearing stiffeners are greater in width than outside edge of flange miter stiffener.

* To match size of gusset plate.

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**Notes:**

1. Intermediate cross frames shall be designed as main members.

2. Intermediate cross frames shall be placed as follows:
   - Curved Girders: Cross Frames shall be placed radially, and shall extend to the intersection of % of bearing and % of girder at supports, wherever possible.
   - Straight Girders: Where the skew angle between the center line of roadway and center line of bearing is 70° or less, place cross frames at 90° to the girders. Where aforementioned angle is greater than 70°, the cross frames shall be parallel to the center line of bearing of the girders.

3. Maximum interior cross frame spacing shall be 25 feet.

4. The smallest angle used for bracing shall be $\frac{3}{2} \times \frac{3}{2} \times \frac{3}{5}$ inches.

5. Weld sizes and number of % ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is 3/16 in.

6. All cross frames are to be completely bolted and torqued before deck slab is poured.
**Notes:**

1. The smallest angle used for bracing shall be 3½ x 3½ x ½ inches.
2. Weld sizes and number of ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is ½ in.
3. All cross frames shall be completely bolted and torqued before deck slab is poured.
4. For bearing stiffener attachment see SUP-SS(GEN)-201.

**DETAIL A**

Scale: None

**CONNCTION DETAIL**

AT SKEWED PIER

Scale: None

When bearing stiffeners are greater in width than outside edge of flange miter stiffener.
When bearing stiffeners are greater in width than outside edge of flange miter stiffener.

**DETAIL A**  
**Scale:** None

**CURVED AND STRAIGHT GIRDERS**  
**Scale:** None

**CONNECTION DETAIL**  
**AT SKewed PIER**  
**Scale:** None

**Notes:**
1. The smallest angle used for bracing shall be $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{3}{8}$ inches.
2. Weld sizes and number of ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is $\frac{3}{8}$ in.
3. All cross frames shall be completely bolted and torqued before deck slab is poured.
4. For bearing stiffener attachment see SUP-SS(GEN)-201.
Notes:
1. The smallest angle used for bracing shall be 3/2 x 3/2 x 3/8 inches.
2. Weld sizes and number of ASTM A 325 bolts shall be determined by the designer. Minimum size weld is 5/8 in.
3. All cross frames shall be completely bolted and torqued before deck slab is poured.
4. For bearing stiffener attachment see SUP-SSGENI-201.

PLAN - 60° OR LESS SKEW ANGLES
Scale: 1/8" = 1'-0"

PLAN - 60° TO 90° SKEW ANGLES
Scale: 1/8" = 1'-0"

Stringer
Angle
Stringer
Stringer

Bent gusset plate (typ.)

Gusset plate (typ.)

Bearing stiffener or connection plate (typ.)

Typ.

Typ.

Typ.
Connection plate

Termination of weld

Weld

Angle

Scale: \( \frac{1}{2}'' = 1'-0'' \) (typical)

CROSS FRAME WELDING DETAIL

Connection plate

Angles

Fill plate, min \( \frac{3}{4}'' \)

wider than angle leg

Scale: \( \frac{1}{2}'' = 1'-0'' \)

DETAIL A

Note:
All cross frame welds to be terminated from edge of gusset plates, fill plates or angles as indicated.

DETAIL B

Scale: \( \frac{1}{2}'' = 1'-0'' \)
Chapter 03 - Superstructure

Section 05 – Structural Steel

SUB-SECTION 03

DECK REPLACEMENTS
(SUP-SS(DR))
Note: Existing members shown dashed.

Existing Stringer

* if existing clip angle is exactly this dimension, angle is to be beveled if contact surface is to be provided.

After dam has been set:

Studs not shown in PLAN.

Continuous weld.

Burn off angle leg if required.

Cut off clip angle to beam with continuous weld.

After dam has been set and clip angle for stud bolt.

Burn off vertical leg of existing clip angle on this line and grind flush.

If remaining leg of angle does not provide a full bearing surface for new clip angle then completely remove existing clip angle and grind top flange to provide a proper surface to receive new weld and clip angle.

Note:

Threaded stud.

Welded stud.

Welded stud.

Nut and washer not shown.

Studs not shown in PLAN.

Continuous fillet weld.

Welded stud.

Clip angle to joint angle with continuous weld.

After dam has been set and clip angle for stud bolt.

Burn off vertical leg of existing clip angle on this line and grind flush.

If remaining leg of angle does not provide a full bearing surface for new clip angle then completely remove existing clip angle and grind top flange to provide a proper surface to receive new weld and clip angle.

Note:

Threaded stud.

Welded stud.

Nut and washer not shown.

Studs not shown in PLAN.

Continuous weld.

Burn off angle leg if required.

Cut off clip angle to beam with continuous weld.

After dam has been set and clip angle for stud bolt.

Burn off vertical leg of existing clip angle on this line and grind flush.

If remaining leg of angle does not provide a full bearing surface for new clip angle then completely remove existing clip angle and grind top flange to provide a proper surface to receive new weld and clip angle.

Note:

Threaded stud.

Welded stud.

Nut and washer not shown.

Studs not shown in PLAN.

Continuous weld.
Notes:
1. Closure plates to be used on all exterior stringers at supports where stringers are not continuous.
2. If stringers are of different depths, at a support, control dimensions shall apply to shallower stringer.
3. Weld to stringer on fixed shoes, if possible, but only weld to one stringer.
4. Do not provide closure plates on the median side of dual bridges where facias are 50' or less apart.
Notes for Spiral Removal and New Shear Studs:
1. Contractor shall cut all spiral shear developers off as close to flange as possible. Burning off spirals from flange will not be allowed.
2. For size and number of new studs per row and for longitudinal spacing of rows, see pertinent superstructure sheet.

Existing spiral shear developer to be removed as indicated below.

* Maximum portion of existing spiral to remain.

Spiral Removal
Scale: 3" = 1'-0"

SUP-SS(GEN)-101

1.0

Sup-SS(DR)-301

Detail No. SUP-SS(GEN)-101.
Notes for Additional Reinforcing:
1. These bars are required in all areas where studs exist and top of stud does not extend into hatched area.
2. These bars shall be epoxy coated.

In lieu of additional reinforcing steel, the contractor has the option of welding extension studs on top of the existing studs (typ.). Length of extension to be determined in the field.

Notes for Optional Extension Studs:
1. Extension studs are required in all areas where studs exist and top of stud does not extend into hatched area.
2. The diameter of the extension studs shall be the same as the existing studs.