Chapter 03 - Superstructure

SECTION 05

STRUCTURAL STEEL (SUP-SS)
Chapter 03 - Superstructure

Section 05 – Structural Steel

SUB-SECTION 01
GENERAL
(SUP-SS(GEN))
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.

In no case shall cover be less than 2 1/2'' (Typ.).

Embedment shall be as deep as possible but shall not be less than 3 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.

1/2'' 4'' 1/2''

4'' Min. Min.

1 1/2'' 1 1/2''

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

STEEL STUD SHEAR
DEVELOPER EMBEDMENT DETAIL

DISTRICT no. SUP-SSGENI-101 SHEET ___ OF ___

APPROVAL

DIRECTOR
OFFICE OF STRUCTURES
DATE: 9/8/76

VERSION

1.0
When longitudinal stiffeners are required, place all longitudinal stiffeners on one side of web, place transverse stiffeners on opposite side.

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 5/16".
Adjust for web thickness, See AASHTO 6.10.11.1 and SUP-SS(GEN)-203.

1/2" Min. (Typical) / 1" Radius

Check edge clearance

IF CROSS FRAMES ARE USED

INTERMEDIATE STIFFENERS - RADIUS CLIPS
Scale: 1" = 1'-0"

Seat angle/plate

MILL to Bear
Prior to Welding
Both Sides

1 1/2" Min. (Typical)

END BEARING

MILL to Bear
Prior to Welding
Both Sides

INTERIOR BEARING
CONTINUOUS GIRDER

BEARING STIFFENERS - RADIUS CLIPS
Scale: 1" = 1'-0"

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 5/6".

DATE: 10-09-2007
Concrete Slab Cantilevered

Concrete Diaphragm with Fascia Stringer

Additional Stringers adjacent thereto

Mill to Bear Prior to Welding Both Sides

Clip 1/2'' Horizontal 2 1/2'' Vertical,

Clip 1/2'' Horizontal 2 1/2'' Vertical,

Clip 1/2'' Horizontal 2 1/2'' Vertical,

Clip 1/2'' Horizontal 2 1/2'' Vertical,

Clip 1/2'' Horizontal 2 1/2'' Vertical,

Clip 1/2'' Horizontal 2 1/2'' Vertical,

AT PIERS

(Where Stringer is CONTINUOUS OVER SUPPORT)

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

<table>
<thead>
<tr>
<th>Location</th>
<th>W= Stiffener Width</th>
<th>Stiffener Thickness</th>
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</thead>
<tbody>
<tr>
<td>Abutment</td>
<td></td>
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<tr>
<td>Pier</td>
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Optional 3/4'' plate

See Optional Plate Detail below

State Highway Administration

Department of Transportation

State of Maryland

OFFICE OF STRUCTURES

DIRECTOR

OFFICE OF STRUCTURES

EXTRACTION

STATE OF MARYLAND

DEPARTMENT OF TRANSPORTATION

OFFICE OF STRUCTURES

BEARING STIFFENERS FOR ROLLED STEEL BEAMS

ANGLE CLIP

Slanted lettering indicates notes "For Office Use Only".
Stiffener width to thickness ratio ≤10 or less.
Width of stiffener: To nearest 1/2'', about 1/2'' less than distance from face of web to edge of flange.
BEARING STIFFENERS FOR ROLLED STEEL BEAMS
OPTIONAL RADIUS CLIP

Mill to Bear Prior to Welding Both Sides

**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>
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</tr>
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<tr>
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<td></td>
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</tbody>
</table>

Slanted lettering indicates notes “For Office Use Only”.
Stiffener width to thickness ratio ≤10 or less.
Width of stiffener: To nearest 1/2” about 1/2” less than distance from face of web to edge of flange.

**OPTIONAL SEAT PLATE DETAIL**

**SHEET 2 OF 2**
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 standard sheets indicate stiffener is extended and welded to flange.
**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.

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**SCALE:** 1 1/2 ” = 1'-0”

**PLAN VIEW OF STRINGER BELOW TOP FLANGE**

* Seat plate width shall be increased as necessary so that plate exceeds stiffener width by at least 1/2".

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**Office of Structures**

**Director**

**State Highway Administration**

**State of Maryland**

**Office of Structures**

**Supersstructure Steel**

**Detail No.** SUP-SS(EN)-204

**Version**

**Date:** 03/07/2013
Note: For skew angle greater than 60° see Detail A. Detail A is applicable to this side of seat angle only.

Note: Concrete diaphragm not shown.
Splice

See Note 3 below.

Beam

1 3/4 ''

1 3/4 ''

@ 3 1/2 '' =

7/8 ''

3 3/4 ''

1 1/2 ''

7/8 ''

1 3/4 ''

1 1/2 ''

@ 3 1/2 '' =

7/8 ''

1 3/4 ''

1 1/2 ''

1 3/4 ''

P

2 s

x

x

P

2 s

x

x

For composite stringers
miss splice bolts.

Filler P
(where required, 1/16 '' 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.

Notes:
1. All bolts to be 7/8'' High Strength Bolts (1/8'' open holes),
   ASTM A 325 unless 1'' High Strength Bolts are required
   by design (1/8'' 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 bottom flange.

PLAN

Scale: 1'' =1'-0''

Elevation

Scale: 1'' =1'-0''

For composite stringers
add note “Space studs to
filler and/or additional
fasteners must be evaluated
as per AASHTO requirements.”

Min. clearances from
bottom of flange
splice plate.

Filler (where required, 1/8'' 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.

Notes:
1. All bolts to be 7/8'' High Strength Bolts (1/8'' open holes),
   ASTM A 325 unless 1'' High Strength Bolts are required
   by design (1/8'' open holes). Bolts to be used when
   weathering structural steel is called for
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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 bottom flange.
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 standard.
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.
Chapter 03 - Superstructure

Section 05 – Structural Steel

SUB-SECTION 02
CROSS FRAMES
(SUP-SS(CF))
All diaphragms are to be completely connected to stringers before deck slab is poured.

Space intermediate diaphragms at 20' to 25 1/2'; i.e., for spans, (Non-curved bridges only). Up to 25% of bearings-no intermediate Diaphragm.

From 25' to 50% of bearings-one Intermediate Diaphragm.
From 50' to 75% of bearings-Two Intermediate Diaphragms, etc.
(See Framing Plan).

All diaphragms are to be completely connected to stringers before deck slab is poured.

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.

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 1/2'; i.e., for spans, (Non-curved bridges only). Up to 25% of bearings-no intermediate Diaphragm.

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°

Note:
Angle clip shown; optional radius clip acceptable.

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 7/8" A325.
4. All bolts holes to be 3/4".
5. Bolt spacing applies regardless of skew.

State of Maryland
Department of Transportation
Office of Structures

Rolled Steel Beams
Intermediate Diaphragm Details
Bolted Connections

Approval

Director
Office of Structures
State Highway Administration
Office of Structures
Note to Designer:
The skew angle shown is the complement of the skew angle as defined in AASHTO Section 6.7.4.

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

Framing Plan
Scale: None

Intermediate cross frames (typ.)
Pier cross frames
Abutment cross frames (typ.)
Note to Designer:
The skew angle shown is the compliment of the skew angle as defined in AASHTO Section 6.7.4.

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.
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 girders and bearing 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° 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 3/2 x 3/2 x 3/2 inches.
5. Weld sizes and number of 1/8" ASTM A 325 bolts shall be determined by the Designer. Minimum size weld shall be 1/8" 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.

<table>
<thead>
<tr>
<th>Detail A</th>
<th>Scale: None</th>
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Intermediate Cross Frames (K-frames) for Fabricated Steel Girders
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 &g, bearing and &g, 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° 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 3½ x 3½ x 5/8 inches.
5. Weld sizes and number of 3/8 " ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is 5/32 in.
6. All cross frames are to be completely bolted and torqued before deck slab is poured.

Bolted Connection
See Note 5.
Stiffener and/or connection plates to be perpendicular to web of girder (Typ.).

"2" Typ. Min.
3'' Min. (Typ.)

Bolted Connection
See Note 5.
Stiffener and/or connection plates to be perpendicular to web of girder (Typ.).

"2" Typ. Min.
3'' Min. (Typ.)

CURVED GIRDER

STRAIGHT GIRDER

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 &g, bearing and &g, 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° 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 3½ x 3½ x 5/8 inches.
5. Weld sizes and number of 3/8 " ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is 5/32 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.

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

**DETAIL A**

Scale: None

Notes:
1. The smallest angle used for bracing shall be 3\(\frac{1}{2}\) x 3\(\frac{1}{2}\) x \(\frac{3}{8}\) 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.

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**BEARING STIFFENER**

Bearing Stiffener

**WEB, GUSSET PLATE, AND FEATURING**

**Bent Gusset**

**Bearing Gusset**

**W.P.**

**Girder Web**

**Skew Angle**

**Note:** Top flange not shown.

**CURVED AND STRAIGHT GIRDER**

Scale: None
Notes:
1. The smallest angle used for bracing shall be 3 1/2 x 3 1/2 x 3/8 inches.
2. Weld sizes and number of ASTM A 325 bolts shall be determined by the Designer. Minimum size weld is 5/16 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.
Note:
All cross frame welds to be terminated from edge of gusset plates, fill plates or angles as indicated.
Chapter 03 - Superstructure

Section 05 – Structural Steel

SUB-SECTION 03

DECK REPLACEMENTS
(SUP-SS(DR))
After dam has been set and clamped into final position, weld clip angle to joint angle with 3/8" continuous fillet weld.

After dam has been set and bolted into final position, weld clip angle to joint angle with 3/8" continuous fillet weld.

**SECTION B-B**

**Vertical leg of joint angle.**

**Vertical leg of joint angle.**

**SECTION A-A**

**Vertical leg of joint angle.**

**Vertical leg of joint angle.**

**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.

**Burn off angle leg if required, to allow for continuous weld.**

**Existing Stringer**

**Existing Stringer**

**Existing members shown dashed.**

**Note:**

- Nut and washer not shown.
- Studs not shown in PLAN.
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.

* 2' at 68°F.

3/8" Closure Plate at exterior stringers.

Exterior Face of Exterior Stringer

Seal Weld

ELEVATION
Scale: None
1. Contractor shall cut all spiral shear developers 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.

* Maximum portion of existing spiral to remain.
NOTES FOR ADDITIONAL REINFORCEMENT:
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.

In no case shall cover be less than 2 1/2” cl.

*5's bent thus spaced to lap with normal slab steel (maximum 7” c/c). Tops of all bars must be in hatched area.

Existing shear stud developers

Scale: 1 1/2” = 1'-0”

Existing Stringer (Composite Spans)