

Deck Forming - SIP Forms & Studs

2018 Bridge Construction Inspection School

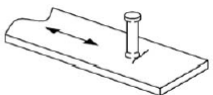
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Fatigue/Cracks – Why we are concerned when welding on or near Bridge Beams/Girders

Detail Category	75-yrs ($ADTT$) ₅₂ Equivalent to Infinite Life (trucks per day)
A	530
B	860
B'	1035
C	1290
C'	745
D	1875
E	3530
E'	6485

? ? Much Larger Number ← Tack Weld or Accidental Strike
6.6.1.2.4—Detailing to Reduce Constraint

Description	Category	Constant	Threshold	Potential Crack Initiation Point	Illustrative Example
9.1 Base metal at stud-type shear connectors attached by fillet or automatic stud welding	C	44×10^6	10	At the toe of the weld in the base metal	

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Example of a Fatigue Crack



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The Repair of the crack shown on the previous slide



SIP Deck Forming

References

- **Sect. 404.03 of the VDOT Specs.** pp. 410-412, 446 -2007 VDOT R&B Specs.
- pp. 465-467, 499 -2016 VDOT R&B Specs.

- **Welder Certification** AWS D1.1
- AWS D1.3
- AWS D1.5

Welder Certification

The Contractor shall submit or shall have the fabricator submit to the Engineer a copy of the certificate of qualifications for each welder, welding operator, or tacker employed in the work. The Contractor shall also submit to the Engineer a certificate stating that the welder, welding operator, or tacker has not exceeded any period of 3 months since the date of qualification without performing satisfactory welding in the required process. The qualification certification shall state the name of the welder, operator, or tacker; name and title of the person who conducted the examination; type of specimens; position of welds; results of tests; and date of the examination. The qualification certification shall be made by a Department approved agency.

Stay-in-Place Forms: Welding

Section 407.04 (a)

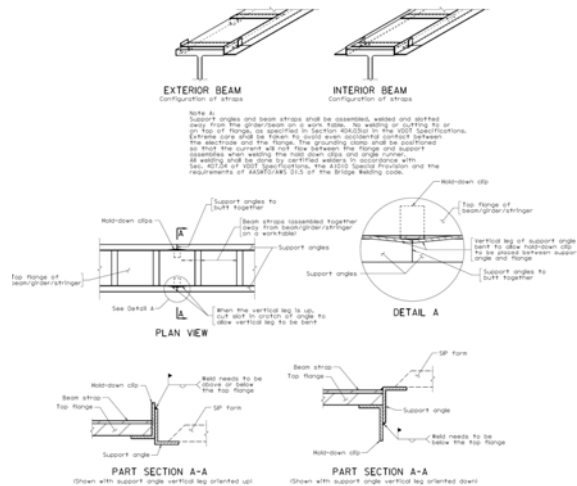
“Structural units shall not be used as a worktable. Welding on other work shall be completed before parts are installed on units”

Stay in Place Form Notes:

Support angles and beam straps shall be assembled and welded away from the girder on a worktable. No welding to or on top of the flange shall be permitted. Extreme care shall be taken to avoid even accidental contact between the electrode and the flange. The grounding clamp shall be positioned so that the current will not flow between the flange and support assemblies when welding the clips. All welding shall be done by certified welders in accordance with Sec. 407.04 of VDOT Specifications and the requirements of AASHTO/AWS D1.1, D1.3 or D1.5 Bridge Welding Code.

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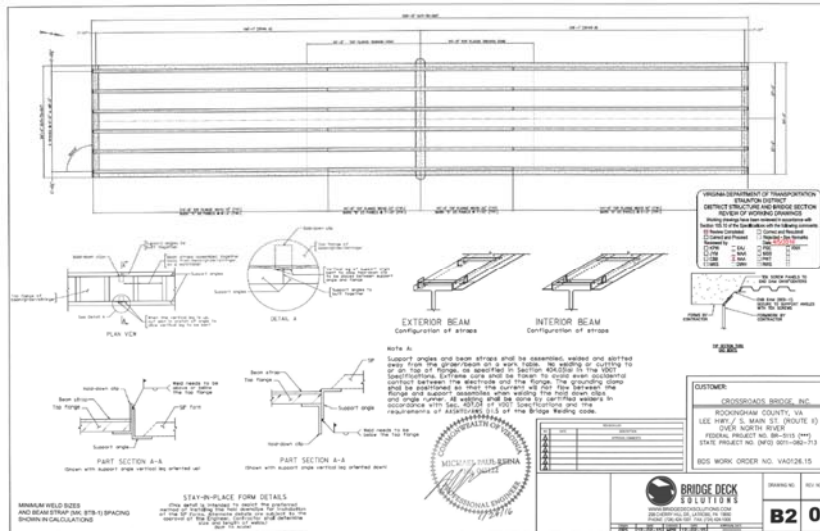
Detail showing Staunton District recommended installation of hold down clips



Actual Detail to use will be what is shown on the reviewed/stamped SIP shop drawings.

Structural Steel

Stay In Place Forms Shopdrawings



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Work Table/Jig for assembling SIP support system



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Work Table/Jig for assembling SIP support system



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Fabricating SIP support system on Work Table/Jig



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Location of grounding clamp



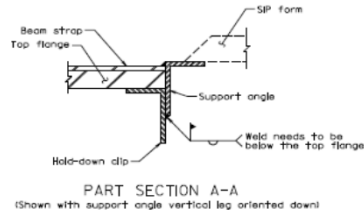
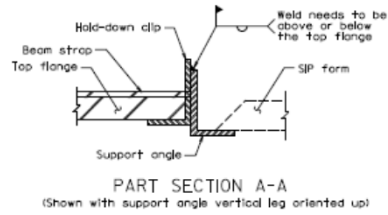
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Support Angle with slot cut to facilitate hold down clip



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Detail showing possible orientations of the support angles



STAY-IN-PLACE FORM DETAILS
(Contractor shall determine size and length of welds.
Alternate details subject to the approval of the Engineer)
(Not to scale)

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Possible orientations of the support angles



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Fabricated form support assembly for exterior beam/girder



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Support assembly installed on exterior beam/girder



Improper SIP Form Installation

Butt welding the hold down clip to the Support angle with flange as a work table for the weld. **NOT PERMITTED**



Improper SIP Form Installation



Form supports tack welded to the beam/girder flange **NOT PERMITTED**

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Improper SIP Form Installation



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SIP Forms on PSC Girders



Stud Shear Connectors

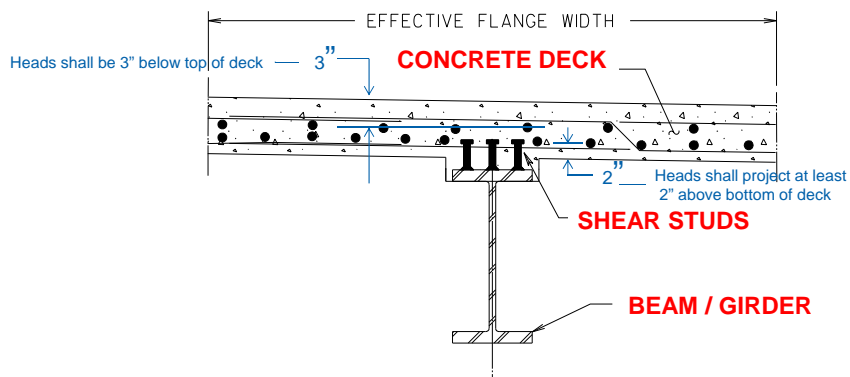
References:

Sect. 407.04(j) of the VDOT R&B Specs. p. 451-2007 VDOT R&B Specs.
p.504 – 2016 VDOT R&B Specs.

Bridge Welding Code AASHTO/AWS D1.5 – Chapter 7 Copies available for
reference in District S&B and Materials Sections

Welder Certification – AWS D1.5

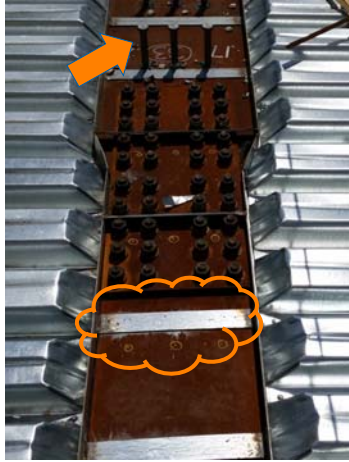
Structural Steel



COMPOSITE DESIGN

Stud Shear Connectors

Field Installed – Required by Specs.



Shop Installed – may be allowed provided erection is performed in accordance with Section 107.17



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Installation of Stud Shear Connectors



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Stud Welding Gun



Arc shield

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Storage: Studs shall be clean, dry and free of rust



Performing Bend Test



Things to know

- Studs shall be at least 4" long
- Studs shall be from the approved list.
- The temperature of the flange be at least 70 degrees F. Preheating will be required when temperature is less than 70 degrees F.
- each operator should qualify by welding a couple studs to a piece of scrap before welding to the girders.
- Inspection and Testing
 - 1) Visual – Visually inspect all installed studs after the arc shield has been removed – the weld shall exhibit a full 360 degree flash.
 - 2) Bend Test – When starting each day or after changes in settings on the welder or a new operator, test the first two studs by bending the studs 30 degrees from vertical by striking with a hammer when the temperature is greater than 50 degrees F. If the temperature is less than 50 degrees the bend test shall be done by slow application of load using a pipe or other means.
- The inspector, where conditions warrant, may select a reasonable number of additional studs to be tested.

Things to know (cont.)

- If any of the welds exhibit a discontinuity/imperfection in the flash then perform a bend test. Bend the stud in the direction opposite from the imperfection.
- The contractor does have the option of repairing the missing flash by adding a 5/16" fillet weld. The repair weld shall extend 3/8" beyond each end of the discontinuity being repaired. The welder performing the fillet weld repair needs to be qualified to perform that weld. Test the repaired stud.

QUESTIONS?