Steel Tutorial

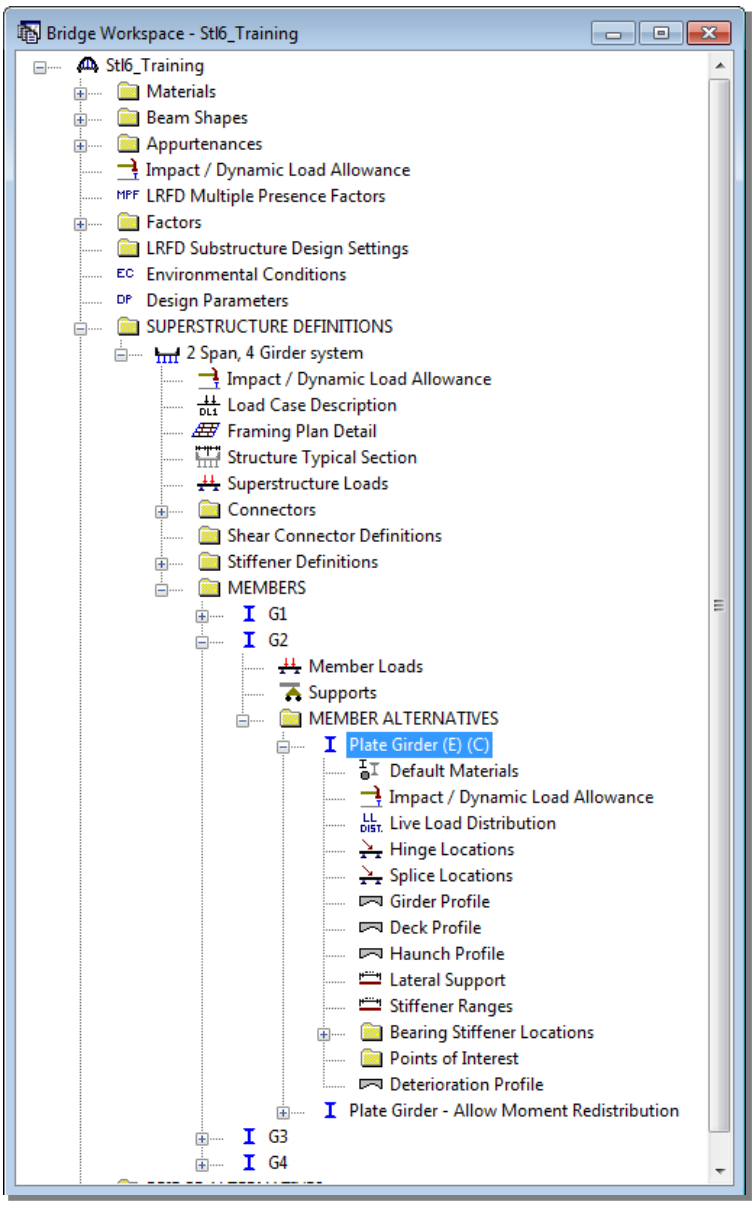
Steel Shear Stud Wizard

STL7 - Steel Shear Stud Wizard

Topics Covered

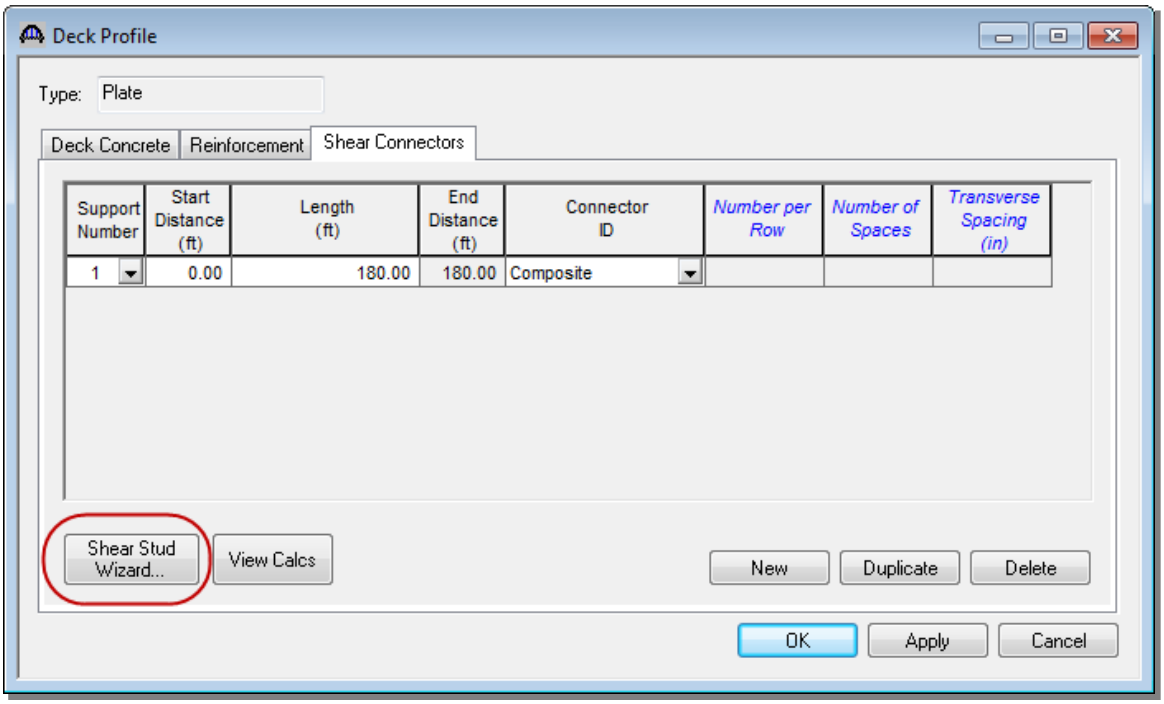
- 2 span steel plate girder input as girder system.
- Shear Stud Wizard

This example uses the bridge in STL7 - Steel Shear Stud Wizard.xml. Open the Bridge Workspace for 'Stl6_Training'. Expand the Bridge Workspace tree to show the member alternative for Member G2.

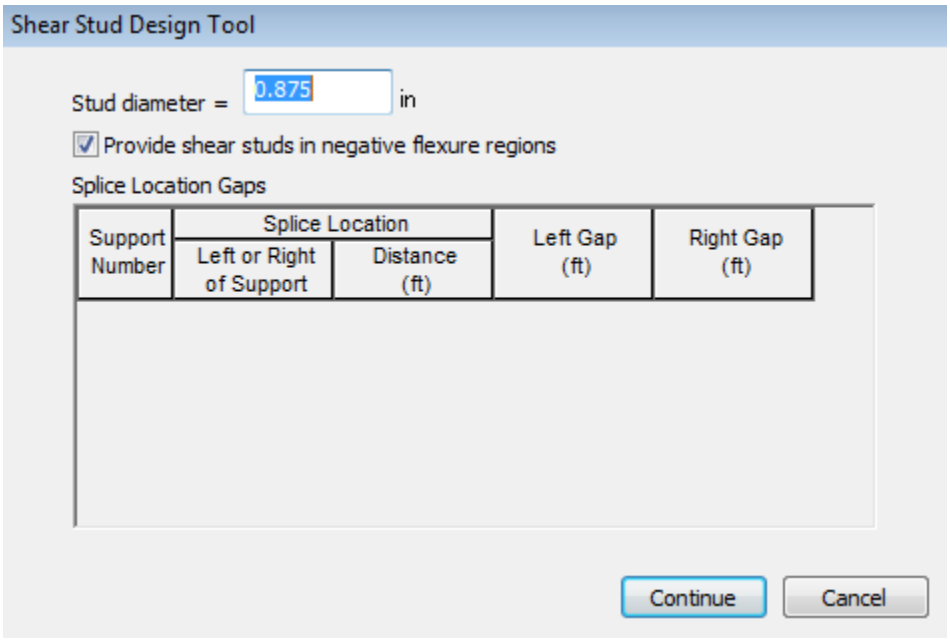


On the Deck Profile: Shear Connectors tab the shear connectors are currently defined as a generic Composite region.

BrD has a Shear Stud Wizard that can compute a shear stud pattern for you.

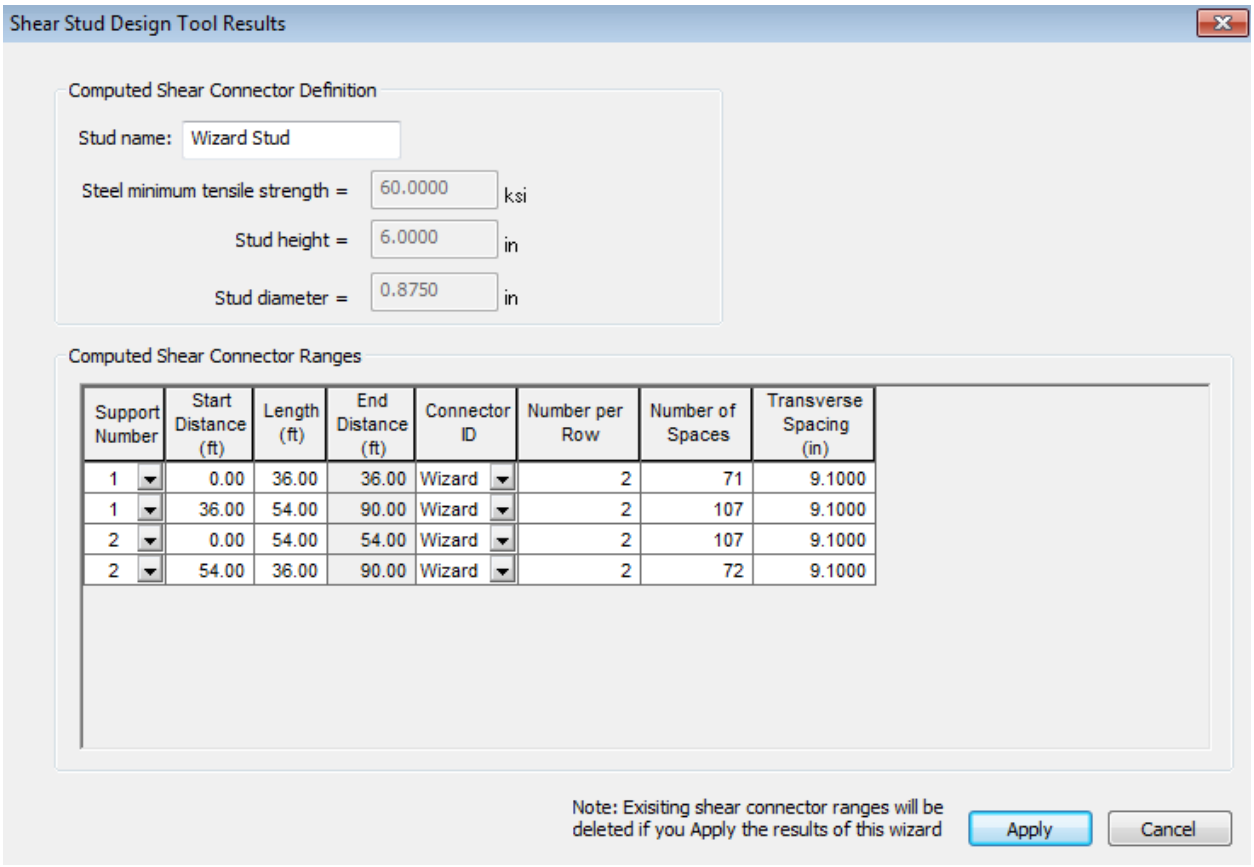


Click the 'Shear Stud Wizard' button and enter the following information.

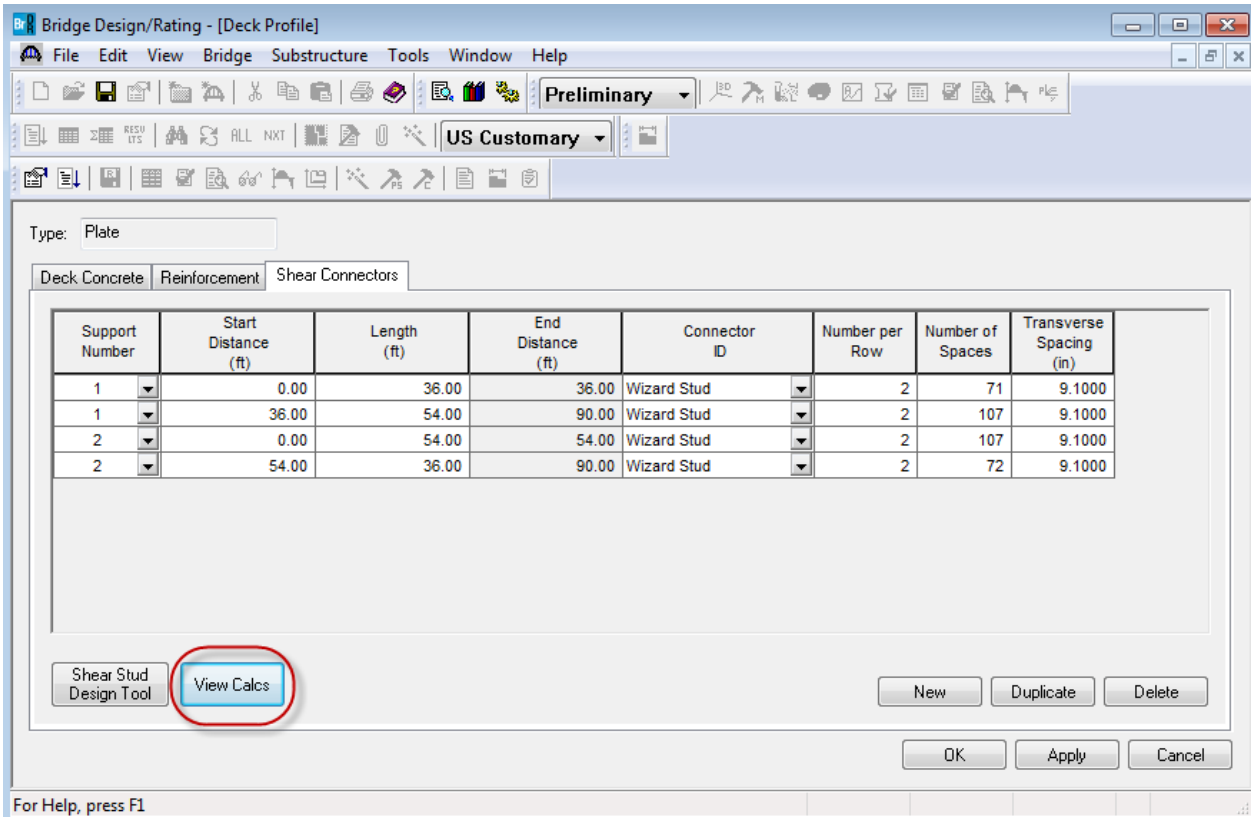


If you do not check the 'Provide shear studs in negative flexure regions', the wizard will not create a stud pattern in the negative moment region between points of dead load contraflexure.

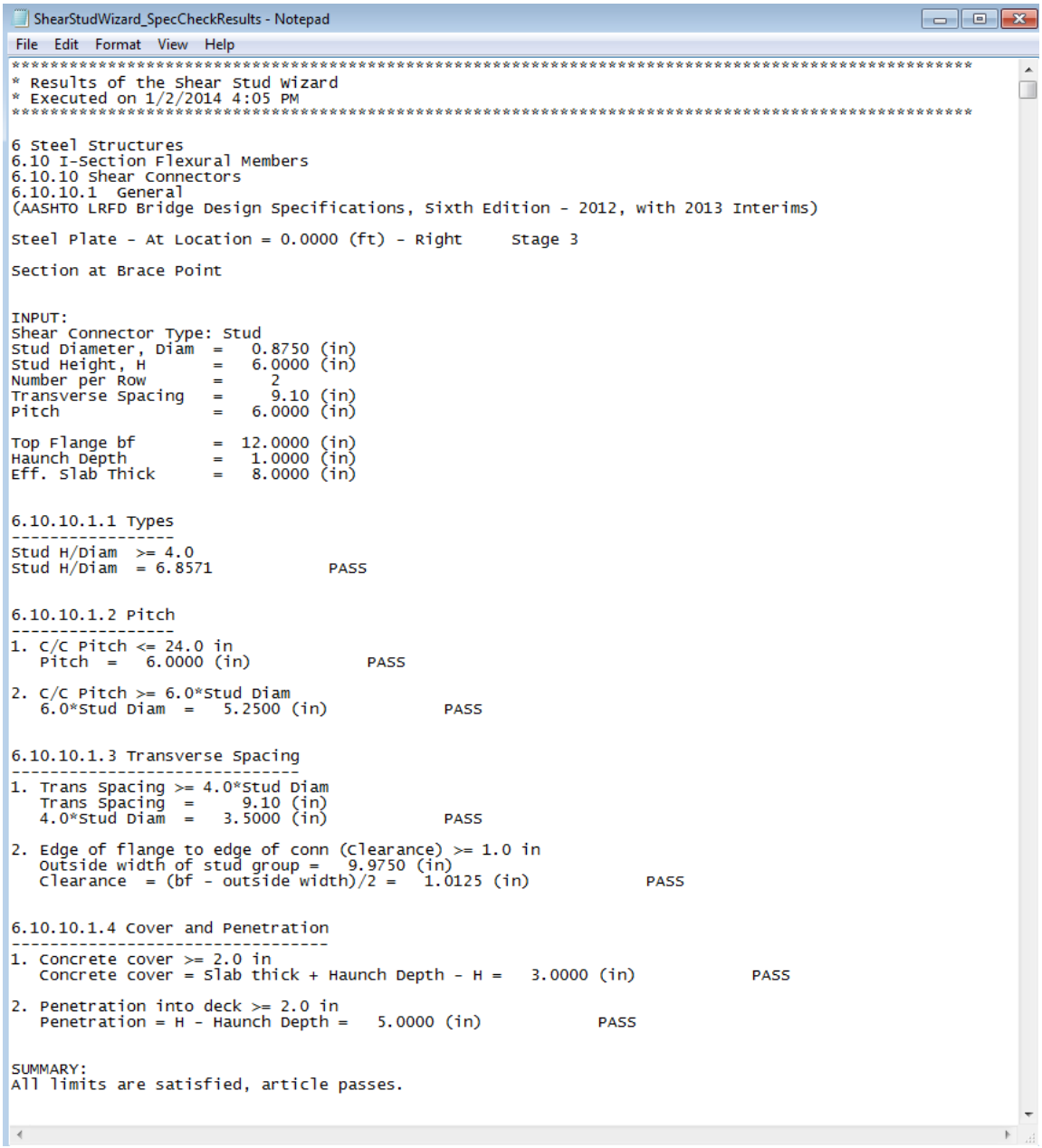
Click the Continue button and the Analysis Progress dialog will launch a dead load and live load analysis and then design a shear stud pattern for you. The resulting design is shown below.



The wizard creates a shear stud definition for you. You can change its name and you can also modify the range data generated by the wizard. Click the 'Apply' button to save the generated data to memory. Note that existing ranges will be deleted if you hit Apply.



The ‘View Calcs’ button on the Deck Profile: Shear Connectors tab opens a text file that contains the output of the articles that were evaluated in the design.



ShearStudWizard_SpecCheckResults - Notepad

File Edit Format View Help

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*****************************************************************************************************************
* Results of the Shear Stud Wizard
* Executed on 1/2/2014 4:05 PM
*****************************************************************************************************************

6 Steel Structures
6.10 I-Section Flexural Members
6.10.10 Shear Connectors
6.10.10.1  General
(AASHTO LRFD Bridge Design Specifications, Sixth Edition - 2012, with 2013 Interims)

Steel Plate - At Location = 0.0000 (ft) - Right     Stage 3

Section at Brace Point


INPUT:
Shear Connector Type: Stud
Stud Diameter, Diam  =   0.8750 (in)
Stud Height, H       =   6.0000 (in)
Number per Row       =     2
Transverse Spacing   =     9.10 (in)
Pitch                =   6.0000 (in)

Top Flange bf        =  12.0000 (in)
Haunch Depth         =   1.0000 (in)
Eff. Slab Thick      =   8.0000 (in)


6.10.10.1.1 Types
-----------------
Stud H/Diam  >= 4.0
Stud H/Diam  = 6.8571            PASS


6.10.10.1.2 Pitch
-----------------
1. C/C Pitch <= 24.0 in
   Pitch  =   6.0000 (in)            PASS

2. C/C Pitch >= 6.0*Stud Diam
   6.0*Stud Diam  =   5.2500 (in)            PASS


6.10.10.1.3 Transverse Spacing
------------------------------
1. Trans Spacing >= 4.0*Stud Diam
   Trans Spacing  =     9.10 (in)
   4.0*Stud Diam  =   3.5000 (in)            PASS

2. Edge of flange to edge of conn (Clearance) >= 1.0 in
   Outside width of stud group =   9.9750 (in)
   Clearance  = (bf - outside width)/2 =   1.0125 (in)            PASS


6.10.10.1.4 Cover and Penetration
---------------------------------
1. Concrete cover >= 2.0 in
   Concrete cover = Slab thick + Haunch Depth - H =   3.0000 (in)            PASS

2. Penetration into deck >= 2.0 in
   Penetration = H - Haunch Depth =   5.0000 (in)            PASS


SUMMARY:
All limits are satisfied, article passes.
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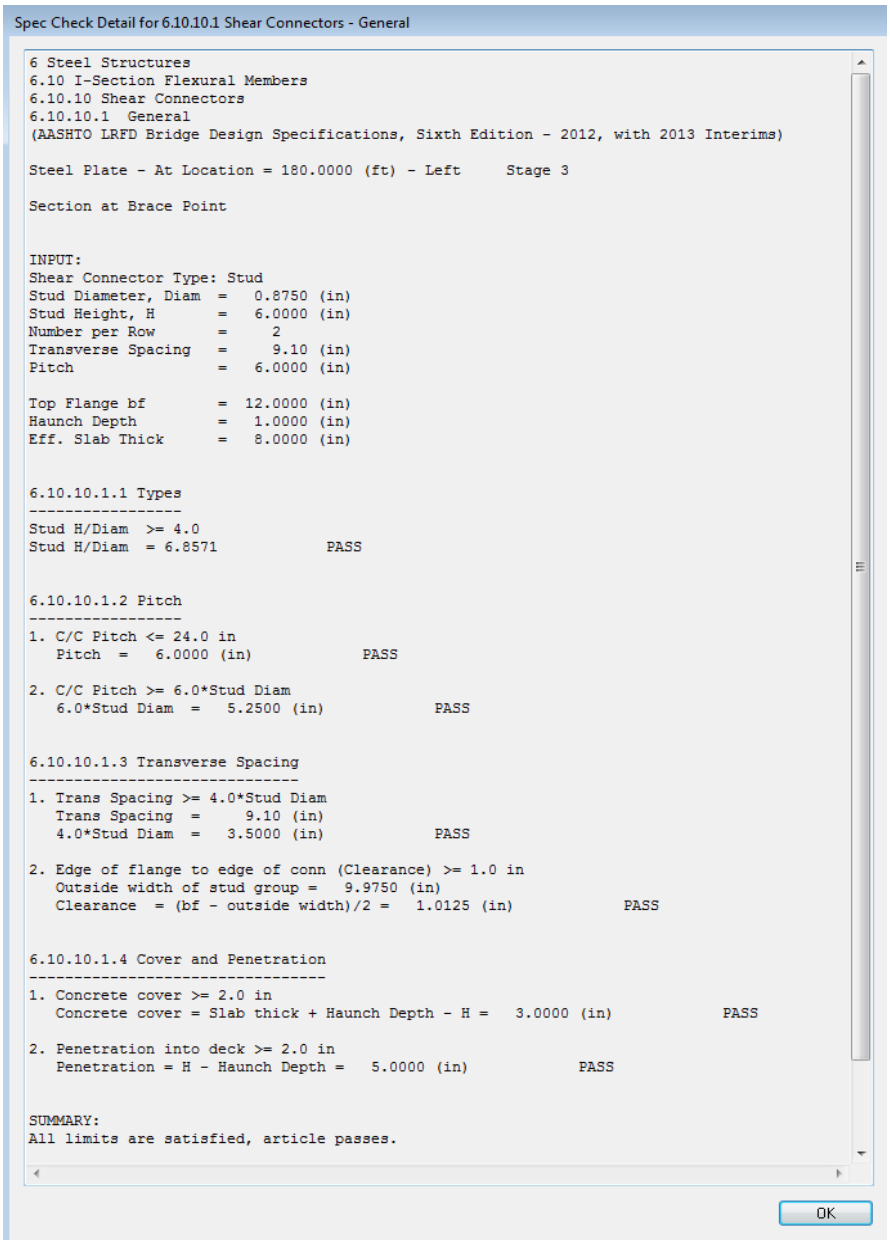
Wizard Design Rules

1. The user enters the stud diameter.
2. The minimum tensile strength of the stud is always 60 ksi (415 MPa) as per AASHTO LRFD Article 6.4.4.
3. Designs are optimized such that all of the following articles pass with a design ratio (i.e. resistance/action) close to 1.1.
4. The Wizard evaluates the following specification articles:
    a. 6.10.10.1.1 Shear Connectors - General - Types
    b. 6.10.10.1.2 Shear Connectors - General - Pitch
    c. 6.10.10.1.3 Shear Connectors - General – Transverse Spacing

d. 6.10.10.1.4 Shear Connectors - General – Cover and Penetration
e. 6.10.10.2 Shear Connectors – Fatigue Resistance
f. 6.10.10.3 Shear Connectors – Special Requirements for Points of Permanent Load Contraflexure (only evaluated at points of dead load contraflexure when the user has chosen to not provide shear studs in the negative flexure regions)
g. 6.10.10.4 Shear Connectors – Strength Limit State (only evaluated at points of maximum live load moment and interior supports as per this article)

After using the Shear Stud Wizard to generate a pattern, launch an HL93 LRFD Design Review again. A sample shear connector article is shown below: