AASHTOWare Bridge Design and Rating Training
Splice1 - Steel Splice Design Review and Rating (BrDR 6.7)

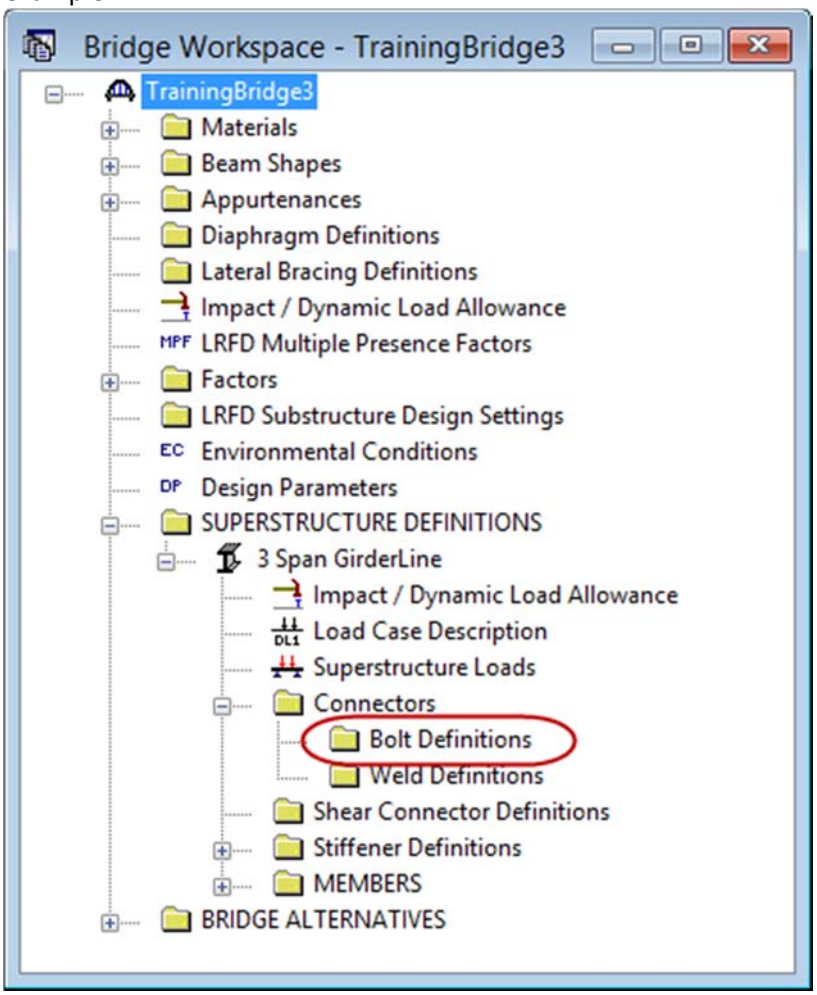
Topics Covered

- Steel splice data entry
- Splice schematic
- Splice analysis options
- LRFD analysis and results
- LRFR analysis and rating

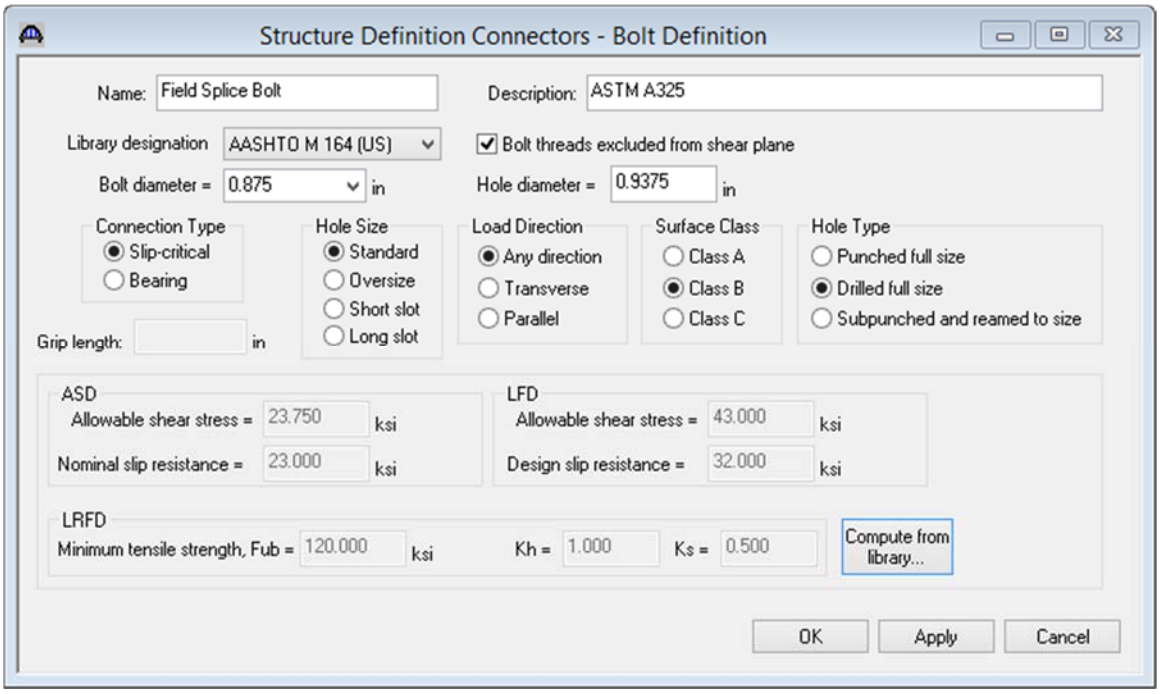
This example describes entering a steel girder splice into BrDR and analyzing it for both LRFD and LRFR.

Steel Splice Data Entry

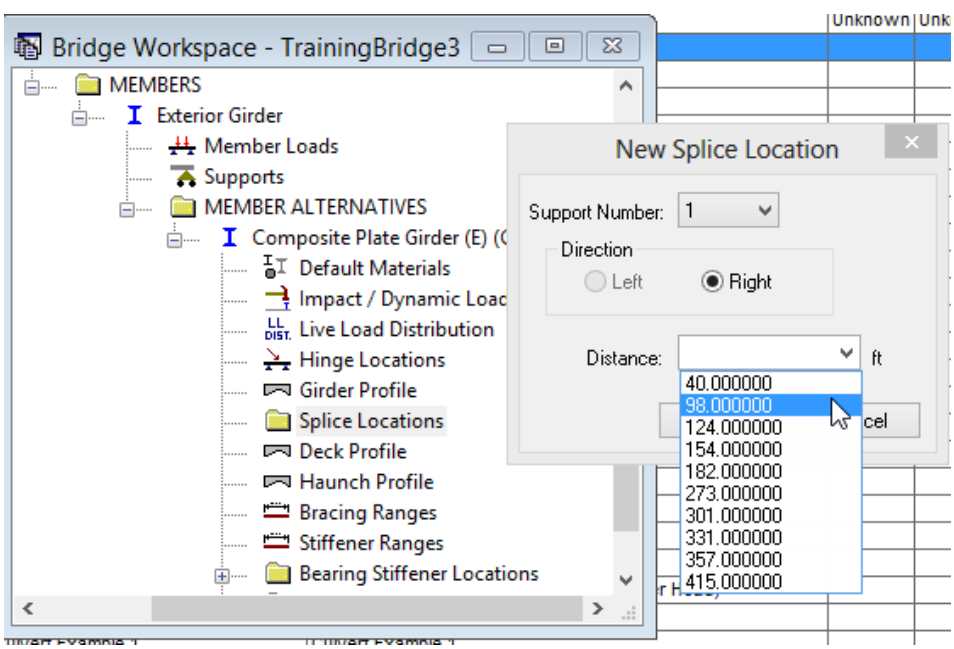
Open bridge BID 3 “Training Bridge 3” in the sample database. This is a 3 span steel plate girder example.



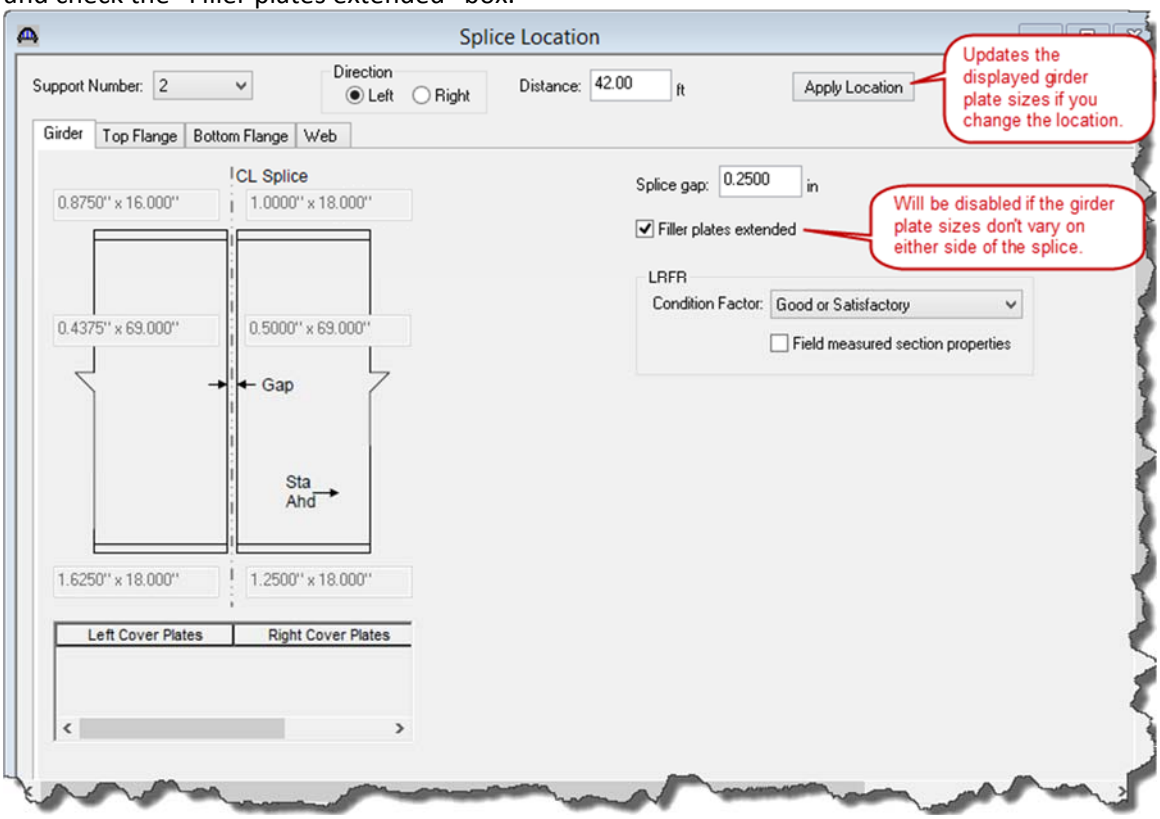
Create a new Bolt Definition with the following properties:



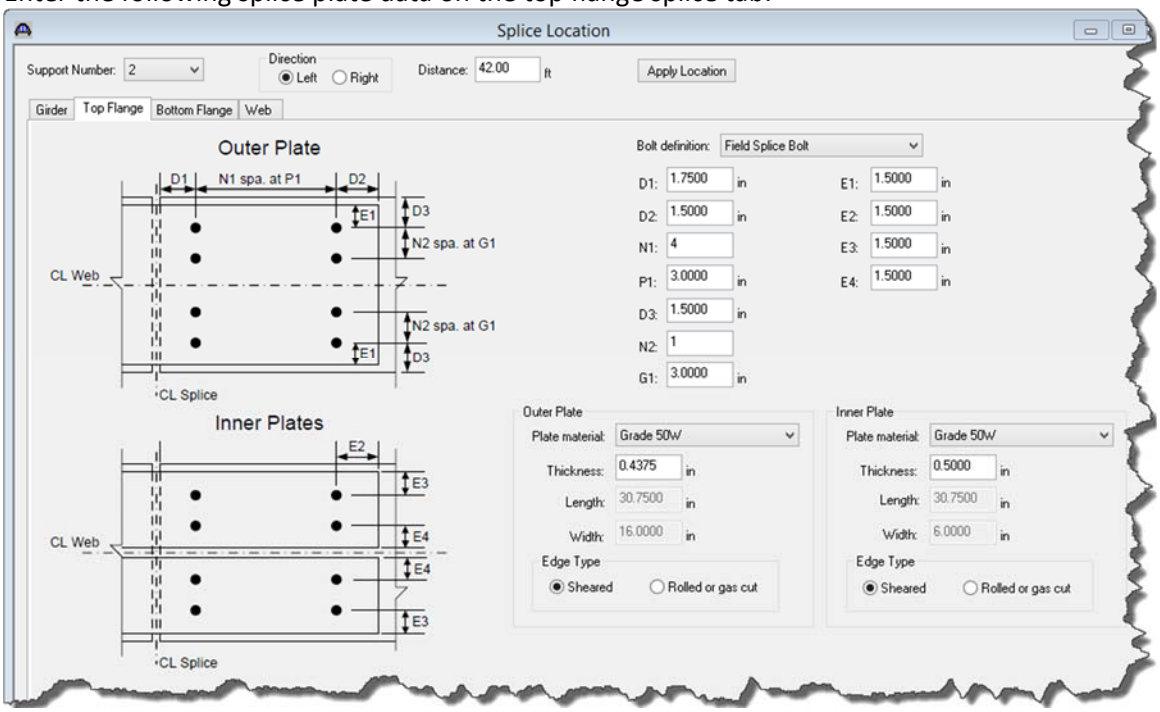
Expand the BWS tree to show the member alternative for Exterior Girder. Double-click on the Splice Locations folder to create a new splice location. The drop-down list contains the locations of girder section change points (flanges and webs) that were described on the Girder Profile window. You can select from this list or type in a location value. For this example, select 98' from the list.



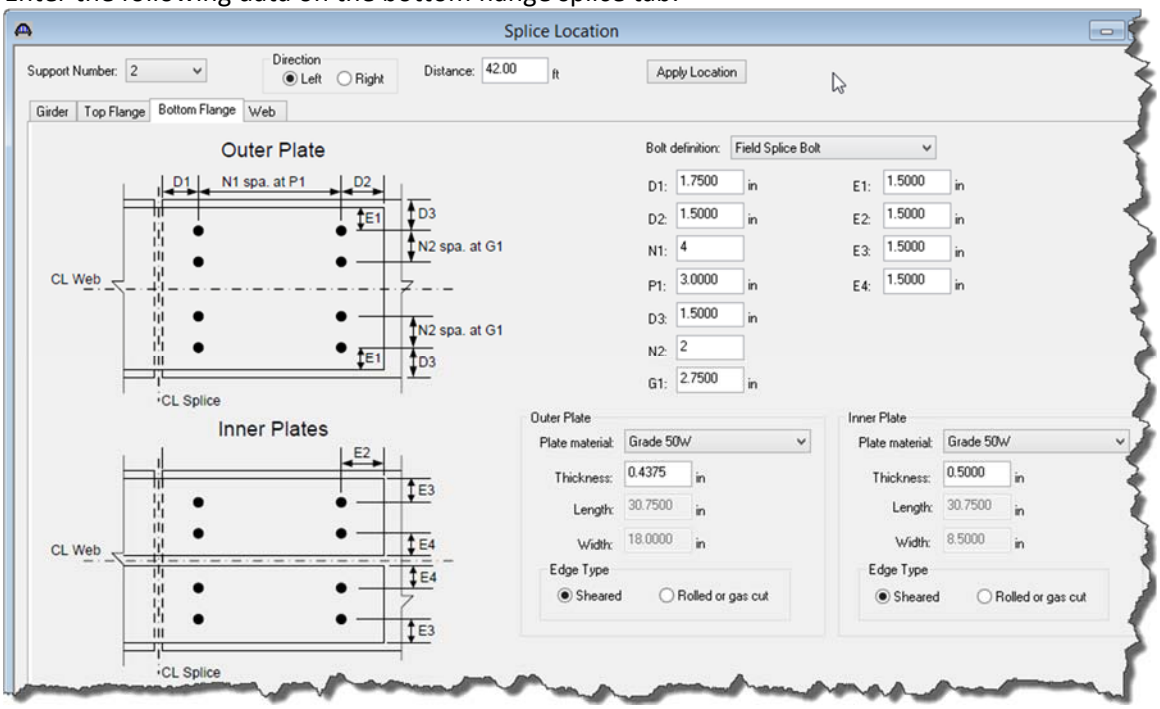
The Splice Location window will appear after you hit OK. Enter the splice gap dimension shown and check the "Filler plates extended" box.



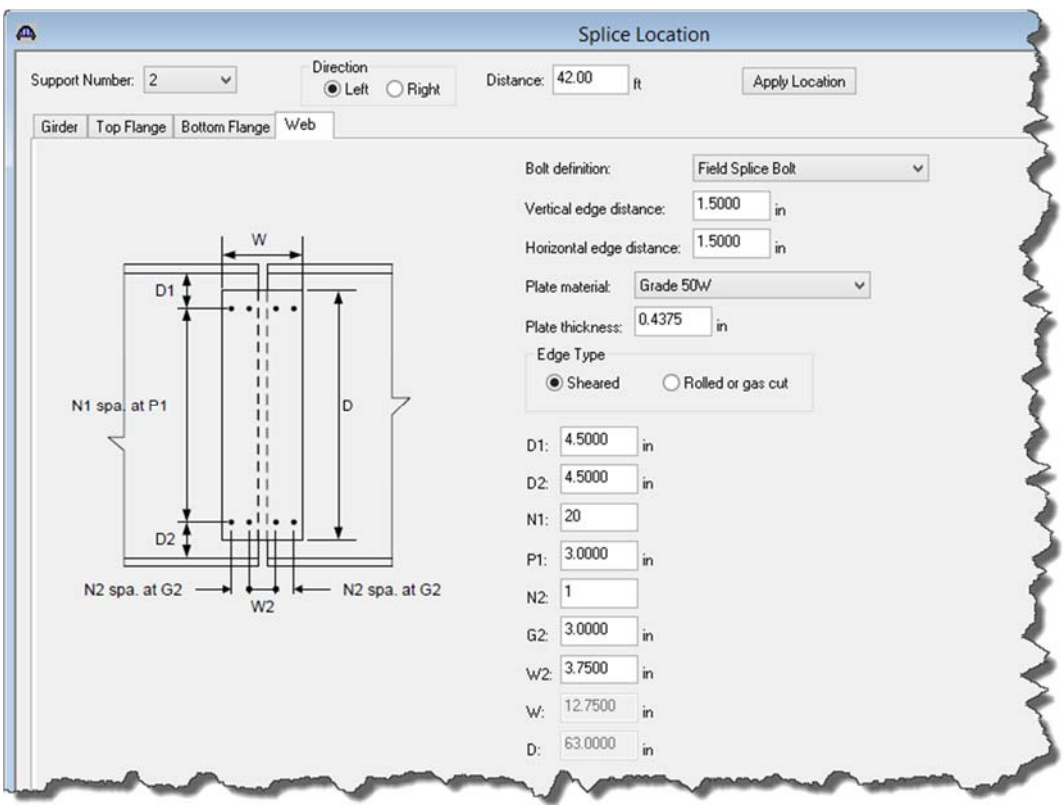
Enter the following splice plate data on the top flange splice tab:



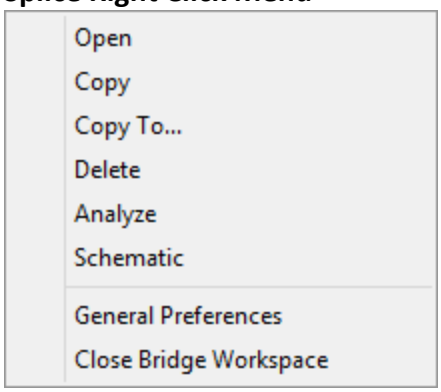
Enter the following data on the bottom flange splice tab:



Enter the following data for the web splice and click OK to close the window and save the data to memory:



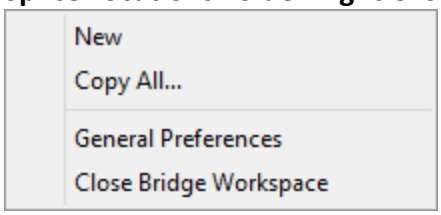
Splice Right Click Menu



Copy – copy and then paste the splice to another member alternative

Copy To – opens a dialog where you can pick 1 or more member alternatives to copy to.

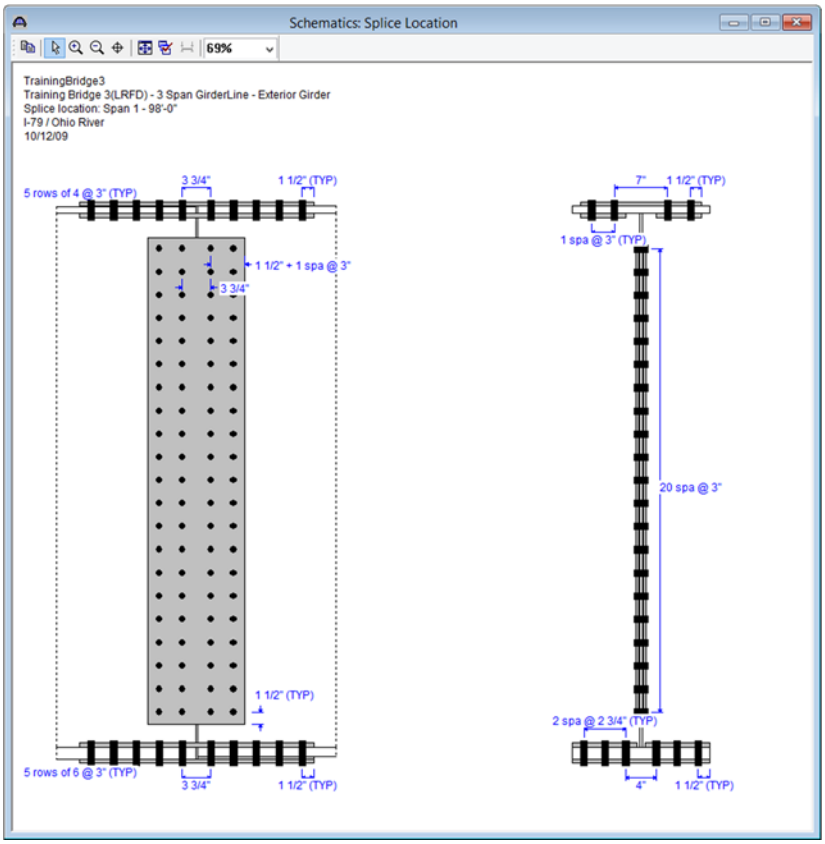
Splice Locations Folder Right Click Menu



Copy All – opens a dialog where you can pick 1 or more member alternatives to copy all of the splices in the member alternative to.

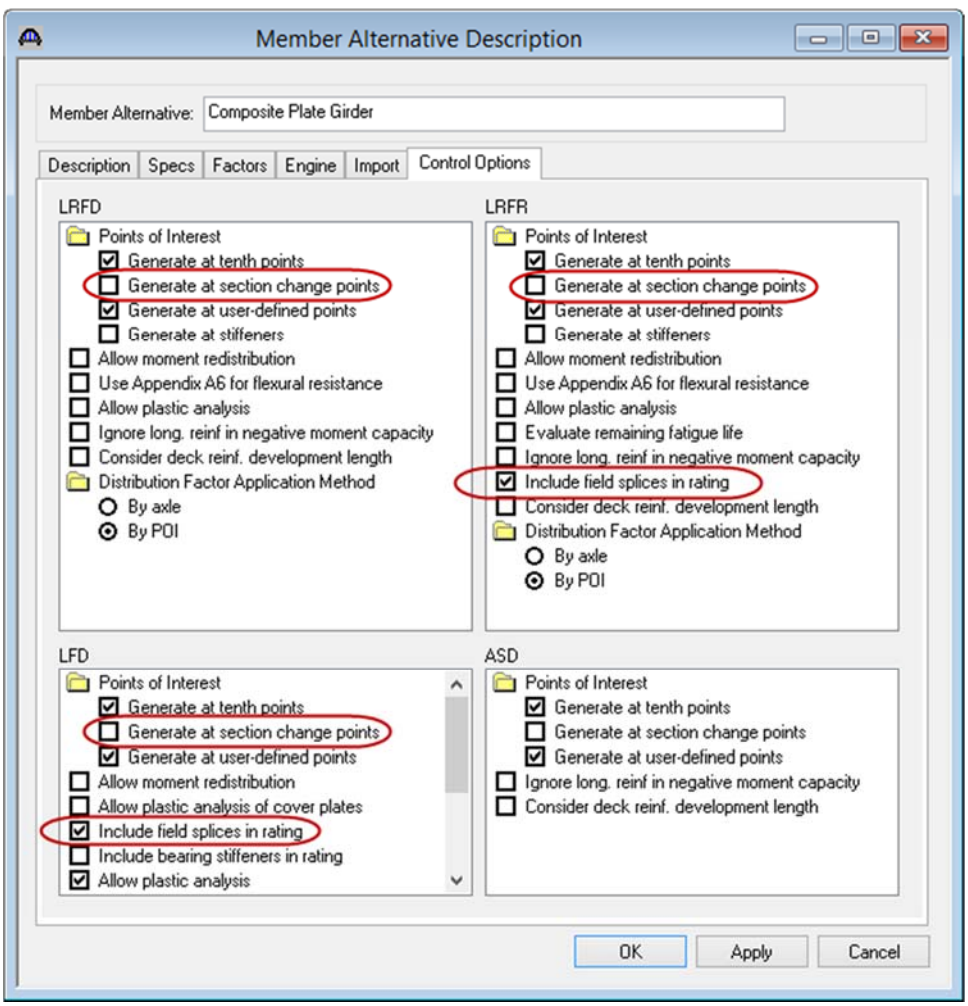
Splice Schematic

Open the splice schematic from either the right-click menu or the toolbar:



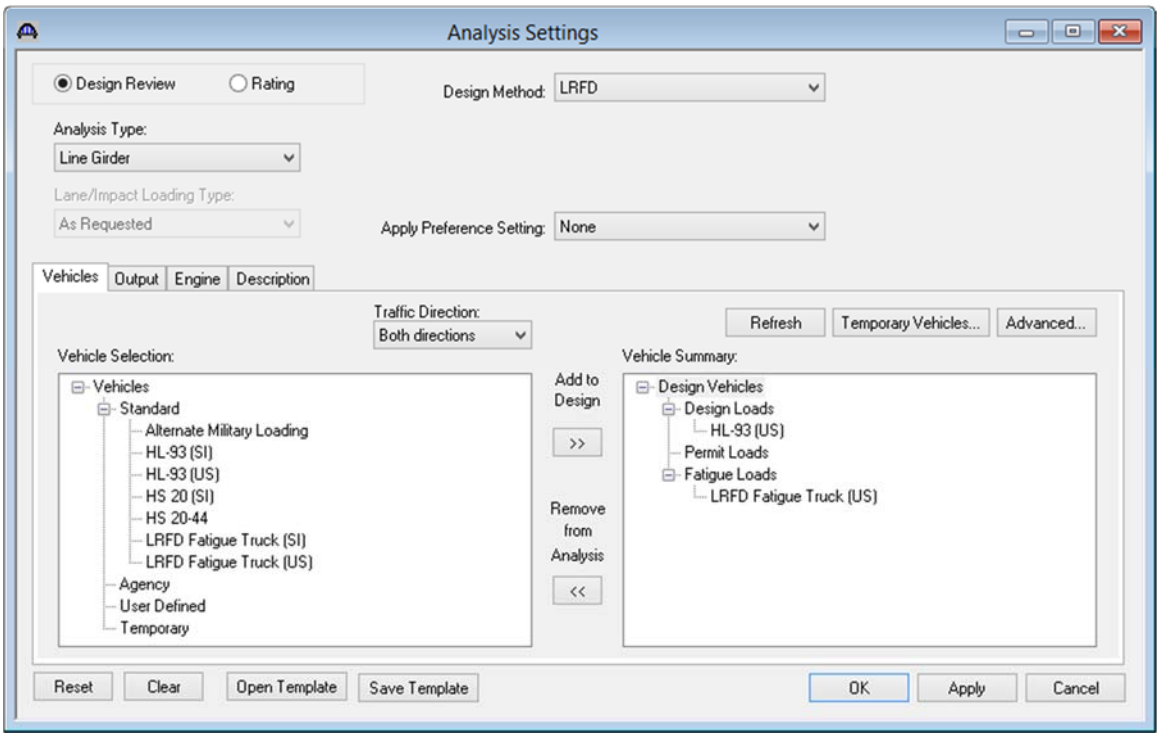
Splice Analysis Options

1. Analyze a single splice:
   Select a Splice Location in the BWS tree and click Analyze. The girder DL and LL analysis will run. Spec checks will be performed at points required for the splice location – the splice itself and stress calculations at adjacent brace points. For LRFR or LFR, the spec checks will include the splice rating articles.
2. Analyze a girder that contains a splice:
   a. LRFD Design Review:
      Select "Generate at section change points" to have spec checking occur at the splice location. Splice articles will be processed in addition to the regular steel girder articles.
   b. LRFR/LFR Rating:
      Select "Generate at section change points" to have spec checking occur at the splice location. Splice articles will be processed in addition to the regular steel girder articles. Also select "Include splices in rating" to have the splice rating articles processed as well.
      Select only "Include splices in rating" to have the splice articles and splice rating articles processed at the splice locations in addition to the regular steel girder articles.



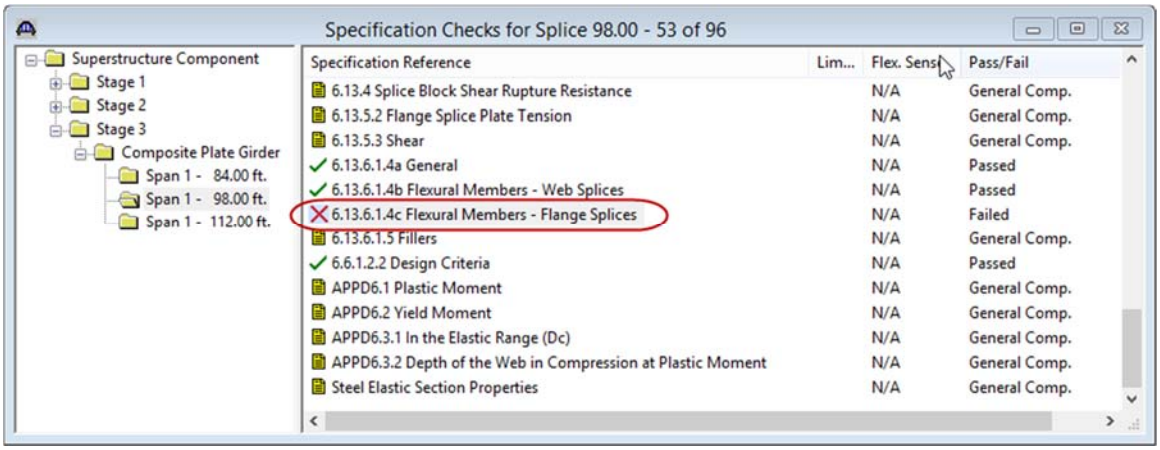
LRFD Design Review

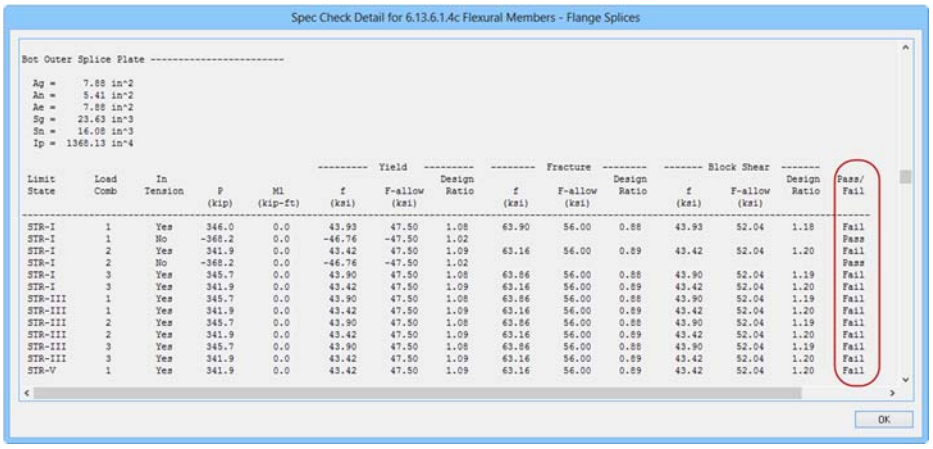
Open the Analysis Settings window and select the HL93 Design Review Template.



Select the splice in the BWS tree, right click and select Analyze. This will launch an analysis and spec check of the points required for the splice – the splice location itself and typically the brace points on the left and right side of the splice location.

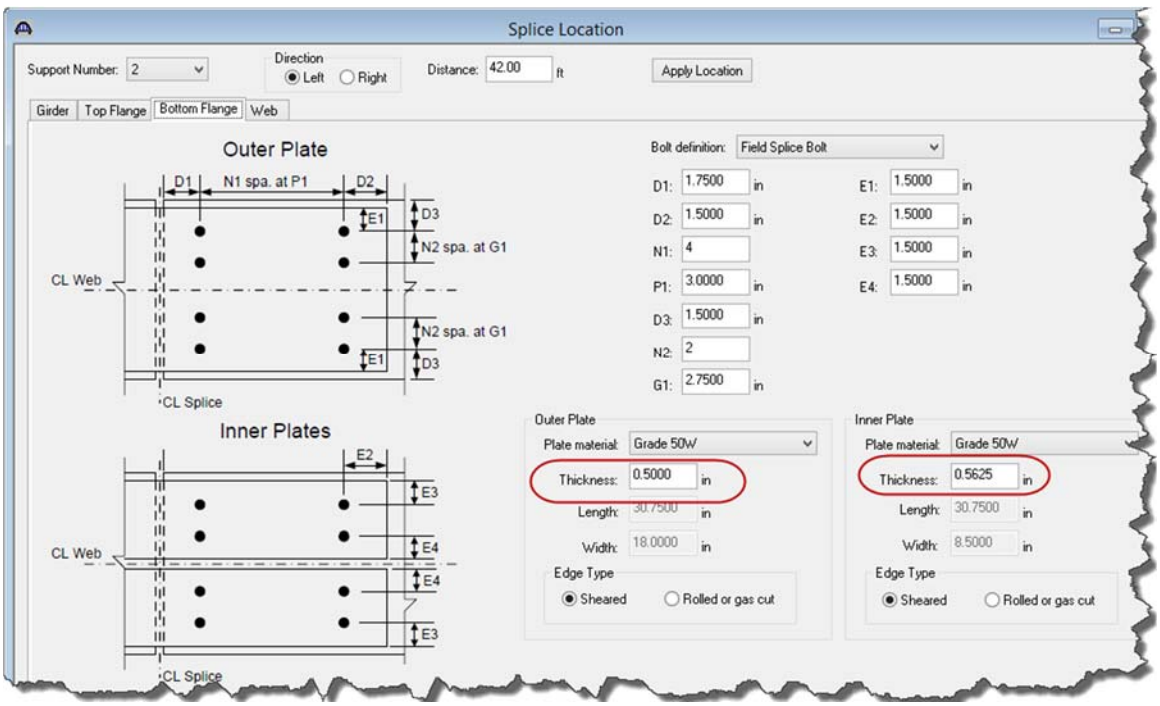
Then open the Spec Check Details window and review the splice articles. LRFD 6.13.6.1.4c Flange Splice fails for the bottom flange splice plates.



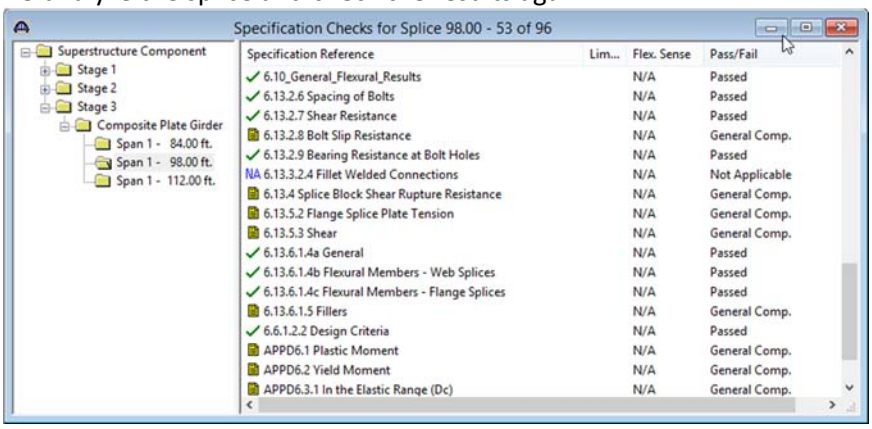


Limit State	Load Comb	In Tension	P (kip)	M1 (kip-ft)	Yield f (ksi)	Yield F-allow (ksi)	Yield Design Ratio	Fracture f (ksi)	Fracture F-allow (ksi)	Fracture Design Ratio	Block Shear f (ksi)	Block Shear F-allow (ksi)	Block Shear Design Ratio	Pass/ Fail
STR-I	1	Yes	346.0	0.0	43.93	47.50	1.08	63.90	56.00	0.88	43.93	52.04	1.18	Fail
STR-I	1	No	-368.2	0.0	-46.76	-47.50	1.02							Pass
STR-I	2	Yes	341.9	0.0	43.42	47.50	1.09	63.16	56.00	0.89	43.42	52.04	1.20	Fail
STR-I	2	No	-368.2	0.0	-46.76	-47.50	1.02							Pass
STR-I	3	Yes	345.7	0.0	43.90	47.50	1.08	63.86	56.00	0.88	43.90	52.04	1.19	Fail
STR-I	3	Yes	341.9	0.0	43.42	47.50	1.09	63.16	56.00	0.89	43.42	52.04	1.20	Fail
STR-III	1	Yes	345.7	0.0	43.90	47.50	1.08	63.86	56.00	0.88	43.90	52.04	1.19	Fail
STR-III	1	Yes	341.9	0.0	43.42	47.50	1.09	63.16	56.00	0.89	43.42	52.04	1.20	Fail
STR-III	2	Yes	345.7	0.0	43.90	47.50	1.08	63.86	56.00	0.88	43.90	52.04	1.19	Fail
STR-III	2	Yes	341.9	0.0	43.42	47.50	1.09	63.16	56.00	0.89	43.42	52.04	1.20	Fail
STR-III	3	Yes	345.7	0.0	43.90	47.50	1.08	63.86	56.00	0.88	43.90	52.04	1.19	Fail
STR-III	3	Yes	341.9	0.0	43.42	47.50	1.09	63.16	56.00	0.89	43.42	52.04	1.20	Fail
STR-V	1	Yes	341.9	0.0	43.42	47.50	1.09	63.16	56.00	0.89	43.42	52.04	1.20	Fail

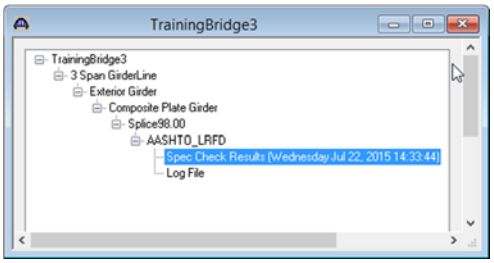
Revise the bottom flange splice plates as follows:

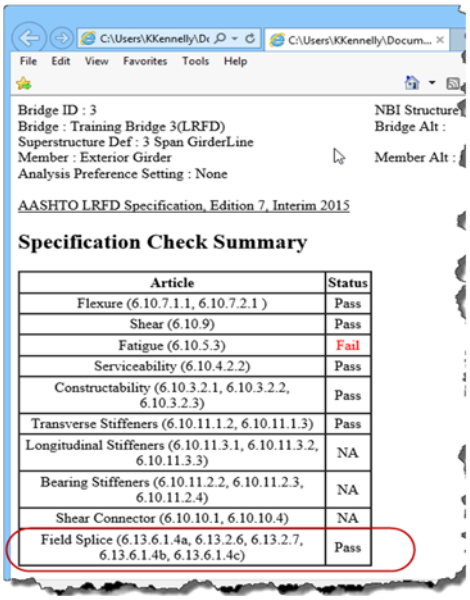


Re-analyze the splice and check the results again:



Additional reporting can be found in the Spec Check Results file:





File Edit View Favorites Tools Help

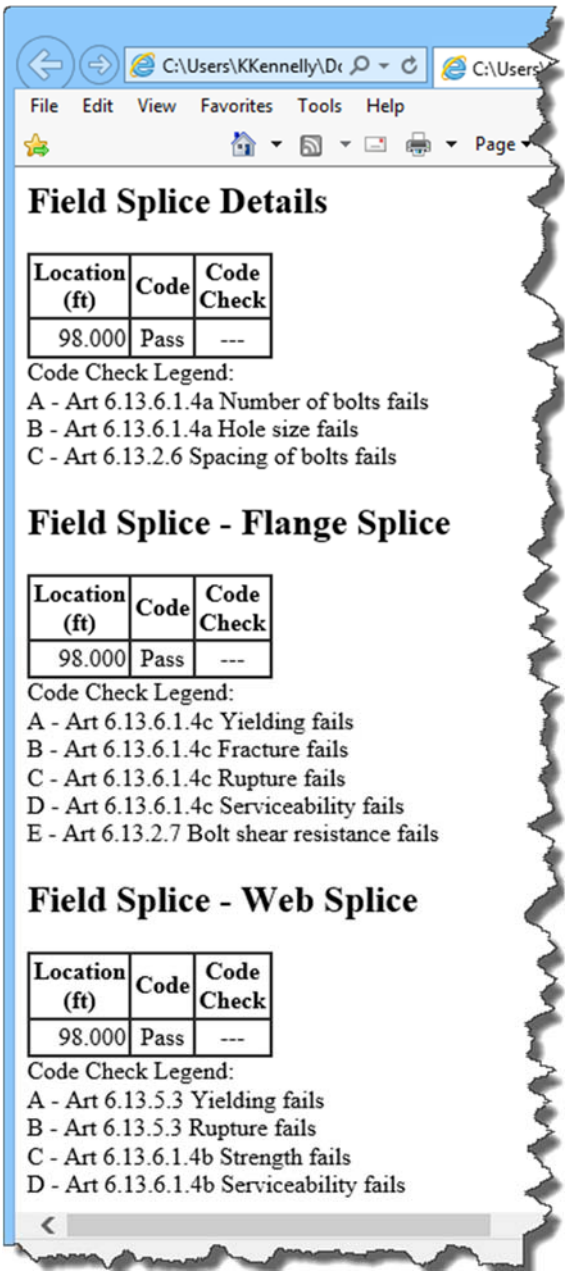
Bridge ID : 3
Bridge : Training Bridge 3(LRFD)
Superstructure Def : 3 Span GirderLine
Member : Exterior Girder
Analysis Preference Setting : None

NBI Structure
Bridge Alt :
Member Alt :

AASHTO LRFD Specification, Edition 7, Interim 2015

Specification Check Summary

Article	Status
Flexure (6.10.7.1.1, 6.10.7.2.1)	Pass
Shear (6.10.9)	Pass
Fatigue (6.10.5.3)	Fail
Serviceability (6.10.4.2.2)	Pass
Constructability (6.10.3.2.1, 6.10.3.2.2, 6.10.3.2.3)	Pass
Transverse Stiffeners (6.10.11.1.2, 6.10.11.1.3)	Pass
Longitudinal Stiffeners (6.10.11.3.1, 6.10.11.3.2, 6.10.11.3.3)	NA
Bearing Stiffeners (6.10.11.2.2, 6.10.11.2.3, 6.10.11.2.4)	NA
Shear Connector (6.10.10.1, 6.10.10.4)	NA
Field Splice (6.13.6.1.4a, 6.13.2.6, 6.13.2.7, 6.13.6.1.4b, 6.13.6.1.4c)	Pass



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Field Splice Details

Location (ft)	Code	Code Check
98.000	Pass	---

Code Check Legend:
A - Art 6.13.6.1.4a Number of bolts fails
B - Art 6.13.6.1.4a Hole size fails
C - Art 6.13.2.6 Spacing of bolts fails

Field Splice - Flange Splice

Location (ft)	Code	Code Check
98.000	Pass	---

Code Check Legend:
A - Art 6.13.6.1.4c Yielding fails
B - Art 6.13.6.1.4c Fracture fails
C - Art 6.13.6.1.4c Rupture fails
D - Art 6.13.6.1.4c Serviceability fails
E - Art 6.13.2.7 Bolt shear resistance fails

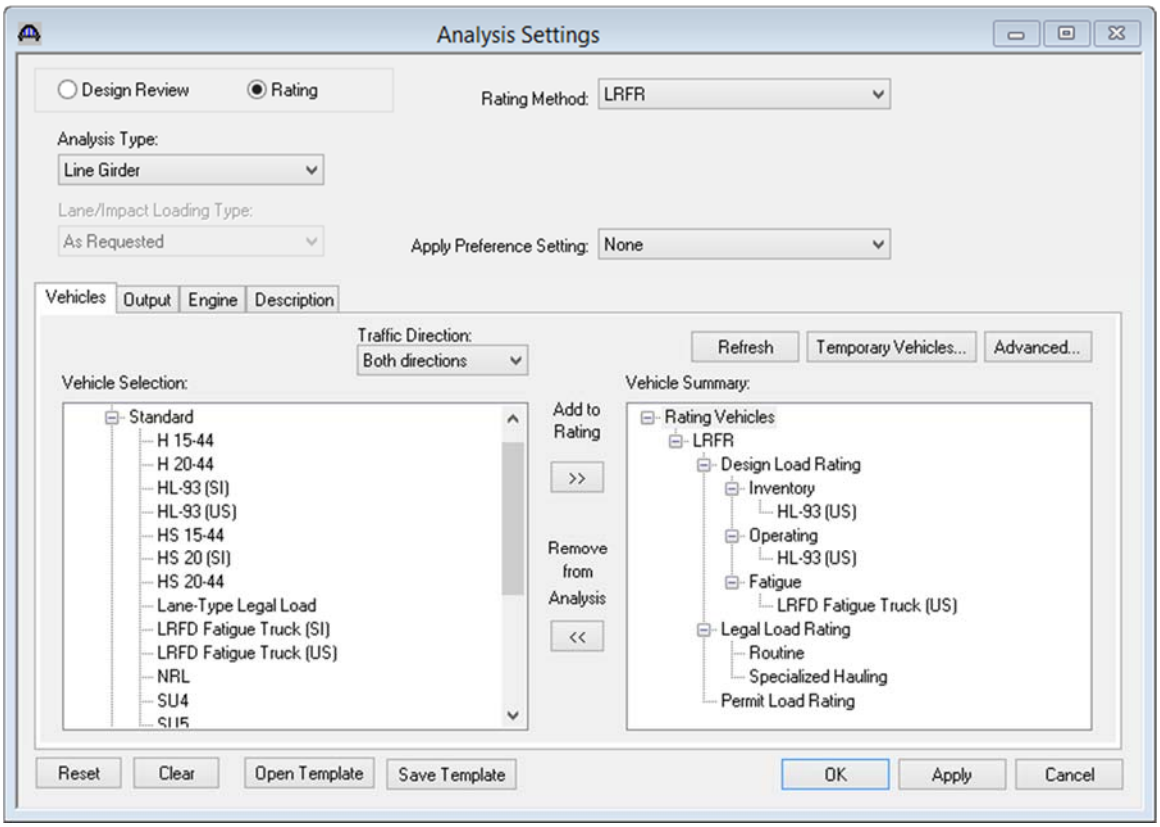
Field Splice - Web Splice

Location (ft)	Code	Code Check
98.000	Pass	---

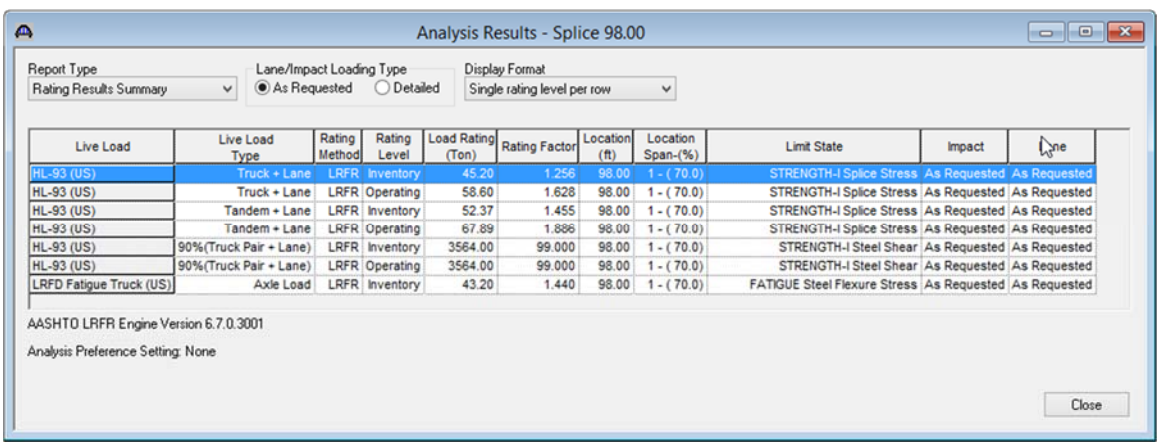
Code Check Legend:
A - Art 6.13.5.3 Yielding fails
B - Art 6.13.5.3 Rupture fails
C - Art 6.13.6.1.4b Strength fails
D - Art 6.13.6.1.4b Serviceability fails

LRFR/LFR Rating

Splices can be rated for either LRFR or LFR. Open the Analysis Settings window and select the "LRFR Design Load Rating Template".



Select the splice in the BWS tree and analyze it. The Tabular Results window shows the controlling rating factors at this location. For this example, some ratings are controlled by the splice and some are controlled by the steel girder.



Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	One
HL-93 (US)	Truck + Lane	LRFR	Inventory	45.20	1.256	98.00	1 - (70.0)	STRENGTH-I Splice Stress	As Requested	As Requested
HL-93 (US)	Truck + Lane	LRFR	Operating	58.60	1.628	98.00	1 - (70.0)	STRENGTH-I Splice Stress	As Requested	As Requested
HL-93 (US)	Tandem + Lane	LRFR	Inventory	52.37	1.455	98.00	1 - (70.0)	STRENGTH-I Splice Stress	As Requested	As Requested
HL-93 (US)	Tandem + Lane	LRFR	Operating	67.89	1.886	98.00	1 - (70.0)	STRENGTH-I Splice Stress	As Requested	As Requested
HL-93 (US)	90%(Truck Pair + Lane)	LRFR	Inventory	3564.00	99.000	98.00	1 - (70.0)	STRENGTH-I Steel Shear	As Requested	As Requested
HL-93 (US)	90%(Truck Pair + Lane)	LRFR	Operating	3564.00	99.000	98.00	1 - (70.0)	STRENGTH-I Steel Shear	As Requested	As Requested
LRFD Fatigue Truck (US)	Axle Load	LRFR	Inventory	43.20	1.440	98.00	1 - (70.0)	FATIGUE Steel Flexure Stress	As Requested	As Requested