AASHTOWare BrDR 7.5.0

Feature Tutorial

Weld Design and Weld Fatigue Analysis

Weld Design and Weld Fatigue Analysis

Topics Covered

- Flange to web weld LRFD Design
- Flange to web weld LRFD Design Review
- Weld Fatigue Analysis

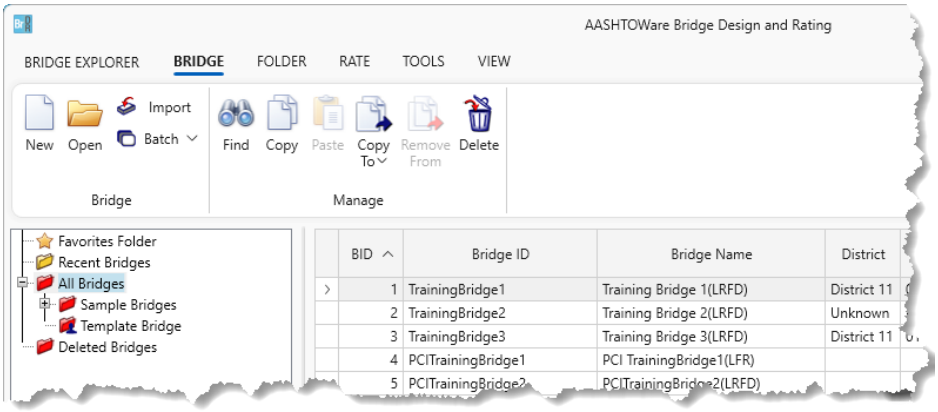
Weld Design and Design Review

Using **BID1** in the sample bridge database, the step-by-step process of fillet weld design at flange-web junction of a scheduled based plate girder is described below.

Weld Design and Design Review Steps

Open BID1

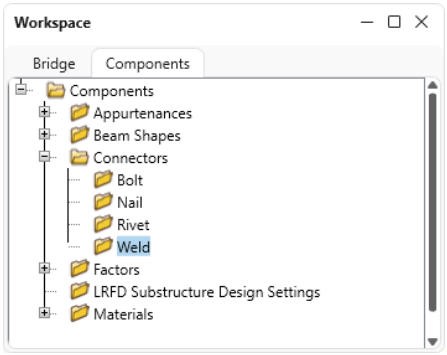
Open BrDR then open **TrainingBridge1** (BID1) by double clicking on the bridge.



Open Connectors - Weld

In the **Bridge Workspace**, **Components** tab, expand **Connectors** and double click on **Weld** to add a weld definition.

Bridge Workspace - Components tab

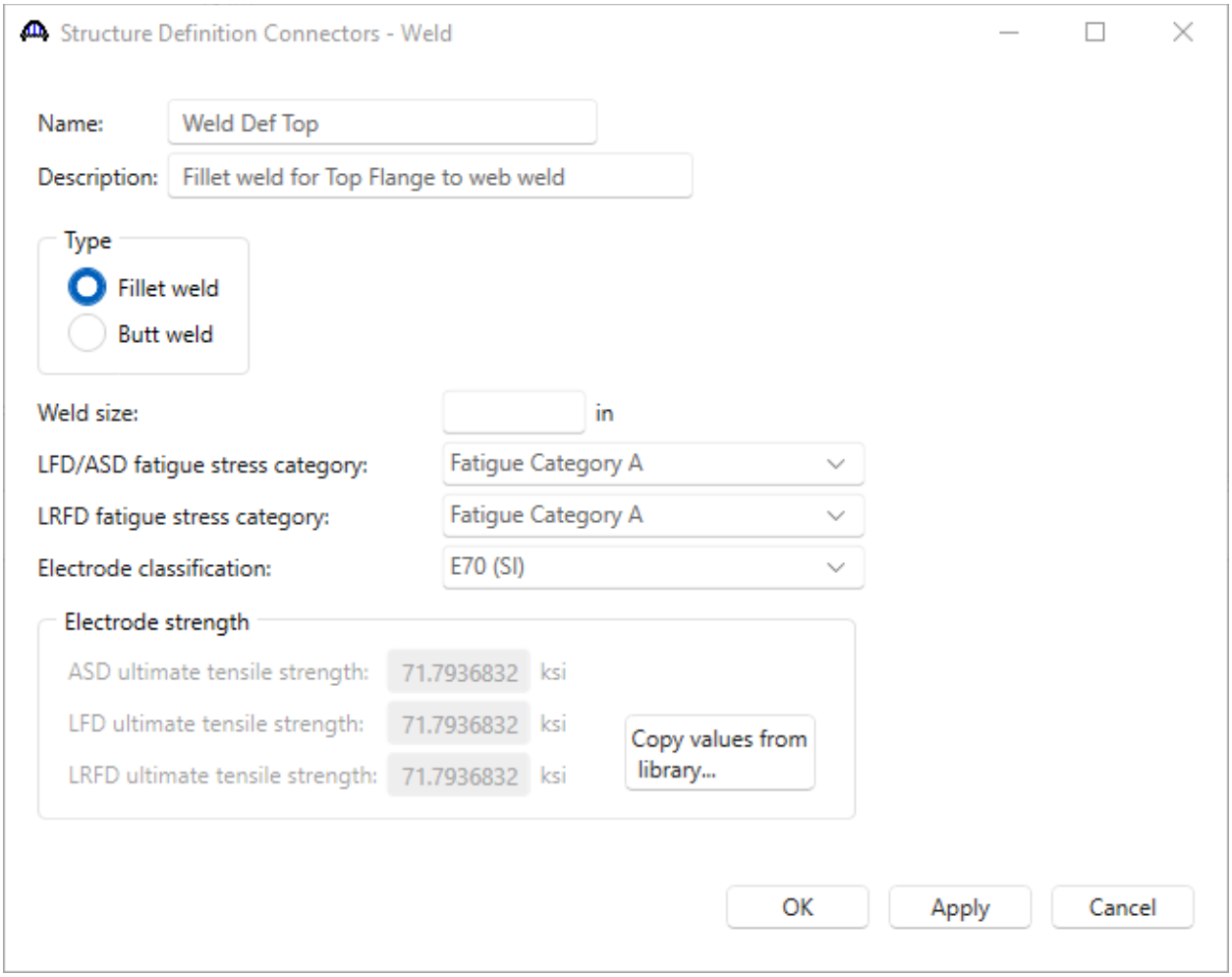


Define the Welds

For weld design of top flange – web fillet weld:

Leave the **Weld size** field blank to be designed as per LRFD article 6.13.3.2.4 (Weld Design). After entering all the fields shown below, click on the **Copy values from library...** button to populate the **Electrode strength** of the weld fields. Click **OK** to save the data.

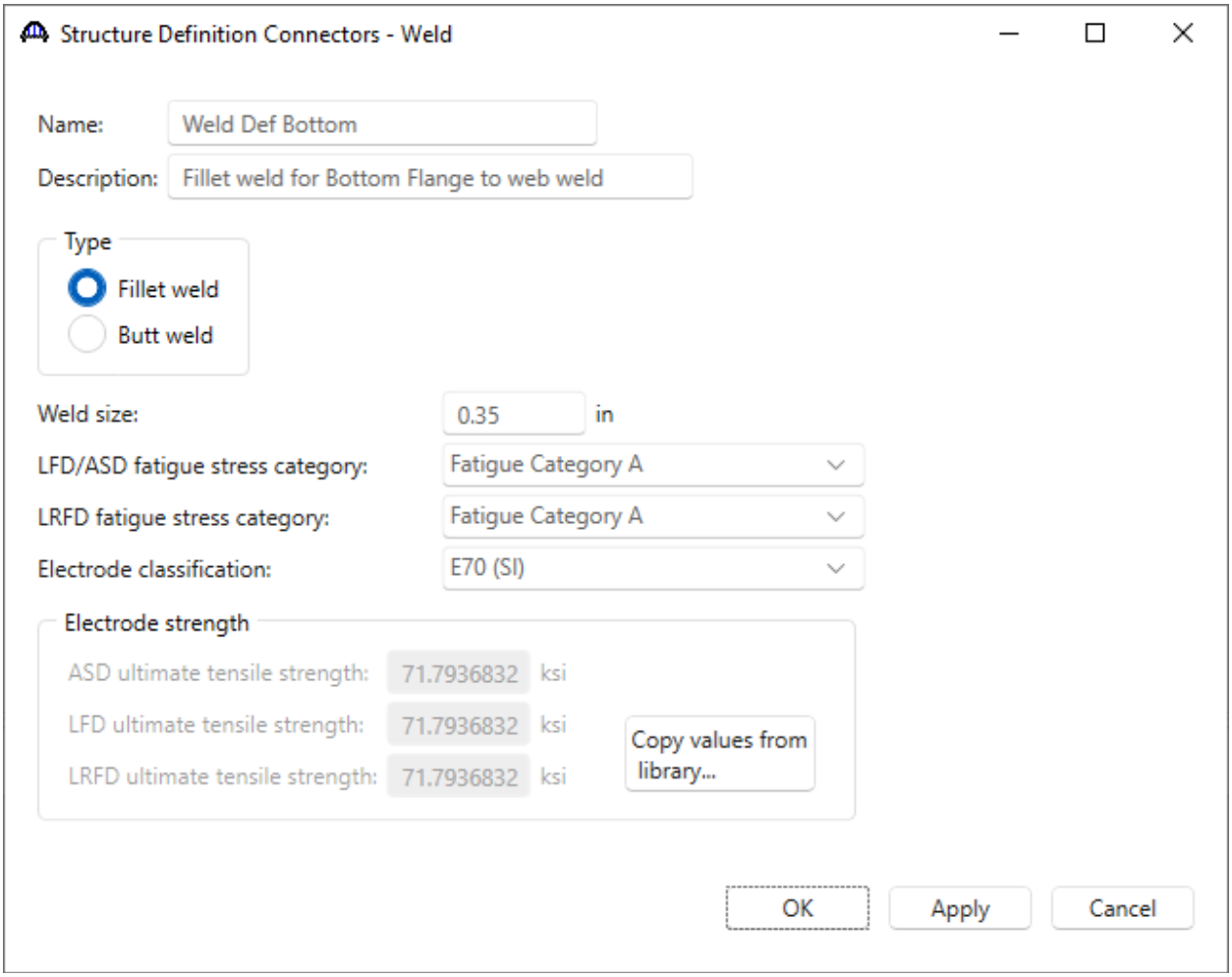
Structure Definition Connectors – Weld (Top)



For weld design review of bottom flange – web fillet weld

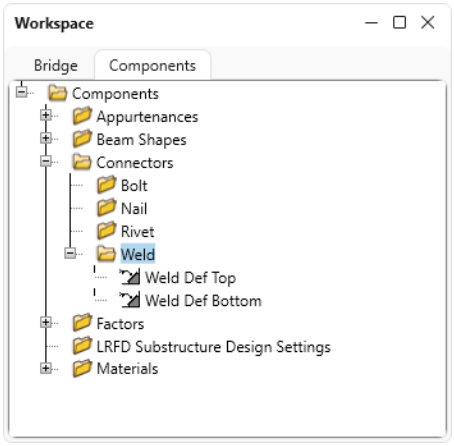
Open **Weld** again and repeat above to define **Weld Def Bottom**. Indicate a value in the **Weld size** field for it to undergo design review as per LRFD article 6.13.3.2.4. Click **OK** to save the definition.

Structure Definition Connectors – Weld (Bottom)



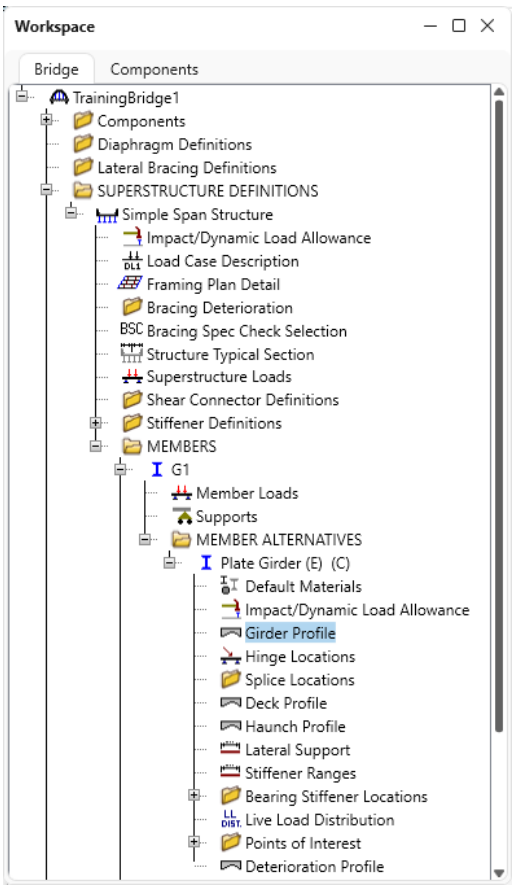
The **Connectors->Weld->Weld Def Top** & **Weld Def Bottom** as defined should reflect on the **TrainingBridge1** tree as shown below.

Bridge Workspace – Components - Weld



Navigate to girder profile:

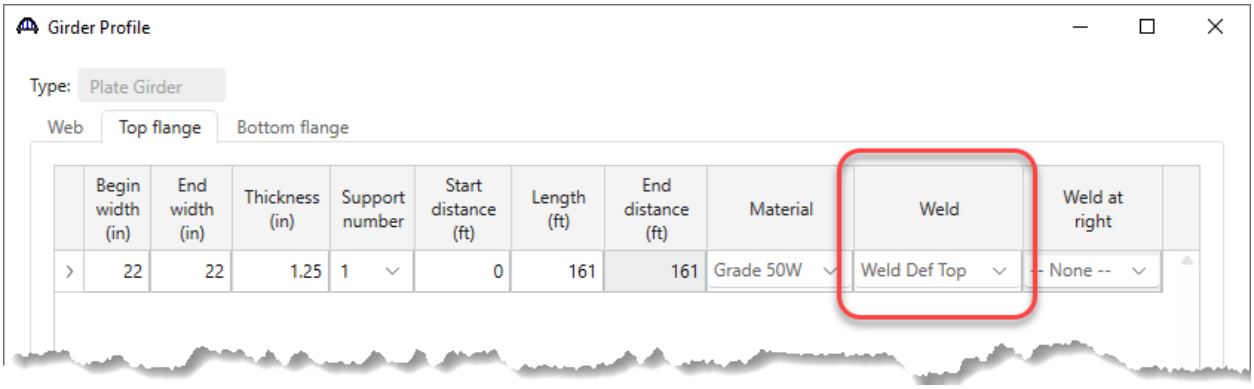
Navigate back to the Bridge tab and expand the **MEMBERS** folder. Expand **G1** and then expand the **MEMBER ALTERNATIVES** folder. Expand **Plate Girder** as shown below and open **Girder Profile**.



Allocate flange - web weld definition

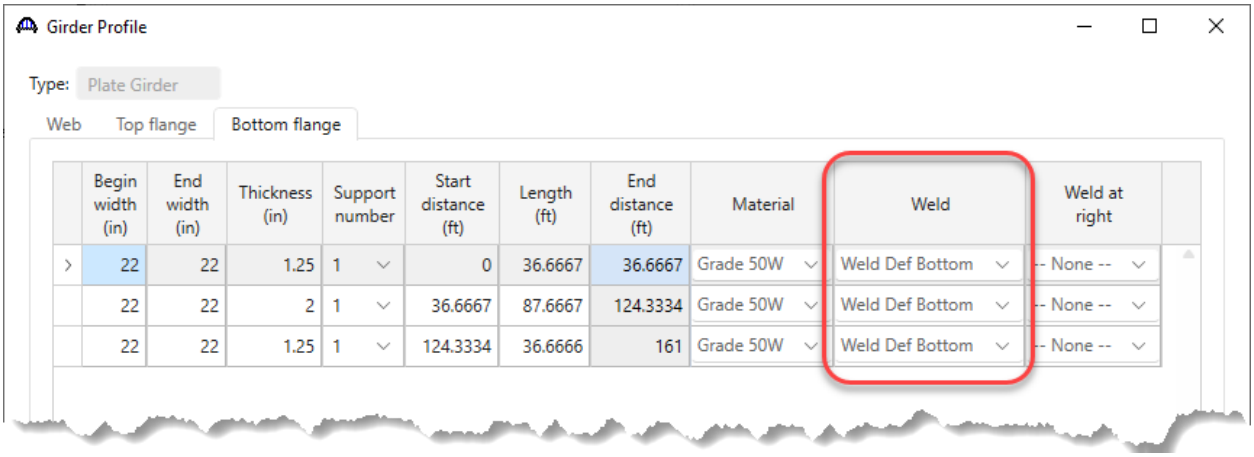
In the **Girder Profile** window, for **Top Flange,** locate the **Weld** field, select **Weld Def Top** from the dropdown as shown below. This will design the top flange-web fillet weld for the range of the top flange plate indicated below.

Girder Profile – Top flange



Repeat the same process for the bottom flange as shown below

Girder Profile – Bottom flange



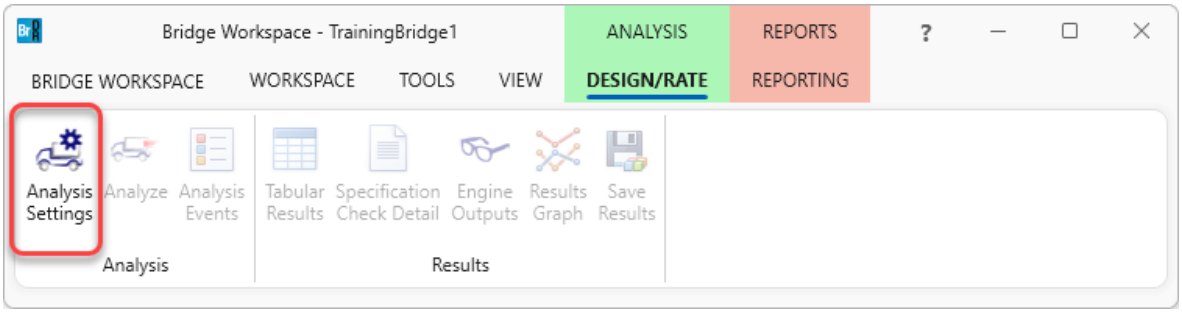
Please note that the same definition can be used for both the top and bottom flange to web welds provided that both the weld definitions are either undergoing design or design review. Similarly different weld definitions can also be used for different ranges of top and bottom flange plates.

Click **OK** to save the details of allocation and close the window.

Define Analysis Settings

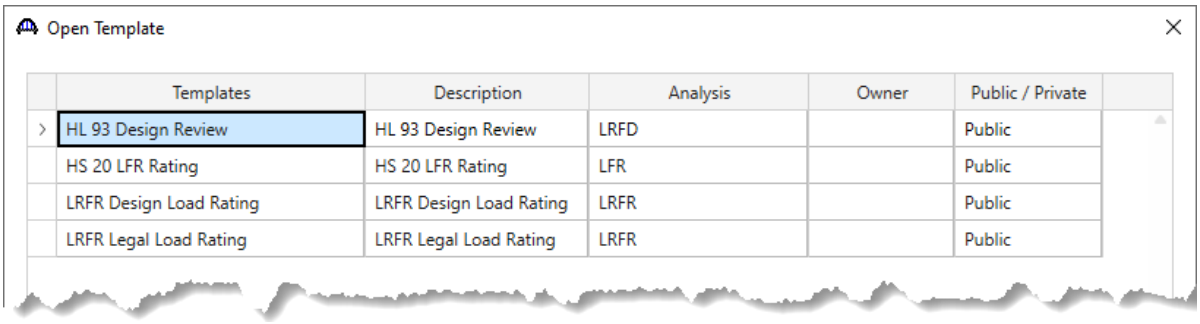
From the **Analysis** group of the **DESIGN/RATE** ribbon, click on the **Analysis Settings** button.

Bridge Workspace – Analysis Settings



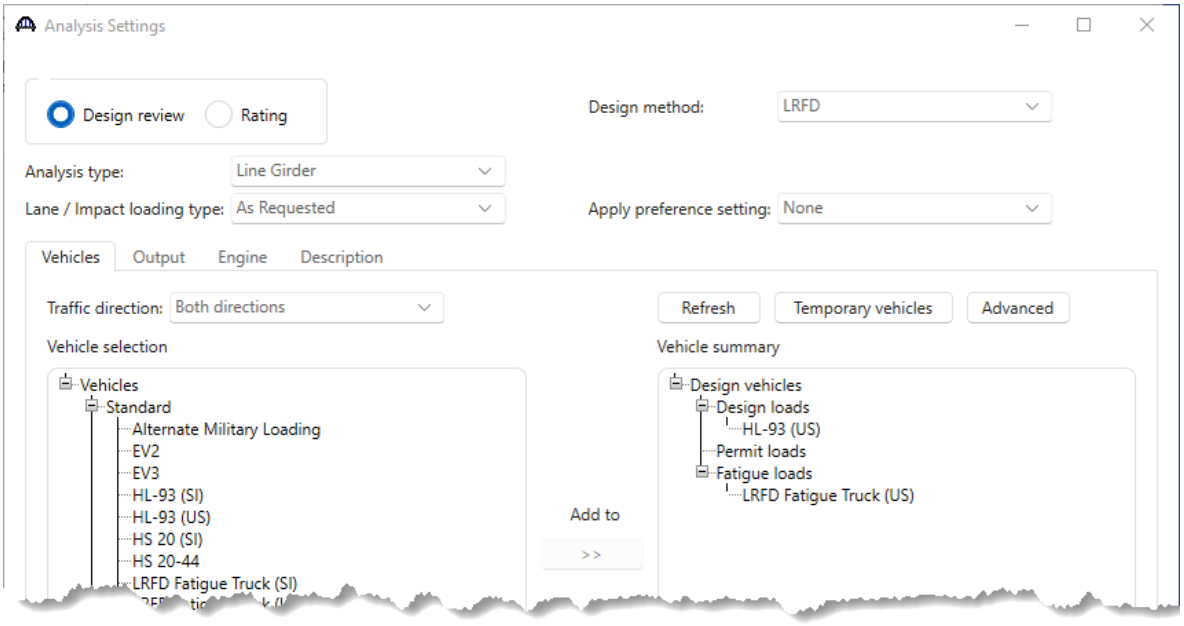
In the **Analysis Settings** window, click on the **Open template** button and select **HL 93 Design Review** as shown below and click **Open**.

Open Template



The **Analysis Settings** window is shown below.

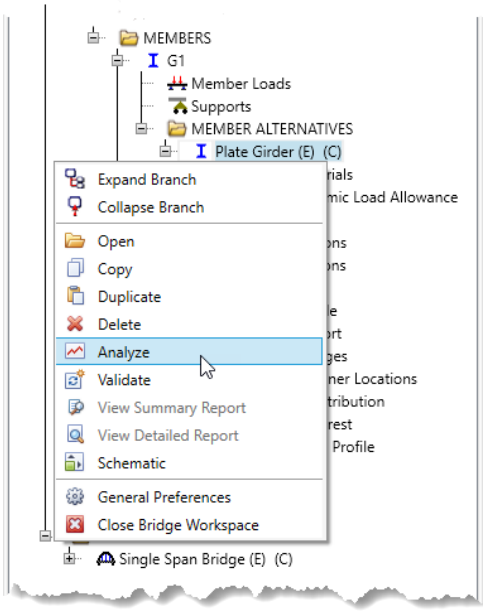
Analysis Settings



Click **OK** to save the settings.

Analyze G1 – Plate Girder:

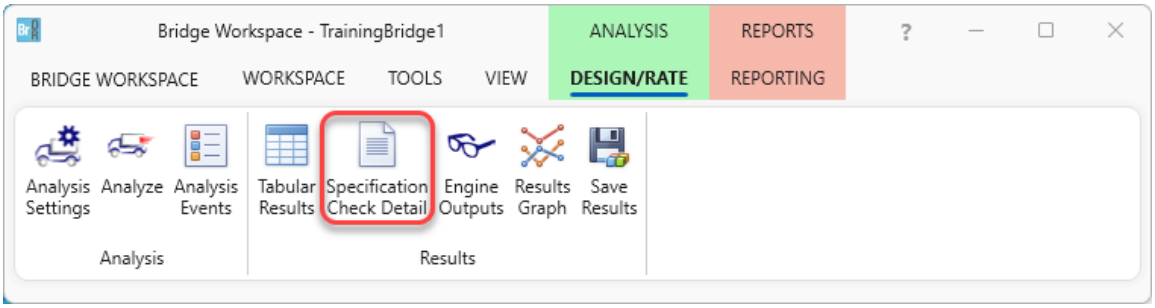
To perform the analysis on the **G1** member alternative, right click on **Plate Girder** and select **Analyze**.



View Spec Check for LRFD article 6.13.3.2.4

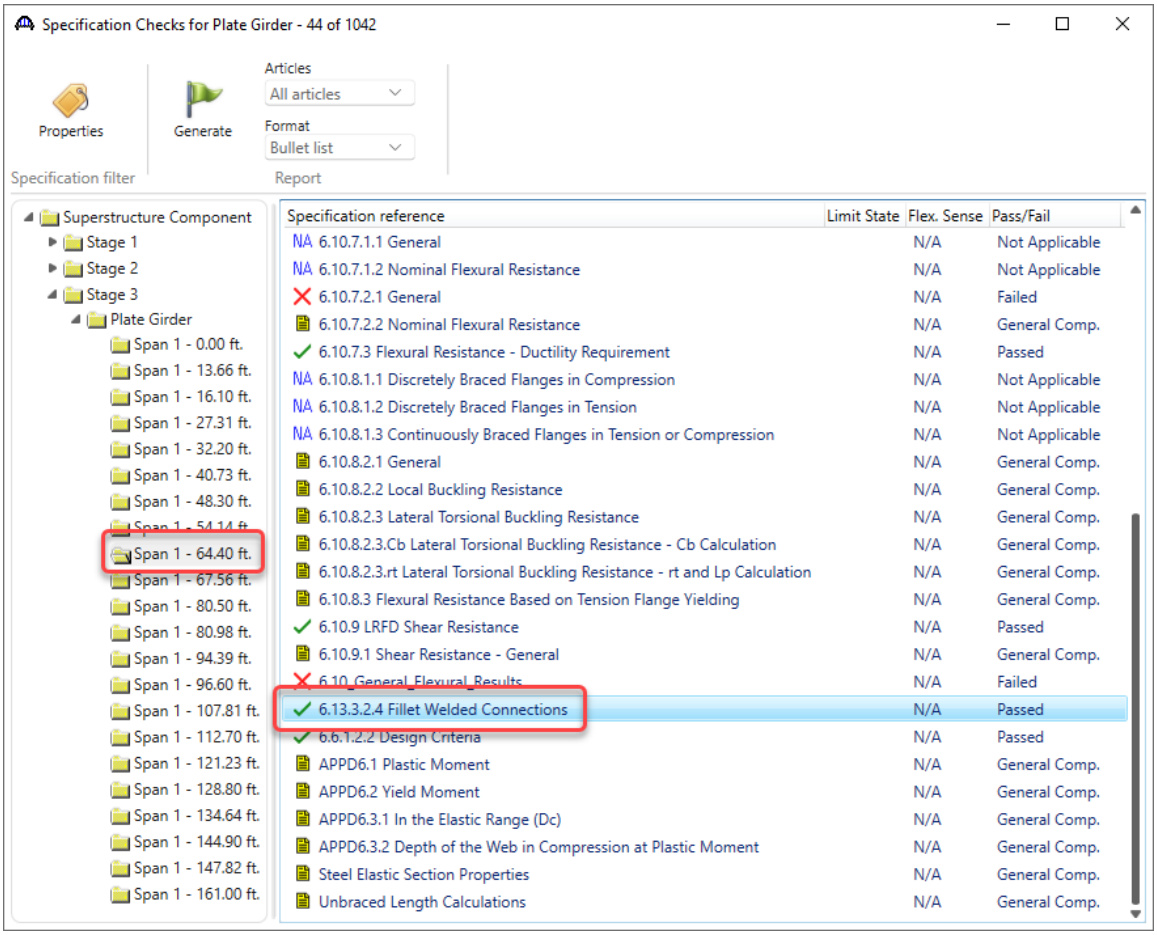
After the analysis completes, click on the **Specification Check Detail** button from the **Results** group of the **DESIGN/RATE** ribbon to open the **Specification Checks** window (with the **Plate Girder** highlighted as shown above).

Bridge Workspace – ANALYSIS DESIGN/RATE ribbon



Navigate to **Superstructure Component->Stage 3->Plate Girder-> Span 1 – 64.4 ft.** (this is a representative point for demonstration; you can navigate to any other spec check point you wish to check).

Open **article 6.13.3.2.4 Fillet Welded Connections** as shown below.



Weld details for top and bottom flange to web welds are provided as below. Note that the Top flange weld size is not visible since it has been designed and shown below.

Specification Check Detail for 6.13.3.2.4 Fillet Welded Connections

```
Top flange to web weld
----------------------
Fexx  =   71.7937 (ksi)
Phie2 =    0.8000
Fu_w  =   70.0000 (ksi)
Fu_tf =   70.0000 (ksi)
Phivu =    0.8500

Bottom Flange to Web Weld
-------------------------
Fexx  =   71.7937 (ksi)
Phie2 =    0.8000
Fu_w  =   70.0000 (ksi)
Fu_bf =   70.0000 (ksi)
Phivu =    0.8500
Weld size =    0.3500 (in)
```

The weld resistances for the top and the bottom flange is shown below.

```
SUMMARY:

Weld Metal Resistance (top flange):
Rr1 = 0.6*Phie2*Fexx           =  34.4610 (ksi)              (6.13.3.2.4-1)
Rr2 = 0.58*Phivu*Fu_tf*SQRT(2) =  48.8045 (ksi)              (6.13.5.3-2)
Rr3 = 0.58*Phivu*Fu_w*SQRT(2)  =  48.8045 (ksi)              (6.13.5.3-2)
Rr  = Min(Rr1, Rr2, Rr3)       =  34.4610 (ksi)

Weld Metal Resistance (bottom flange):
Rr1 = 0.6*Phie2*Fexx           =  34.4610 (ksi)              (6.13.3.2.4-1)
Rr2 = 0.58*Phivu*Fu_bf*SQRT(2) =  48.8045 (ksi)              (6.13.5.3-2)
Rr3 = 0.58*Phivu*Fu_w*SQRT(2)  =  48.8045 (ksi)              (6.13.5.3-2)
Rr  = Min(Rr1, Rr2, Rr3)       =  34.4610 (ksi)
```

Fillet - weld design for the top flange to web

Design Step 1

Allowable weld size was determined as per the strength criteria as shown in the tables below. Please note that thickness and size have the same meaning here.

$$\text{Required weld thickness} = \frac{v\ (\text{total})}{Rr}$$

Factored load computation for weld design (top flange):

Limit State	Flex Type	VDL Stage 1 (kip)	vDL Stage 1 (kip/in)	VDL Stage 2 (kip)	vDL Stage 2 (kip/in)
STR-I	Pos	37.22	0.42	11.73	0.15
STR-I	Pos	26.80	0.30	6.54	0.09
STR-I	Pos	37.22	0.42	11.73	0.15
STR-I	Pos	26.80	0.30	6.54	0.09
STR-III	Pos	37.22	0.42	11.73	0.15
STR-III	Pos	26.80	0.30	6.54	0.09
STR-III	Pos	37.22	0.42	11.73	0.15
STR-III	Pos	26.80	0.30	6.54	0.09
STR-V	Pos	37.22	0.42	11.73	0.15
STR-V	Pos	26.80	0.30	6.54	0.09
STR-V	Pos	37.22	0.42	11.73	0.15
STR-V	Pos	26.80	0.30	6.54	0.09

Limit State	Flex Type	Load Combo	VLL (kip)	vLL (kip/in)	vtotal (kip/in)	Required Weld Size (Strength) (in)	Design Ratio	Code
STR-I	Pos	1	124.24	1.71	2.29	0.0939	2.000	Pass
STR-I	Pos	1	-72.29	-1.00	-0.61	0.0251	2.000	Pass
STR-I	Pos	2	101.61	1.40	1.97	0.0810	2.000	Pass
STR-I	Pos	2	-59.99	-0.83	-0.44	0.0181	2.000	Pass
STR-III	Pos	1	0.00	0.00	0.57	0.0235	2.000	Pass
STR-III	Pos	1	0.00	0.00	0.39	0.0159	2.000	Pass
STR-III	Pos	2	0.00	0.00	0.57	0.0235	2.000	Pass
STR-III	Pos	2	0.00	0.00	0.39	0.0159	2.000	Pass
STR-V	Pos	1	95.84	1.32	1.90	0.0778	2.000	Pass
STR-V	Pos	1	-55.77	-0.77	-0.38	0.0157	2.000	Pass
STR-V	Pos	2	78.39	1.08	1.65	0.0679	2.000	Pass
STR-V	Pos	2	-46.28	-0.64	-0.25	0.0103	2.000	Pass

Design Step 2

The weld size was optimized using article 6.13.3.4 as shown below to provide the final designed weld size for the top flange to web weld.

```
Designed top flange fillet weld size:
-------------------------------------
Article 6.13.3.4
Maximum fillet weld size allowed = 0.4375 (in)
Minimum fillet weld size allowed = 0.3125 (in)
Design fillet weld size at the top flange = 0.3125 (in)
```

Fillet - weld design review for the bottom flange to web:

Design Review Step 1

The bottom flange weld size (which was provided) was reviewed as per article 6.13.3.4 (allowable weld size) as shown below:

```
Bottom Flange Weld:
-------------------
Throat(eff)       =   0.2475 (in)
Area(eff)         =   0.4950(in^2/in)
Weld Resistance   =   Rr*A(eff)
Weld Resistance   =  17.0573(kip/in)

Article 6.13.3.4:
Maximum weld size allowed =    0.4375 (in)          Pass
Minimum weld size allowed =    0.3125 (in)          Pass
```

Design Review Step 2

The bottom flange weld size specification check was performed

Specification Check for bottom flange-web weld:

Limit State	Flex Type	VDL Stage 1 (kip)	vDL Stage 1 (kip/in)	VDL Stage 2 (kip)	vDL Stage 2 (kip/in)
STR-I	Pos	37.22	0.49	11.73	0.13
STR-I	Pos	26.80	0.35	6.54	0.07
STR-I	Pos	37.22	0.49	11.73	0.13
STR-I	Pos	26.80	0.35	6.54	0.07
STR-III	Pos	37.22	0.49	11.73	0.13
STR-III	Pos	26.80	0.35	6.54	0.07
STR-III	Pos	37.22	0.49	11.73	0.13
STR-III	Pos	26.80	0.35	6.54	0.07
STR-V	Pos	37.22	0.49	11.73	0.13
STR-V	Pos	26.80	0.35	6.54	0.07
STR-V	Pos	37.22	0.49	11.73	0.13
STR-V	Pos	26.80	0.35	6.54	0.07

Limit State	Flex Type	Load Combo	VLL (kip)	vLL (kip/in)	vtotal (kip/in)	Required Weld Size(Strength) (in)	Design Ratio	Code
STR-I	Pos	1	124.24	1.32	1.94	0.0798	8.771	Pass
STR-I	Pos	1	-72.29	-0.77	-0.34	0.0140	49.910	Pass
STR-I	Pos	2	101.61	1.08	1.70	0.0699	10.010	Pass
STR-I	Pos	2	-59.99	-0.64	-0.21	0.0087	80.893	Pass
STR-III	Pos	1	0.00	0.00	0.62	0.0256	27.369	Pass
STR-III	Pos	1	0.00	0.00	0.43	0.0175	39.930	Pass
STR-III	Pos	2	0.00	0.00	0.62	0.0256	27.369	Pass
STR-III	Pos	2	0.00	0.00	0.43	0.0175	39.930	Pass
STR-V	Pos	1	95.84	1.02	1.64	0.0674	10.384	Pass
STR-V	Pos	1	-55.77	-0.59	-0.17	0.0068	99.000	Pass
STR-V	Pos	2	78.39	0.83	1.46	0.0598	11.707	Pass
STR-V	Pos	2	-46.28	-0.49	-0.07	0.0027	99.000	Pass

For article 6.13.3.2.4 to pass, the weld design (top flange) and the weld design review (bottom flange) should both Pass.

Close the bridge **BID1** without saving it.

Weld Fatigue Analysis

Table 1: Weld Fatigue Analysis Detail

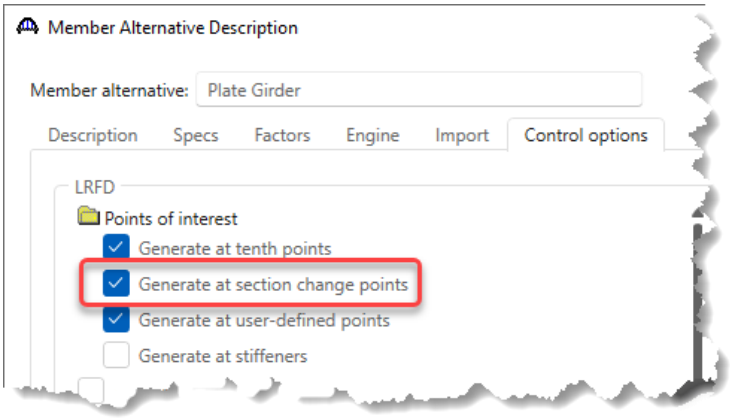
Fatigue Detail	**Conditions for Generation**	**Fatigue Category**
Web to flange weld	Detail automatically generated at every analysis point for plate girders.	Category based on the 'LRFD fatigue stress category' defined on the 'Structure Definition Connectors – Weld definition' window. Otherwise, determined from the Specification.
Plate girder flange groove welded butt splices	Detail automatically generated at every analysis point where condition exists. Analysis point at transition is generated if user picks 'Generate at section change points'.	Schedule based beams: Category based on the 'LRFD fatigue stress category' defined on the 'Structure Definition Connectors – Weld Definition' window. Otherwise, determined from the Specification. Cross Section based beams: Determined from the Specification since the user cannot assign a weld definition.
Bearing stiffener weld to top/bottom flange	• Analysis point generated at every bearing stiffener location at an offset distance from the C.L. of bearing specified by the user on the 'Bearing Stiffener Location' window if user picked 'Generate at stiffeners' • Detail only generated if 'Top' or 'Bottom' flange welds are defined on the 'Bearing Stiffener Definition' window	Category based on the 'LRFD fatigue stress category' defined on the 'Structure Definition Connectors – Weld Definition' window.
Bearing stiffener weld to web	• Analysis point generated at every bearing stiffener location at an offset distance from the c.l. of bearing specified by the user on the 'Bearing	Category based on the 'LRFD fatigue stress category' defined on the 'Structure Definition Connectors – Weld Definition'

Fatigue Detail	Conditions for Generation	Fatigue Category
	Stiffener Location' window if user picked 'Generate at stiffeners' • Detail automatically generated at every analysis point where stiffener exists	window. Otherwise, determined from the Specification.
Transverse stiffener weld to top/bottom flange	• Analysis point generated at every stiffener location defined on the 'Stiffener Ranges' window if user picked "Generate at stiffeners' • Detail only generated if the 'Top' or 'Bottom' flange welds are defined on the 'Transverse Stiffener Definition' • Detail not generated at the respective flanges if the 'Top Gap' or 'Bottom Gap' user input on the 'Transverse Stiffener Definition' window is greater than zero	Category based on the 'LRFD fatigue stress category' defined on the 'Structure Definition Connectors – Weld Definition' window.
Transverse stiffener weld to web	• Analysis point generated at every stiffener location if user picked "Generate at stiffeners' • Detail automatically generated at every analysis point where stiffener exists • Distance to the fatigue detail from the top or bottom of web is based on the user input 'Top Gap' and /or 'Bottom Gap' on the 'Transverse Stiffener Definition' window. If the values are left blank, the distance is considered to be 0.0	Category based on the 'LRFD fatigue stress category' defined on the 'Structure Definition Connectors – Weld Definition' window. Otherwise, determined from the Specification.
Shear stud weld to top flange	• Detail automatically generated at every analysis point where shear connectors exist • Detail is only generated if a defined shear connector is used. The detail	Determined from the Specification.

Fatigue Detail	Conditions for Generation	Fatigue Category
	will not be generated for ranges where "Composite" is chosen as the Connector ID	
Longitudinal Stiffeners	• Analysis point generated at the start and end of the stiffener if user picked 'Generate at stiffeners' • Detail automatically generated at every analysis point where a plate longitudinal stiffener exists	• Category at the start and end of the stiffener is determined from the Specification • Category based on the 'LRFD fatigue stress category' defined on the 'Structure Definition Connectors – Weld Definition' window. Otherwise, determined from the Specification
Welded cover plates	• Analysis point at start and end of cover plate is generated if user picks 'Generate at section change points' • Start and end cover plate detail automatically generated at every analysis point where a welded cover plate starts or ends • Cover plate side weld detail automatically generated at every analysis point that contains a welded cover plate	Category based on the 'LRFD fatigue stress category' defined on the 'Structure Definition Connectors – Weld Definition' window. Otherwise, determined from the Specification.

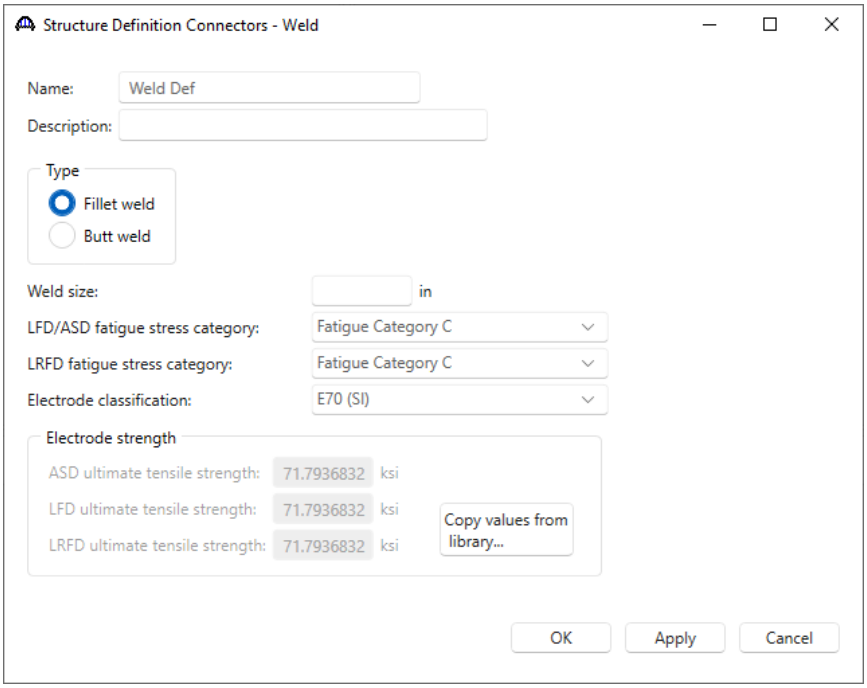
The above table provides the list of locations stating when and where the weld fatigue analysis is carried out. The fatigue analysis of flange butt welds and welded cover plates at the start/end can be obtained by editing the **Member Alternative Description** window **-> Control Options** tab **-> LRFD -> Point of Interest -> Generate at section change points** as shown below.

Member Alternative Description – Control options



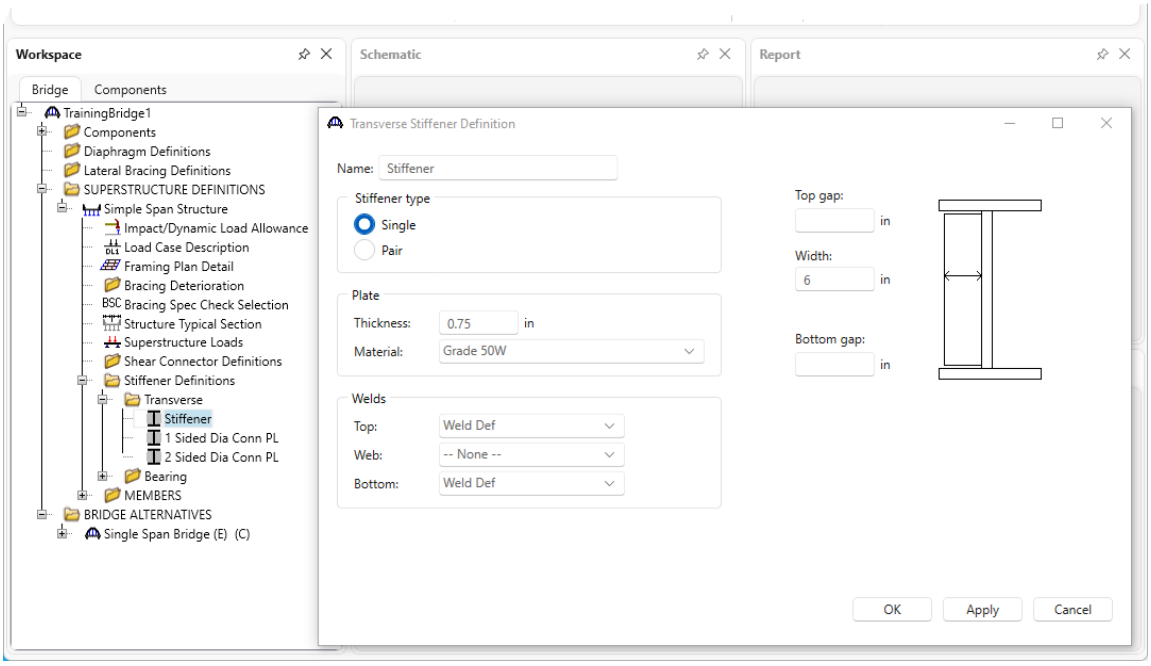
As discussed in the beginning of this section, open **BID1** from the **Bridge Explorer** and define a weld definition as defined above in the section **Structure Definition Connector** and name it **Weld Def.** Assign the LRFD Fatigue Category as **Fatigue Category C**.

Structure Definition Connectors - Weld

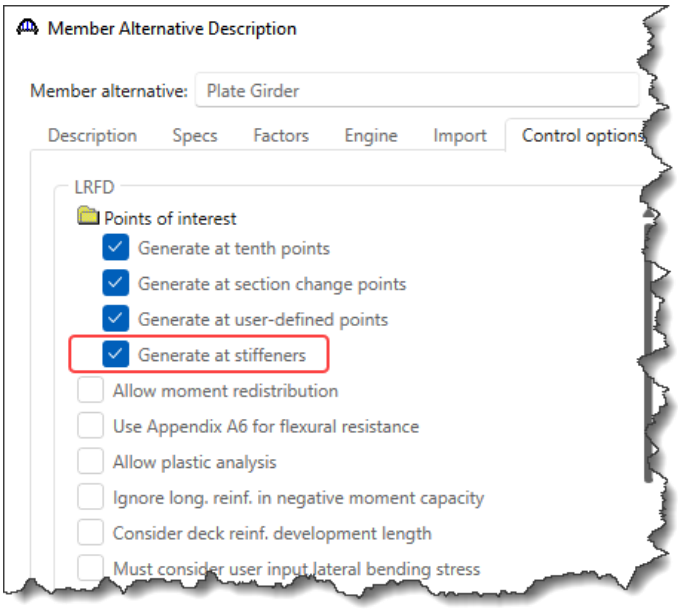


Stiffener Definitions – Transverse Stiffener Definition

Open the **Stiffener Definitions – Transverse Stiffener Definition** and assign the weld definition as shown below.



Before running the LRFD design review for **Member G1, Member Alternative: Plate Girder** as shown in the previous section, make sure that in the **Control options tab** the **Generate at Stiffeners** option is selected**.**



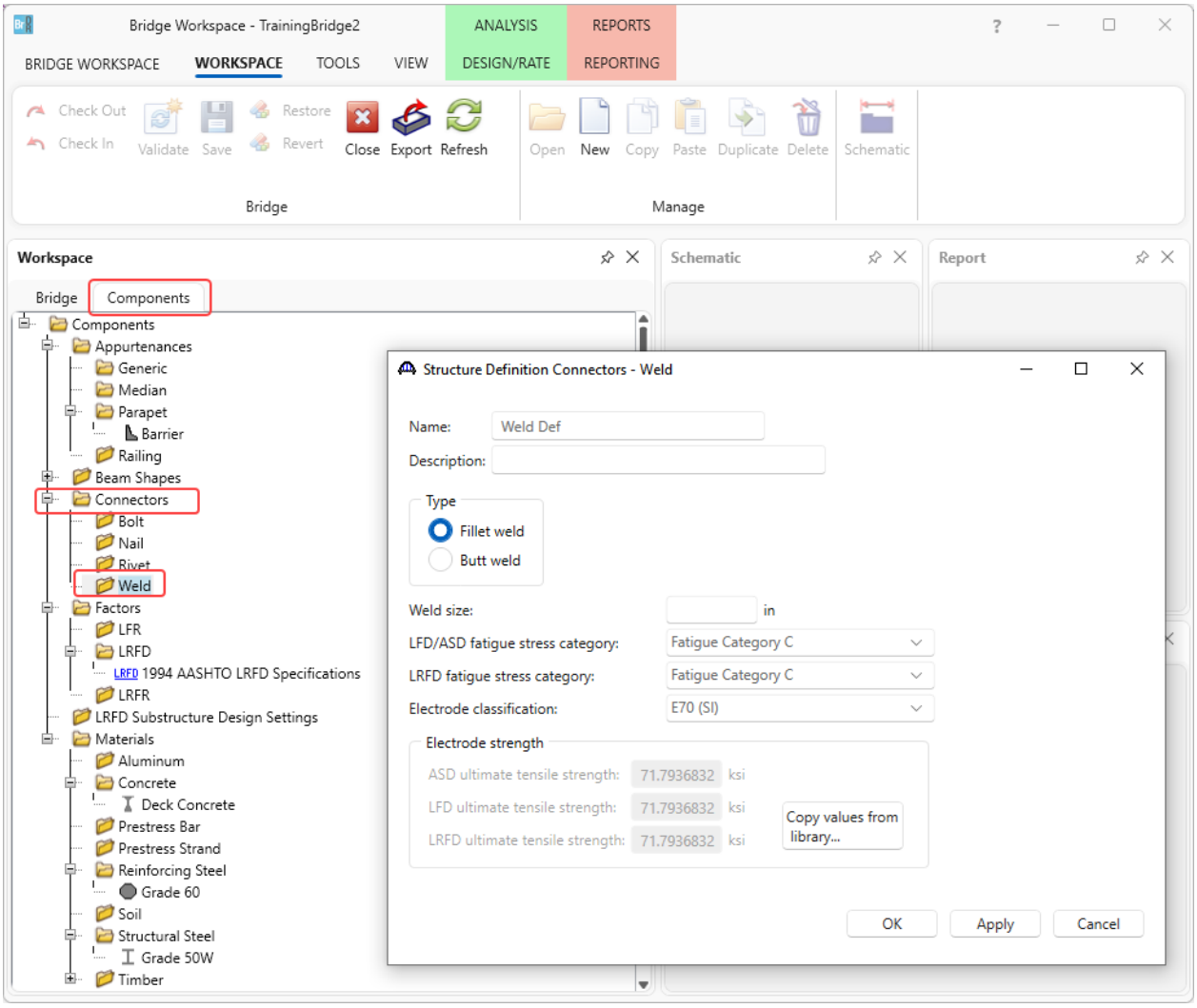
Perform the LRFD design review using the same settings shown in the previous section. After the LRFD design review, go to Spec check at **Stage 3->Plate Girder->Span 1 – 16.08 ft**., **article 6.6.1.2.2 Design Criteria**. This is a location of a transverse stiffener.

As shown below, the article shows the fatigue analysis for transverse stiffener to web weld (fatigue category from specification), for transverse stiffener to flange weld (fatigue category defined) and flange to web weld (fatigue category from specification).

Detail	Cat.	ADTT(SL) 75 year T6.6.1.2.3-2	Max Mz LL+I (kip-ft)	Min Mz LL+I (kip-ft)	Limit State	Dist from Bottom (in)	----- Stress ------ DL (ksi)	+LLz (ksi)	-LLz (ksi)	A*10^8 ((ksi^-3))	(F)TH (ksi)	(F)n (ksi)	f (ksi)	Fn/f	Code
TranStiffFlgWeld	C	1680	1412.90	0.00	FAT-I	70.25	-11.88	-0.84	0.00***	---	---	---	---	---	---
TranStiffFlgWeld	C	1680	1412.90	0.00	FAT-I	1.25	13.48	5.75	0.00	44.00	10.00	10.00	5.75	1.74	Pass
TranStiffWebWeld	C'	975	1412.90	0.00	FAT-I	70.25	-11.88	-0.84	0.00***	---	---	---	---	---	---
TranStiffWebWeld	C'	975	1412.90	0.00	FAT-I	1.25	13.48	5.75	0.00	44.00	12.00	12.00	5.75	2.09	Pass
TopFlgWebWeld	B	1120	1412.90	0.00	FAT-I	70.25	-11.88	-0.84	0.00***	---	---	---	---	---	---
BotFlgWebWeld	B	1120	1412.90	0.00	FAT-I	1.25	13.48	5.75	0.00	120.00	16.00	16.00	5.75	2.78	Pass

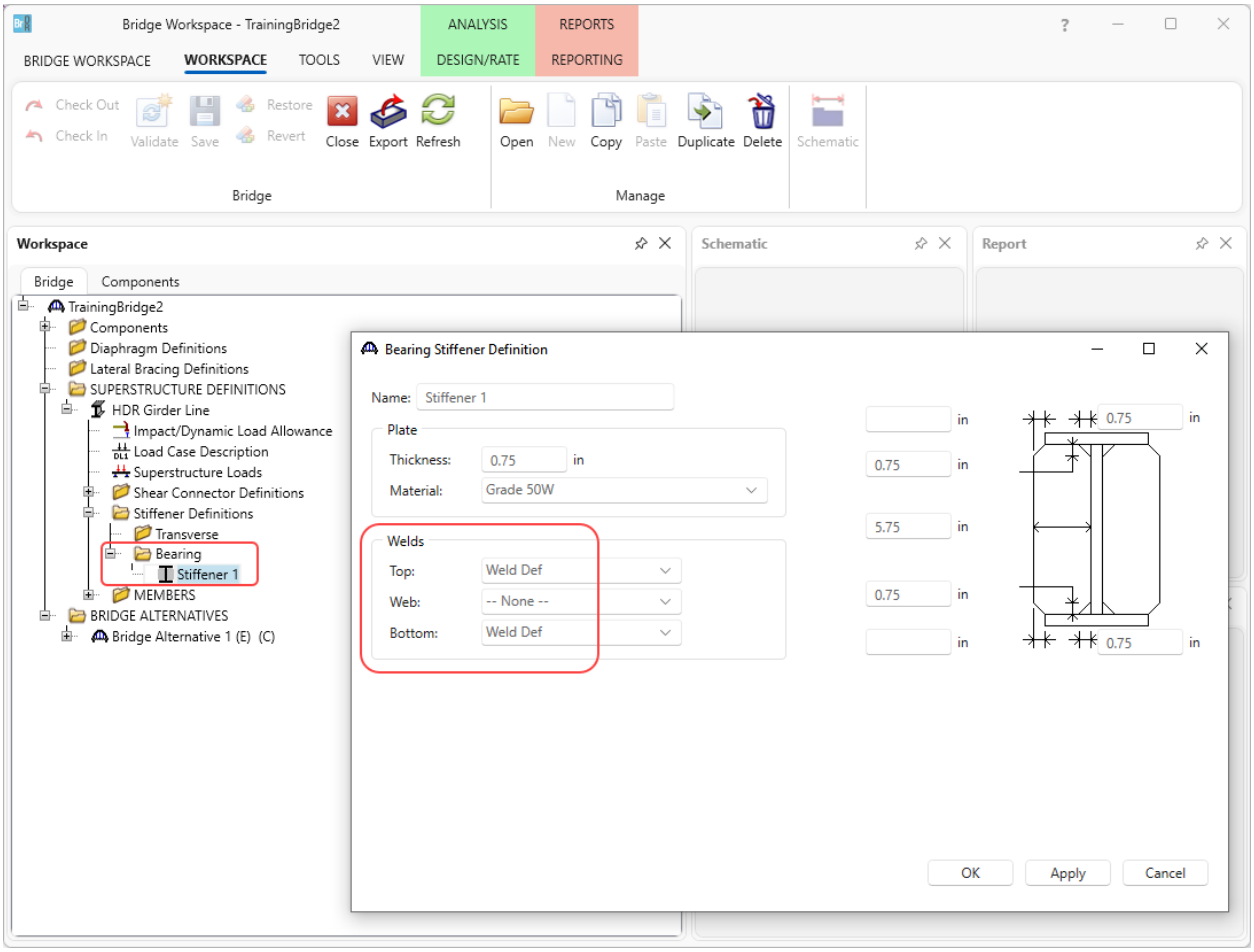
Close the **BID1** and open **BID2** from the Bridge Explorer**.**

Define a bearing stiffener to flange weld with LRFD **Fatigue Category C** as shown below.



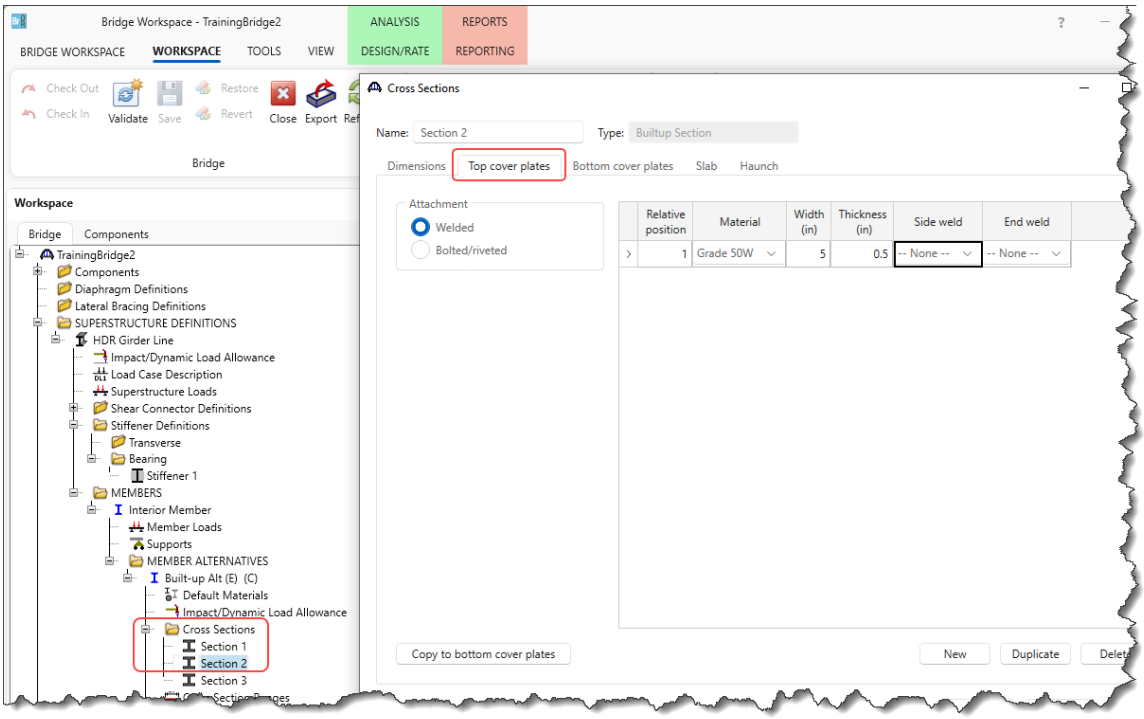
Bearing Stiffener Definition

Assign the weld definition to the top and the bottom flange of the **Bearing Stiffener** as shown below.



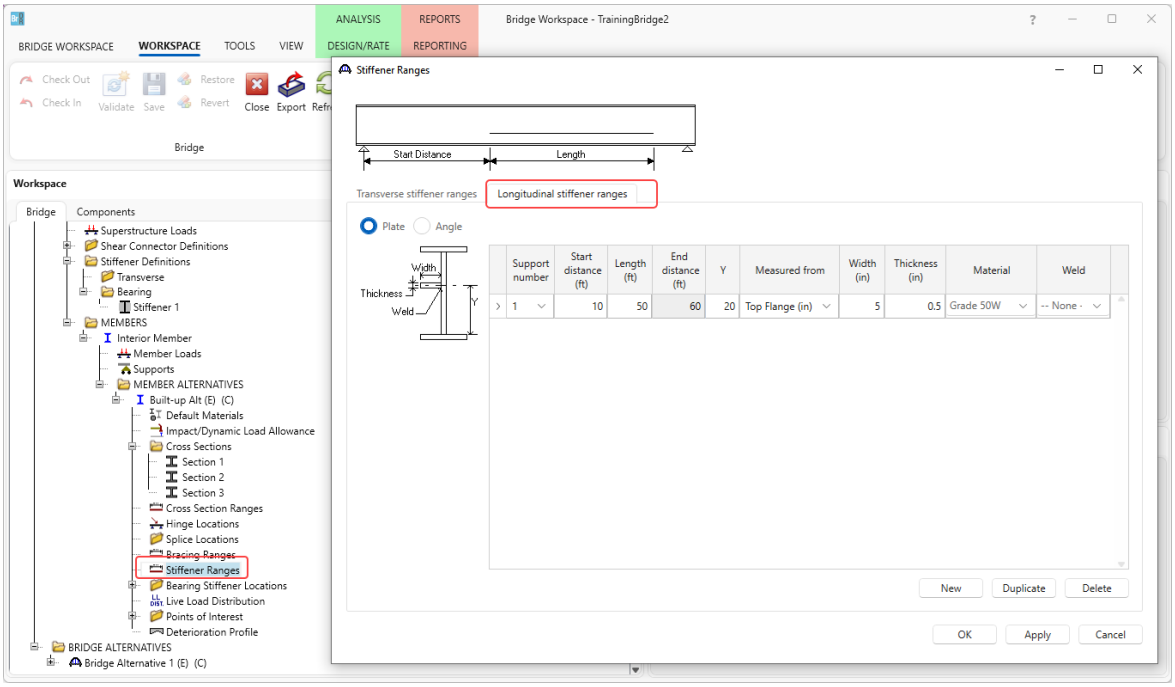
Cross Sections

Navigate to **Cross Sections - Section 2**, add a top cover plate as shown below

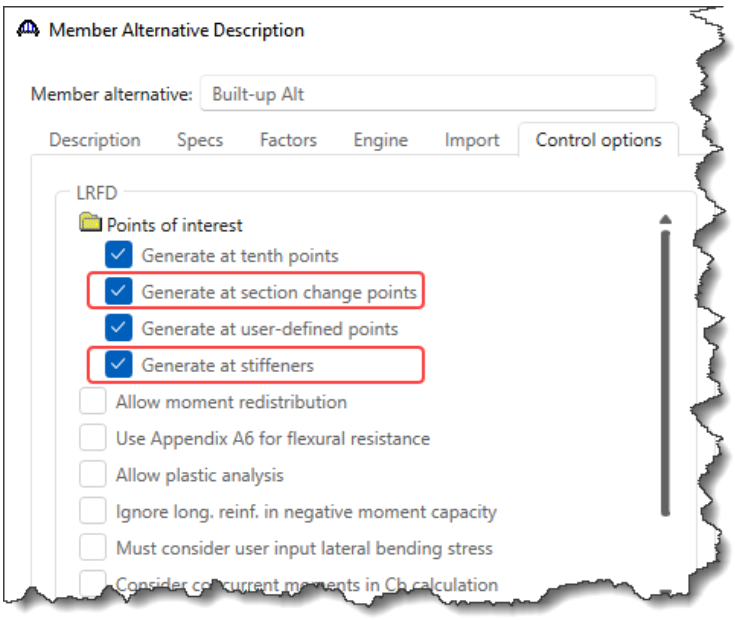


Stiffener Ranges

Open the **Stiffener Ranges** and define a plate longitudinal stiffener as shown below.



Before running the LRFD design review of **Interior Member - Member Alternative: Built-up Alt**, make sure that the following options are checked in the **Control options** tab of the **Member Alternative Description** window.



As described in the previous section, perform an LRFD Design review. After the LRFD design review completes, open the **Specification Check Detail** window. The article of interest is **6.6.1.2.2 Design Criteria**.

Open the Spec check at **Stage 3->Built-up Alt->Span 1 - 63 ft. (Left)**

This shows the fatigue analysis of flange and web groove weld and shear connector welds to the top flange as shown below. All the fatigue categories are from specification.

Detail	Cat.	ADTT(SL) 75 year T6.6.1.2.3-2	Max Mz LL+I (kip-ft)	Min Mz LL+I (kip-ft)	Limit State	Dist from Bottom (in)	----- Stress ----- DL (ksi)	+LLz (ksi)	-LLz (ksi)	A*10^8 ((ksi^-3))	(F)TH (ksi)	(F)n (ksi)	f (ksi)	Fn/f	Code
ShearConnector	C	1680	494.15	-347.23	FAT-I	37.63	-0.80	-0.34	0.24***	---	---	---	---	---	---
CovPlFlgEndWeld	E	4615	225.90	-158.74	FAT-II	37.63	-0.80	-0.16	0.11***	---	---	---	---	---	---
FlgWeldAtRight	B	1120	494.15	-347.23	FAT-I	37.63	-0.80	-0.34	0.24***	---	---	---	---	---	---
FlgWeldAtRight	B	1120	494.15	-347.23	FAT-I	0.00	1.09	7.15	-5.02	120.00	16.00	16.00	12.17	1.31	Pass
WebWeldAtRight	B	1120	494.15	-347.23	FAT-I	36.88	-0.76	-0.19	0.13***	---	---	---	---	---	---
WebWeldAtRight	B	1120	494.15	-347.23	FAT-I	0.88	1.05	6.97	-4.90	120.00	16.00	16.00	11.87	1.35	Pass

Spec check at **Stage 3->Built-up Alt->Span 1 - 89.5 ft. (Left)**

This shows the fatigue analysis of the bearing stiffener top and bottom flange (fatigue category defined) and the web weld (fatigue category from spec).

Detail	Cat.	ADTT(SL) 75 year T6.6.1.2.3-2	Max Mz LL+I (kip-ft)	Min Mz LL+I (kip-ft)	Limit State	Dist from Bottom (in)	Stress DL (ksi)	Stress +LLz (ksi)	Stress -LLz (ksi)	A*10^8 ((ksi^-3))	(F)TH (ksi)	(F)n (ksi)	f (ksi)	Fn/f	Code
BrgStiffFlgWeld	C'	650 +	0.00	-493.29	FAT-I	37.50	23.77*	0.00	0.41	44.00	12.00	12.00	0.41	29.30	Pass
BrgStiffFlgWeld	C'	650 +	0.00	-493.29	FAT-I	1.50	-21.48*	0.00	-4.50***	---	---	---	---	---	---
BrgStiffWebWeld	C'	650 +	0.00	-493.29	FAT-I	36.75	22.83*	0.00	0.31	44.00	12.00	12.00	0.31	39.04	Pass
BrgStiffWebWeld	C'	650 +	0.00	-493.29	FAT-I	2.25	-20.54*	0.00	-4.39***	---	---	---	---	---	---
ShearConnector	C	1120 +	0.00	-493.29	FAT-I	39.00	25.65*	0.00	0.61	44.00	10.00	10.00	0.61	16.29	Pass
CovPlFlgSideWeld	B	746 +	0.00	-493.29	FAT-I	38.50	25.03*	0.00	0.55	120.00	16.00	16.00	0.55	29.31	Pass

Spec check at **Stage 3->Built-up Alt->Span 1 - 90 ft. (Left)**

This shows the fatigue analysis of the cover plate side weld to the top flange (fatigue category from specification).

Detail	Cat.	ADTT(SL) 75 year T6.6.1.2.3-2	Max Mz LL+I (kip-ft)	Min Mz LL+I (kip-ft)	Limit State	Dist from Bottom (in)	Stress DL (ksi)	Stress +LLz (ksi)	Stress -LLz (ksi)	A*10^8 ((ksi^-3))	(F)TH (ksi)	(F)n (ksi)	f (ksi)	Fn/f	Code
ShearConnector	C	1120 +	0.00	-496.05	FAT-I	39.00	26.27*	0.00	0.62	44.00	10.00	10.00	0.62	16.20	Pass
CovPlFlgSideWeld	B	746 +	0.00	-496.05	FAT-I	38.50	25.62*	0.00	0.55	120.00	16.00	16.00	0.55	29.15	Pass

Spec check at **Stage 3->Built-up Alt->Span - 27 ft. (Left)**

This shows the fatigue analysis of the cover plate end weld to the top flange (fatigue category from specification).

Detail	Cat.	ADTT(SL) 75 year T6.6.1.2.3-2	Max Mz LL+I (kip-ft)	Min Mz LL+I (kip-ft)	Limit State	Dist from Bottom (in)	Stress DL (ksi)	Stress +LLz (ksi)	Stress -LLz (ksi)	A*10^8 ((ksi^-3))	(F)TH (ksi)	(F)n (ksi)	f (ksi)	Fn/f	Code
ShearConnector	C	1680	493.18	-346.23	FAT-I	39.00	-0.48	-0.61	0.43***	---	---	---	---	---	---
CovPlFlgSideWeld	B	1120	493.18	-346.23	FAT-I	38.50	-0.47	-0.55	0.38***	---	---	---	---	---	---

Speck check at **Stage 3->Built-up Alt->Span 1 - 10 ft. (Right)**

This shows the fatigue analysis of the start of the longitudinal stiffener (fatigue category from specification).

Detail	Cat.	ADTT(SL) 75 year T6.6.1.2.3-2	Max Mz LL+I (kip-ft)	Min Mz LL+I (kip-ft)	Limit State	Dist from Bottom (in)	Stress DL (ksi)	Stress +LLz (ksi)	Stress -LLz (ksi)	A*10^8 ((ksi^-3))	(F)TH (ksi)	(F)n (ksi)	f (ksi)	Fn/f	Code
LongStiffWebWeld	E	4615	162.59	-24.24	FAT-II	16.88	1.21	1.19	-0.18	11.00	4.50	2.87	1.37	2.10	Pass

Speck check at **Stage 3->Built-up Alt->Span 1 - 60 ft. (Left)**

This shows the fatigue analysis of the end of the longitudinal stiffener (fatigue category from specification).

Detail	Cat.	ADTT(SL) 75 year T6.6.1.2.3-2	Max Mz LL+I (kip-ft)	Min Mz LL+I (kip-ft)	Limit State	Dist from Bottom (in)	Stress DL (ksi)	Stress +LLz (ksi)	Stress -LLz (ksi)	A*10^8 ((ksi^-3))	(F)TH (ksi)	(F)n (ksi)	f (ksi)	Fn/f	Code
LongStiffWebWeld	E	4615	244.65	-149.06	FAT-II	16.88	0.59	1.79	-1.09	11.00	4.50	2.87	2.88	1.00	Fail