Steel Tutorial

Steel Fishbelly Web Examples

STL9 – Steel Fishbelly Web

Topics Covered

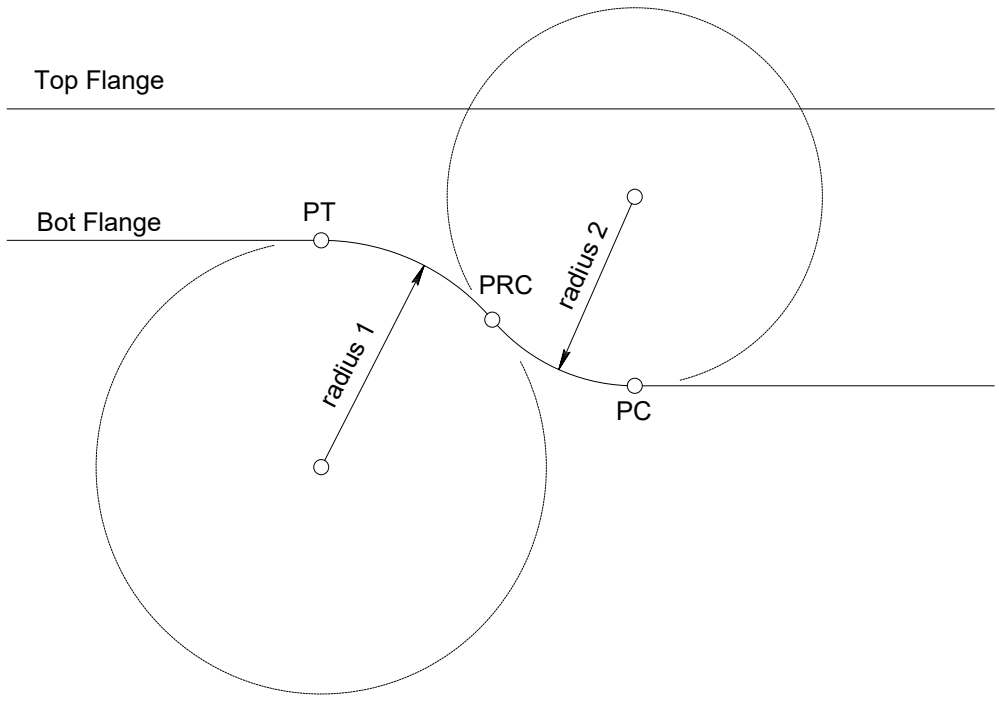
- Steel plate girder fishbelly web profiles
- Reverse parabolic
- Reverse circular curve
- Analyze with AASHTO LFR engine

Fishbelly web profiles are either reverse circular or reverse parabolic web profiles. Fishbelly web profiles can be modeled in BrDR for steel plate or built-up girders. This example reviews the input of reverse parabolic and reverse circular web profiles.

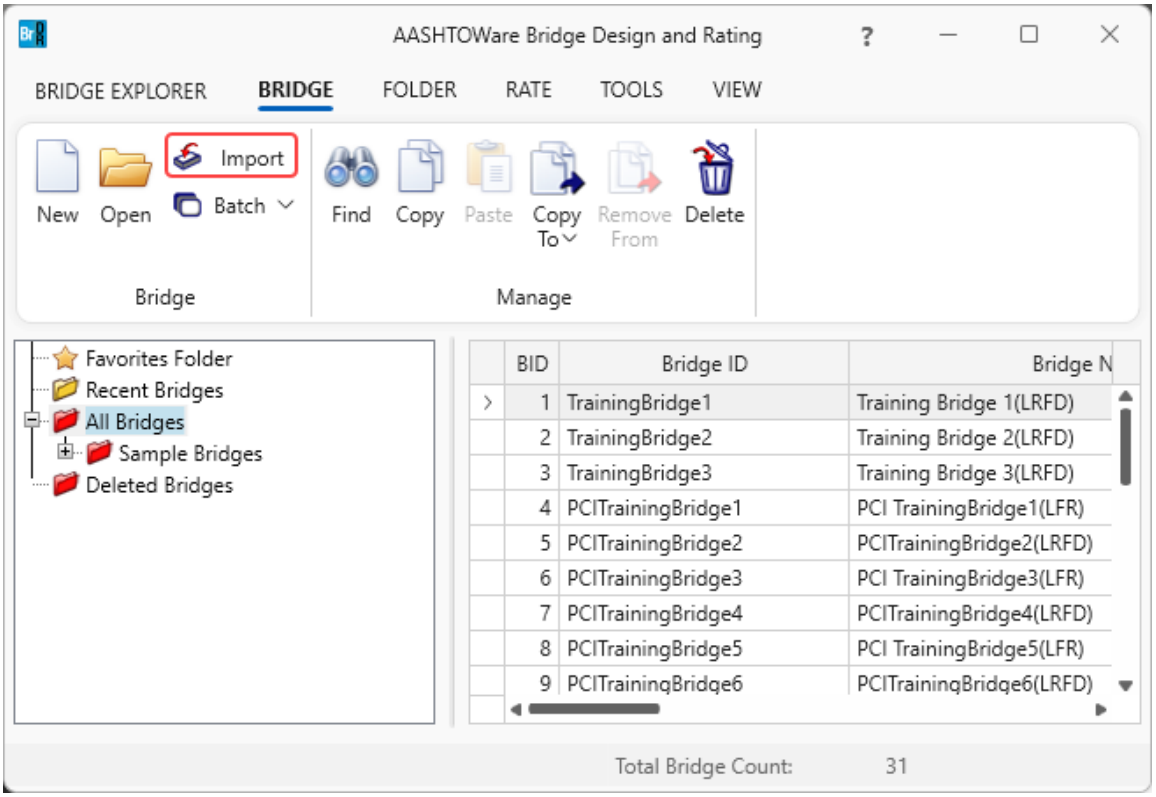
Fishbelly Web Profiles

- Only available for steel plate and built-up girders
- Available for both schedule based and cross section based input
- Fishbelly profiles must be either totally parabolic or totally circular. Adjacent parabolic and circular sections are not allowed.
- BrDR LFR engine is the only analysis engine currently available for rating

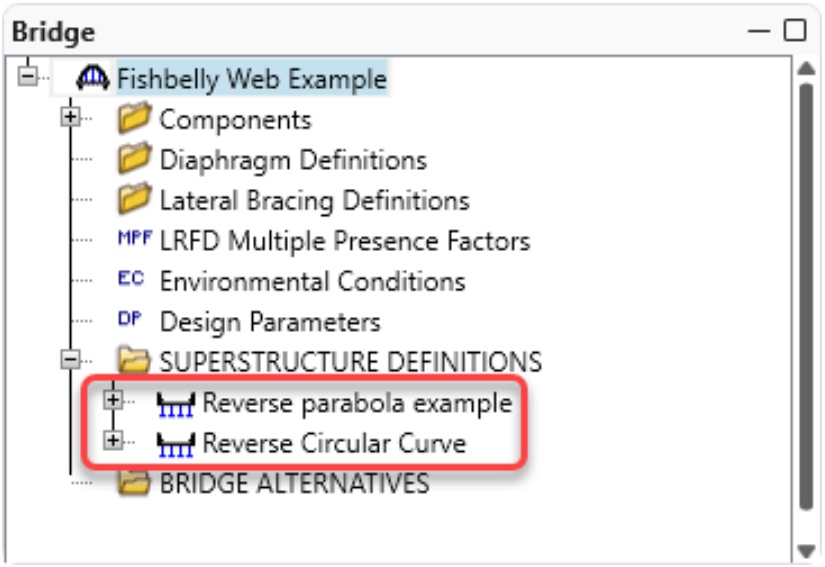
The following sketch illustrates a reverse circular web profile:



Using the **Import** option from Bridge Explorer, import the STL9 bridge provided with this tutorial.



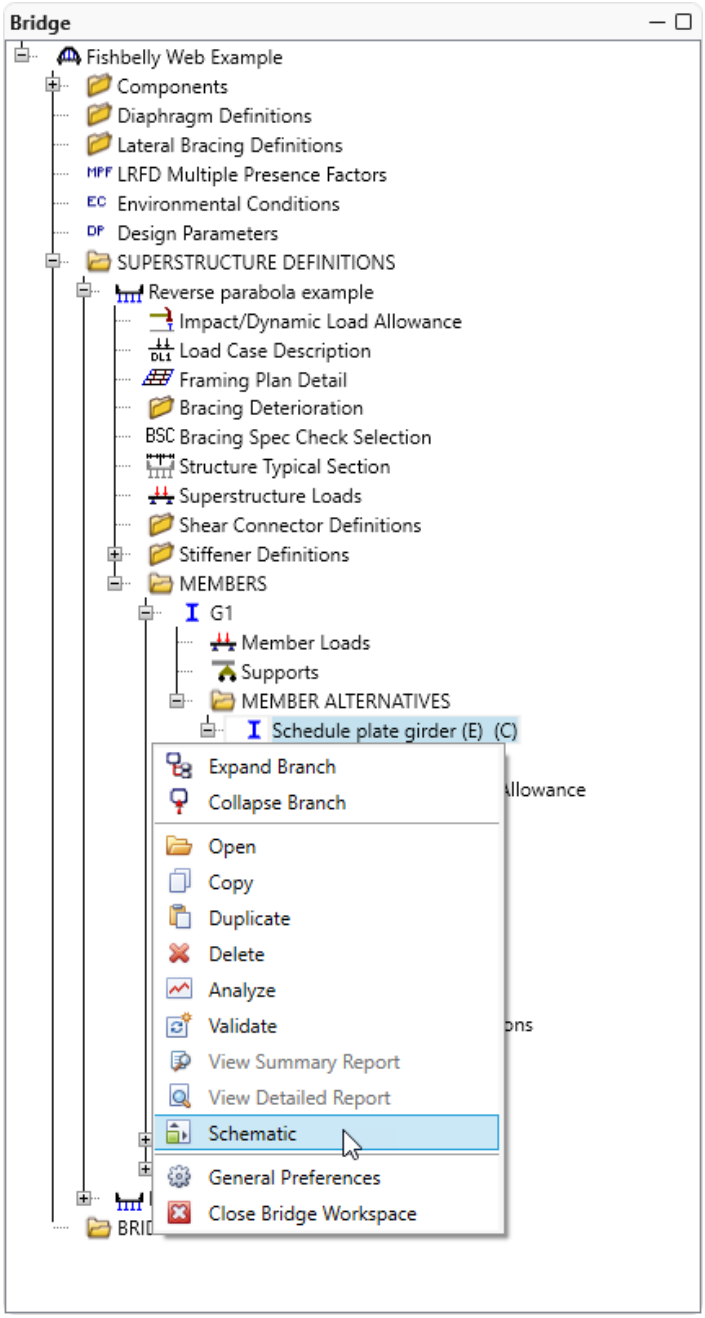
Open the Bridge Workspace for **Fishbelly Web Example**. This bridge contains a reverse parabolic and a reverse circular curve web profile example.



Reverse Parabolic

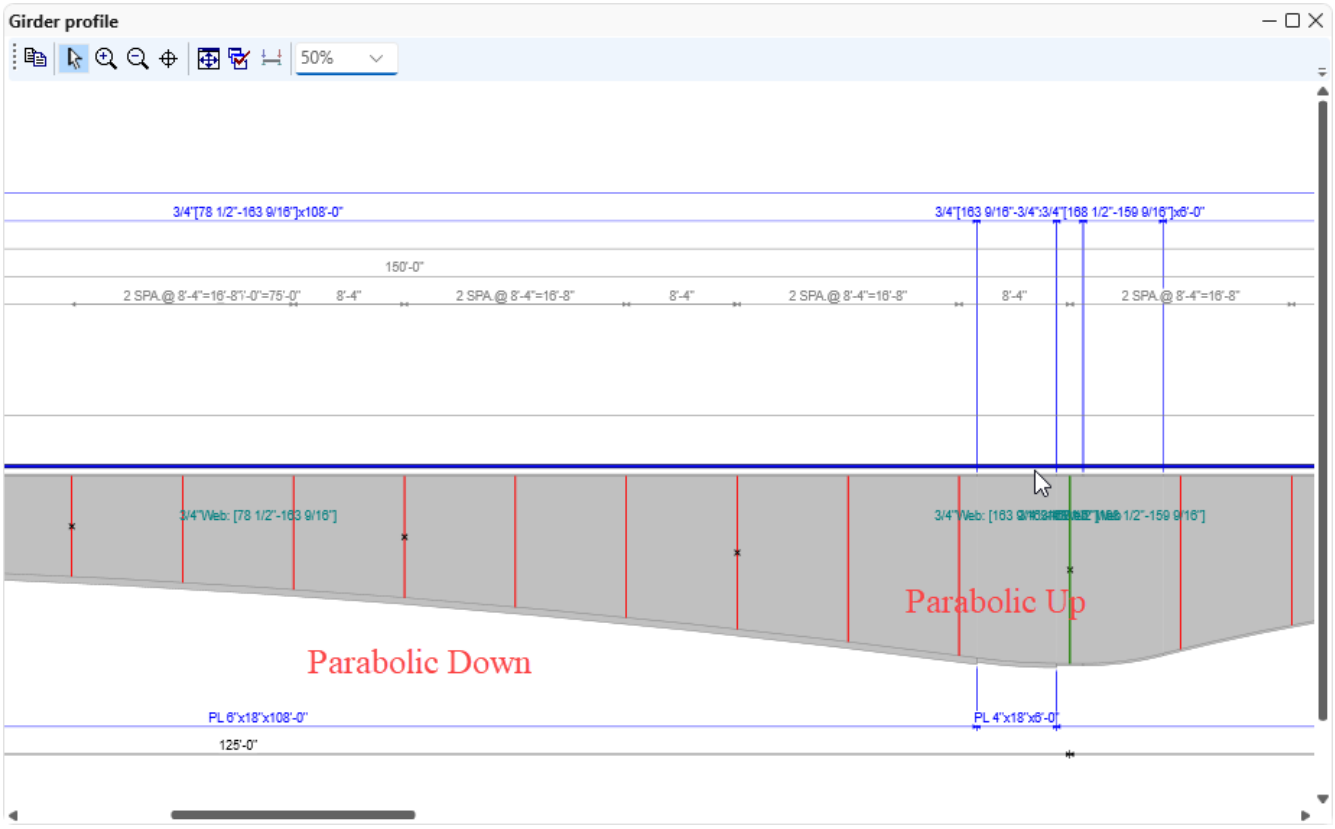
Schematic

Using the **Reverse parabola example**, navigate to **G1**, **Schedule Plate Girder** member alternative, **right click** and select **Schematic** for the member alternative on the Bridge Workspace.



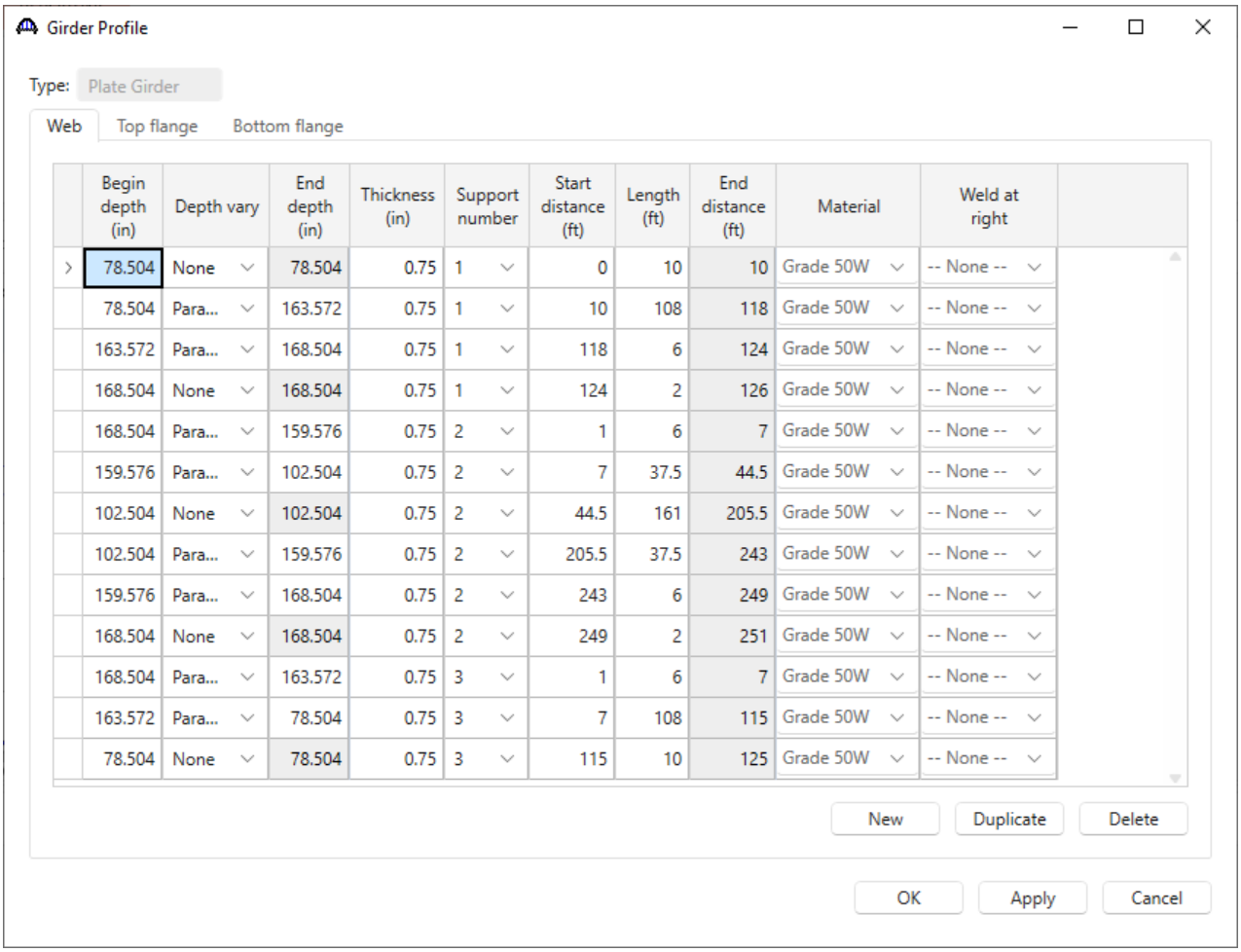
The following shows the **Girder profile** schematic with some additional text shown to describe where the reverse parabolic web profile exists. (The display of stiffeners in the schematic has been turned off.)

Note: The **Parabolic Down** and **Parabolic Up** labels shown below do not show up in BrDR, they have been added to the schematic for this training example only.



Girder Profile

Double click on the Girder Profile node in the Bridge Workspace tree. The input data describing the web profile is shown below:

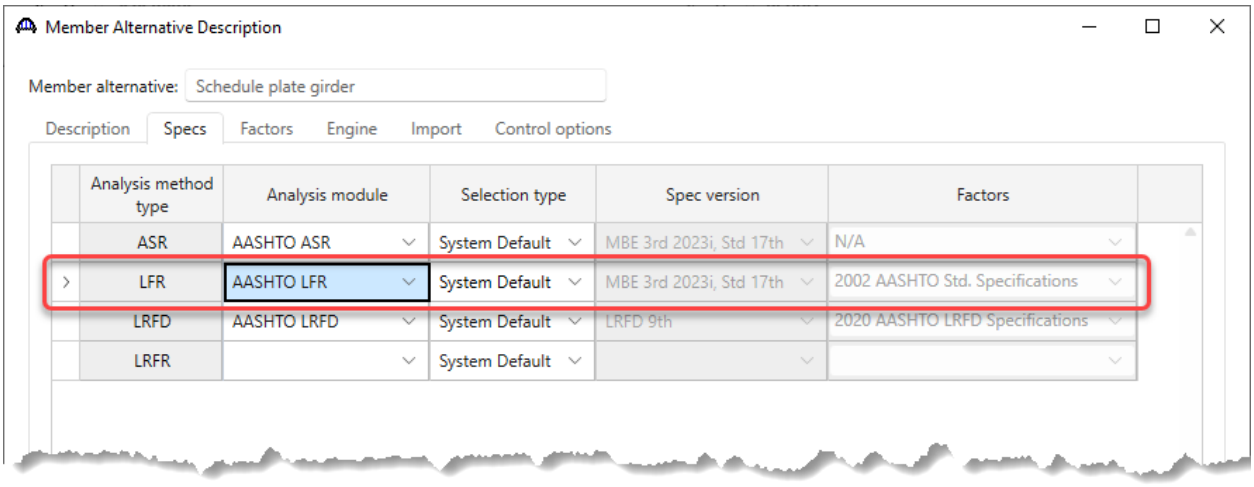


Click **OK** to close the window.

Analyze with AASHTO LFR engine

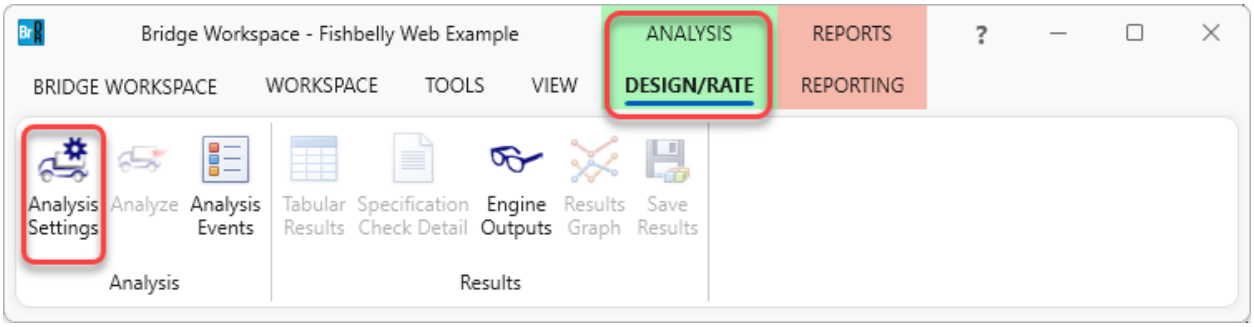
Member Alternative - Specs

Open the **Schedule plate girder** member alternative **Specs** tab and be sure the **AASHTO LFR** Analysis module is selected as the **LFR Analysis method type**. This is the only analysis engine available for fishbelly web profiles.

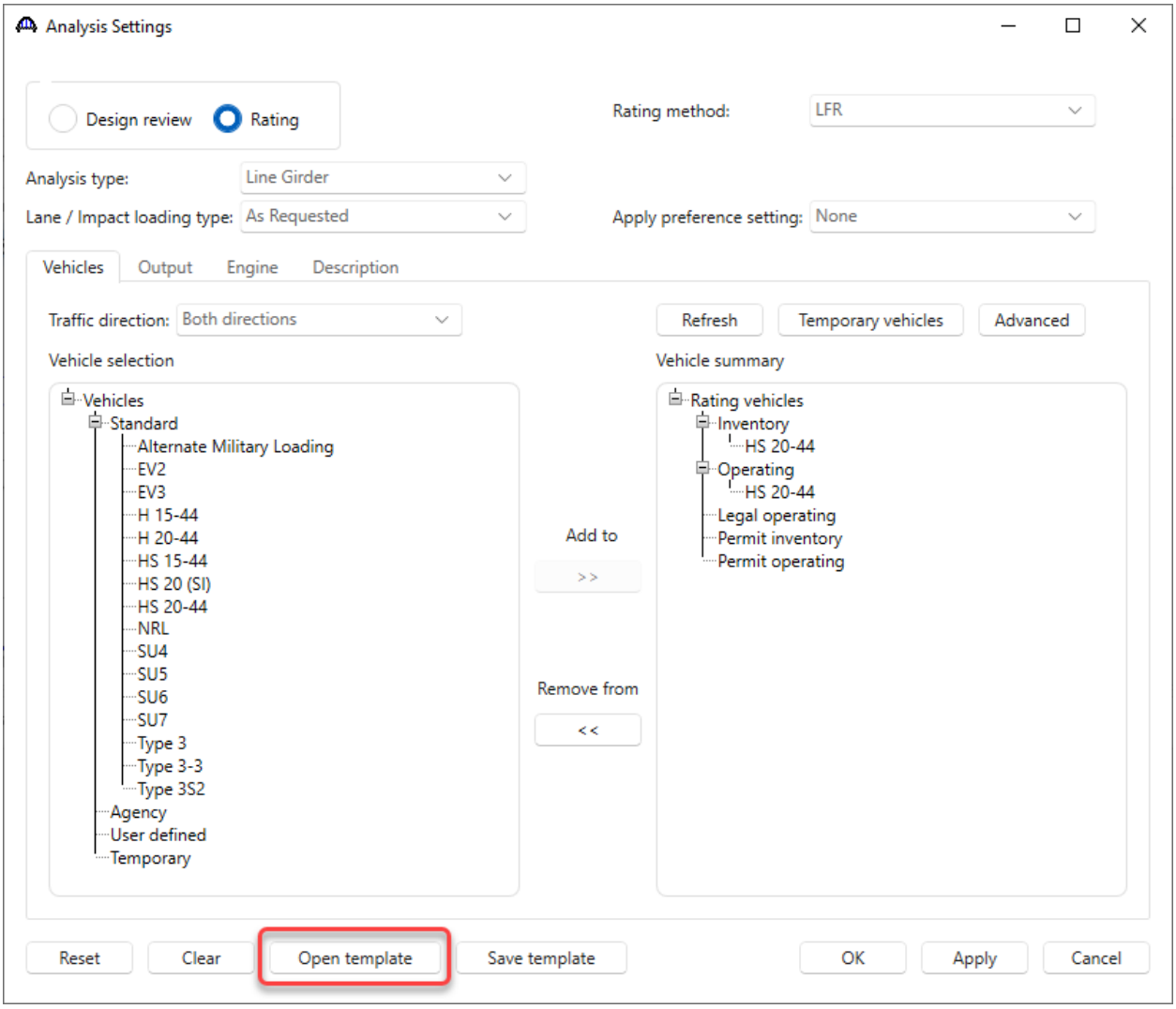


Analysis Settings

With the focus on the **G1 Schedule plate girder** member alternative click on the **Analysis Settings** button from the **Analysis** group of the **DESIGN/RATE** in the ribbon.

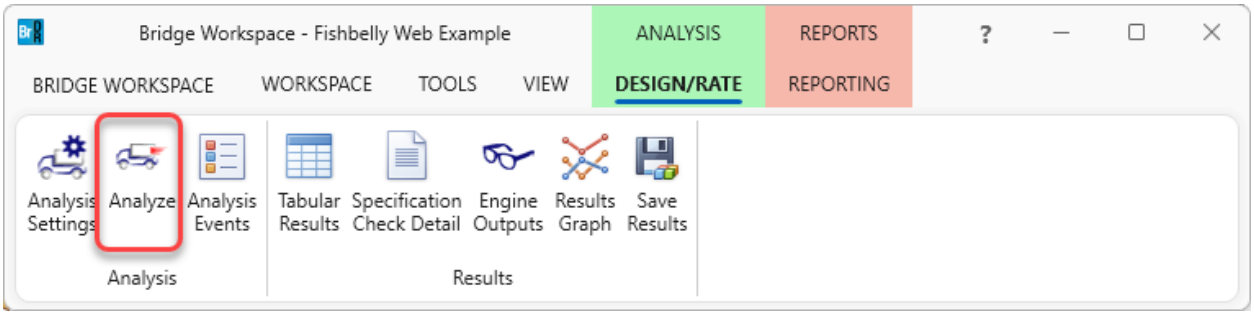


In the **Analysis Settings** window select the **HS 20 LFR Rating** template.



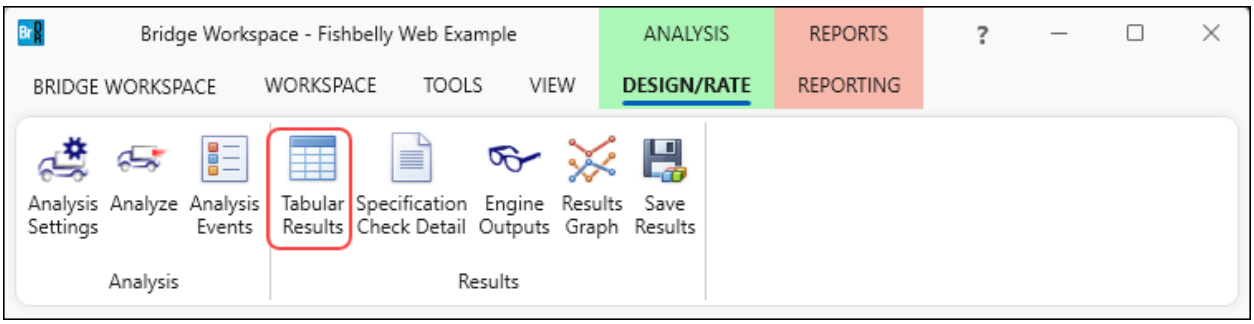
Click **OK** to apply the data and close the window.

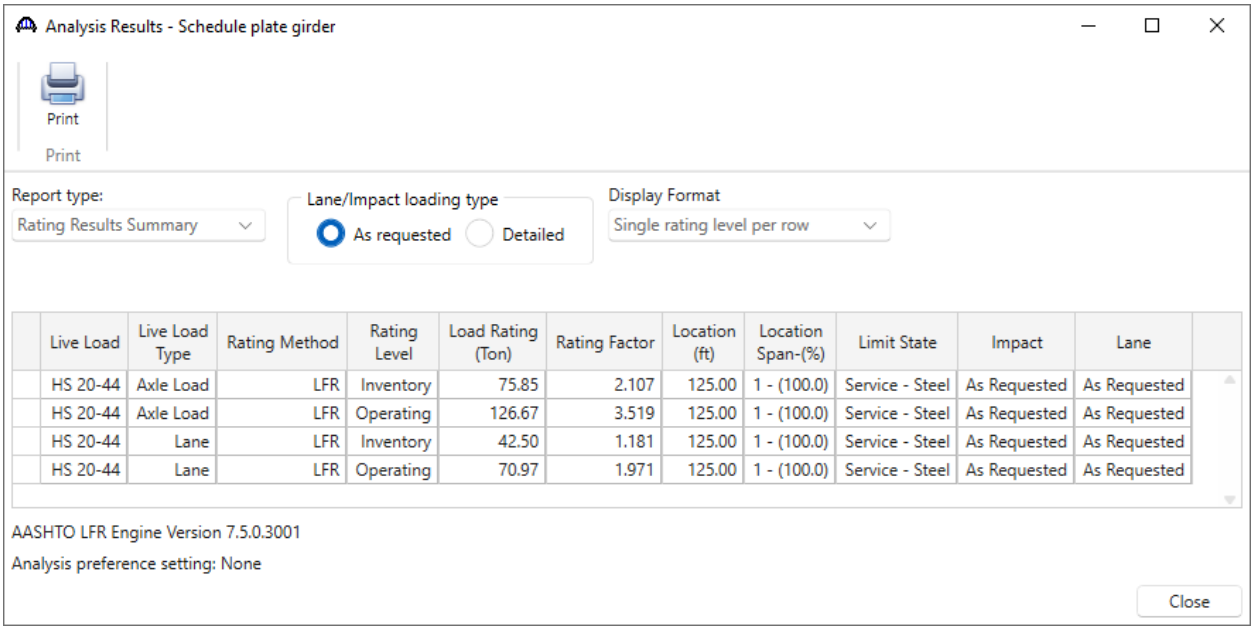
With the focus still on the **G1 Schedule plate girder** member alternative click on the **Analyze** button.



Tabular Results

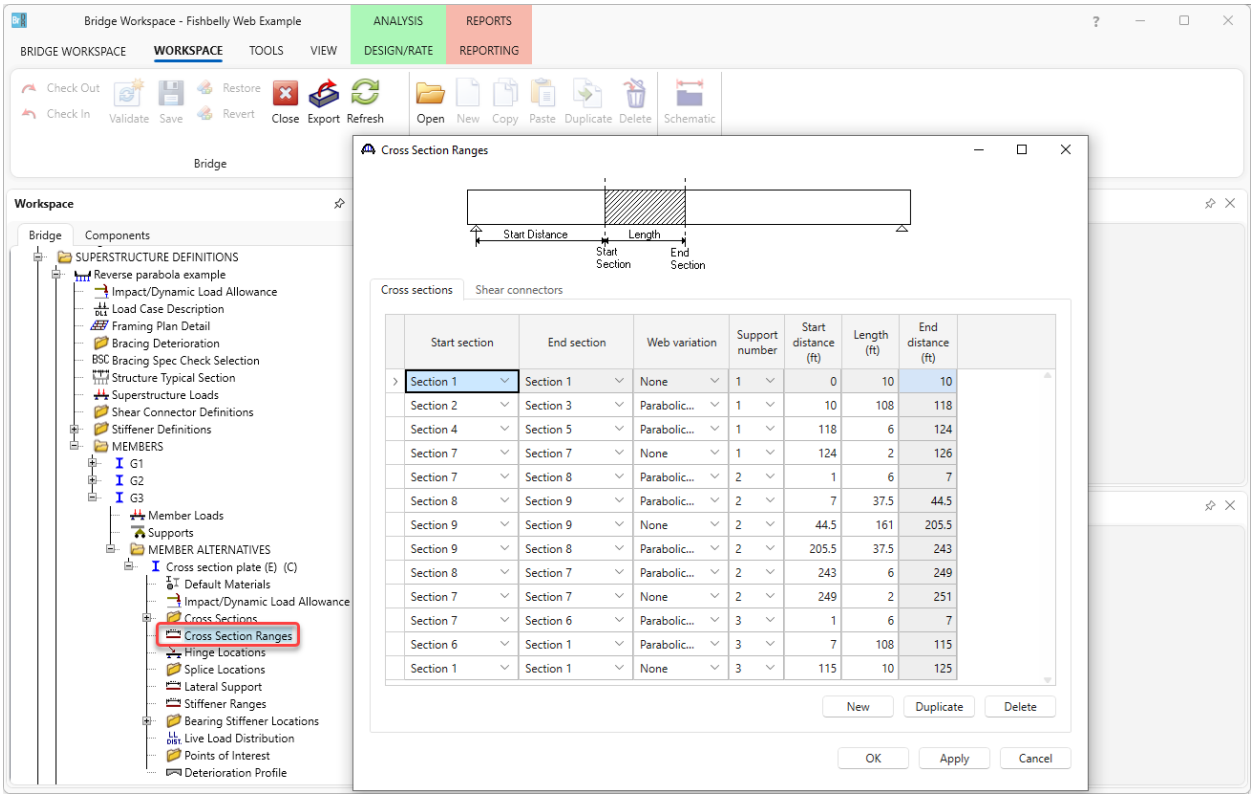
When the analysis rating is finished, click on the **Tabular Results** button from the **Results** group of the **DESIGN/RATE** ribbon. The rating results are shown below.





Reverse Parabolic - Cross Section Ranges

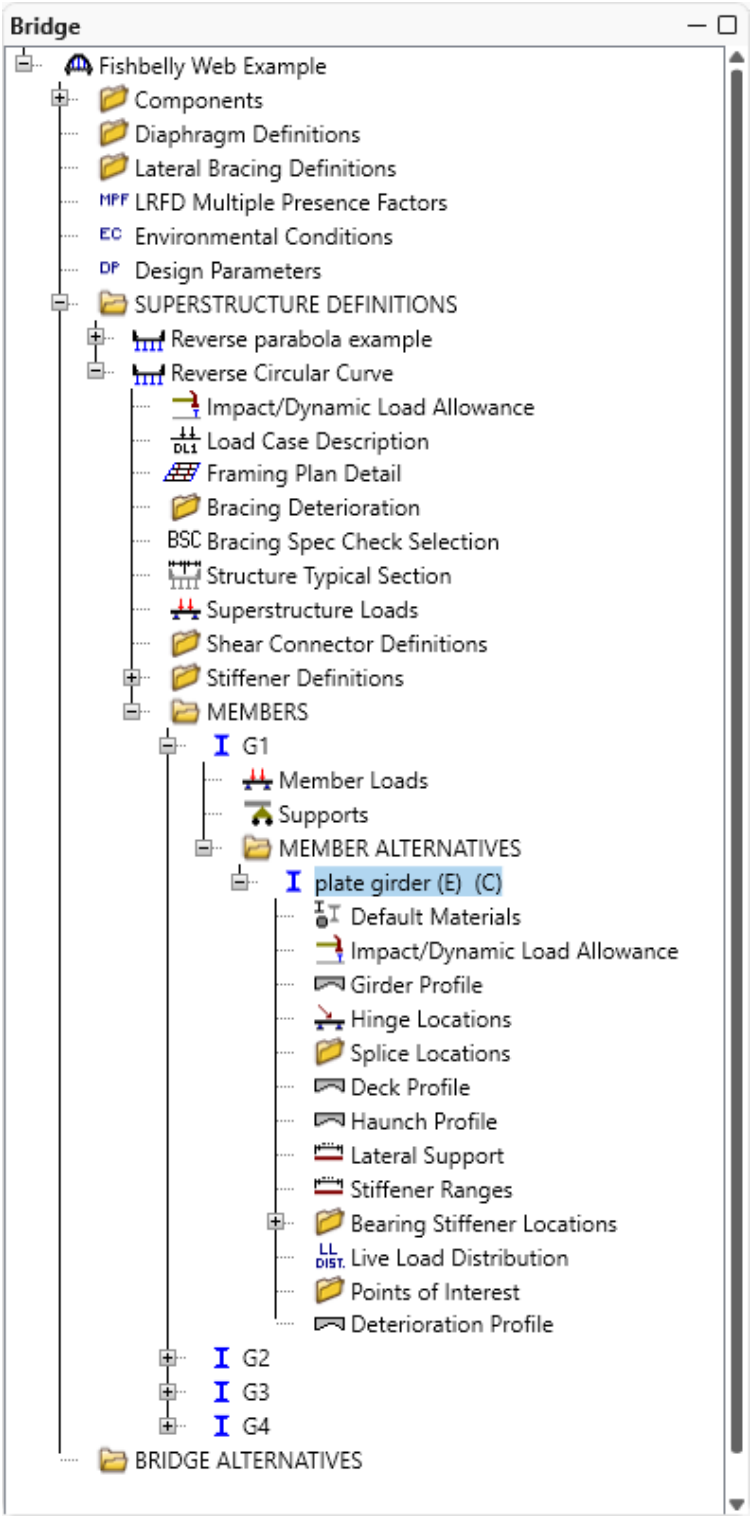
This superstructure definition also contains the reverse parabola described as a cross-section plate girder. Open the **Cross Section Ranges** window for the member alt in member **G3** as shown below:



Rating this member alternative gives the same rating results as the schedule based alternative for member **G1**.

Reverse Circular Curve

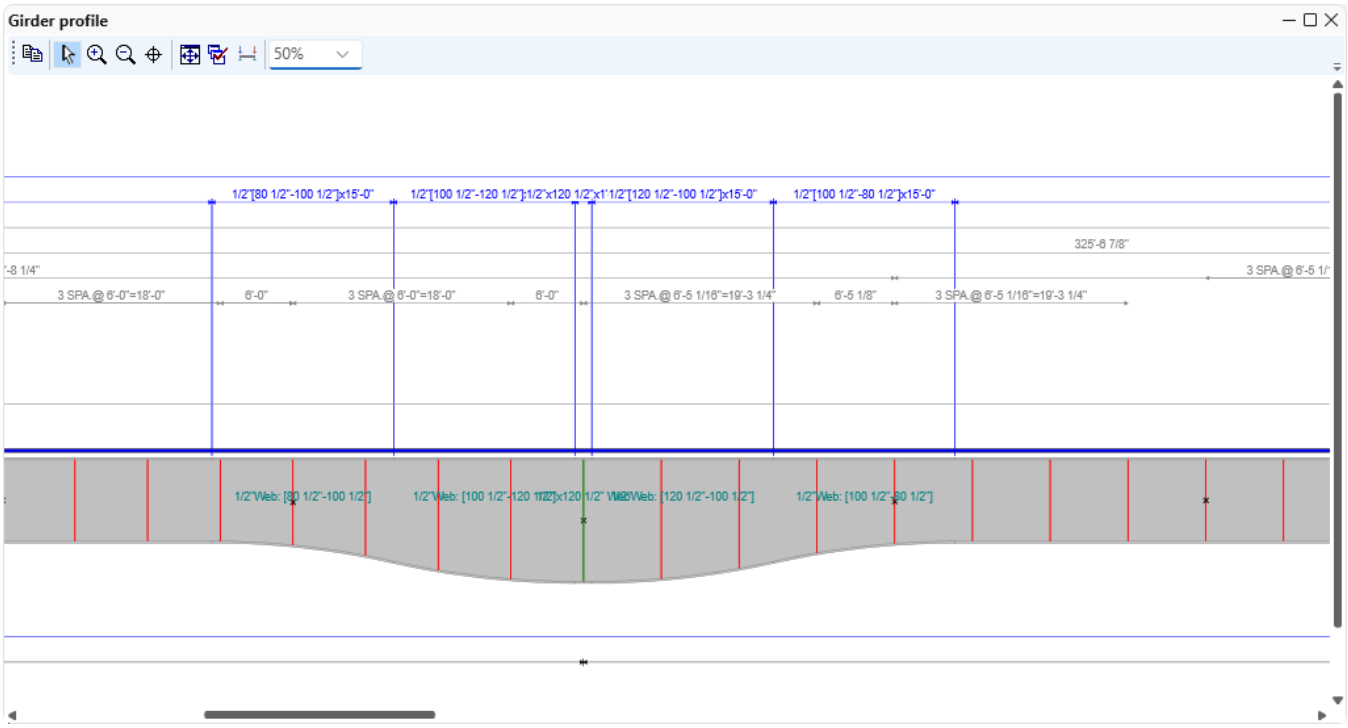
A reverse circular curve web profile is included in this bridge as well. Open the **plate girder** member alternative for **G1** in the **Reverse Circular Curve** superstructure definition.



STL9 – Steel Fishbelly Web

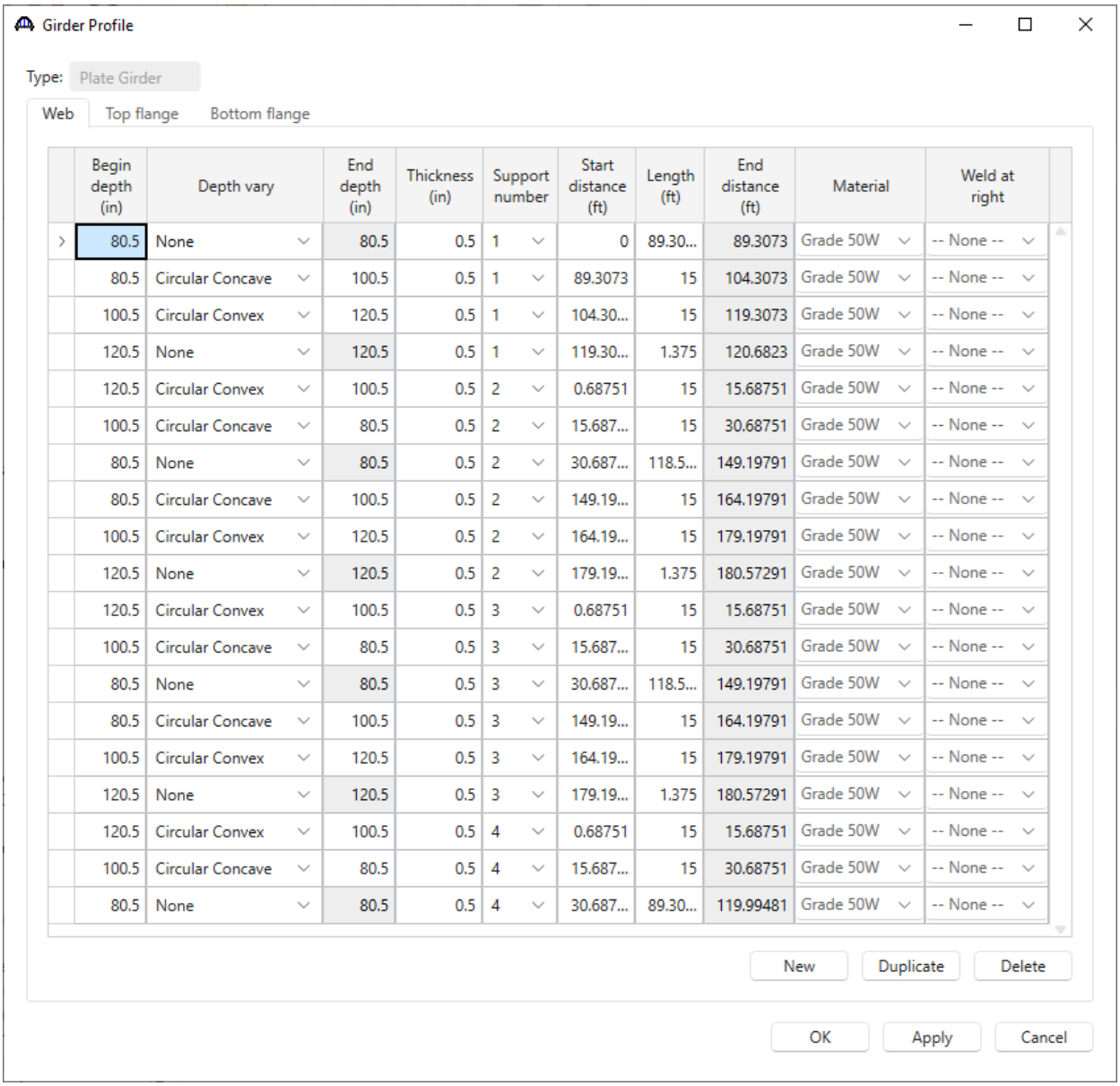
Schematic

The member alternative schematic is shown below.



Girder Profile

The **Girder Profile** window describing the reverse circular webs is shown below along with the BrDR LFR ratings for an HS20 vehicle.

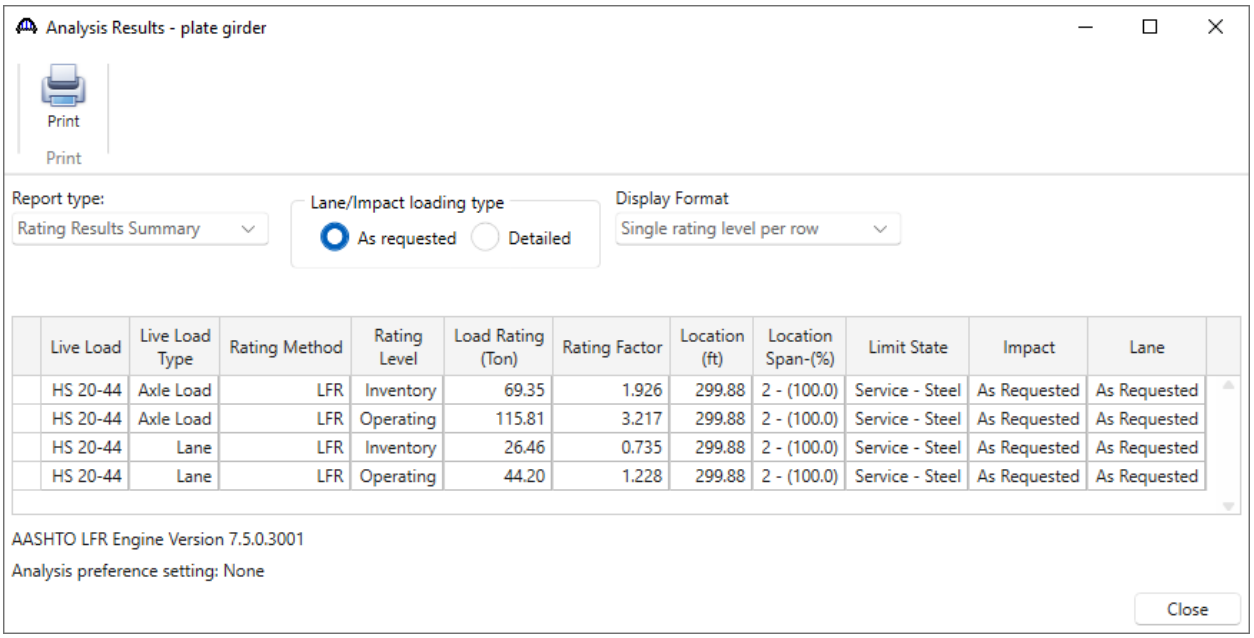


	Begin depth (in)	Depth vary	End depth (in)	Thickness (in)	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld at right
›	80.5	None	80.5	0.5	1	0	89.30...	89.3073	Grade 50W	-- None --
	80.5	Circular Concave	100.5	0.5	1	89.3073	15	104.3073	Grade 50W	-- None --
	100.5	Circular Convex	120.5	0.5	1	104.30...	15	119.3073	Grade 50W	-- None --
	120.5	None	120.5	0.5	1	119.30...	1.375	120.6823	Grade 50W	-- None --
	120.5	Circular Convex	100.5	0.5	2	0.68751	15	15.68751	Grade 50W	-- None --
	100.5	Circular Concave	80.5	0.5	2	15.687...	15	30.68751	Grade 50W	-- None --
	80.5	None	80.5	0.5	2	30.687...	118.5...	149.19791	Grade 50W	-- None --
	80.5	Circular Concave	100.5	0.5	2	149.19...	15	164.19791	Grade 50W	-- None --
	100.5	Circular Convex	120.5	0.5	2	164.19...	15	179.19791	Grade 50W	-- None --
	120.5	None	120.5	0.5	2	179.19...	1.375	180.57291	Grade 50W	-- None --
	120.5	Circular Convex	100.5	0.5	3	0.68751	15	15.68751	Grade 50W	-- None --
	100.5	Circular Concave	80.5	0.5	3	15.687...	15	30.68751	Grade 50W	-- None --
	80.5	None	80.5	0.5	3	30.687...	118.5...	149.19791	Grade 50W	-- None --
	80.5	Circular Concave	100.5	0.5	3	149.19...	15	164.19791	Grade 50W	-- None --
	100.5	Circular Convex	120.5	0.5	3	164.19...	15	179.19791	Grade 50W	-- None --
	120.5	None	120.5	0.5	3	179.19...	1.375	180.57291	Grade 50W	-- None --
	120.5	Circular Convex	100.5	0.5	4	0.68751	15	15.68751	Grade 50W	-- None --
	100.5	Circular Concave	80.5	0.5	4	15.687...	15	30.68751	Grade 50W	-- None --
	80.5	None	80.5	0.5	4	30.687...	89.30...	119.99481	Grade 50W	-- None --

Click **OK** to close the window.

Tabular Results

Run an LFR analysis using the **HS 20 LFR Rating** template as discussed in the previous section. The rating results are shown below.



Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HS 20-44	Axle Load	LFR	Inventory	69.35	1.926	299.88	2 - (100.0)	Service - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFR	Operating	115.81	3.217	299.88	2 - (100.0)	Service - Steel	As Requested	As Requested
HS 20-44	Lane	LFR	Inventory	26.46	0.735	299.88	2 - (100.0)	Service - Steel	As Requested	As Requested
HS 20-44	Lane	LFR	Operating	44.20	1.228	299.88	2 - (100.0)	Service - Steel	As Requested	As Requested