

AASHTOWare BrDR 7.5.0

Floor System Tutorial

FS2 – Floorbeam Stringer Line Example

FS2 – Floorbeam Stringer Line Example

BrDR Tutorial

Topics Covered

- Superstructure composed of floorbeams and stringers.
- Line Superstructure Definition
- Plate girder floorbeams, linearly varying web.
- Rolled beam stringers.

This example demonstrates entering a Floorbeam-Stringer superstructure in BrDR using the Line superstructure definition approach. This example targets an advanced user familiar with the basics of BrDR.

Superstructure composed of girders, floorbeams and stringers.

From the **Bridge Explorer** create a **New** bridge and enter the following description data.

FS Line

Bridge ID: FS Line NBI structure ID (8): FS Line

Template Superstructures
 Bridge completely defined Culverts
 Substructures

Description Description (cont'd) Alternatives Global reference point Traffic Custom agency fields

Name: Floorbeam Stringer Line Example Year built: []

Description: []

Location: [] Length: [] ft

Facility carried (7): [] Route number: -1

Feat. intersected (6): [] Mi. post: []

Default units: US Customary

Bridge association... BrR BrD BrM

OK Apply Cancel

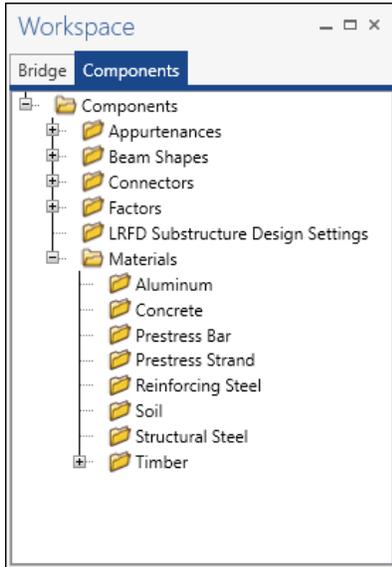
Close the window by clicking **OK**.

FS2 – Floorbeam Stringer Line Example

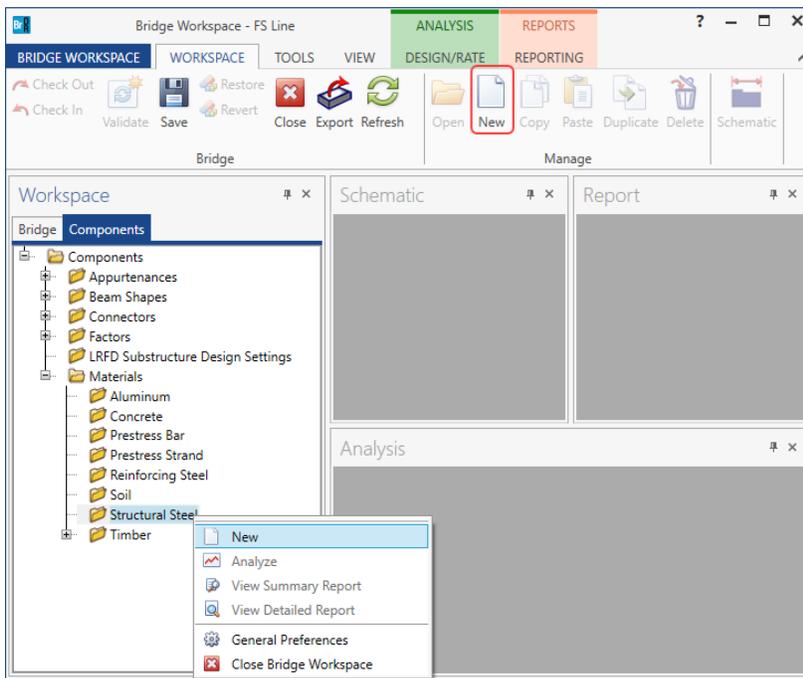
Bridge Materials

To enter the materials to be used by members of the bridge, in the **Components** tab of the **Bridge Workspace**, click on the **+** button to expand the tree for **Materials**.

The tree with the expanded **Materials** branch is shown below.

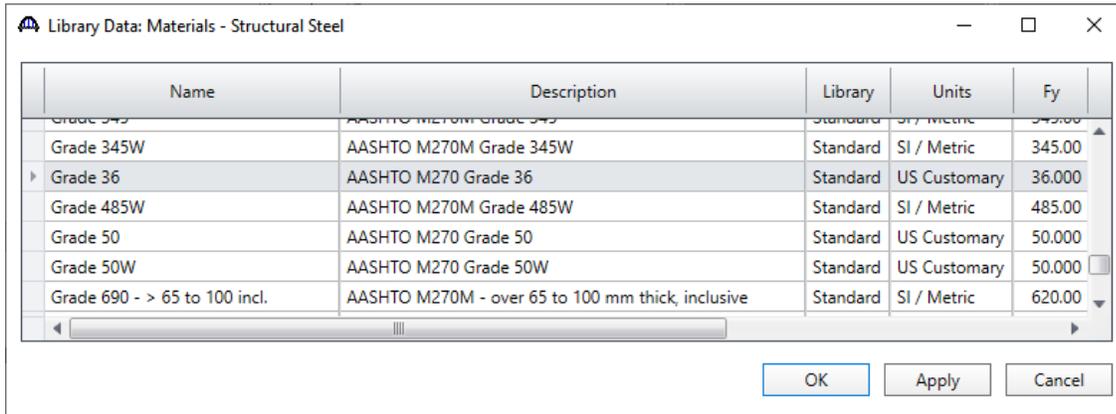


To add a new structural steel material, in the **Components** tab of the **Bridge Workspace**, click on **Materials**, **Structural Steel**, and select **New** from the **Manage** group of the **WORKSPACE** ribbon (or right mouse click on **Structural Steel** and select **New**). The window shown below will open.

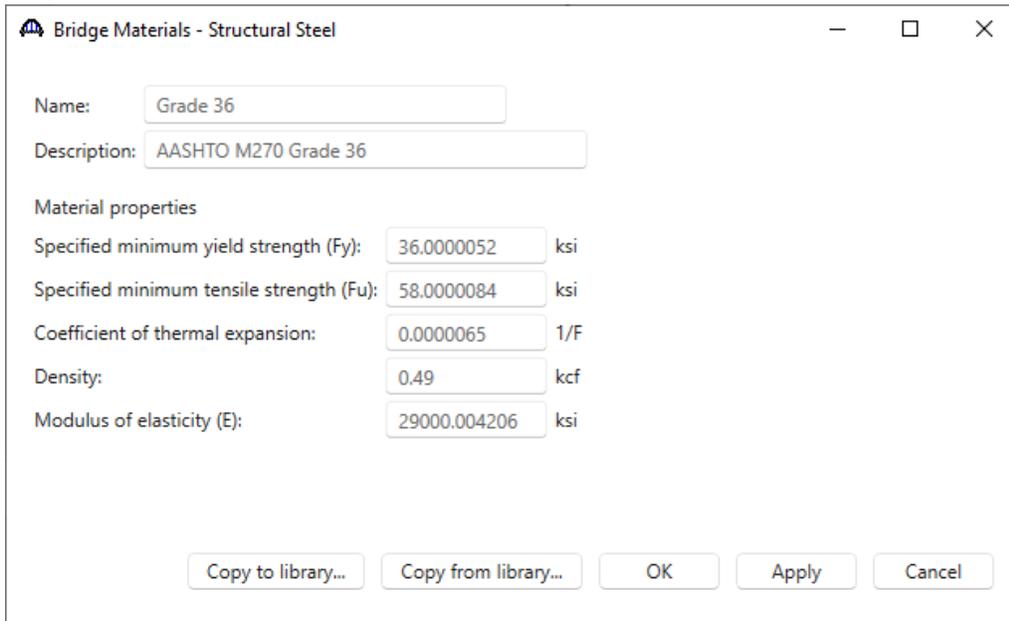


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Add the structural steel material by clicking the **Copy from library...** button. The following window opens. Select **Grade 36** and click **OK**.



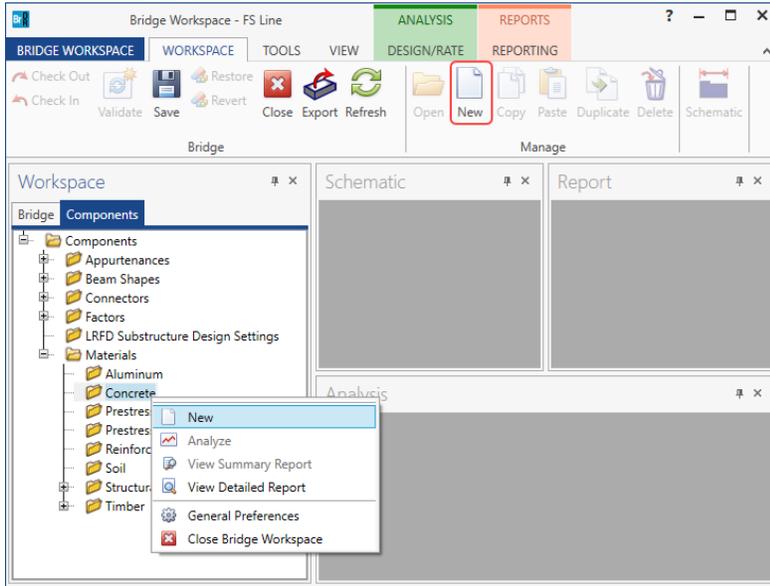
The selected material properties are copied to the **Bridge Materials – Structural Steel** window as shown below.



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

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Add a new concrete material, by clicking on **Materials, Concrete**, and select **New** from the **Manage** group of the **WORKSPACE** ribbon (or right mouse click on **Concrete** and select **New**). The window shown below will open.



Enter the values shown above the **Compute** button and click the **Compute** button to compute the remaining values below them.

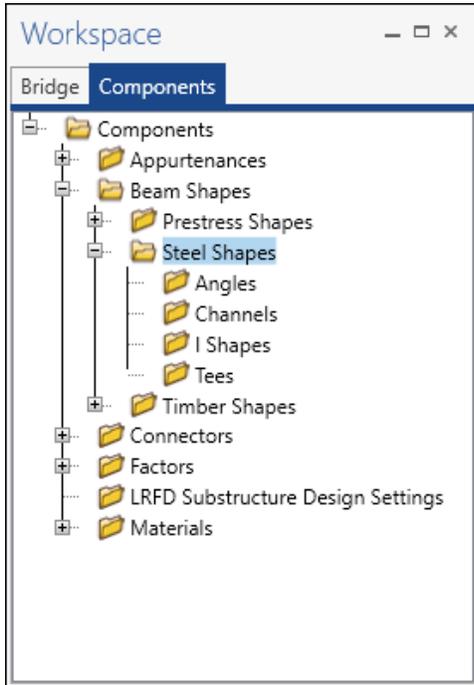
Name:	3.5 ksi concrete
Description:	
Compressive strength at 28 days (f'c):	3.5 ksi
Initial compressive strength (f'ci):	
Composition of concrete:	Normal
Density (for dead loads):	0.15 kcf
Density (for modulus of elasticity):	0.145 kcf
Poisson's ratio:	0.2
Coefficient of thermal expansion (α):	0.000006 1/F
Splitting tensile strength (fct):	
LRFD Maximum aggregate size:	
Compute	
Std modulus of elasticity (Ec):	3408.787789 ksi
LRFD modulus of elasticity (Ec):	3814.69399 ksi
Std initial modulus of elasticity:	
LRFD initial modulus of elasticity:	
Std modulus of rupture:	0.443706 ksi
LRFD modulus of rupture:	0.448999 ksi
Shear factor:	1

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

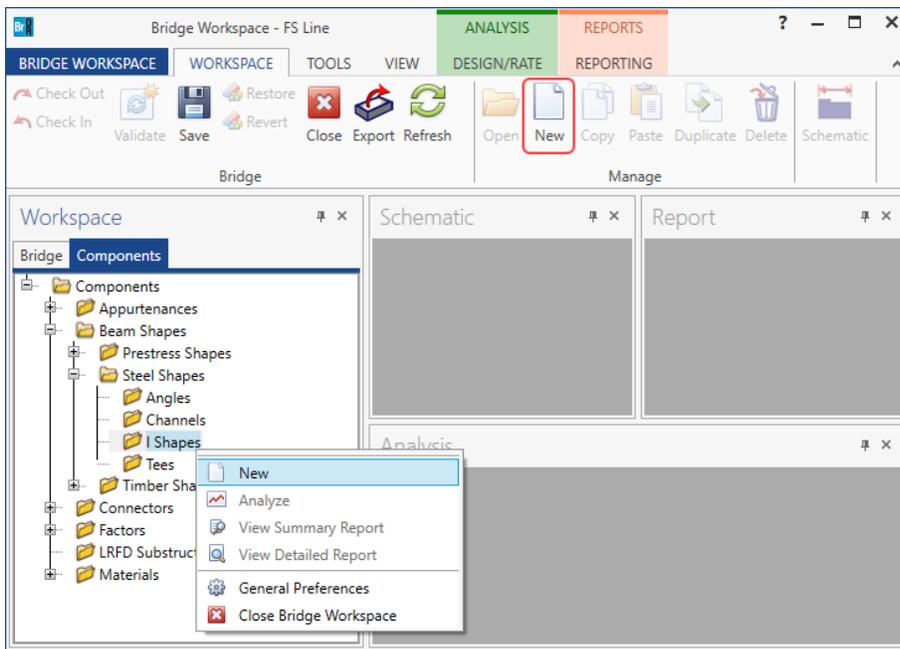
FS2 – Floorbeam Stringer Line Example

Beam Shapes

To enter a steel beam shape to be used in this bridge expand the tree labeled **Beam Shapes** and **Steel Shapes** as shown below. The partially expanded **Components** tree with the **Steel Shapes** node expanded is shown below.

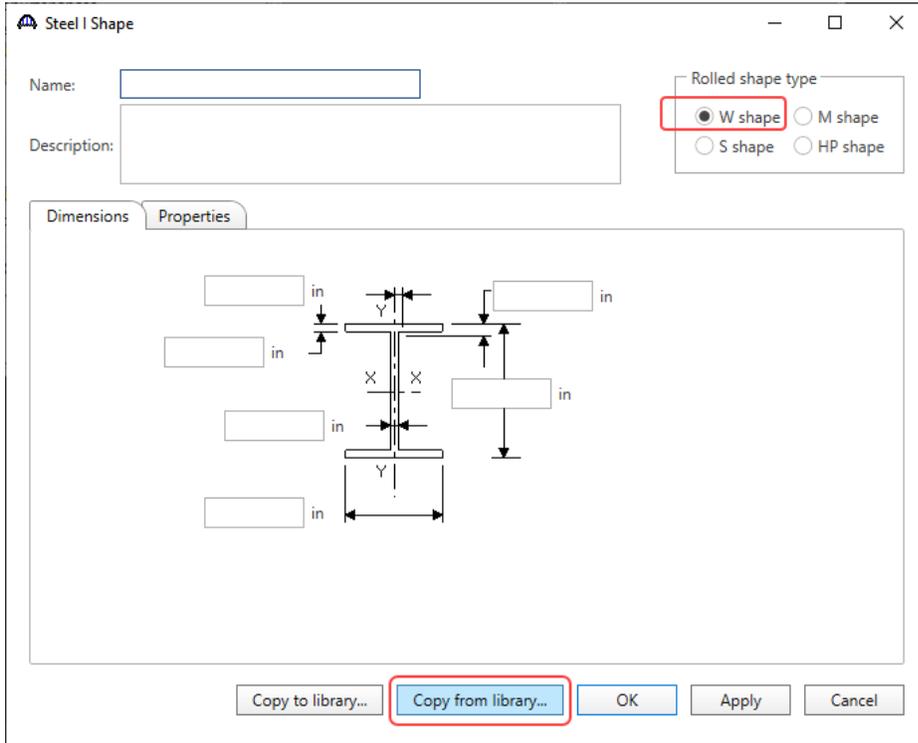


To add a new steel I shape, click on the **I Shapes** node in the **Components** tree and select **New** from the **Manage** group of the **WORKSPACE** ribbon (or right mouse click on **I Shapes** and select **New** or double click on **I Shapes** in the **Components** tree). The window shown below will open.

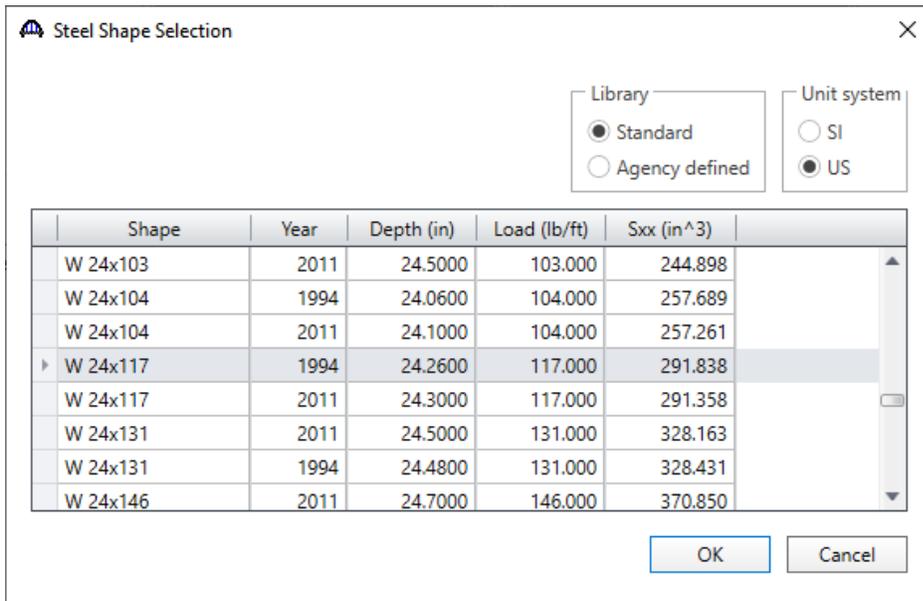


FS2 – Floorbeam Stringer Line Example

Select the **Rolled shape type** as **W shape** and click the **Copy from library...** button. The **Steel Shape Selection** window will appear.



This window displays all the steel shapes available in the library. The list can be sorted by clicking on any of the column headers (e.g., **Shape**, **Year**, **Depth** etc.). Select **W24x117 (Year – 1994)** and click **OK**.



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The beam properties are copied to the **Steel I Shape** window as shown below.

The screenshot shows the 'Steel I Shape' dialog box with the following details:

- Name:** W 24x117
- Description:** W 24x117 Imported from AISC Tables (1994)
- Rolled shape type:** W shape (selected), M shape, S shape, HP shape
- Dimensions:** A diagram of a W 24x117 beam with the following dimensions:
 - Top flange thickness: 0.8500 in
 - Web thickness: 0.5500 in
 - Bottom flange thickness: 12.8000 in
 - Top flange width: 1.6250 in
 - Web height: 24.2600 in
- Buttons:** Copy to library..., Copy from library..., OK, Apply, Cancel

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

Similarly add a **W16x67 (Year – 1994)** steel I shape. The **Steel I Shape** window will be updated as shown below.

The screenshot shows the 'Steel I Shape' dialog box updated for a W 16x67 beam with the following details:

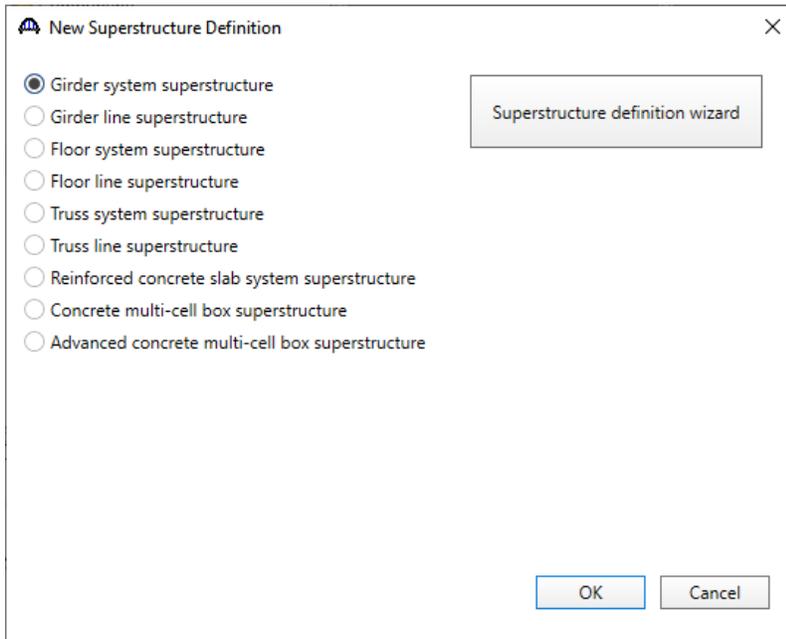
- Name:** W 16x67
- Description:** W 16x67 Imported from AISC Tables (1994)
- Rolled shape type:** W shape (selected), M shape, S shape, HP shape
- Dimensions:** A diagram of a W 16x67 beam with the following dimensions:
 - Top flange thickness: 0.6650 in
 - Web thickness: 0.3950 in
 - Bottom flange thickness: 10.2350 in
 - Top flange width: 1.3750 in
 - Web height: 16.3300 in
- Buttons:** Copy to library..., Copy from library..., OK, Apply, Cancel

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

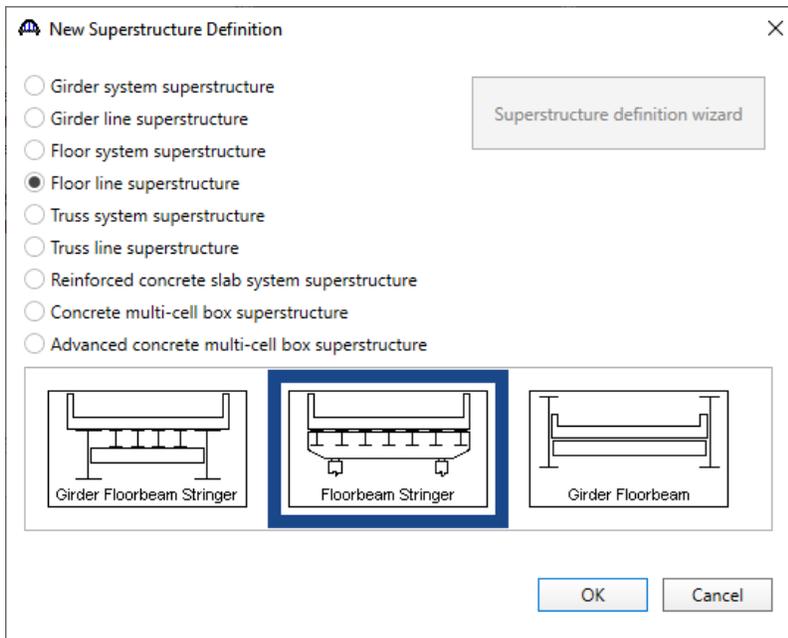
FS2 – Floorbeam Stringer Line Example

Line Superstructure Definition

Returning to the **Bridge** tab of the **Bridge Workspace**, double click on **SUPERSTRUCTURE DEFINITIONS** (or click on **SUPERSTRUCTURE DEFINITIONS** and select **New** from the **Manage** group of the **WORKSPACE** ribbon or right mouse click on **SUPERSTRUCTURE DEFINITIONS** and select **New** from the popup menu) to create a new structure definition. The window shown below will appear.



Selecting **Floor line superstructure** displays three types of floor line superstructure definitions. Select the **Floorbeam Stringer** and click **OK**.



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The **Floorbeam Stringer Floor Line Superstructure Definition** window will open. Enter the data as shown below.

Floorbeam Stringer Floor Line Superstructure Definition

Definition Analysis Engine

Name: Floor Line FS

Description:

Default units: US Customary

Reference line length: 180.00 ft

Live load lanes

Multi-lane
 Single lane

LRFD fatigue

Truck lanes:

Override

Truck fraction:

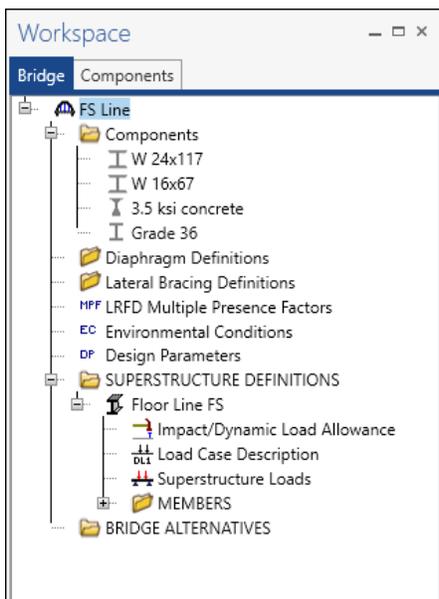
Member alt. types

Steel
 P/S
 R/C
 Timber

OK Apply Cancel

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

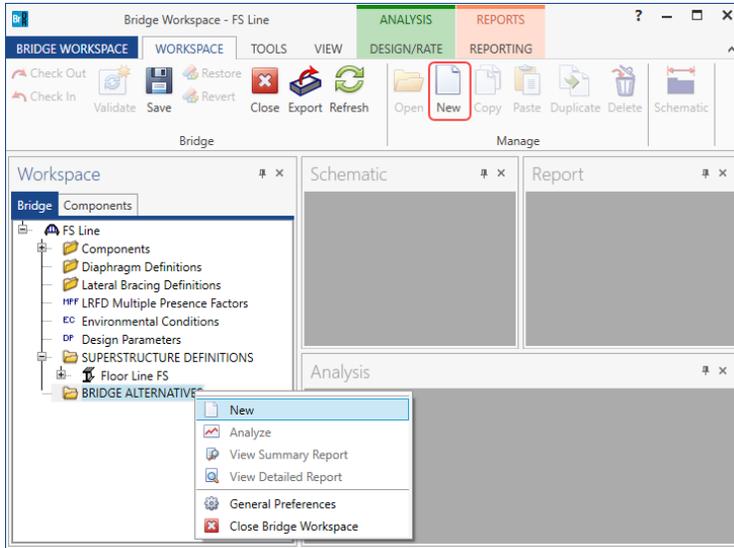
The partially expanded **Bridge Workspace** tree is shown below.



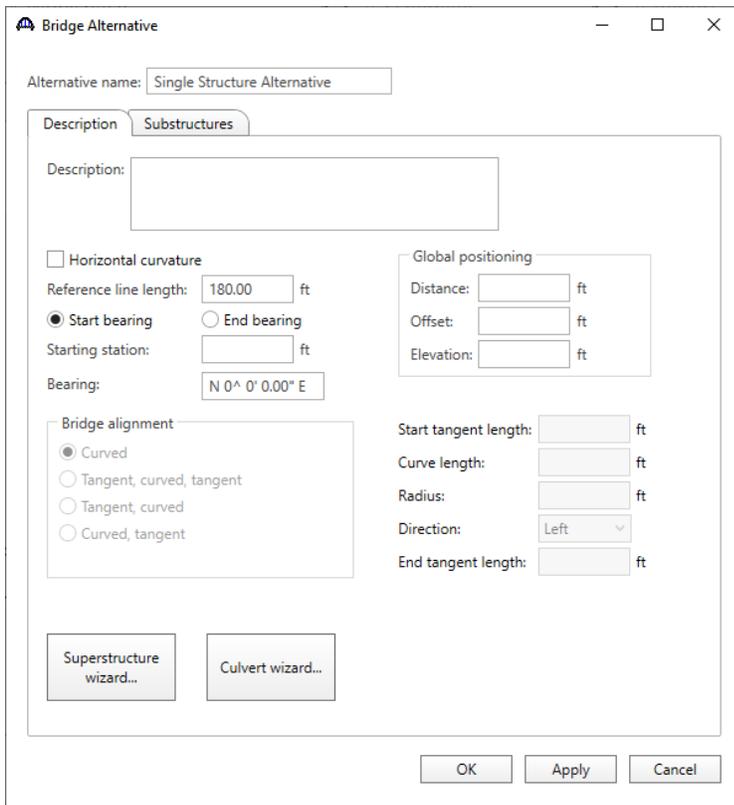
FS2 – Floorbeam Stringer Line Example

BRIDGE ALTERNATIVES

Navigate to the **BRIDGE ALTERNATIVES** node in the **Bridge Workspace** tree and create a new bridge alternative by double-clicking on **BRIDGE ALTERNATIVES** (or click on **BRIDGE ALTERNATIVES** and select **New** from the **Manage** group of the **WORKSPACE** ribbon).



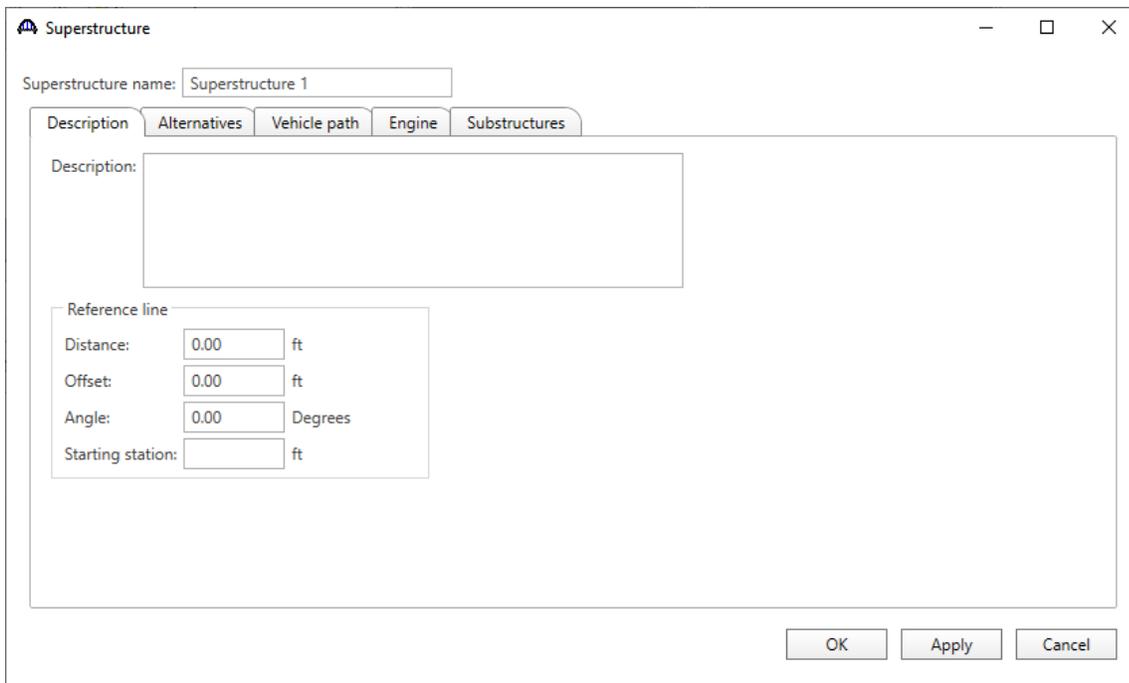
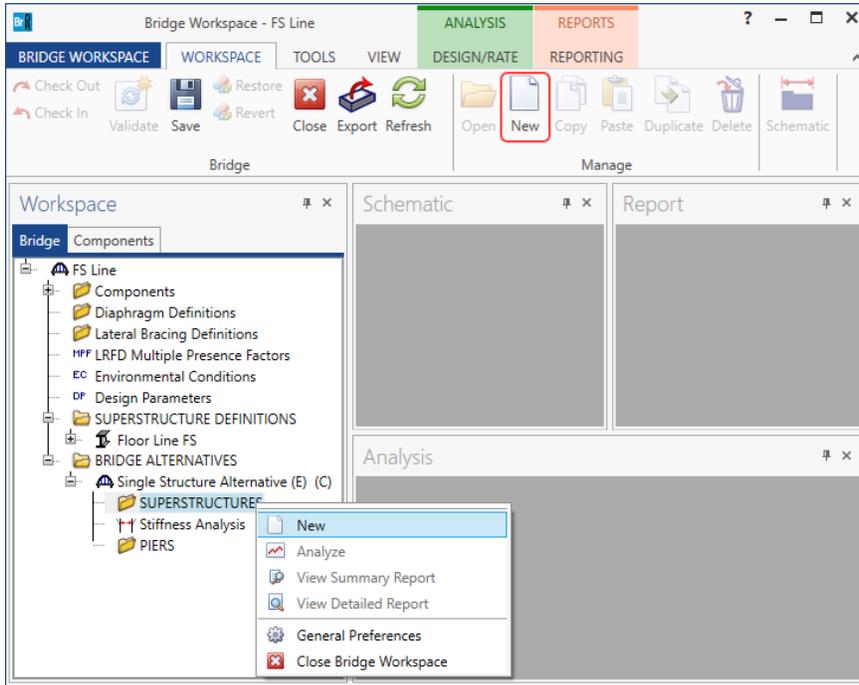
Enter the following data.

A screenshot of the 'Bridge Alternative' dialog box. The 'Alternative name' field contains 'Single Structure Alternative'. The 'Description' tab is selected, and the 'Substructures' sub-tab is active. The 'Description' field is empty. The 'Horizontal curvature' checkbox is unchecked. The 'Reference line length' is 180.00 ft. The 'Start bearing' radio button is selected. The 'Starting station' is empty. The 'Bearing' is N 0° 0' 0.00" E. The 'Global positioning' section has 'Distance', 'Offset', and 'Elevation' fields empty. The 'Bridge alignment' section has 'Curved' selected. The 'Start tangent length', 'Curve length', 'Radius', and 'End tangent length' fields are empty. The 'Direction' dropdown is set to 'Left'. There are 'Superstructure wizard...' and 'Culvert wizard...' buttons at the bottom. 'OK', 'Apply', and 'Cancel' buttons are at the bottom right.

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

FS2 – Floorbeam Stringer Line Example

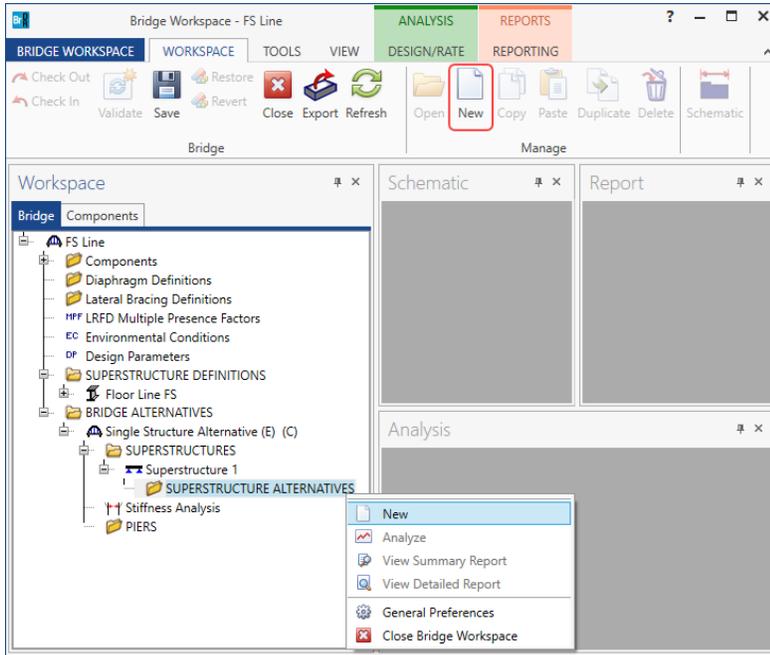
Expand the **Single Structure Alternative** node in the **Bridge Workspace** tree by clicking the **+** button. Double-click on the **SUPERSTRUCTURES** node (or select **SUPERSTRUCTURES** and click **New** from the **Manage** group of the **WORKSPACE** ribbon) and enter the following new superstructure.



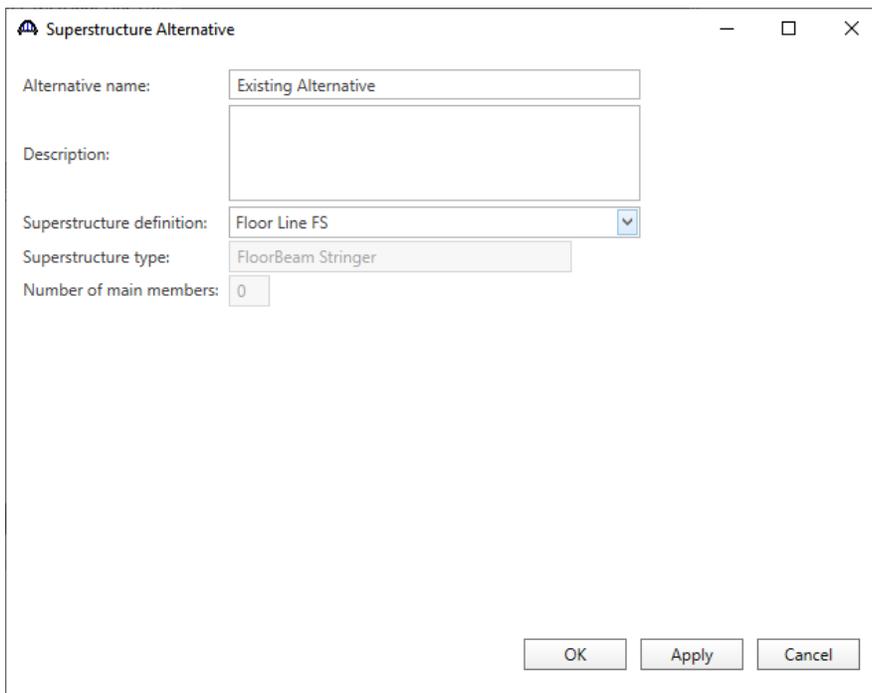
Click **OK** to apply the data and close the window.

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Expand the **Superstructure 1** node in the **Bridge Workspace** tree by clicking the **+** button. Double-click on the **SUPERSTRUCTURE ALTERNATIVES** node (or select **SUPERSTRUCTURE ALTERNATIVES** and click **New** from the **Manage** group of the **WORKSPACE** ribbon) and enter the following new superstructure alternative.



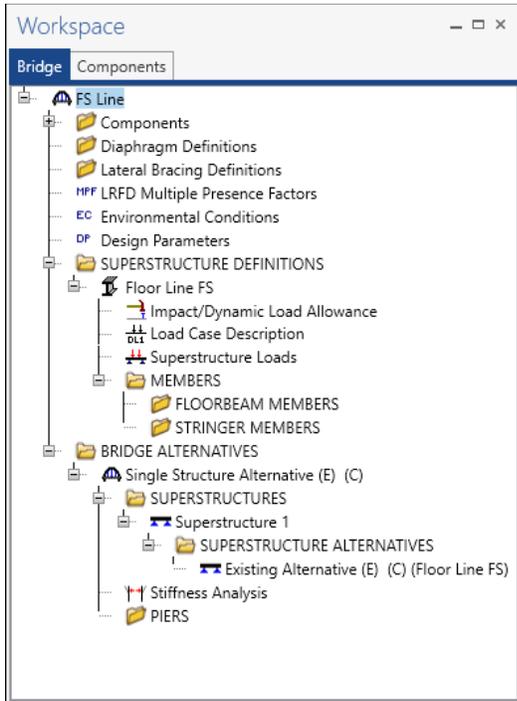
Select the **Superstructure definition Floor Line FS** as the current superstructure definition for this Superstructure Alternative.



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

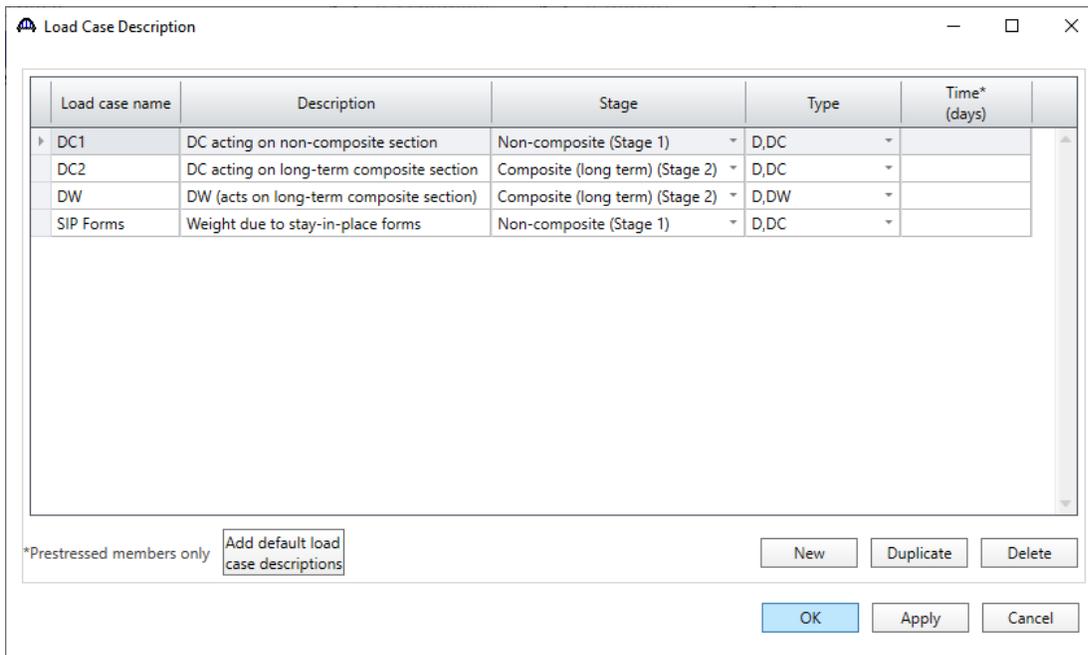
FS2 – Floorbeam Stringer Line Example

The partially expanded **Bridge Workspace** tree is shown below.



Load Case Description

Navigate to the **Floor Line FS** superstructure definition and double-click on the **Load Case Description** node in the **Bridge Workspace** tree to open the **Load Case Description window**. Click on the **Add default load case description** button to create the following load cases.



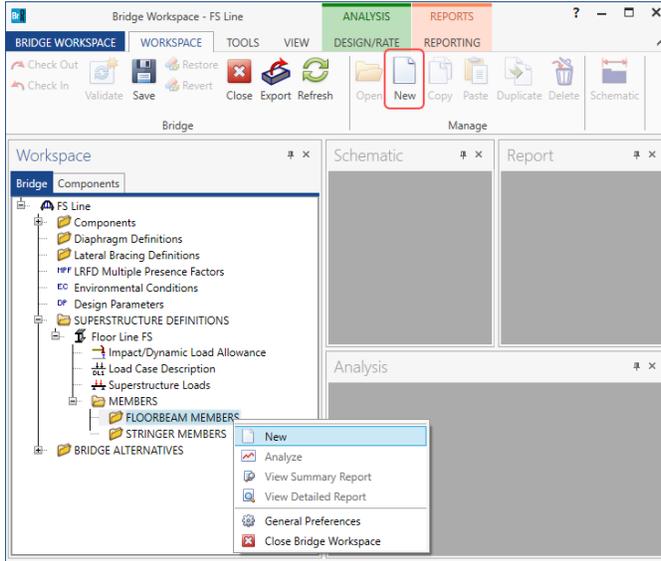
Click **OK** to apply the data and close the window.

FS2 – Floorbeam Stringer Line Example

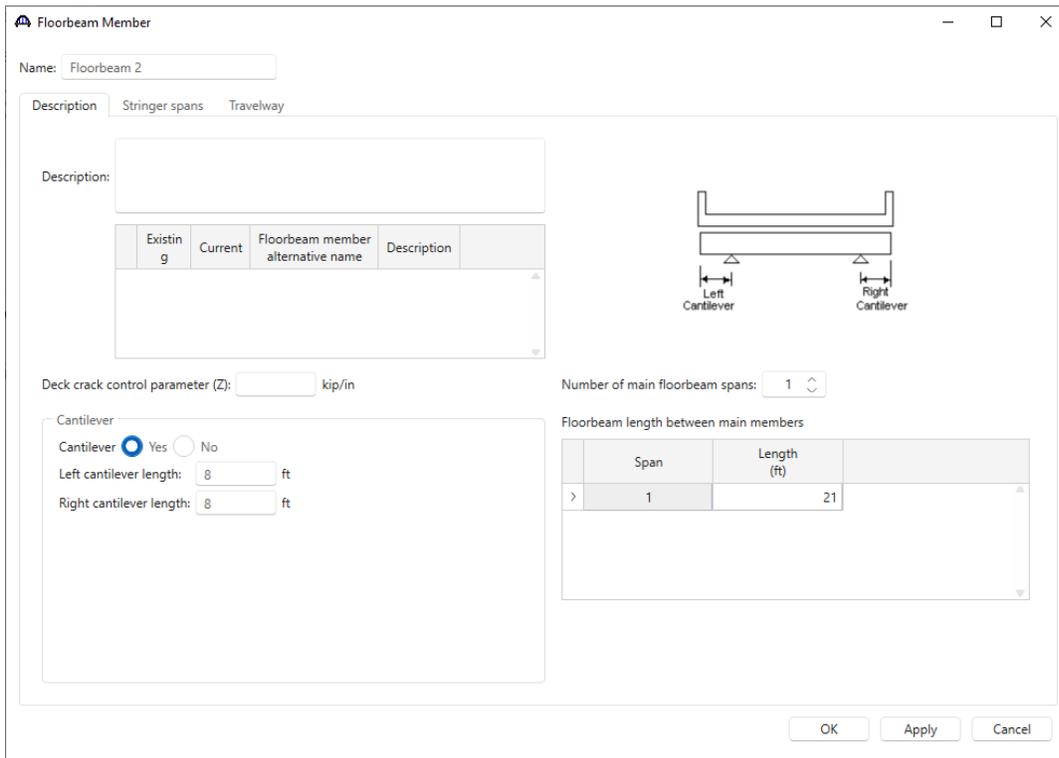
This superstructure does not contain any transverse or bearing stiffeners so they will not be created in this example.

Floorbeam Members - Description

Create a new floorbeam member by expanding **MEMBERS**, selecting **FLOORBEAM MEMBERS** in the **Bridge Workspace** tree and clicking the **New** button from the **Manage** group of the **WORKSPACE** ribbon (or right click and select **New**). The following **Floorbeam Members** window opens.



Enter the data in the Description tab as shown below.



Existing	Current	Floorbeam member alternative name	Description

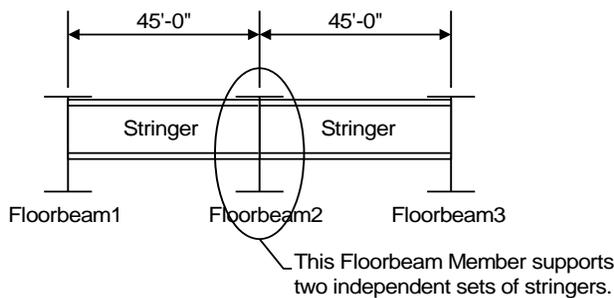
Span	Length (ft)
1	21

FS2 – Floorbeam Stringer Line Example

Floorbeam Members – Stringer spans

The **Stringer spans** tab on the **Floorbeam Member** window describes the stringer spans that the floorbeam member supports. The **Stringer spans** tab allows the user to describe the stringers that contribute live load to this floorbeam member. This tab allows the analysis engine to compute the stringer live load reaction on the floorbeam due to one wheel line of a vehicle. The analysis engine will then use data from the **Floorbeam Member: Travelway** to place the appropriate number of wheel lines on the floorbeam member and move the wheel lines across the floorbeam to produce the critical loading. The actual stringer spacing is not entered nor used to transfer the live load from the stringers to the floorbeam.

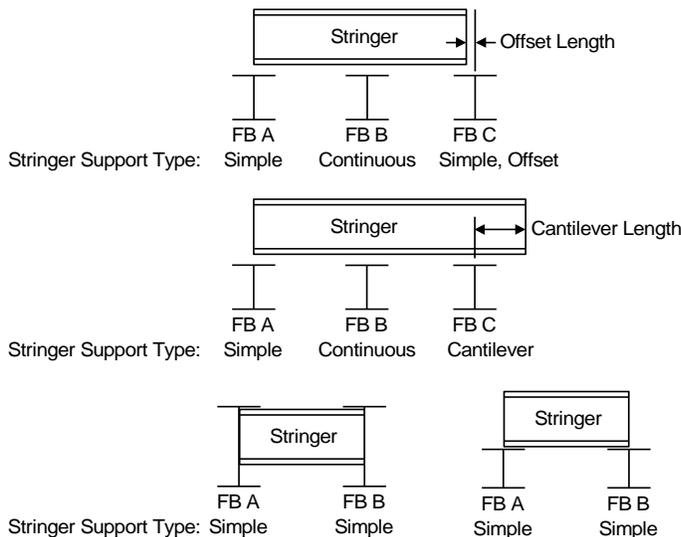
The first item on this tab is the question **Is this floorbeam shared by two independent sets of stringer spans?** Select **Yes** since this floorbeam is supporting two structurally independent sets of stringers as shown in the sketch below. The option to specify the span lengths for the stringer to the left of Floorbeam 2 and for the stringer to the right of Floorbeam 2 will now be available.



2 floorbeams support the stringer to the left in this example.
2 floorbeams support the stringer to the right in this example.

When entering the floorbeam spacing in the grid, the type of stringer support at each floorbeam can be specified.

The following sketches illustrate the different types of stringer supports available.



FS2 – Floorbeam Stringer Line Example

For this example, the stringer support types are all simple. Lastly check the floorbeam member being described in the grid. The completed **Stringer spans** tab is shown below.

Name: Floorbeam 2

Use this tab to define the stringer span lengths that act on this floorbeam
 Is this floorbeam shared by two independent sets of stringer spans? Yes No

Number of floorbeams supporting the stringer to the left that contributes live load to this floorbeam: 2

Number of floorbeams supporting the stringer to the right that contributes live load to this floorbeam: 2

Floorbeam	Floorbeam spacing (ft)	Continuous	Left offset/cantilever length (ft)	Right offset/cantilever length (ft)	Select the floorbeam being described
A	0.00	Simple			<input type="checkbox"/>
B	45.00	Simple			<input checked="" type="checkbox"/>
C	45.00	Simple			<input type="checkbox"/>

Computed resulting stringer span

Span	Length (ft)
1	45.000

OK Apply Cancel

Floorbeam Members – Travelway

The **Travelway** tab on the **Floorbeam Member** window describes the following lane positions for loading the floorbeam member.

Name: Floorbeam 2

Travelway number	Distance from leftmost main member to left edge of travelway (ft)	Total travelway width (ft)
1	6.50	24.00

New Duplicate Delete

OK Apply Cancel

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

FS2 – Floorbeam Stringer Line Example

Floorbeam Member Loads

Expand the **Floorbeam 2** floorbeam member and double click on **Floorbeam Member Loads** in the **Bridge Workspace** tree to open the **Floorbeam Member Loads** window. Since this floorbeam member is being described using the Line approach, the dead loads from the stringers acting on the floorbeam must be entered. The deck slab acting on the floorbeam will be described in the floorbeam member alternative so the dead load due to the deck slab will not be input as a load on the floorbeam. It will be computed by the system when the member alternative is exported to the analysis engine.

The stringer dead loads acting on the floorbeam can be input as either a uniform load acting over the length of the floorbeam or as concentrated loads acting at the stringer locations. In this example, these loads will be entered as concentrated loads at the stringer locations. The following shows how the interior stringer DC1 deadloads are computed.

Interior Stringer DC1 Load on Floorbeam

Component	Load (lb/ft)
Selfweight	117
Haunch	13.3
Diaphragms	<u>5.27</u>
Total =	135.57

The reaction on the floorbeam due to the stringer load is computed as follows:

$$R = \frac{(135.57 \text{ lb/ft}) * 45'}{2} = 3050 \text{ lb} = 3.05 \text{ kips}$$

Since the floorbeam is supporting 2 sets of stringers, the total reaction on the floorbeam for an interior stringer is 6.10 kips. This load is applied as a concentrated load on the floorbeam at the stringer location. The same procedure is followed to determine the dead load reaction on the floorbeam for the exterior stringers.

FS2 – Floorbeam Stringer Line Example

Pedestrian load: lb/ft

Uniform Distributed Concentrated

	Load case name	Distance (ft)	Px (kip)	Py (kip)	M (kip-ft)
>	DC1	1		3.62	
	DC1	8		6.1	
	DC1	15		6.1	
	DC1	22		6.1	
	DC1	29		6.1	
	DC1	37		3.62	

New Duplicate Delete

OK Apply Cancel

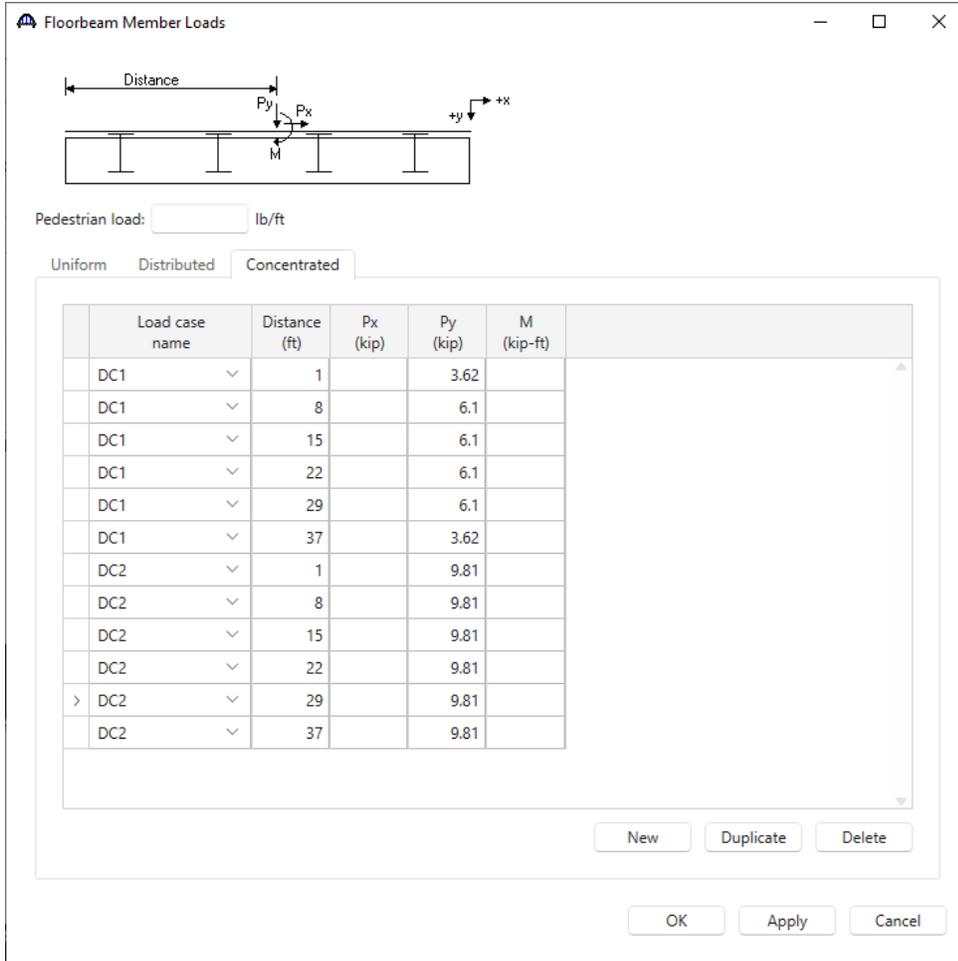
The DC2 dead load on the floorbeam is the load due to the appurtenances. This load is also applied to the floorbeam as concentrated loads at the stringer locations.

$$\text{Uniform dead load on each stringer} = \frac{2(150 \text{ lb/ft}) + 2(505 \text{ lb/ft})}{6 \text{ stringers}} = 218 \text{ lb/ft}$$

$$\text{Concentrated load on the floorbeam} = (218 \text{ lb/ft}) \frac{45'}{2} = 4905 \text{ lb} = 4.905 \text{ kips}$$

Since the floorbeam is supporting 2 sets of stringers, the total reaction due to the appurtenances on the floorbeam for a stringer is 9.81 kips.

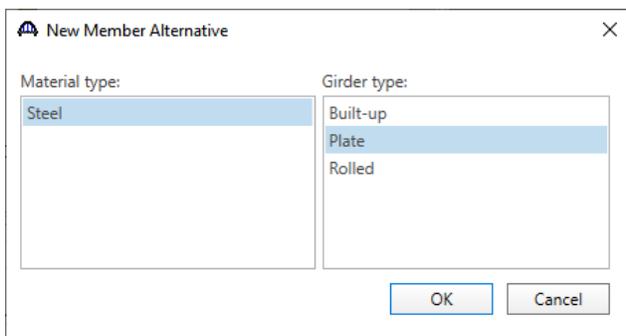
FS2 – Floorbeam Stringer Line Example



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

Floorbeam Member Alternative (Plate girder floorbeams, linearly varying web)

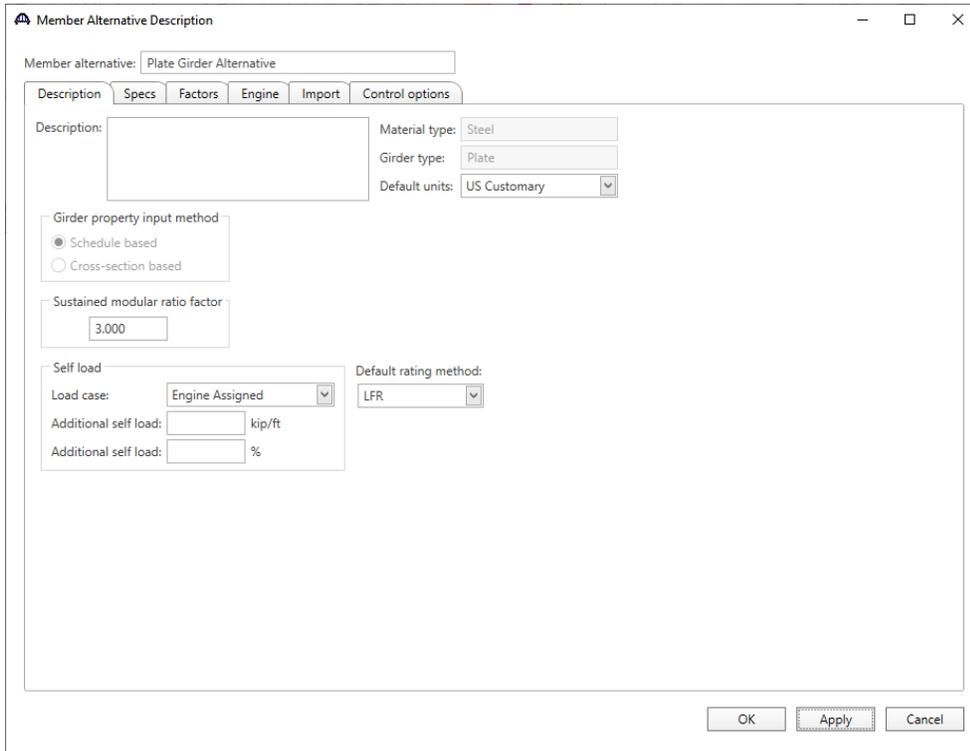
Now create a schedule based steel plate girder floorbeam member alternative by selecting the **FLOORBEAM MEMBER ALTERNATIVES** node in the **Bridge Workspace** tree and click **New** from the **Manage** group of the **WORKSPACE** ribbon (or right click and select **New**). The following window opens.



Select **Steel** as the **Material type**, **Plate** as the **Girder type** and click **OK**.

FS2 – Floorbeam Stringer Line Example

The **Member Alternative Description** window opens as shown below. Enter the following data.

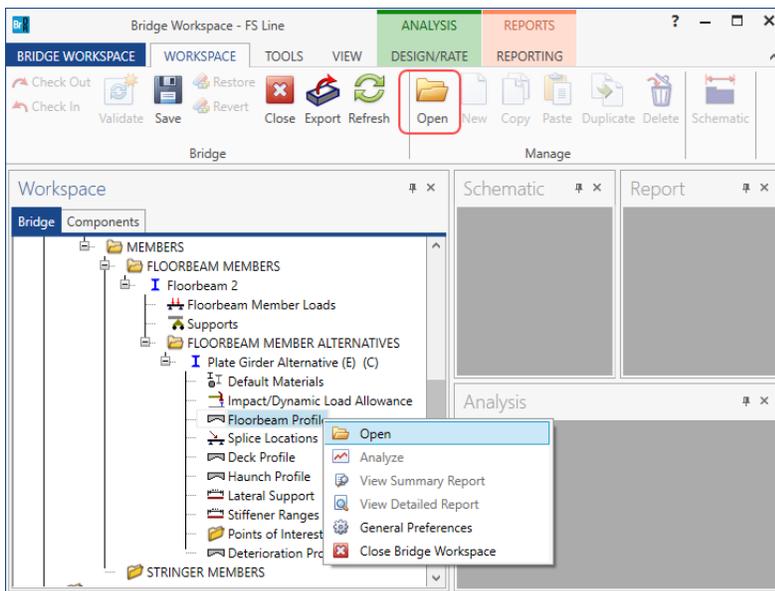


The screenshot shows the "Member Alternative Description" dialog box. The "Member alternative" field is set to "Plate Girder Alternative". The "Description" tab is active, showing a large empty text area for the description. To the right, there are fields for "Material type" (Steel), "Girder type" (Plate), and "Default units" (US Customary). Below these are two radio buttons for "Girder property input method": "Schedule based" (selected) and "Cross-section based". A "Sustained modular ratio factor" field is set to 3.000. The "Self load" section includes a "Load case" dropdown set to "Engine Assigned", and two "Additional self load" fields (one for kip/ft and one for %). The "Default rating method" dropdown is set to "LFR". At the bottom right, there are "OK", "Apply", and "Cancel" buttons.

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

Floorbeam Profile

Expand the **Plate Girder Alternative** member alternative and double click on the **Floorbeam Profile** node in the **Bridge Workspace** tree (or right click and select **Open** or select **Open** from the **WORKSPACE** ribbon) to open the **Floorbeam Profile** window as shown below.



FS2 – Floorbeam Stringer Line Example

Describe the floorbeam profile as shown below.

Floorbeam Profile

Type:

Web | **Top flange** | Bottom flange

Begin depth (in)	Depth vary	End depth (in)	Thickness (in)	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld at right
27.0000	Linear	42.0000	0.6250	0.00	7.00	7.00	Grade 36	-- None --
42.0000	None	42.0000	0.6250	7.00	23.00	30.00	Grade 36	-- None --
42.0000	Linear	27.0000	0.6250	30.00	7.00	37.00	Grade 36	-- None --

New Duplicate Delete

OK Apply Cancel

Describe the flanges as shown below.

Floorbeam Profile

Type:

Web | **Top flange** | Bottom flange

Begin width (in)	End width (in)	Thickness (in)	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld	Weld at right
16.0000	16.0000	2.0000	0.00	37.00	37.00	Grade 36	-- None --	-- None --

Floorbeam Profile

Type:

Web | **Top flange** | Bottom flange

Begin width (in)	End width (in)	Thickness (in)	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld	Weld at right
16.0000	16.0000	2.0000	0.00	37.00	37.00	Grade 36	-- None --	-- None --

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

FS2 – Floorbeam Stringer Line Example

Deck Profile

Next open the **Deck Profile** window by double clicking the **Deck Profile** node in the **Bridge Workspace** tree. Enter the data describing the structural properties of the deck. The floorbeam spacing is entered as the tributary width of the deck so the export can compute the dead load of the deck slab.

Deck Profile

Type: Plate

Deck concrete | Reinforcement | Shear connectors

Load case: Engine Assigned

Material	Start distance (ft)	Length (ft)	End distance (ft)	Total thickness (in)	Tributary start width (in)	Tributary end width (in)	Structural thickness (in)	Effective flange width (Std) (in)	Effective flange width (LRFD) (in)	n
3.5 ksi concrete	0.00	37.00	37.00	9.0000	540.0000	540.0000	8.5000	63.0000	63.0000	

New Duplicate Delete

OK Apply Cancel

Navigate to the **Shear connectors** tab and enter the following data.

Deck Profile

Type: Plate

Deck concrete | Reinforcement | Shear connectors

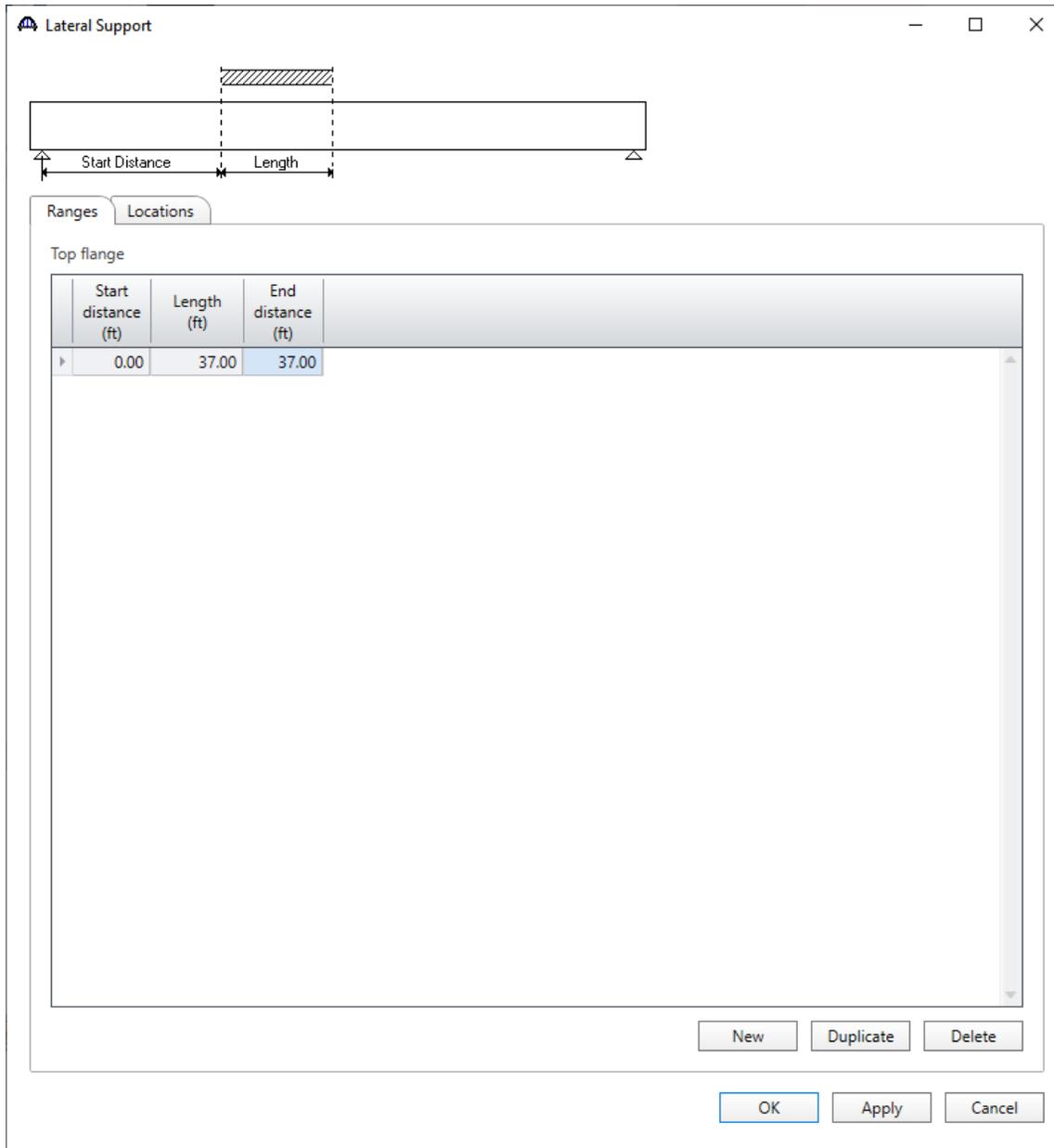
Start distance (ft)	Length (ft)	End distance (ft)	Connector ID	Number of spaces	Number per row	Transverse spacing (in)
0.00	37.00	37.00	Composite			

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

FS2 – Floorbeam Stringer Line Example

Lateral Support

Open the **Lateral Support** window by double clicking the **Lateral Support** node in the **Bridge Workspace** tree. Define the lateral support for the top flange of the floorbeam as follows.



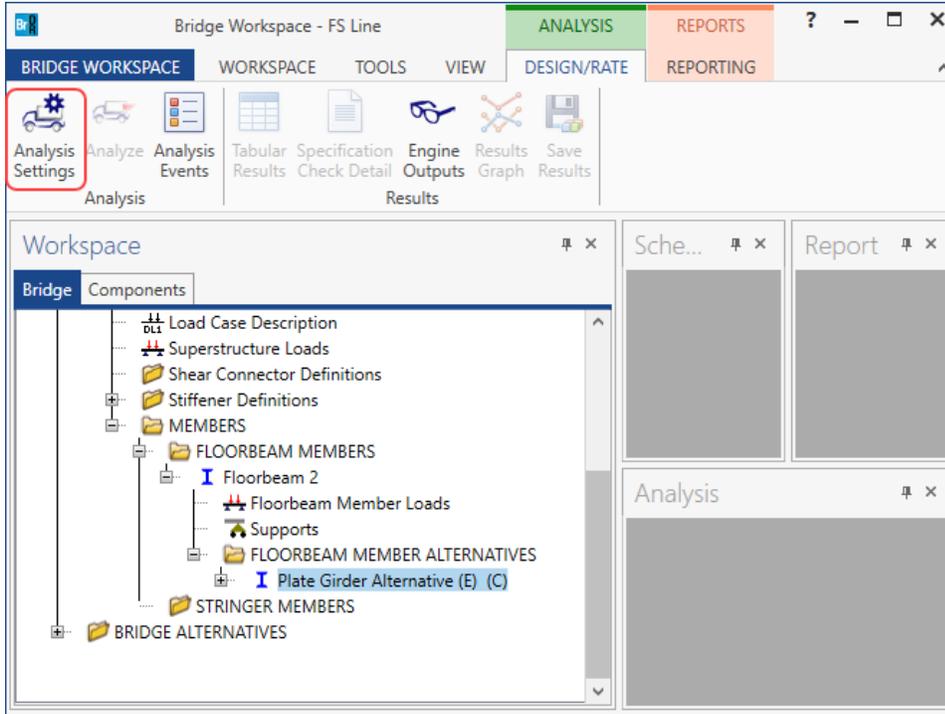
Click **OK** to apply the data and close the window.

The description of the floorbeam member alternative is complete.

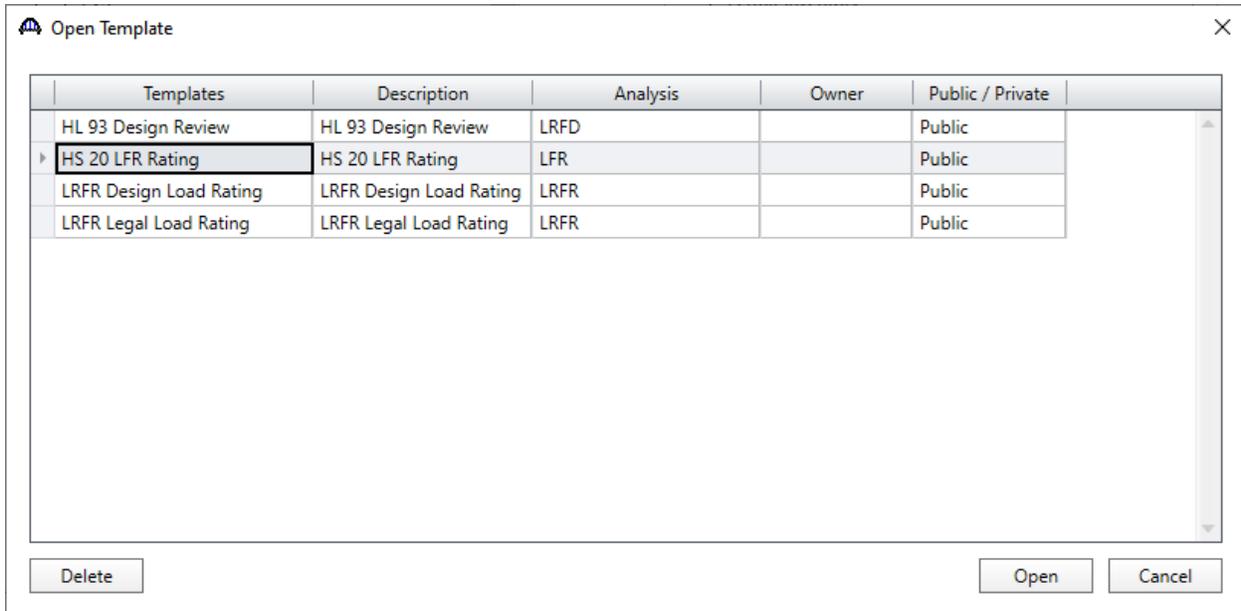
FS2 – Floorbeam Stringer Line Example

LFR Analysis – Floorbeam member alternative

To perform an LFR rating of the floorbeam member alternatives, select **Plate Girder Alternative** in the **Bridge Workspace** tree and click the **Analysis Settings** button on the **Analysis** group of the **DESIGN/RATE** ribbon. The window shown below opens.

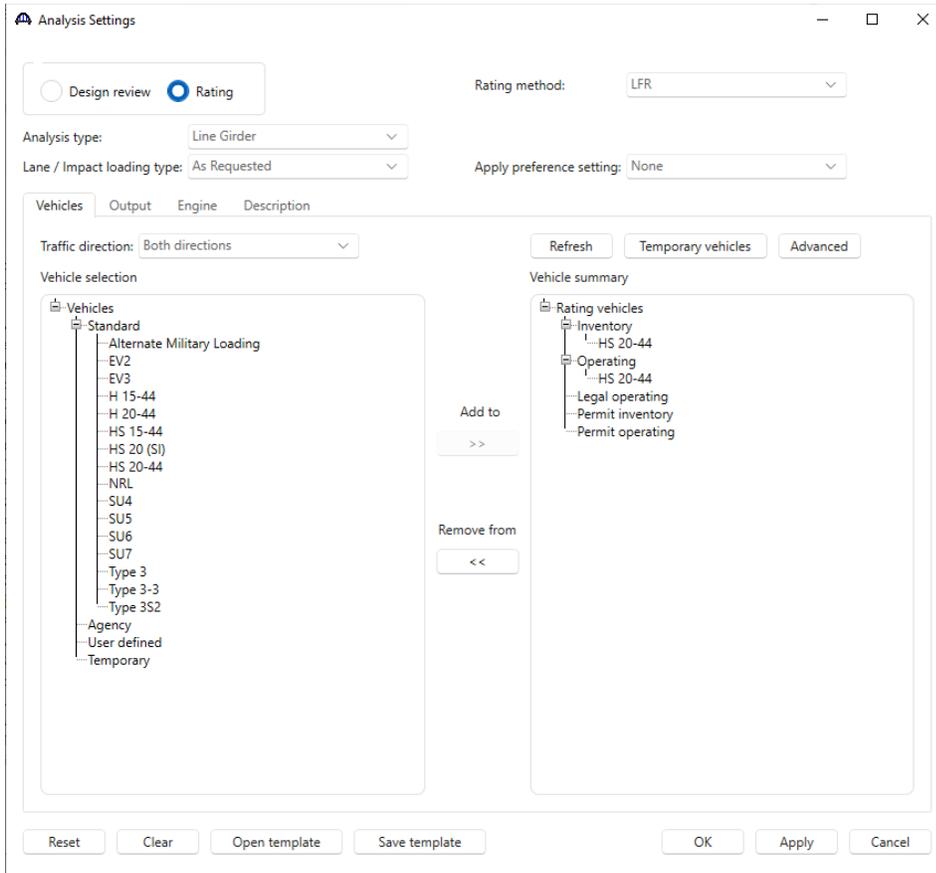


Click the **Open Template** button and select the **HS 20 LFR Rating** to be used in the rating and click **Open**.



FS2 – Floorbeam Stringer Line Example

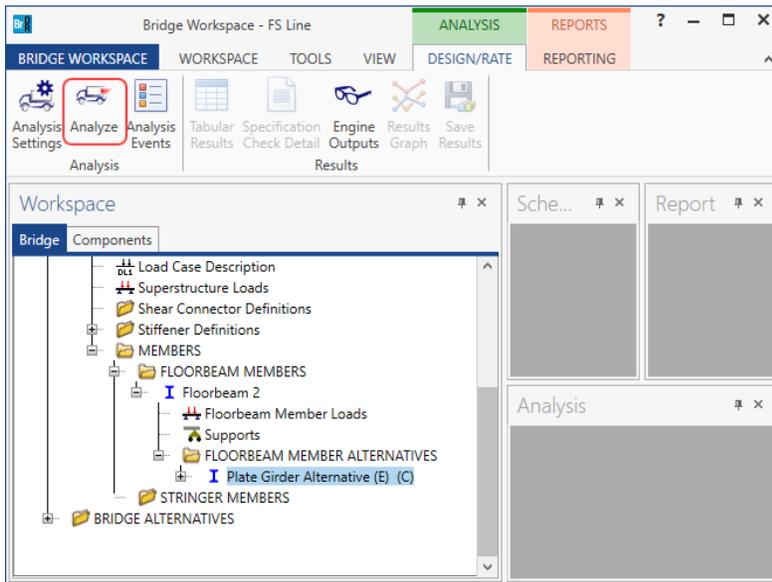
The **Analysis Settings** window will be populated as shown below.



Click **OK** to save the analysis settings and close the window.

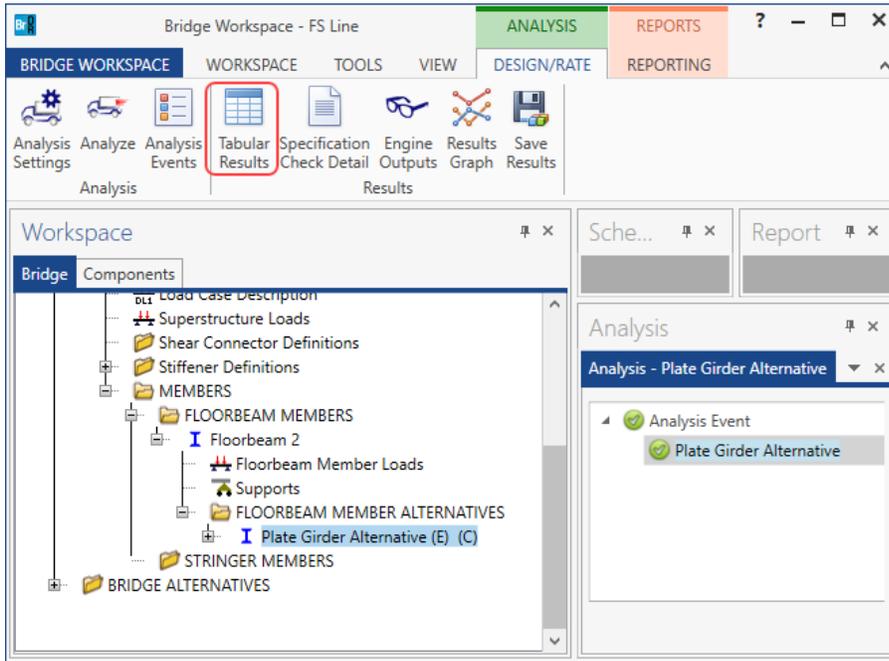
Tabular Results

Next click the **Analyze** button on the **Analysis** group of the **DESIGN/RATE** ribbon to perform the rating.



FS2 – Floorbeam Stringer Line Example

When the rating is finished, results can be reviewed by clicking the **Tabular Results** button on the **Results** group of the ribbon.



The window shown below will open.

Analysis Results - Plate Girder Alternative
— □ ×

Print
 Print

Report type:

Lane/Impact loading type
 As requested Detailed

Display Format

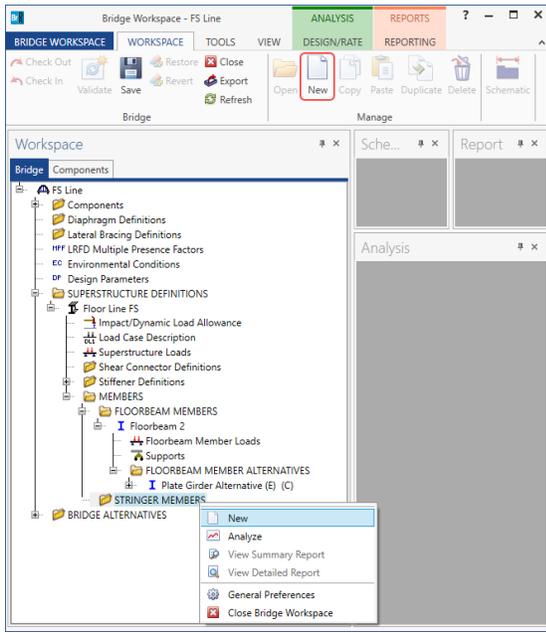
Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HS 20-44	Axle Load	LFR	Inventory	88.64	2.462	29.00	2 - (100.0)	Design Shear - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFR	Operating	148.03	4.112	29.00	2 - (100.0)	Design Shear - Steel	As Requested	As Requested
HS 20-44	Lane	LFR	Inventory	96.34	2.676	29.00	2 - (100.0)	Design Shear - Steel	As Requested	As Requested
HS 20-44	Lane	LFR	Operating	160.88	4.469	29.00	2 - (100.0)	Design Shear - Steel	As Requested	As Requested

AASHTO LFR Engine Version 7.5.0.3001
 Analysis preference setting: None

FS2 – Floorbeam Stringer Line Example

Stringer Members - Description

Now create one of the interior stringer members. To open the **Stringer Member** window, select **STRINGER MEMBERS** in the **Bridge Workspace** tree and click on the **New** button from the **Manage** group of the **WORKSPACE** ribbon (or right click and select **New**, or double click on **STRINGER MEMBERS**) as shown below.



Enter the following data for the stringer member.

The Stringer Member dialog box is shown with the following data entered:

- Name: Stringer 2 Unit 1
- Description: (empty)
- Deck crack control parameter (Z): (empty) kip/in
- Stringer spacing: 7.00 ft
- Member location: Interior (selected)
- Number of stringer spans: 1
- Stringer spacing lengths table:

Span	Span length (ft)	Cantilever span
1	45.00	

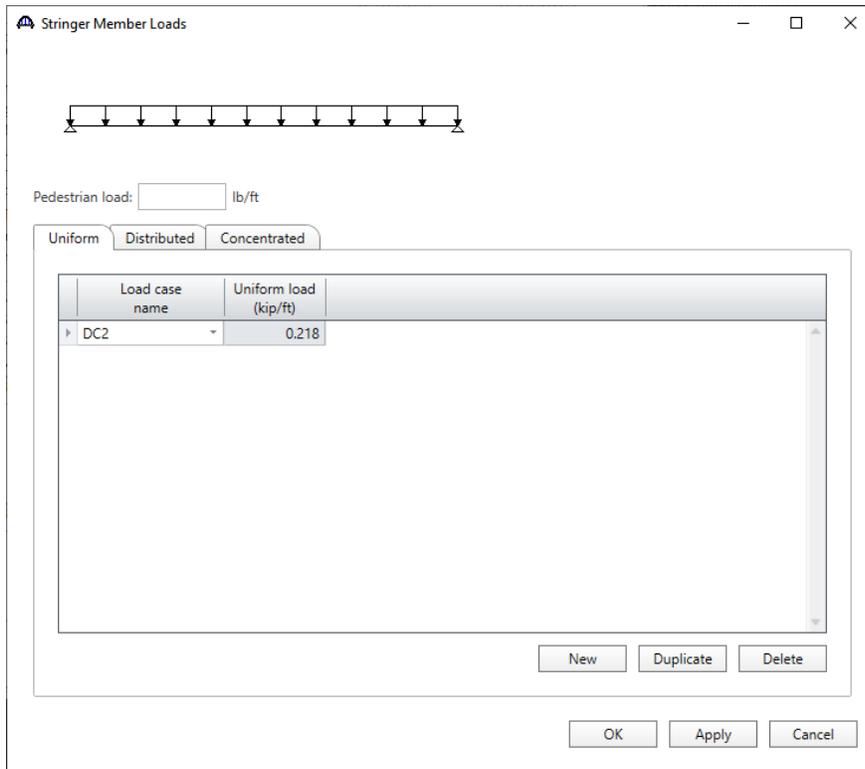
Buttons: OK, Apply, Cancel

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

FS2 – Floorbeam Stringer Line Example

Stringer Member Loads

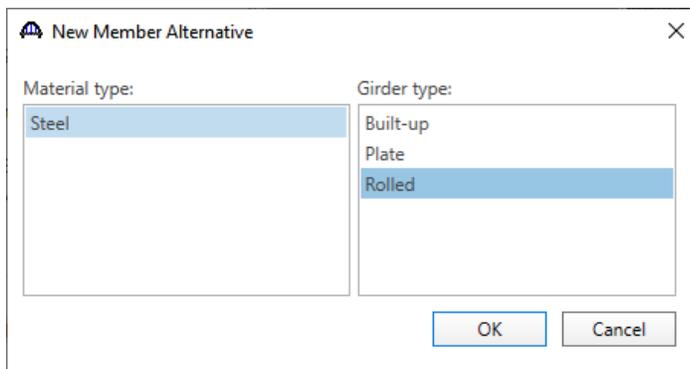
Double click on the **Stringer Member Loads** node in the **Bridge Workspace** tree and add the following member load to the stringer for the weight of the appurtenances as shown below.



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

Stringer Member Alternative (Rolled beam stringers)

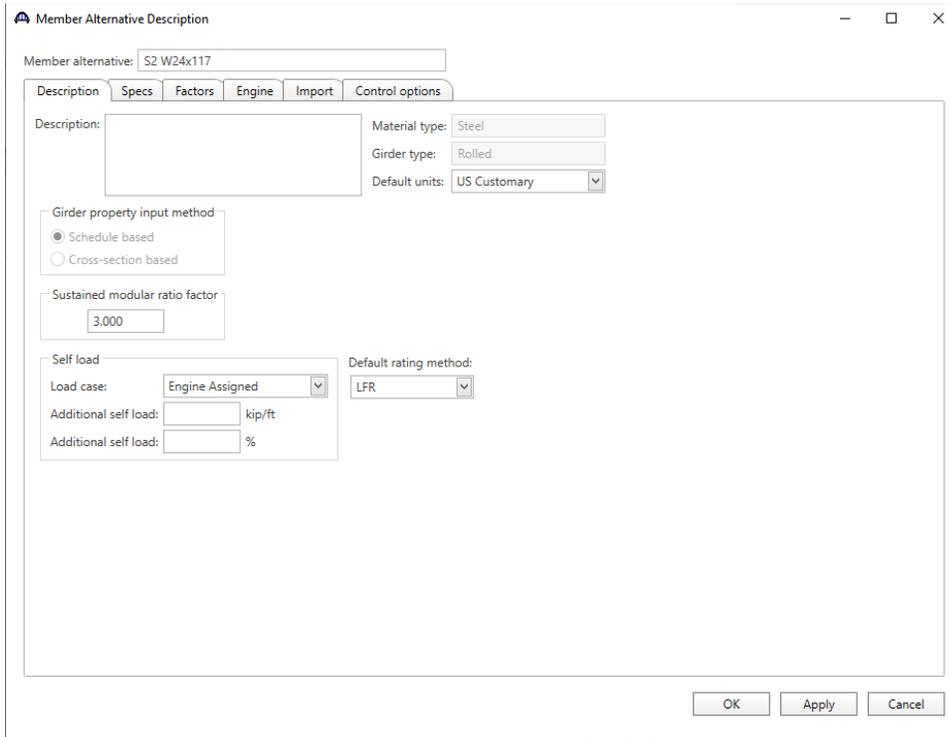
Now create a schedule based steel rolled beam member alternative by selecting the **STRINGER MEMBER ALTERNATIVES** node in the **Bridge Workspace** tree and click **New** from the **Manage** group of the **WORKSPACE** ribbon (or right click and select **New**). The following window opens.



Select **Steel** as the **Material type**, **Rolled** as the **Girder type** and click **OK**.

FS2 – Floorbeam Stringer Line Example

The **Member Alternative Description** window opens as shown below. Enter the following data.

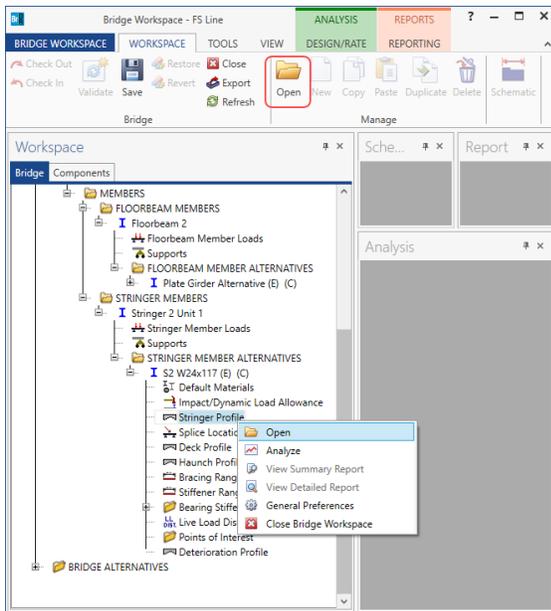


The screenshot shows the "Member Alternative Description" dialog box. The "Member alternative" field is set to "S2 W24x117". The "Description" field is empty. The "Material type" is "Steel", "Girder type" is "Rolled", and "Default units" is "US Customary". Under "Girder property input method", "Schedule based" is selected. The "Sustained modular ratio factor" is set to "3.000". Under "Self load", "Load case" is "Engine Assigned", "Additional self load" is "kip/ft", and "Additional self load" is "%". The "Default rating method" is "LFR". At the bottom, there are "OK", "Apply", and "Cancel" buttons.

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

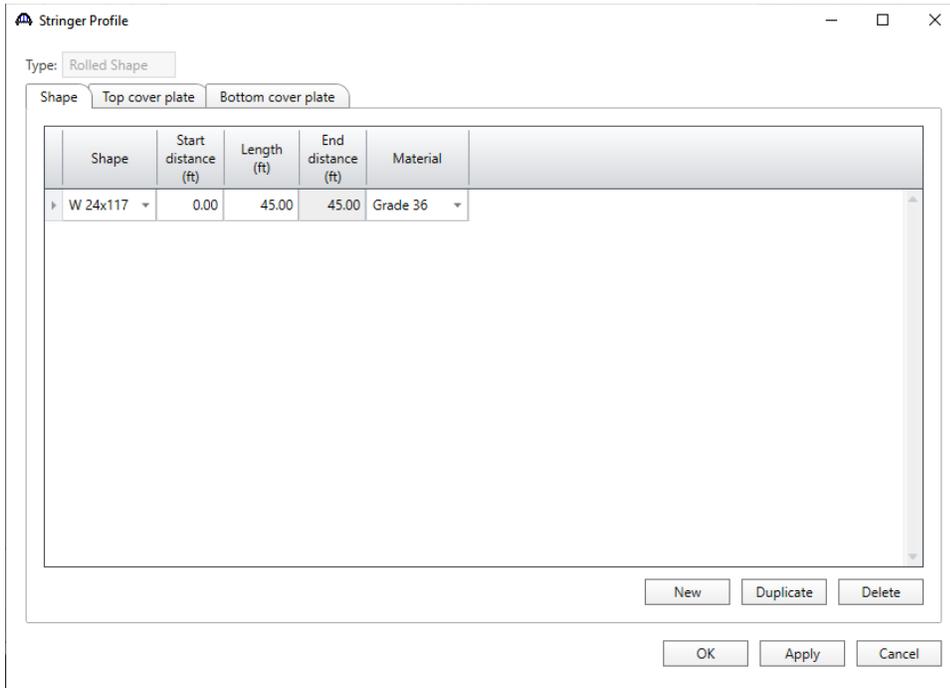
Stringer Profile

Expand the **S2 W24x117** member alternative and double click on the **Stringer Profile** node in the **Bridge Workspace** tree (or right click and select **Open** or select **Open** from the **WORKSPACE** ribbon) to open the **Stringer Profile** window as shown below.



FS2 – Floorbeam Stringer Line Example

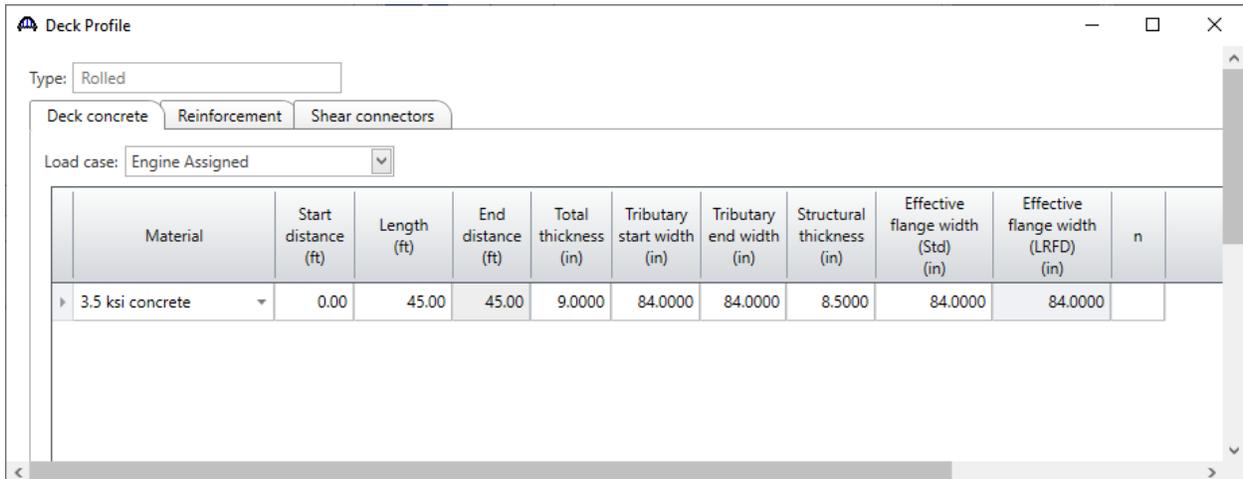
Describe the stringer profile as shown below.



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

Deck Profile

Next open the **Deck Profile** window by double clicking the **Deck Profile** node in the **Bridge Workspace** tree. Enter the data describing the structural properties of the deck.



FS2 – Floorbeam Stringer Line Example

Navigate to the **Shear connectors** tab and enter that data as shown below.

The screenshot shows the 'Deck Profile' dialog box with the 'Shear connectors' tab selected. The 'Type' is set to 'Rolled'. The table below contains one row of data:

Start distance (ft)	Length (ft)	End distance (ft)	Connector ID	Number of spaces	Number per row	Transverse spacing (in)
0.00	45.00	45.00	Composite			

Buttons at the bottom include 'New', 'Duplicate', 'Delete', 'OK', 'Apply', and 'Cancel'.

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

Haunch Profile

Open the **Haunch Profile** window by double clicking the **Haunch Profile** node in the **Bridge Workspace** tree. Define the haunch profile as follows.

The screenshot shows the 'Steel Haunch Profile' dialog box. The 'Haunch type' section has four icons, with the first one selected. The 'Embedded flange' checkbox is unchecked. A diagram shows a haunch profile with dimensions Z1, Z2, and Y1. The table below contains one row of data:

Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)
0.00	45.00	45.00	0.0000	0.0000	1.0000

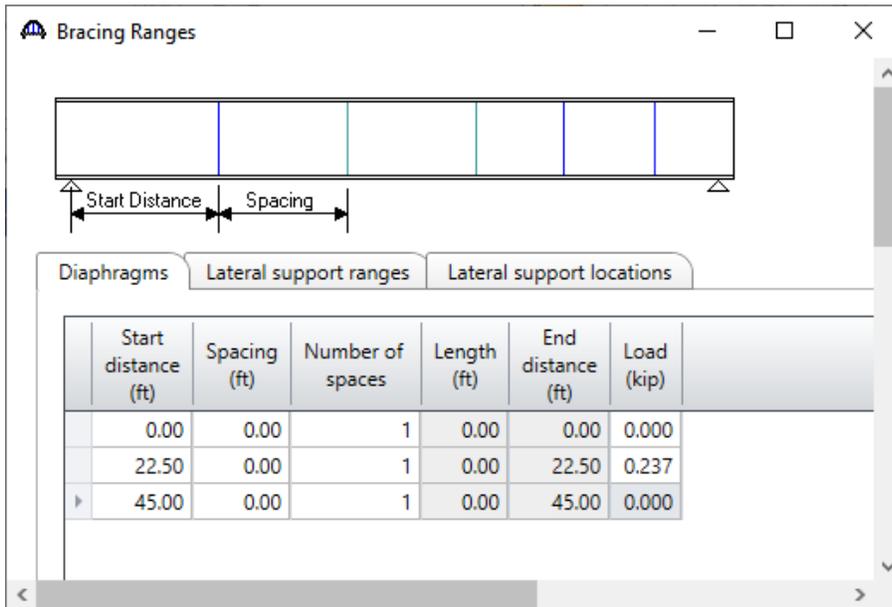
Buttons at the bottom include 'New', 'Duplicate', 'Delete', 'OK', 'Apply', and 'Cancel'.

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

FS2 – Floorbeam Stringer Line Example

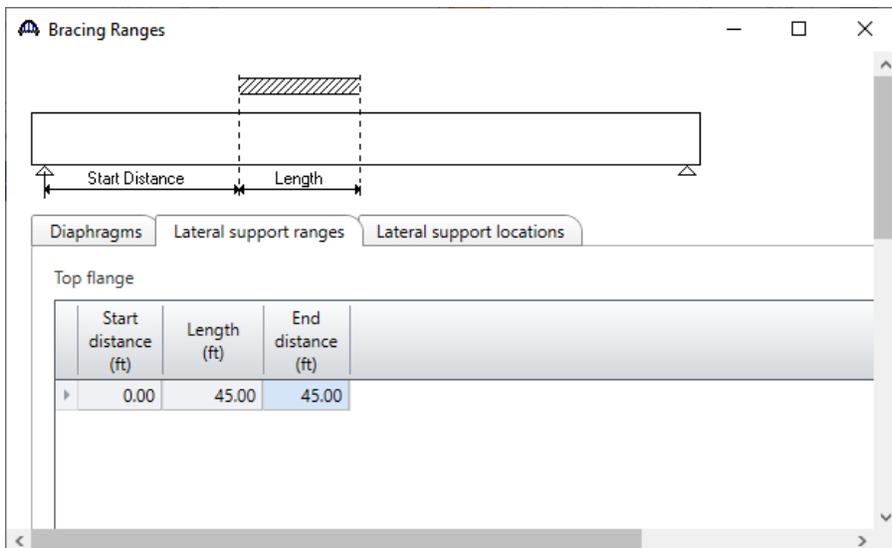
Bracing Ranges - Diaphragms

Open the **Bracing Ranges** window by double clicking the **Bracing Ranges** node in the **Bridge Workspace** tree. Specify the brace points for the stringer. Specify a brace point at the beginning and end of the stringer where the stringer frames into the floorbeam. Also specify the load as 0 kips since there really is not a diaphragms at those locations.



Bracing Ranges – Lateral support ranges

Navigate to the **Lateral support ranges** tab of this window and describe the lateral support for the top flange of the stringer as shown below.

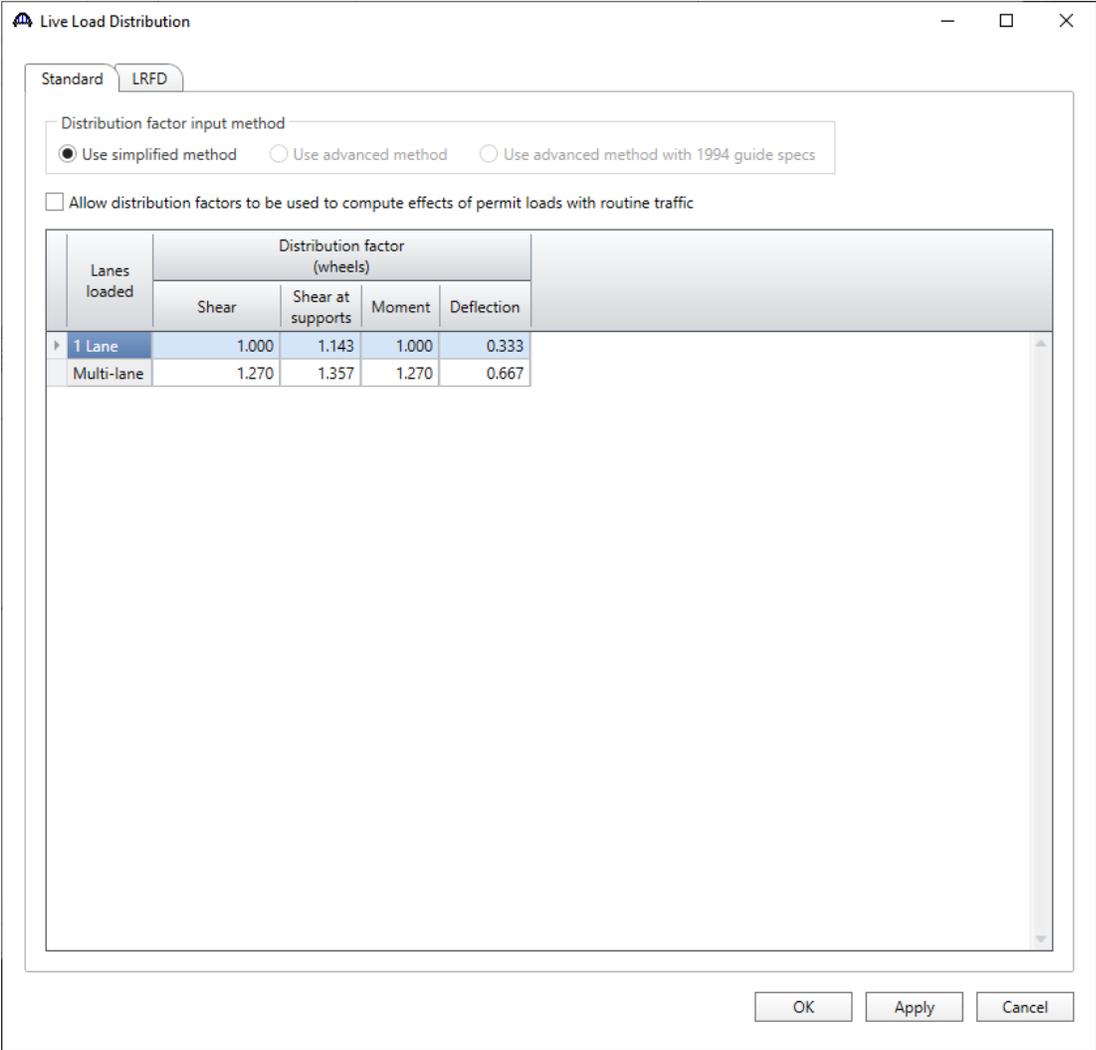


Click **OK** to apply the data and close the window.

FS2 – Floorbeam Stringer Line Example

Live Load Distribution

Open the **Live Load Distribution** window by double clicking the **Live Load Distribution** node in the **Bridge Workspace** tree. Enter the live load distribution factors as follows.



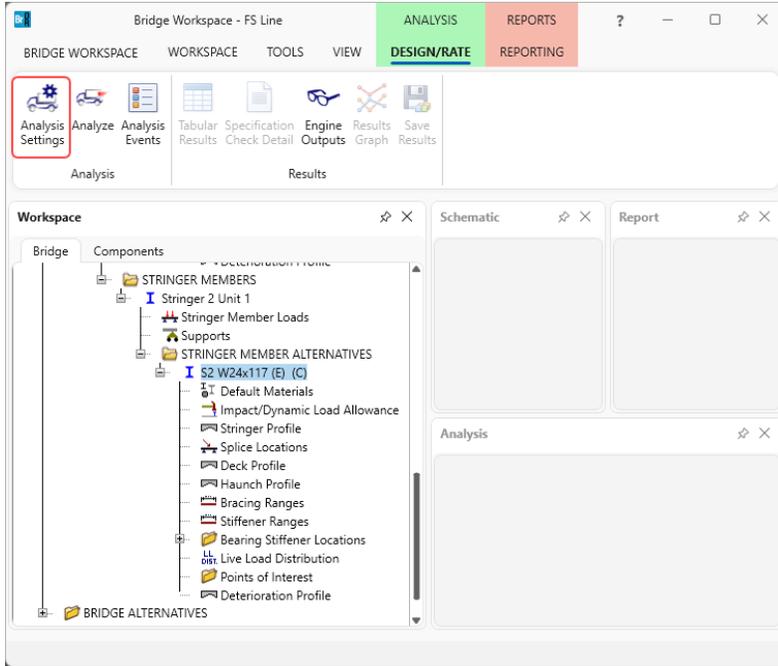
Click **OK** to apply the data and close the window.

The description of an interior stringer member is now complete. The stringer member alternative can now be rated.

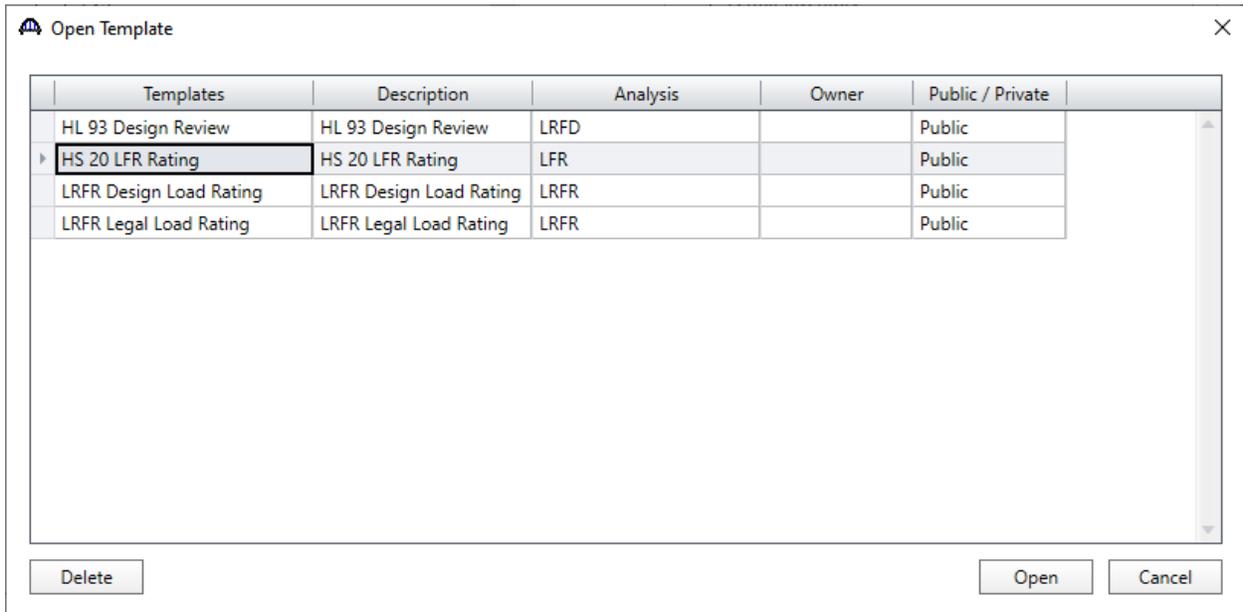
FS2 – Floorbeam Stringer Line Example

LFR Analysis – Stringer member alternative

To perform an LFR rating of the stringer member alternatives, select **S2 W24x117** in the **Bridge Workspace** tree and click the **Analysis Settings** button on the **Analysis** group of the **DESIGN/RATE** ribbon. The window shown below opens.

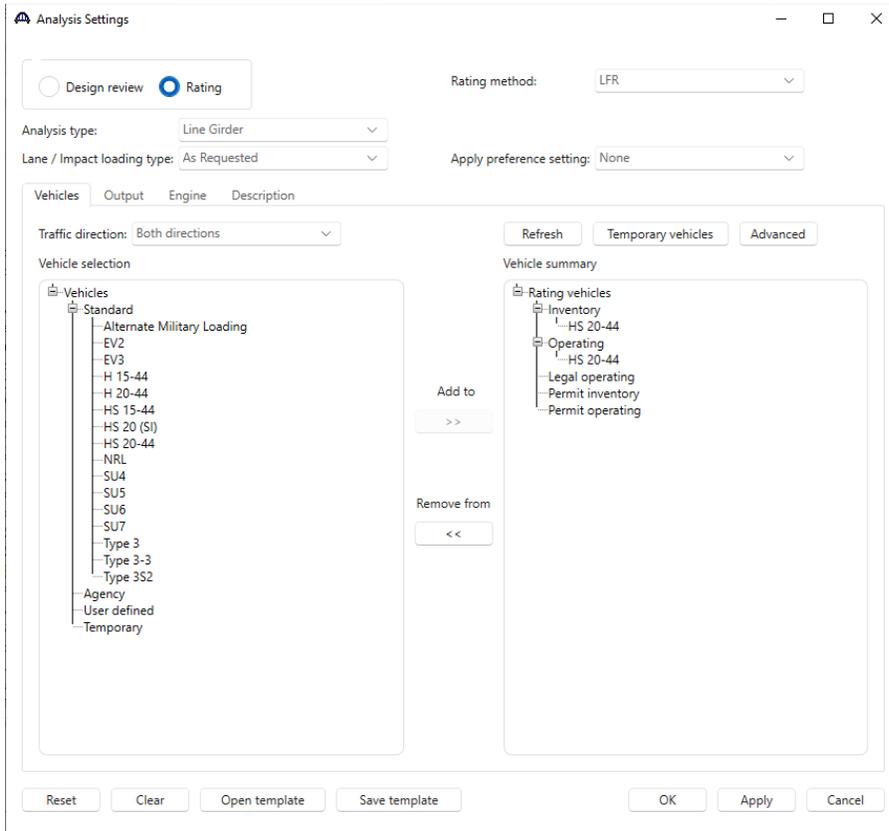


Click the **Open Template** button and select the **HS 20 LFR Rating** to be used in the rating and click **Open**.



FS2 – Floorbeam Stringer Line Example

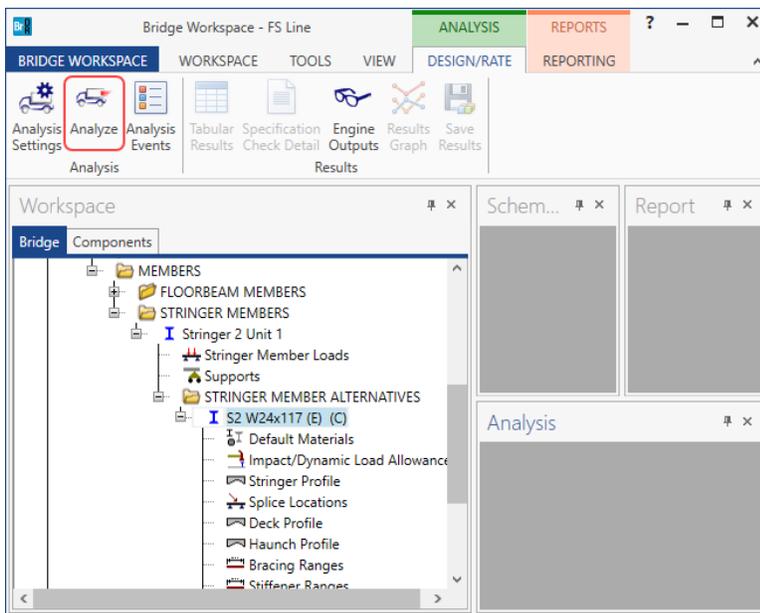
The **Analysis Settings** window will be populated as shown below.



Click **OK** to save the analysis settings and close the window.

Tabular Results

Next click the **Analyze** button on the **Analysis** group of the **DESIGN/RATE** ribbon to perform the rating.



FS2 – Floorbeam Stringer Line Example

When the rating is finished results can be reviewed by clicking the **Tabular Results** button on the **Results** group of the ribbon.

The window shown below will open.

The screenshot shows a software window titled "Analysis Results - S2 W24x117". It features a toolbar with a "Print" button. Below the toolbar are three controls: "Report type:" with a dropdown menu set to "Rating Results Summary", "Lane/Impact loading type:" with radio buttons for "As requested" (selected) and "Detailed", and "Display Format:" with a dropdown menu set to "Single rating level per row". The main area contains a table with the following data:

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	31.67	0.880	22.50	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFR	Operating	52.90	1.469	22.50	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFR	Inventory	46.06	1.279	22.50	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFR	Operating	76.91	2.136	22.50	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested

At the bottom of the window, it displays "AASHTO LFR Engine Version 7.5.0.3001" and "Analysis preference setting: None". A "Close" button is located in the bottom right corner.