AASHTOWare BrDR 7.5.0

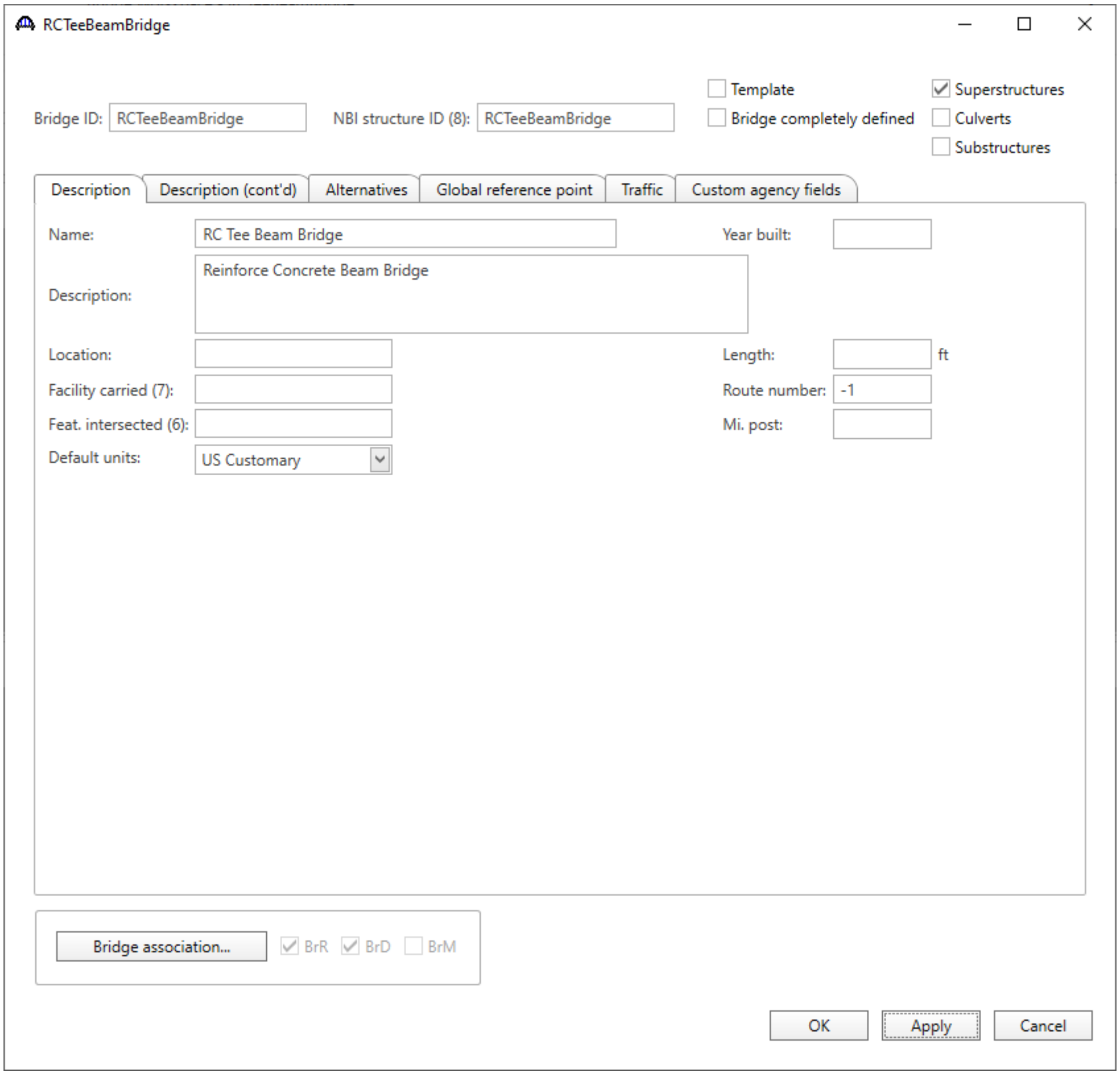
Reinforced Concrete Structure Tutorial

RC1 – Single Span Reinforced Concrete Tee Beam Example

BrDR Training

RC1 - Single Span Reinforced Concrete Tee Beam Example

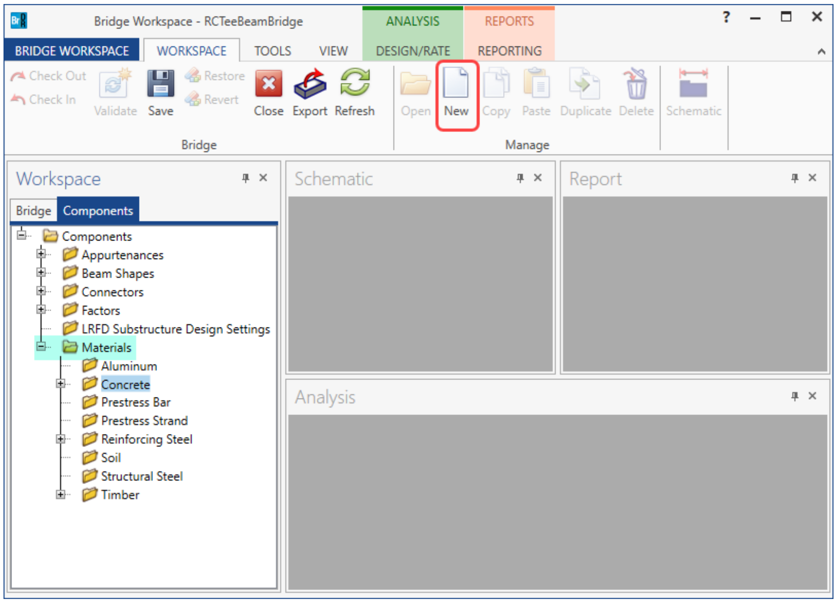
From the **Bridge Explorer** create a **new bridge** and enter the following description data:



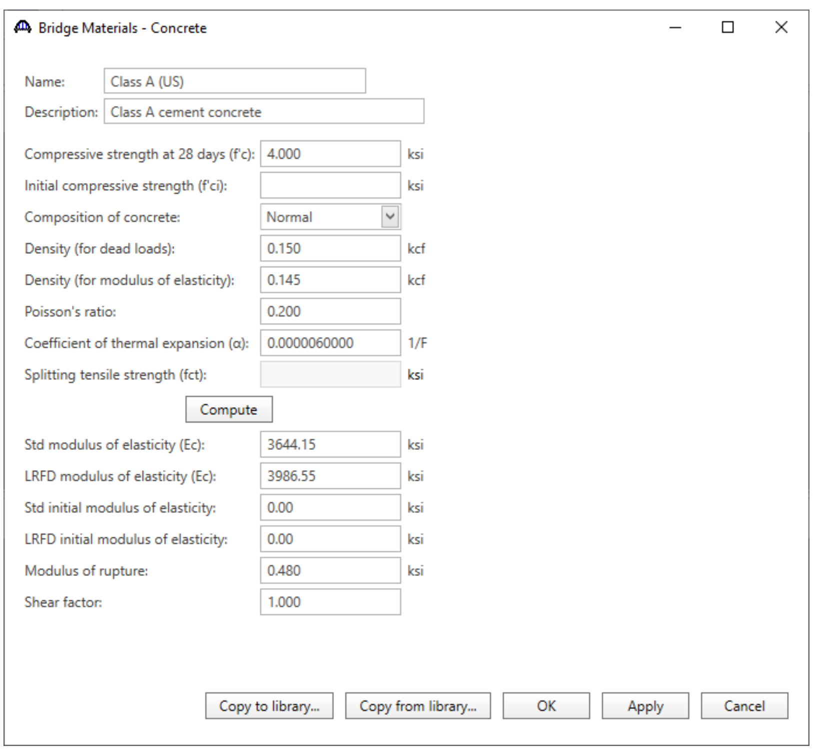
Close the window by clicking **OK**. This saves the data to memory and closes the window.

Bridge Materials

To add a new concrete material, in the **Components** tab of the Bridge Workspace, click on **Materials**, **Concrete,** and select **New** from the **Manage** group of the **Workspace** ribbon (or right mouse click on Concrete and select **New**).

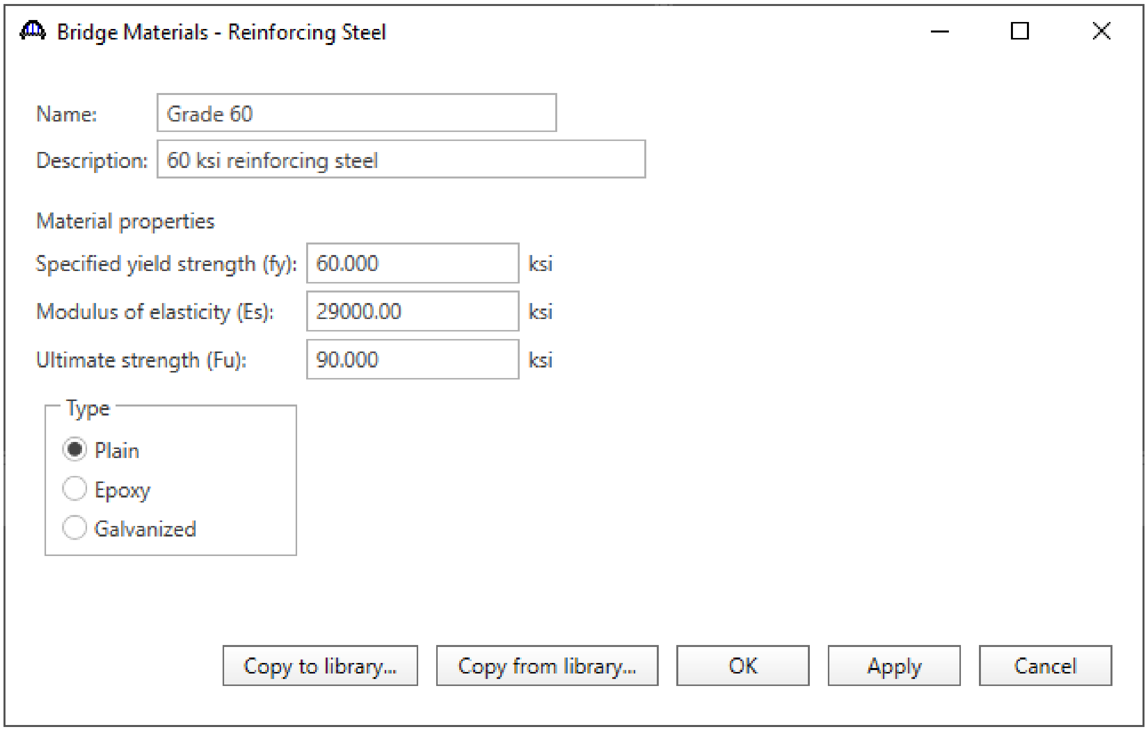


The window shown below will open. Enter the values shown above the Compute button and click the **Compute** button to compute the remaining values below them.



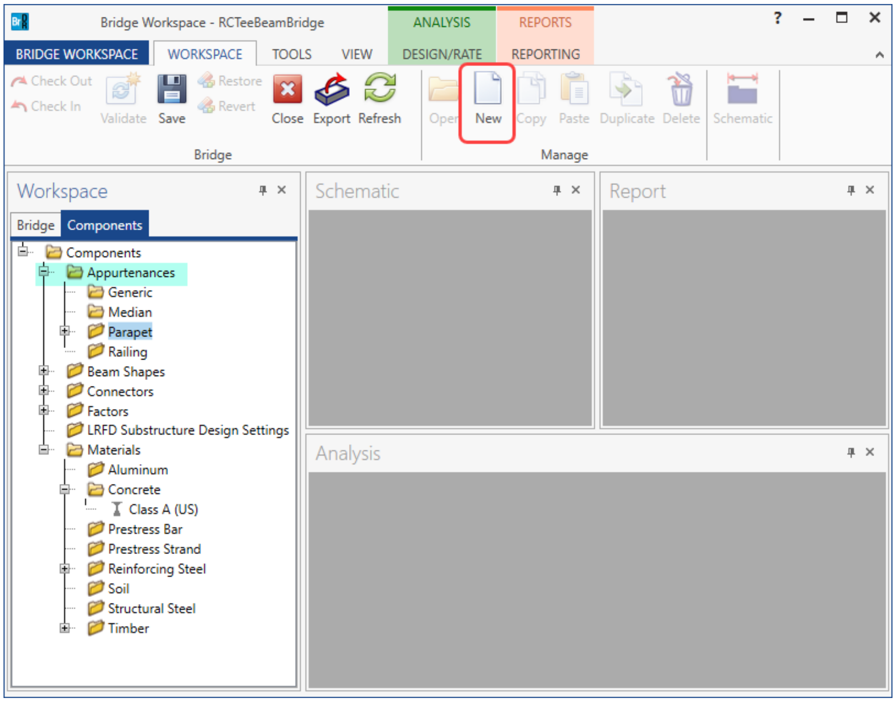
Click **OK** to save the data to memory and close the window.

Add the following **reinforcing steel** in the same manner.

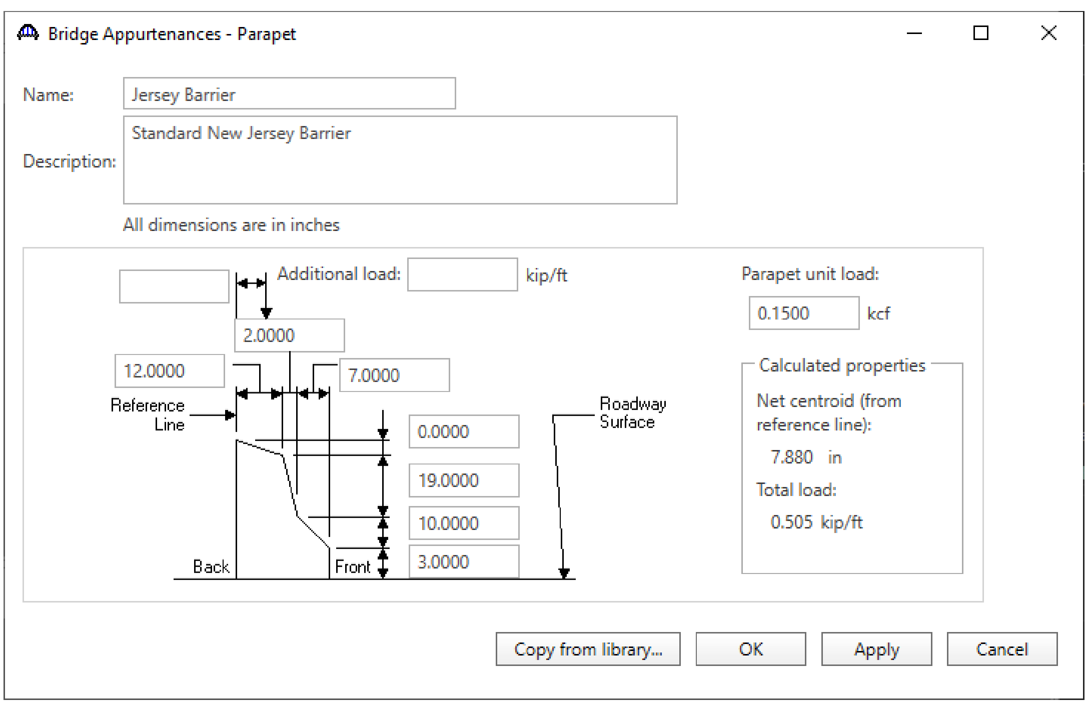


Bridge Appurtenances

To enter the appurtenances to be used within the bridge expand the tree branch labeled **Appurtenances**. To define a parapet, select **Parapet** and click on **New** from the **Manage** button on the Workspace ribbon (double click on **Parapet** in the **Components** tree).



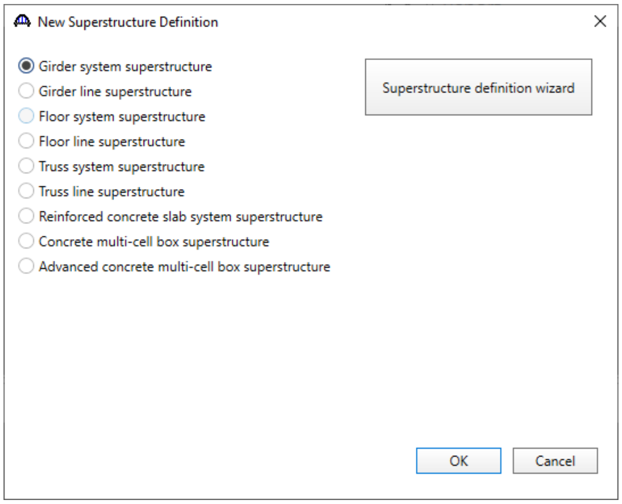
Enter the parapet dimensions as shown below.



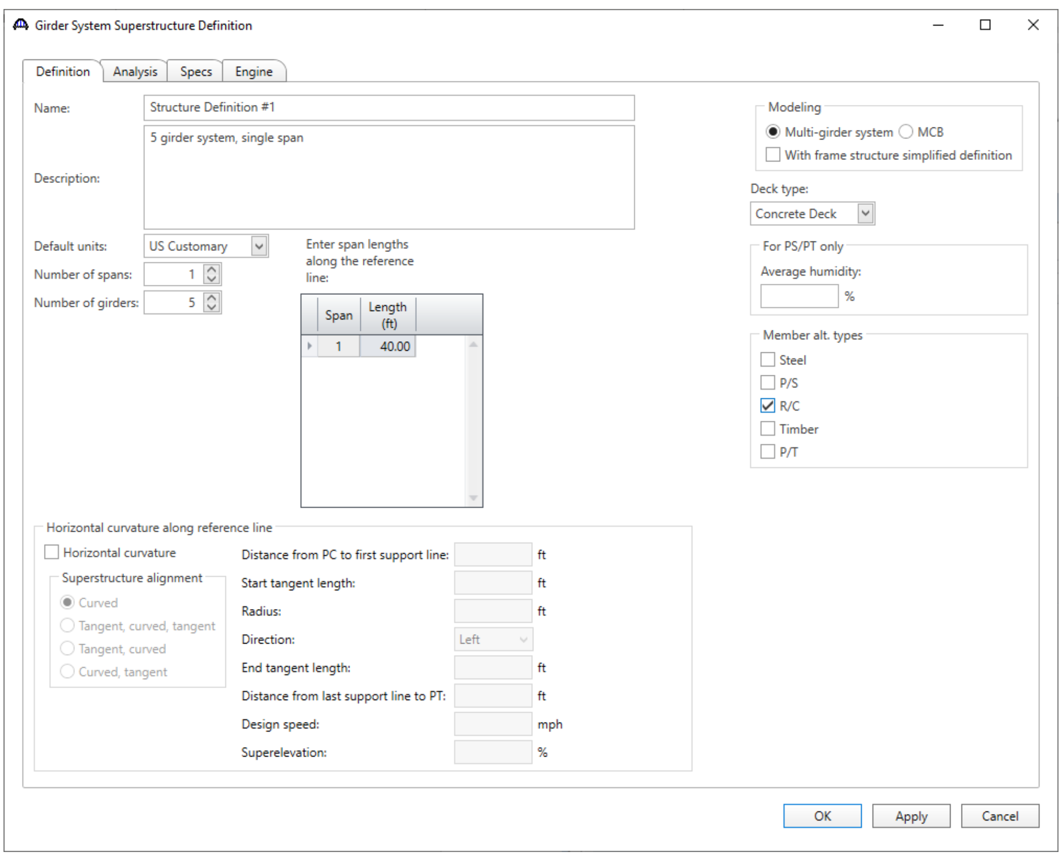
Click **OK** to save the data to memory and close the window.

Superstructure definition

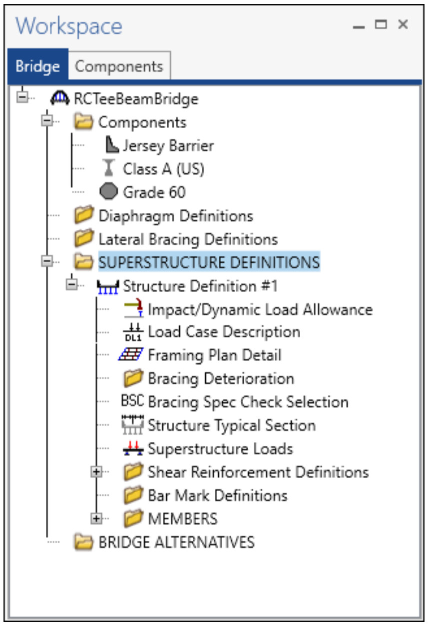
Returning to the **Bridge** tab of the **Bridge Workspace**, double click on **SUPERSTRUCTURE DEFINITIONS** (or click on **SUPERSTRUCTURE DEFINITIONS** and select **New** from the **Manage** group of the Workspace ribbon or right mouse click on **SUPERSTRUCTURE DEFINITIONS** and select **New** from the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



Select **Girder system superstructure,** click **OK** and the **Superstructure Definition** window will open. Enter the data as shown below:

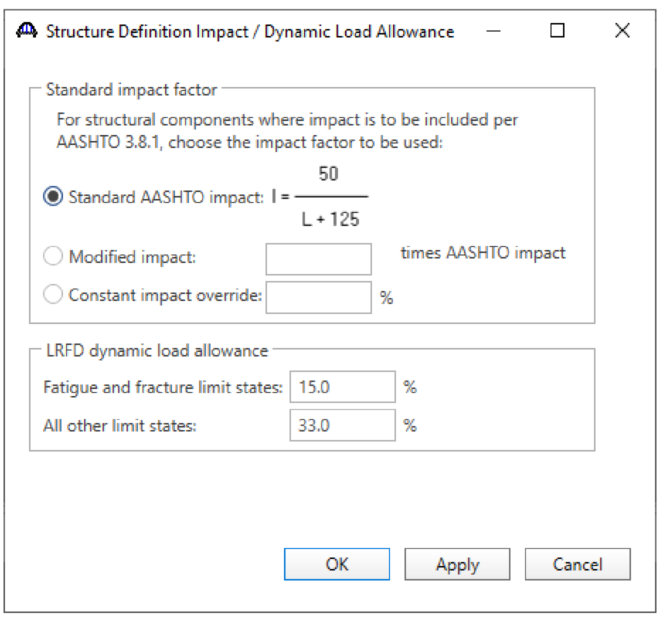


The partially expanded **Bridge Workspace** tree is shown below:



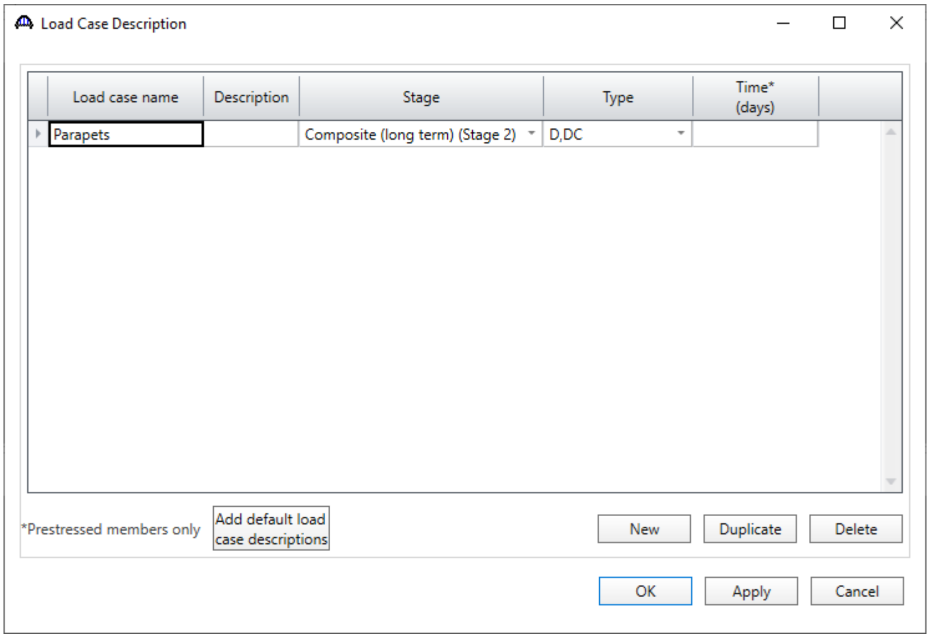
Impact/Dynamic Load Allowance

Enter the impact to be used for the superstructure definition by double clicking on **Impact/Dynamic Load Allowance** in the Bridge Workspace tree. The **Structure Definition Impact / Dynamic Load Allowance** window shown below will open. The values shown below are default values. No changes are required



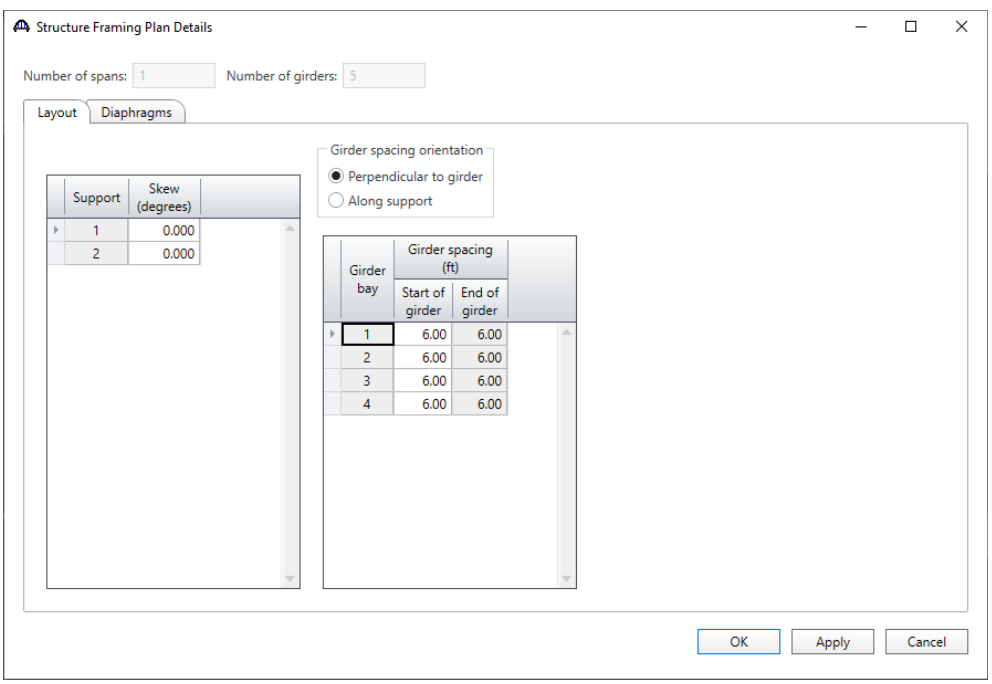
Load Case Description

Double-click on the **Load Case Description** node in the **Bridge Workspace** tree to open the **Load Case Description window** and define the dead load cases. The completed **Load Case Description** window is shown below.



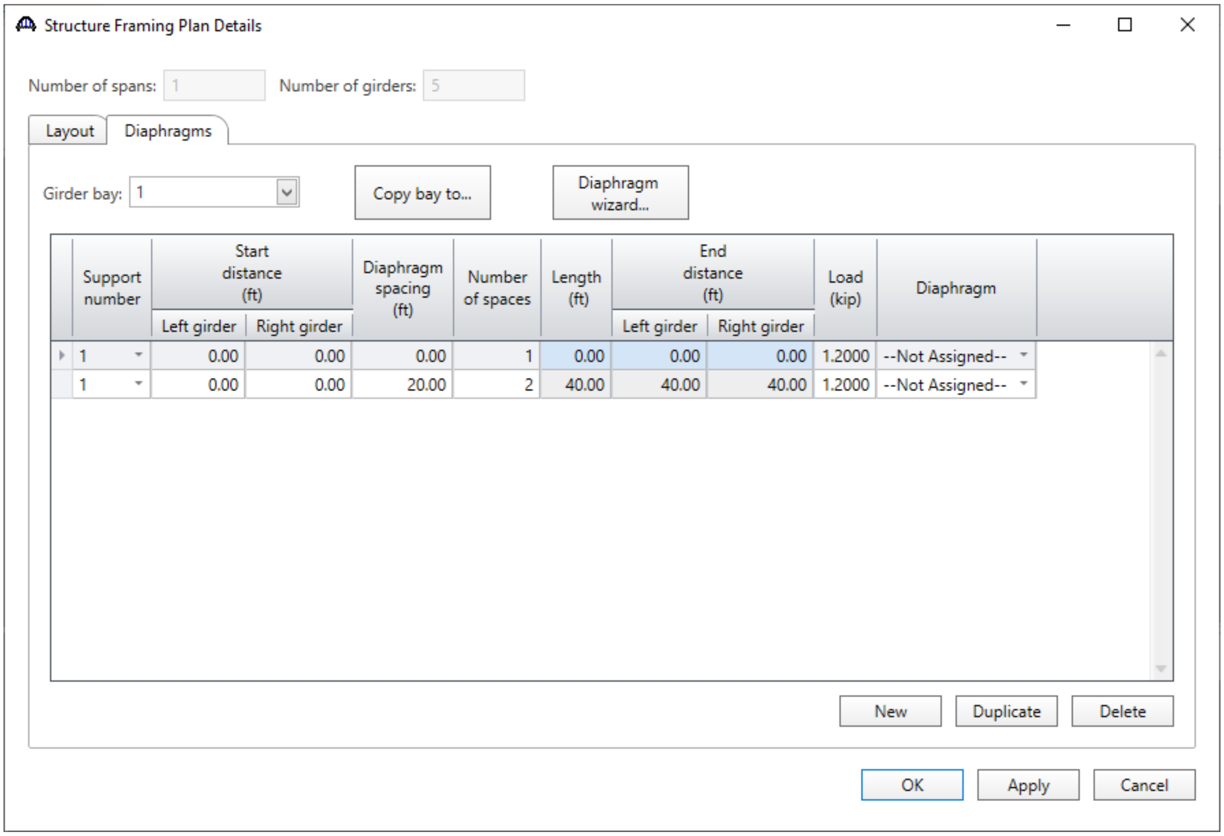
Structure Framing Plan Detail - Layout

Double-click on **Framing Plan Detail** in the **Bridge Workspace** tree to describe the framing plan in the **Structure Framing Plan Details** window. Enter the data as shown below.



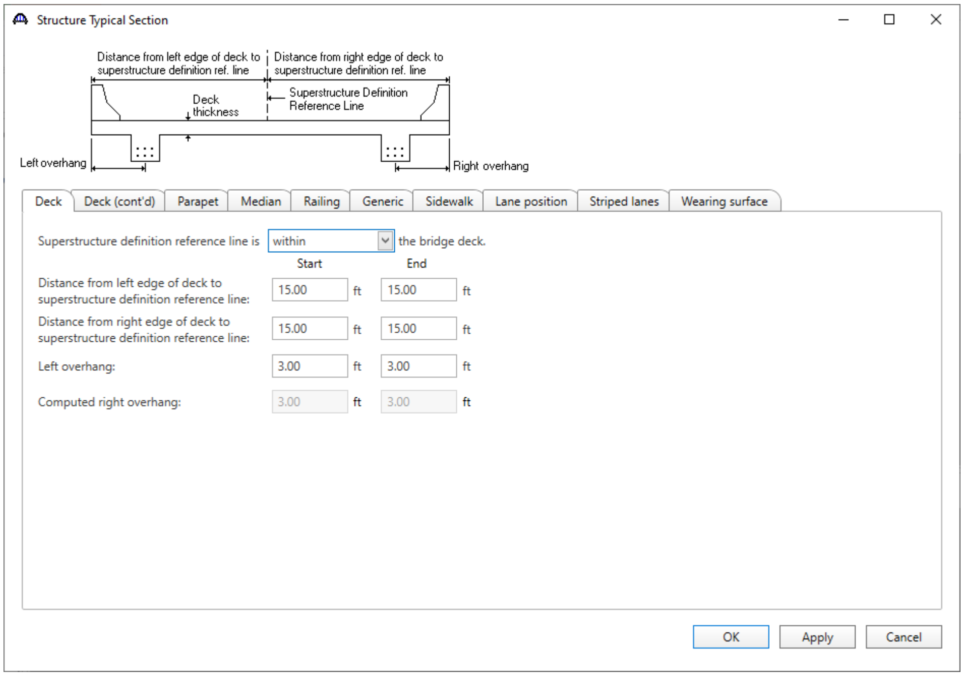
Structure Framing Plan Detail - Diaphragms

Switch to the **Diaphragms** tab to enter diaphragm spacing. Enter the diaphragm locations shown below for **girder bay 1**. Click on the **Copy bay to…** button to copy the diaphragm locations to bays 2 to 4.



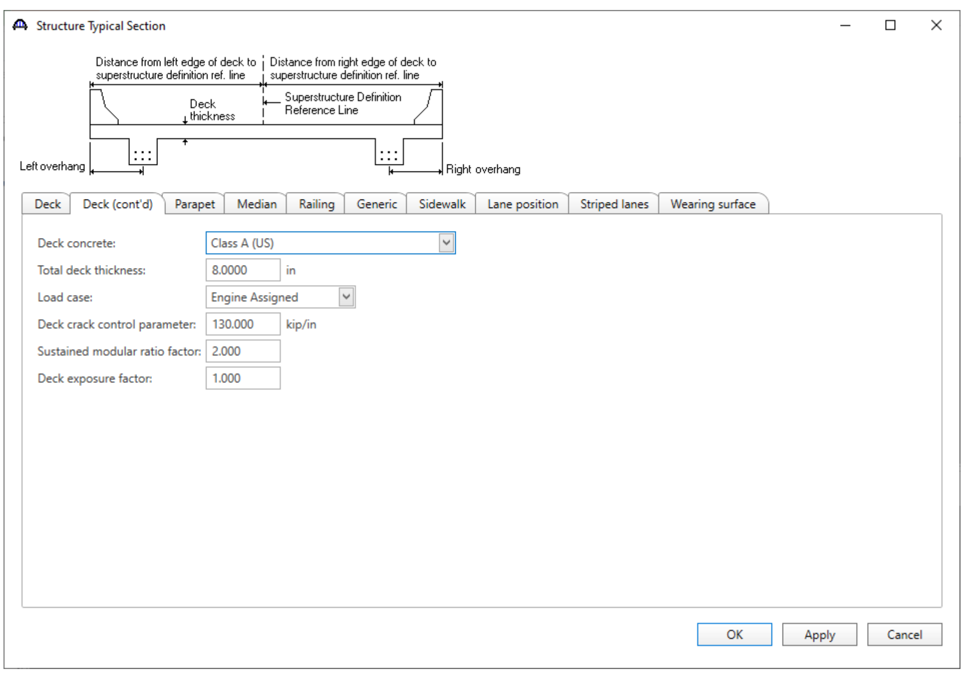
Structure Typical Section - Deck

Next define the structure typical section by double-clicking on **Structure Typical Section** in the Bridge Workspace tree. Input the data describing the typical section as shown below.



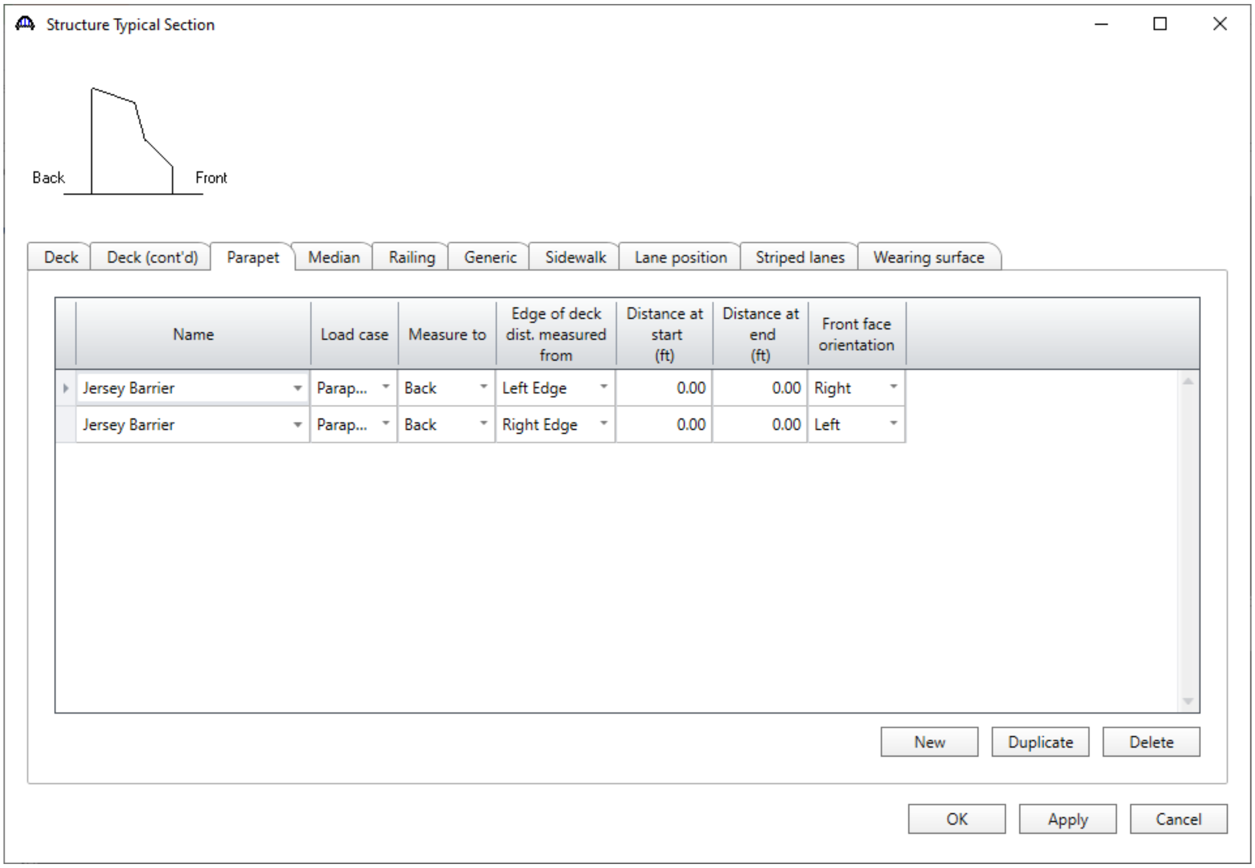
Structure Typical Section - Deck

The **Deck (cont'd)** tab is used to enter information about the deck concrete and thickness. The material to be used for the deck concrete is selected from the list of bridge materials described before.



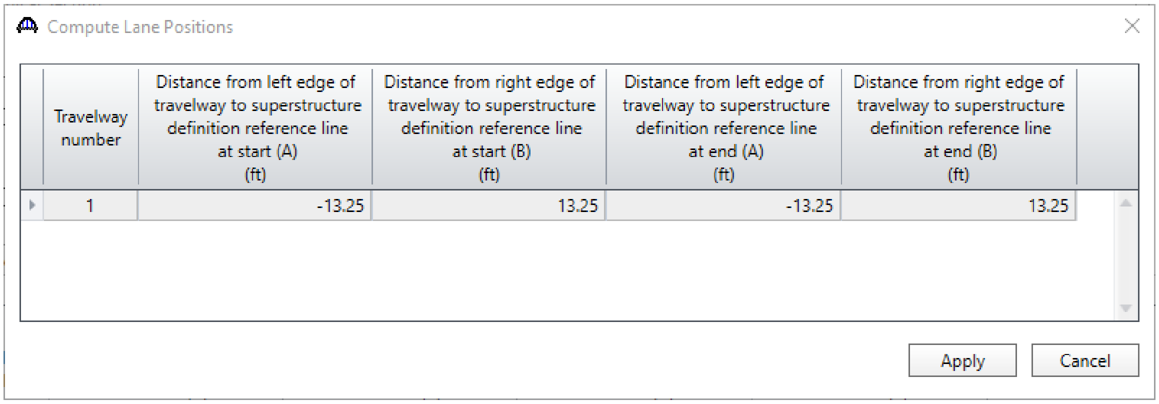
Structure Typical Section - Parapets

The two parapets are described using the **Parapet** tab. Click **New** to add a row to the table. The name of the parapet defaults to the only barrier described for the bridge. Change the **Load Case** to **Parapets** and select **Back** in the **Measure to** field (we are locating the parapet on the deck by referencing the back of the parapet to the left edge of the deck). Enter **0.0** for the **Distance at start** and **Distance at end**. Change the **Front face orientation** to **Right**. The completed tab is shown below.

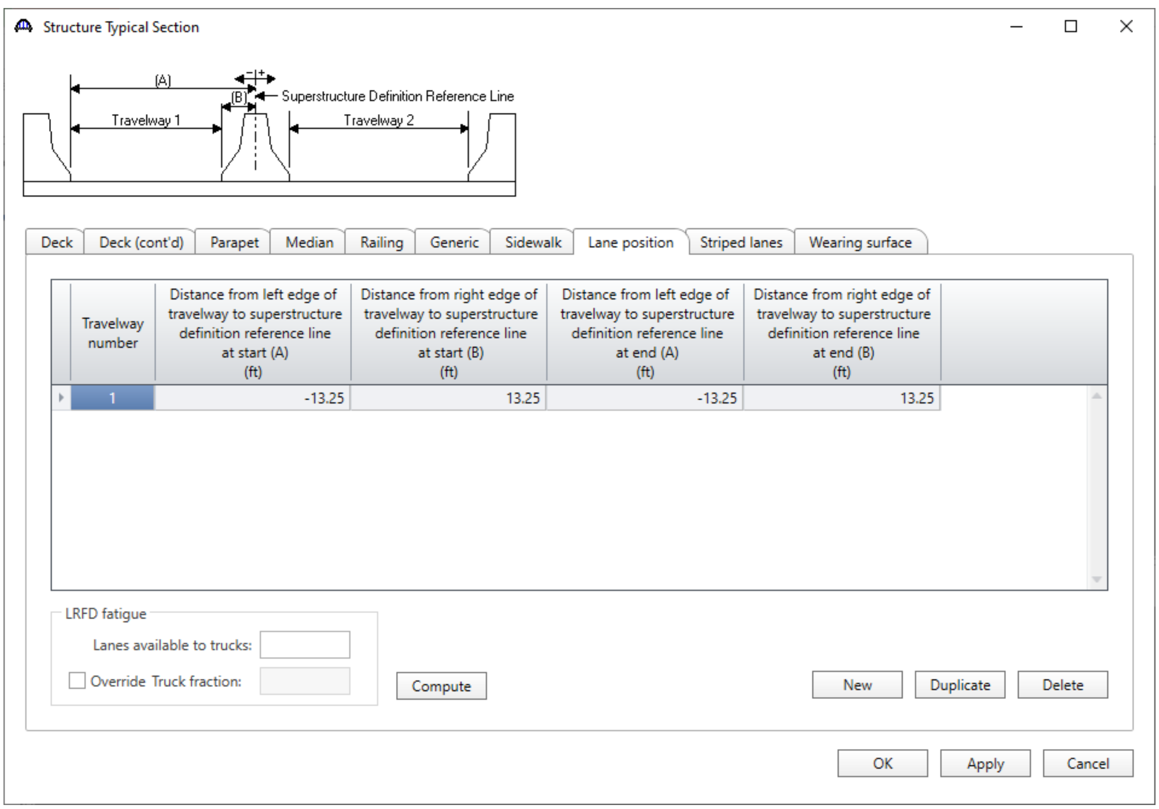


Structure Typical Section - Lane positions

Select the **Lane position** tab. Enter the values shown below or click the **Compute…** button to automatically compute the lane positions. A window showing the results of the computation opens.

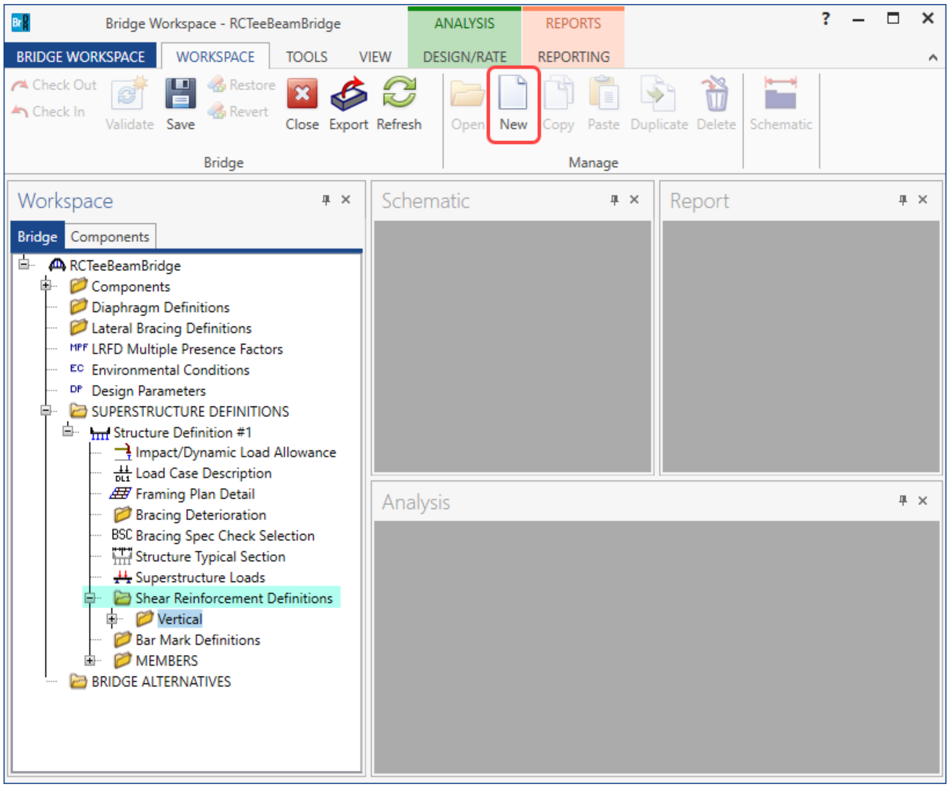


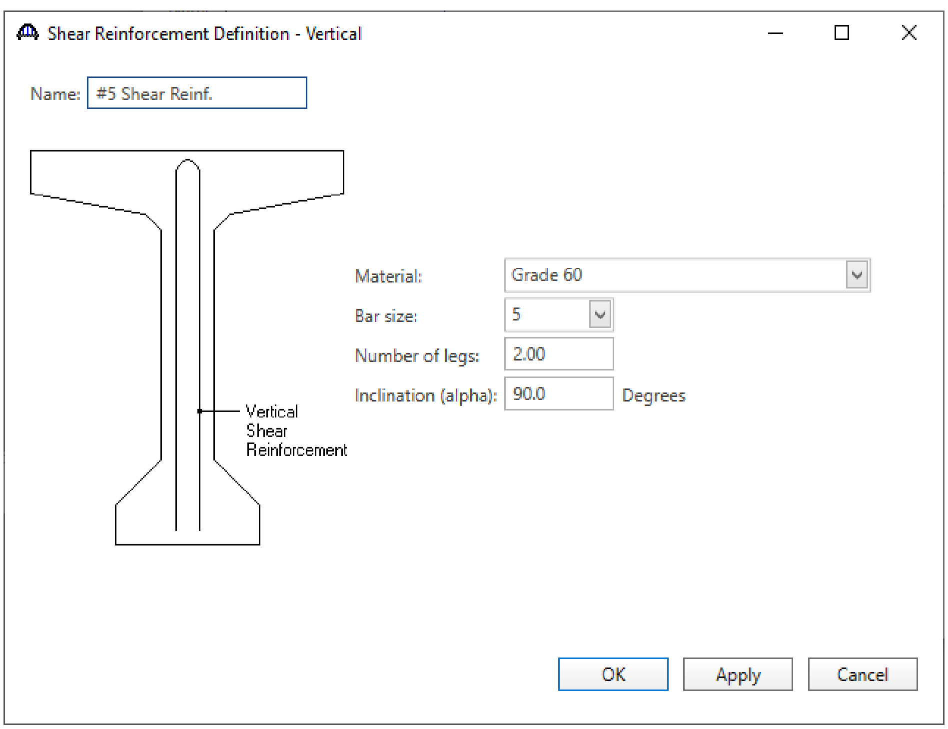
Click **Apply** to apply the computed values. The Lane position tab is populated as shown below.



Shear Reinforcement

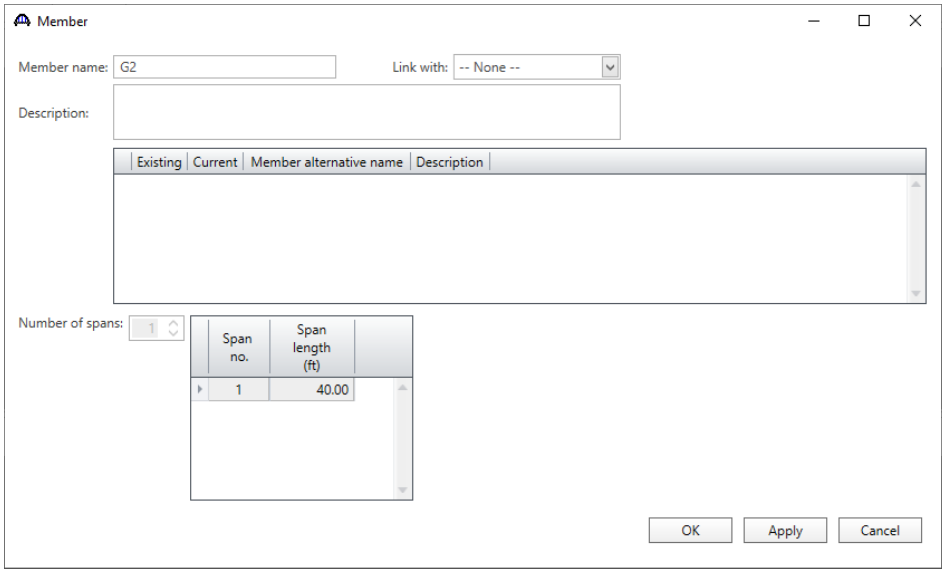
Define shear reinforcement to be used by the girders. Expand the **Shear Reinforcement Definitions** on the Bridge Workspace tree and click on **New** from the **Manage** group of the Workspace ribbon (or double click on **Vertical)**. Define the stirrup as shown below. Click **OK** to save to memory and close the window.





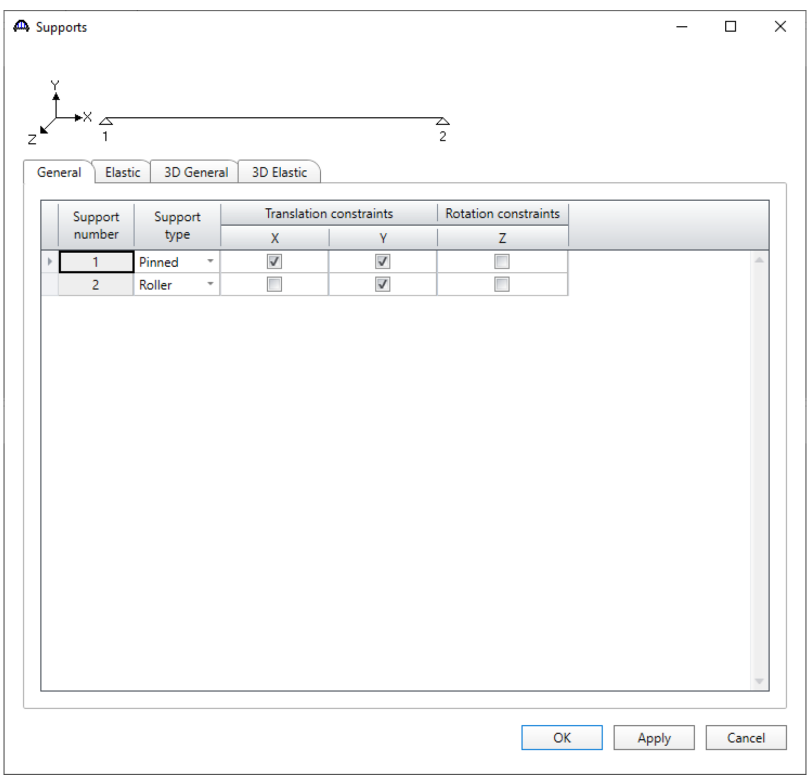
Describing a member

The **Member** window shows the data that was generated when the structure definition was created. No changes are required at this time. After Member Alternatives are defined it will appear in the list of member alternatives.



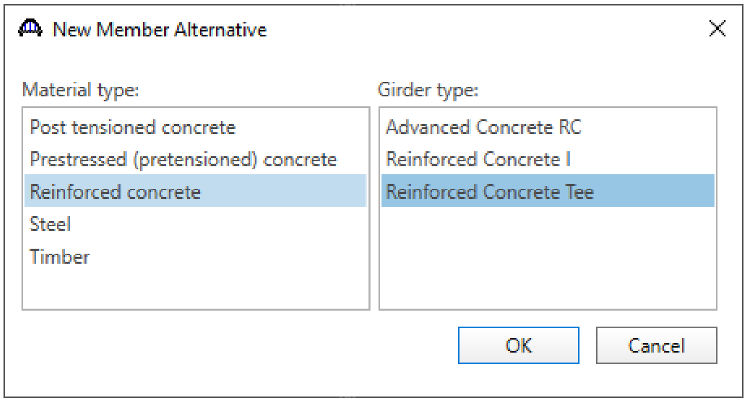
Support Constraints

Expand the **G2** member on the **Bridge Workspace** tree and double click on **Support constraints** to open the **Support Constraints** window. Support constraints were generated when the structure definition was created and are shown below. No changes are required.

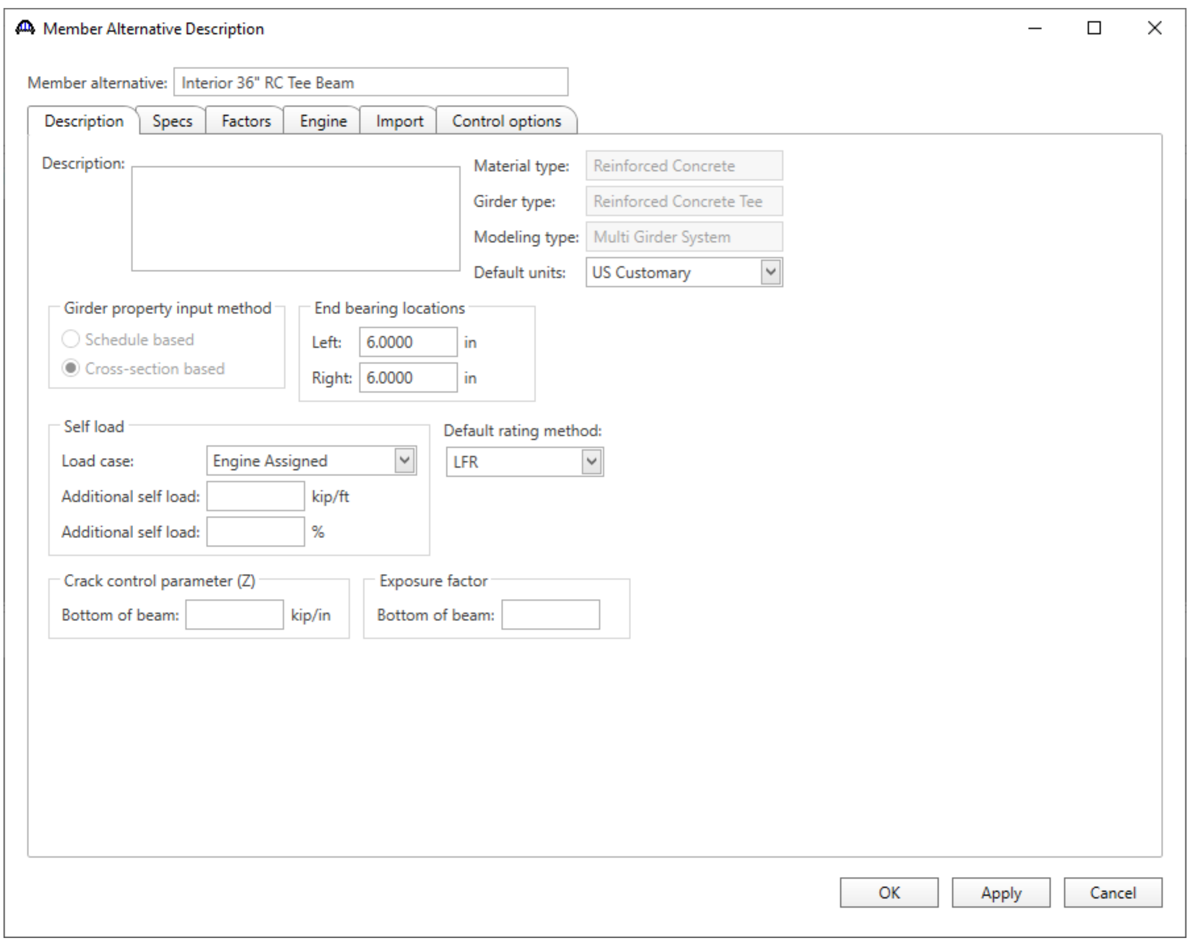


Defining a Member Alternative

Double click on **MEMBER ALTERNATIVES** in the Bridge Workspace tree for member **G2** to create a new alternative. The **New Member Alternative** window shown below will open. Select **Reinforced concrete** for the **Material type** and **Reinforced Concrete Tee** for the **Girder type**.

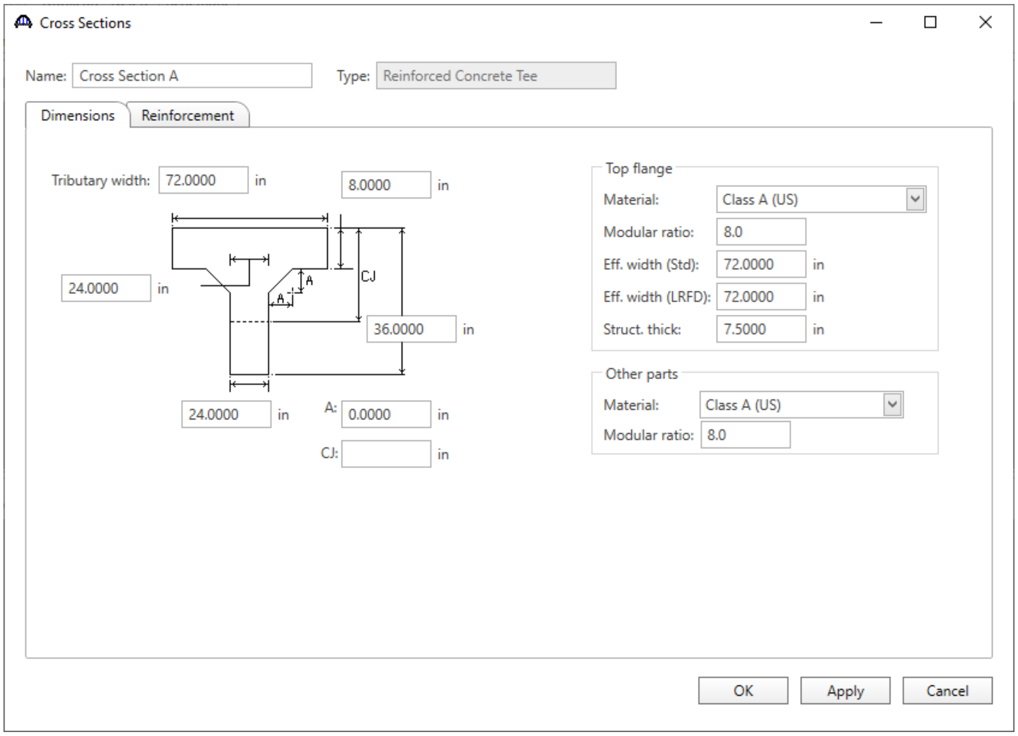


The **Member Alternative Description** window will open as shown below. Enter details as shown below and Click **OK** to save to memory and close the window.

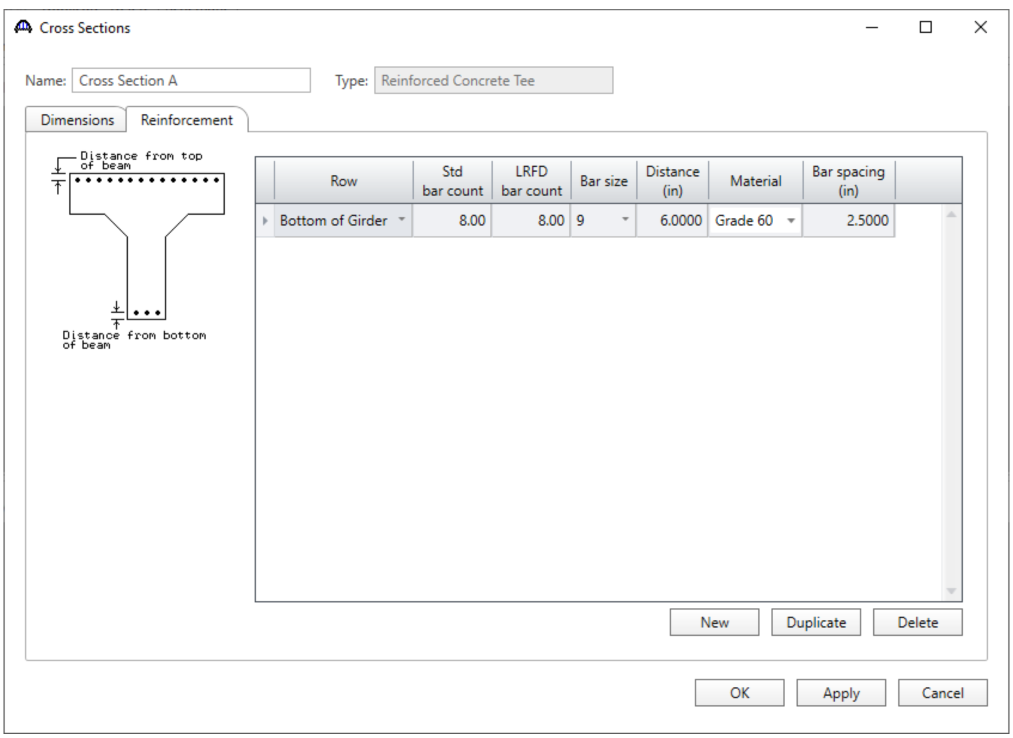


Cross sections

Next create the cross sections that define the girder geometry by double clicking on **Cross Sections** in the Bridge Workspace tree. The **Dimensions** tab of the **Cross Sections** window is shown below.

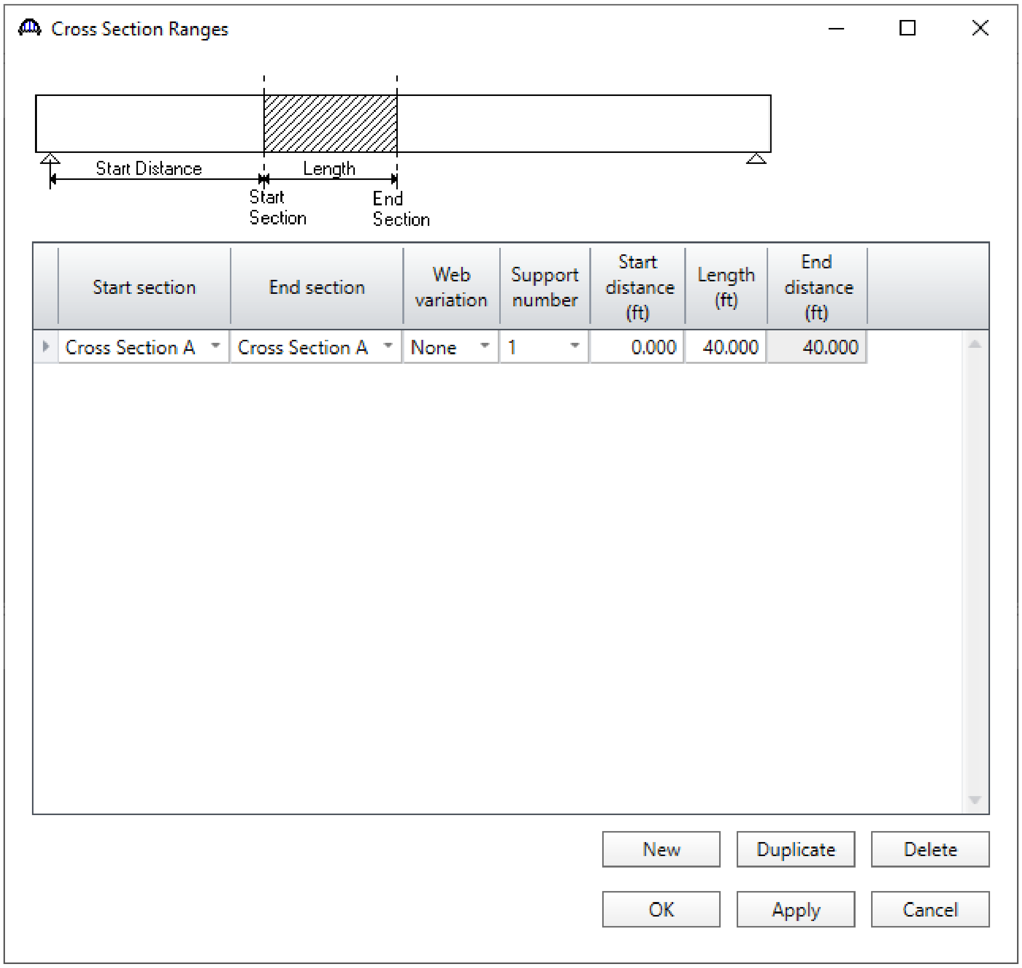


The **Reinforcement** tab is shown below.



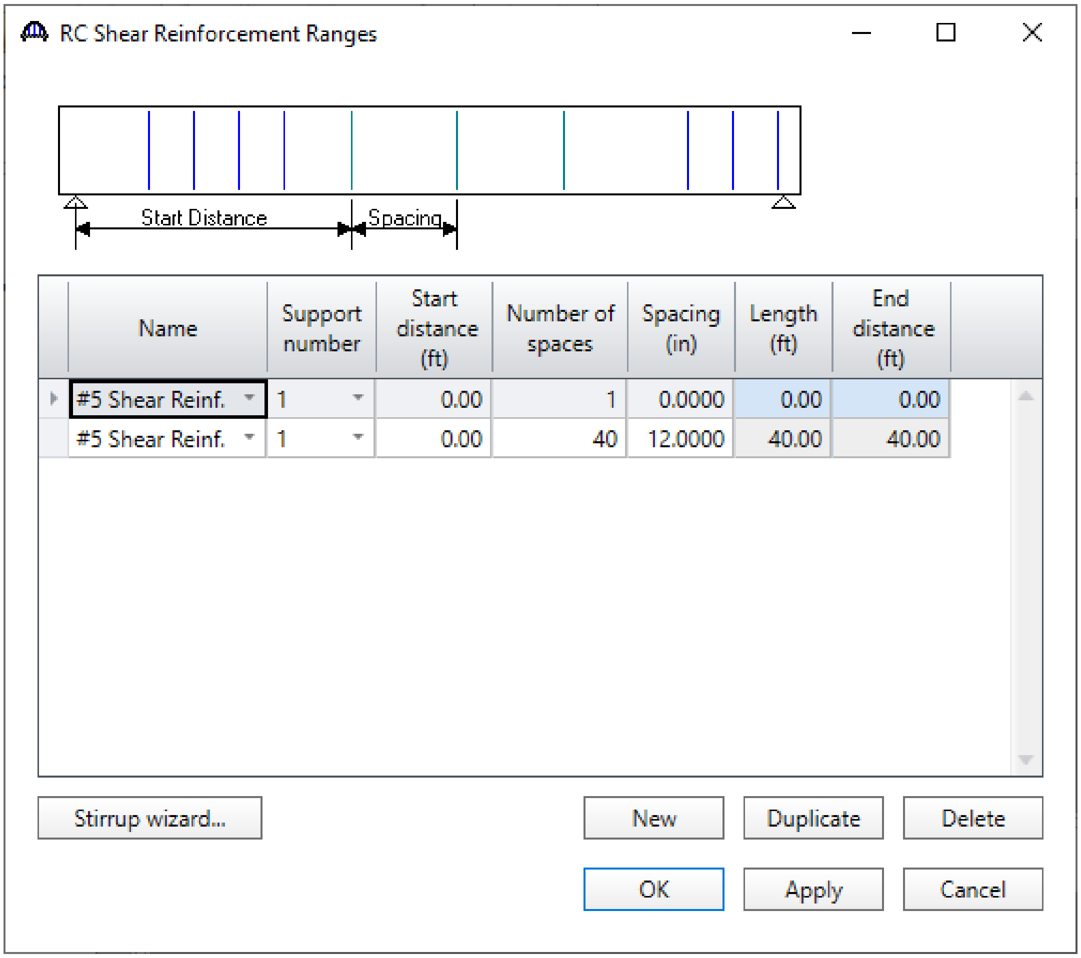
Cross section ranges

Next, describe the ranges over which the cross sections apply. Double-click on **Cross Section Ranges** on the Bridge Workspace tree to open the **Cross Section Ranges** window and enter data as shown below:



Shear Reinforcement Ranges

Double-click on **Shear Reinforcement Ranges** on the Bridge Workspace tree to open the **Shear Reinforcement Ranges** window and enter data as shown below:

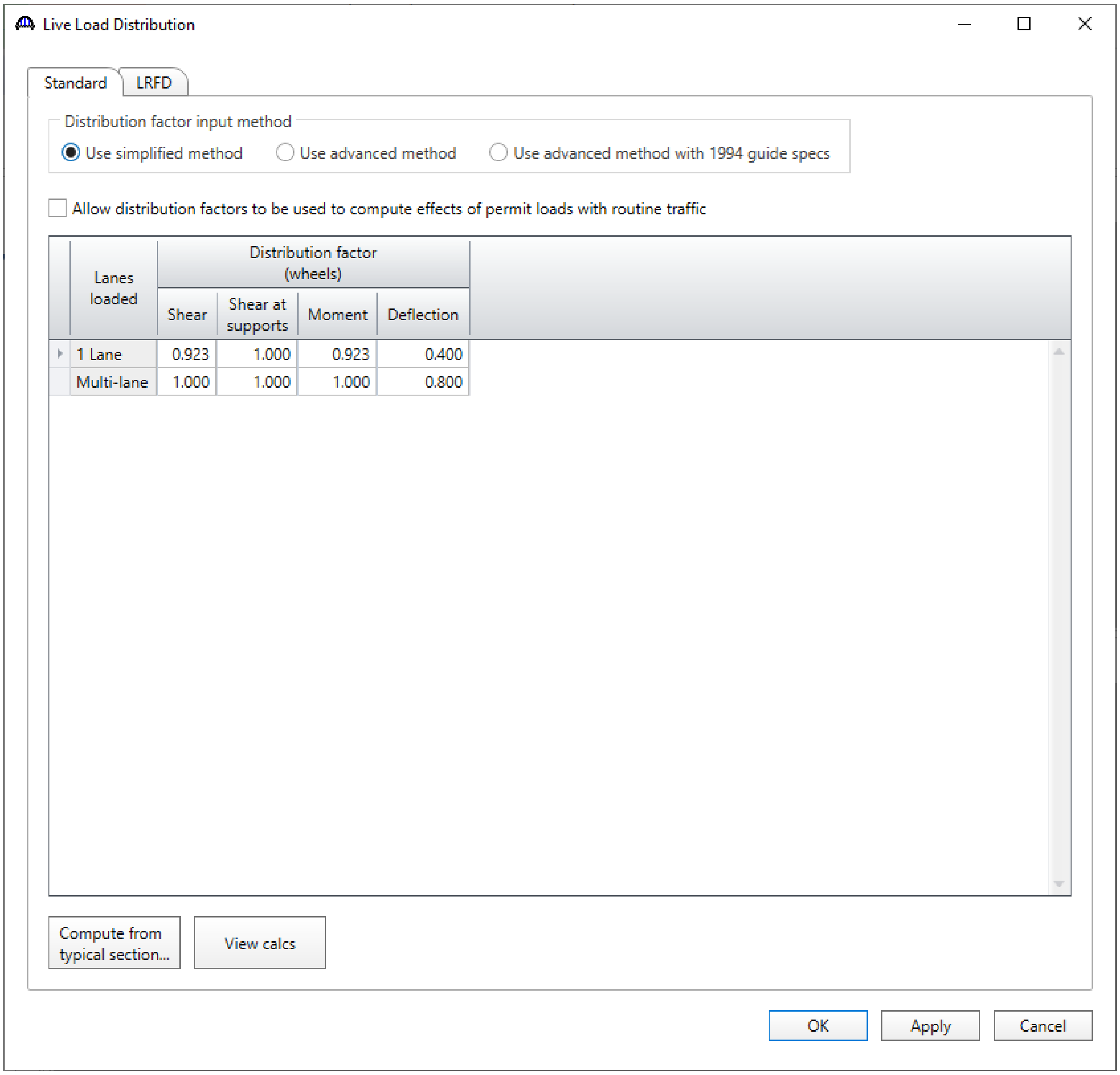


Because the range does not include a stirrup at the beginning of the range, we must define two ranges. The range that begins at the left end of the beam with one space and a spacing of 0.0 inches locates the first stirrup. The range that begins at the left end of the beam with 40 spaces and a spacing of 12 inches locates the rest of the stirrups.

Live Load Distribution factors

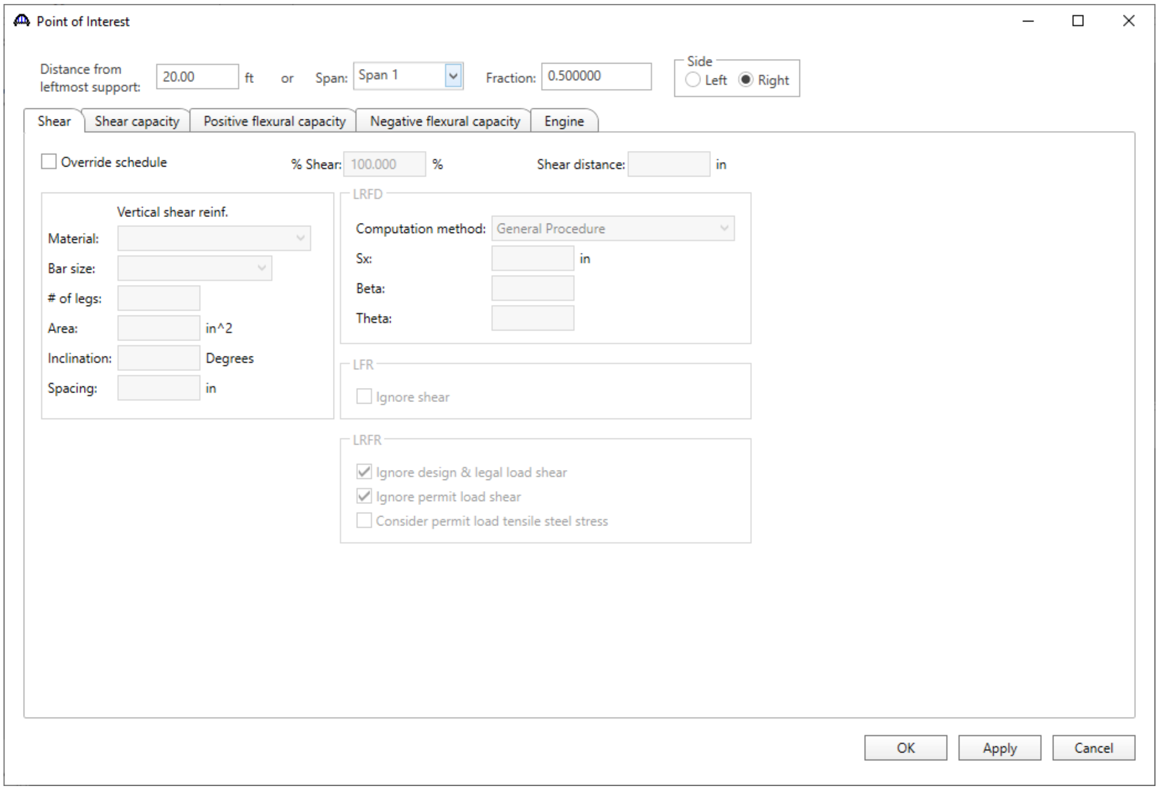
Distribution Factors (Standard):

Open the **Live Load Distribution** window from the Bridge Workspace tree and enter the following values for Standard live load distribution factors.



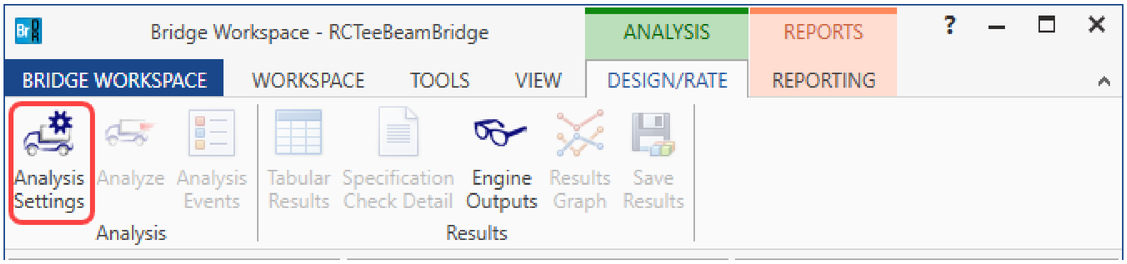
Point of Interest

Define points of interest using the **Points of Interest** window shown below. A window for defining a point of interest is opened by double-clicking on the **Points of Interest** Bridge Workspace tree item.

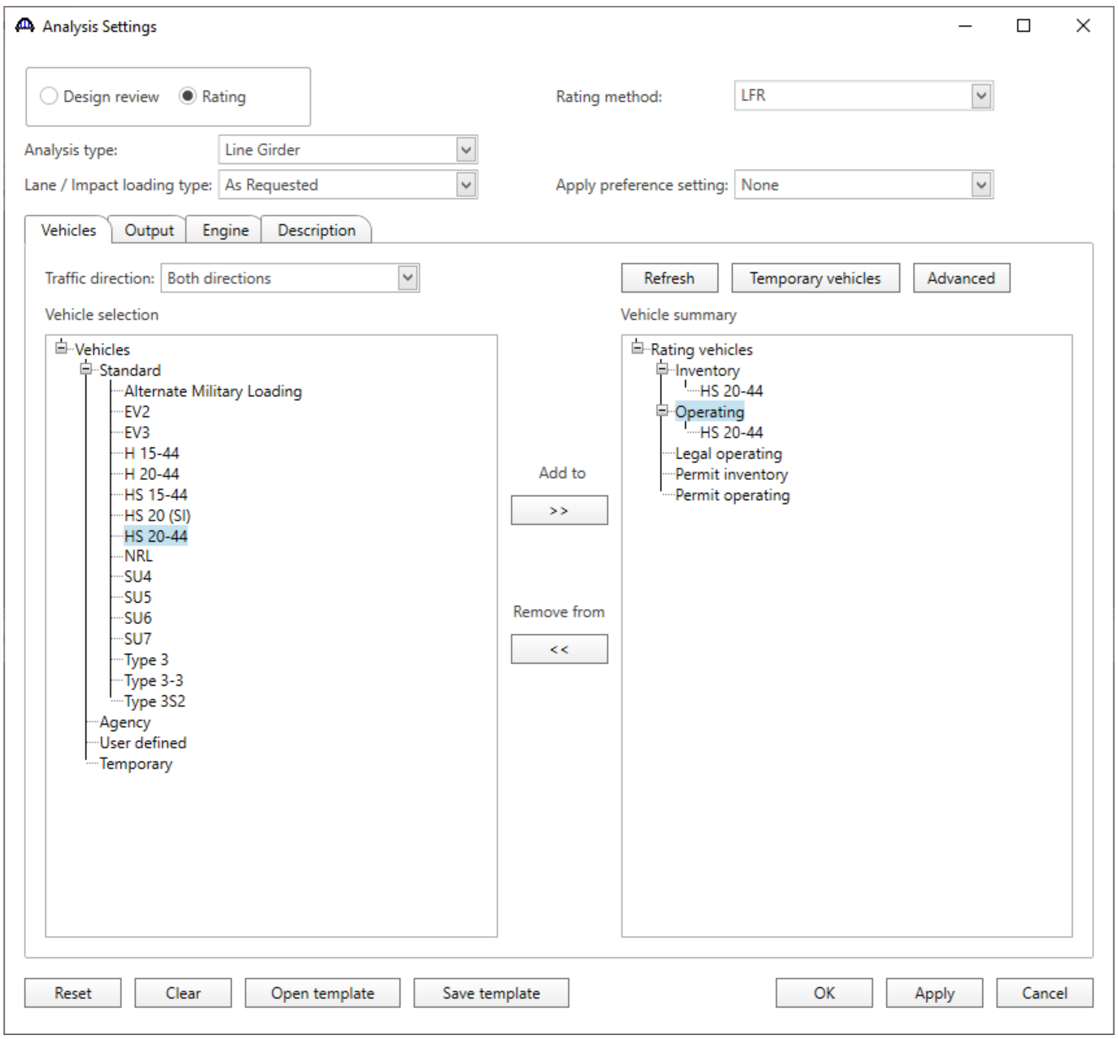


LFR Rating

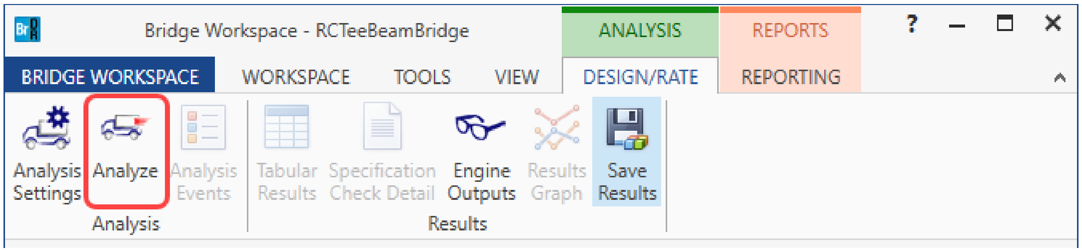
To perform an **LFR** rating, click the **Analysis Settings** button on the **Analysis** group of the **DESIGN/RATE** ribbon which opens the **Analysis Settings** window.



Select the vehicles to be used in the rating as shown below and click **OK**.

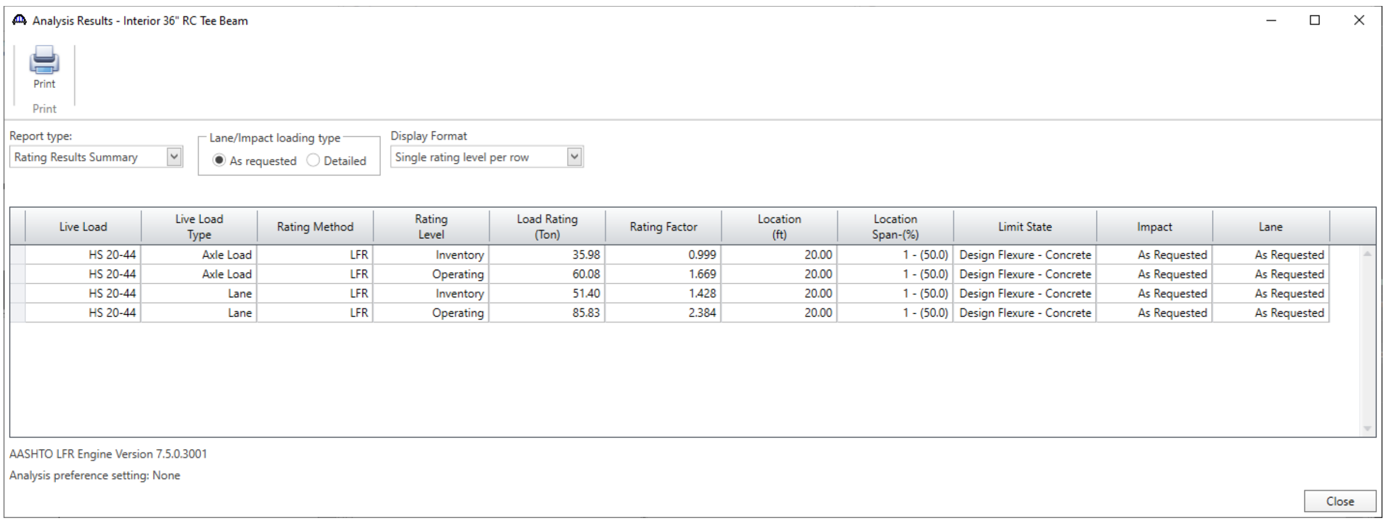


Next click the **Analyze** button on the **Analysis** group of the **DESIGN/RATE** ribbon to perform the rating.



Tabular Results

When the rating is finished results can be reviewed by clicking the **Tabular Results** button on the **Results** group of the **DESIGN/RATE** ribbon. The window shown below will open.



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	35.98	0.999	20.00	1 - (50.0)	Design Flexure - Concrete	As Requested	As Requested
HS 20-44	Axle Load	LFR	Operating	60.08	1.669	20.00	1 - (50.0)	Design Flexure - Concrete	As Requested	As Requested
HS 20-44	Lane	LFR	Inventory	51.40	1.428	20.00	1 - (50.0)	Design Flexure - Concrete	As Requested	As Requested
HS 20-44	Lane	LFR	Operating	85.83	2.384	20.00	1 - (50.0)	Design Flexure - Concrete	As Requested	As Requested