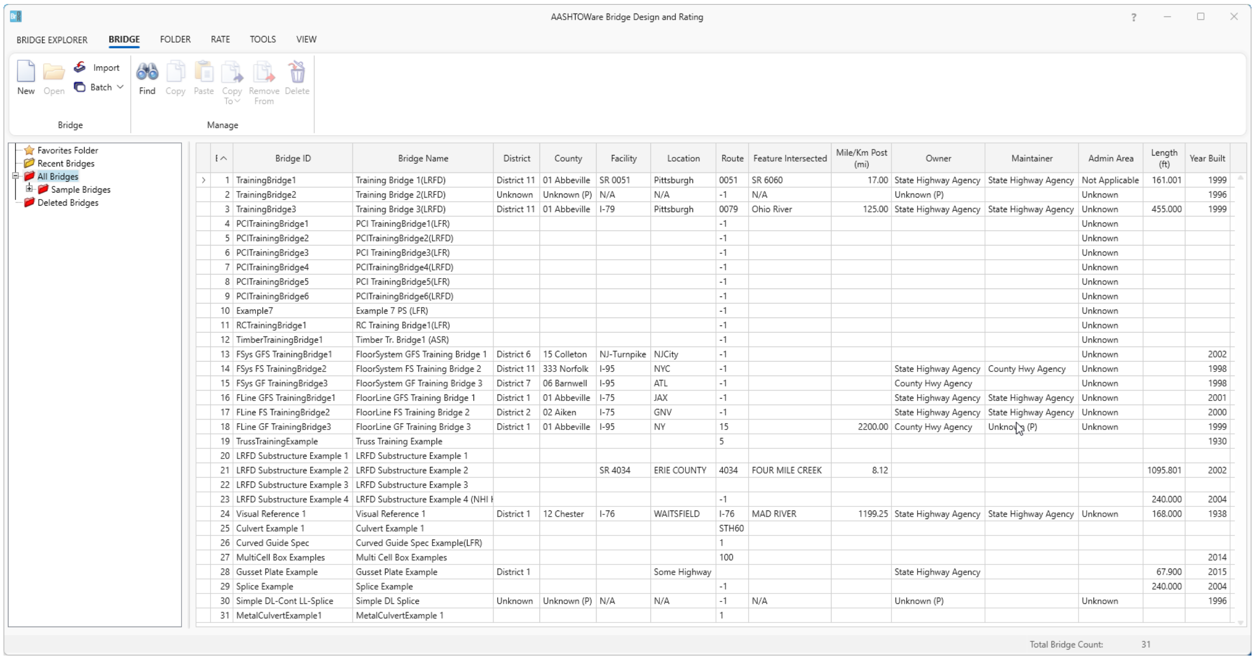
AASHTOWare BrDR 7.5.0

Getting Started Tutorial

BrDR Tutorial Workbook

Creating a New Folder Based on a List

Folders are used in the **Bridge Explorer** to help organize bridges. The following illustrates the folders in the **Bridge Explorer** tree as delivered with BrDR 7.5.0.

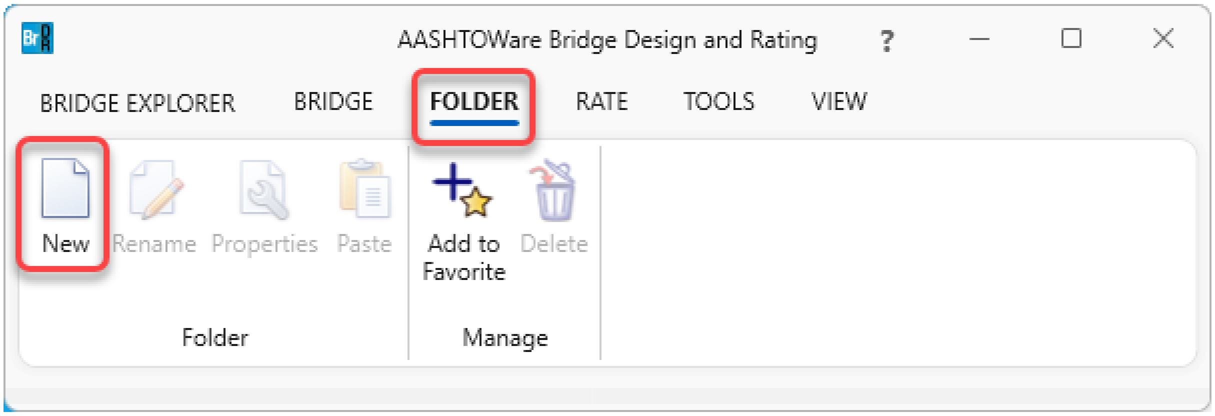


The **All Bridges** folder contains all the bridges shown in the list on the right side of the **Bridge Explorer**.

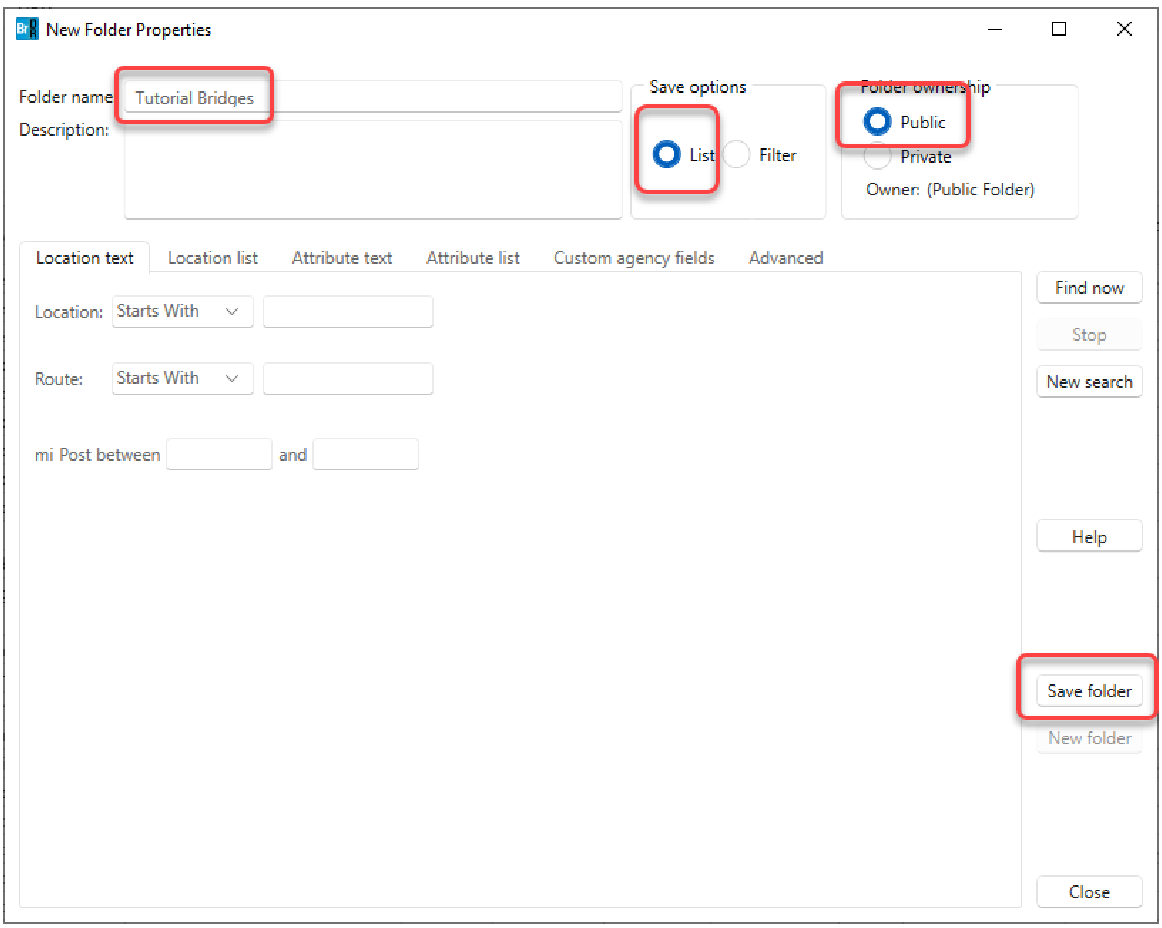
Folders can be created based on a list or on a filter. The list option will create a folder that contains only the bridges specified. The filter option will automatically add bridges that match the filter criteria when these bridges are added to the database. A red folder in the tree indicates that the folder is dynamic and is populated based on a filter. A yellow folder in the tree indicates that the folder is static and is populated based on a predefined list.

Use the following procedure to create a new folder using the list option.

Select **Folder** from the ribbon then click the **New** button.

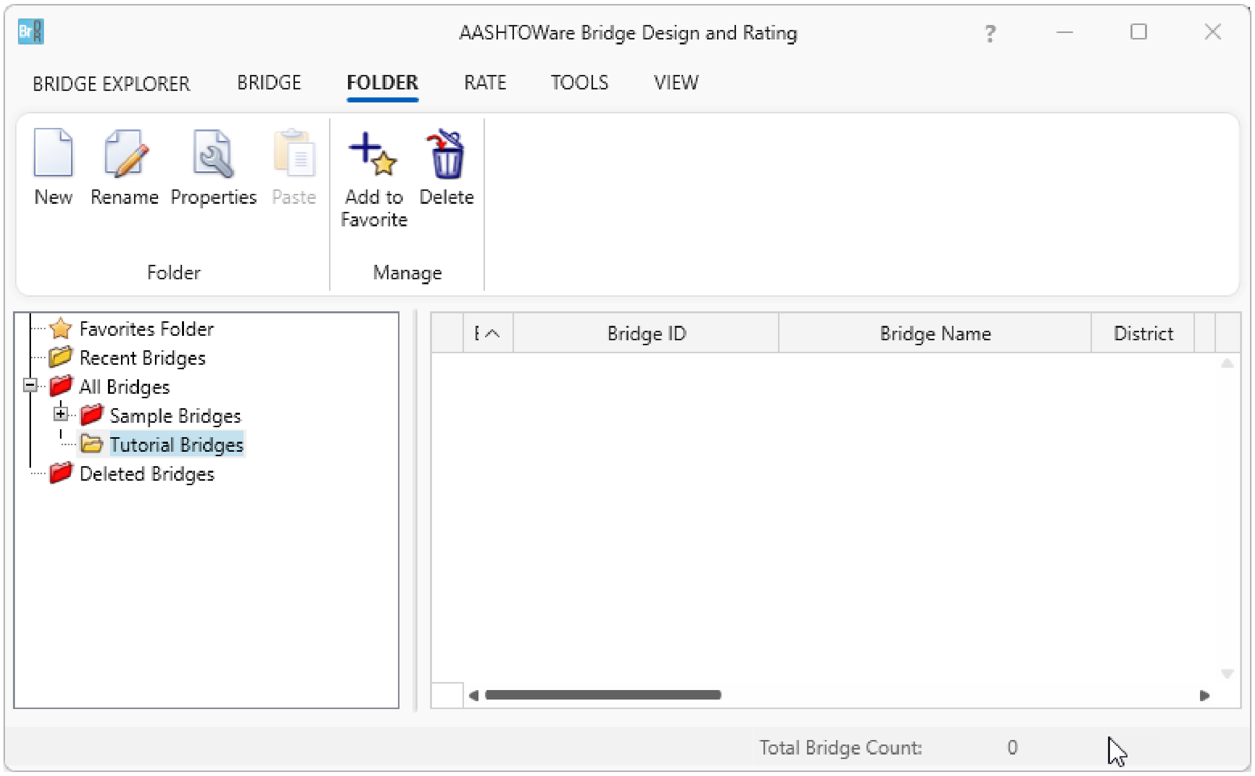


The following window is presented.



- Type the name of the new folder in the **Folder name** text box as **Tutorial Bridges**.
- Select the **Save options** as **List**.
- Select **Folder ownership** as **Public**.
- Select **Save folder** to create the folder.

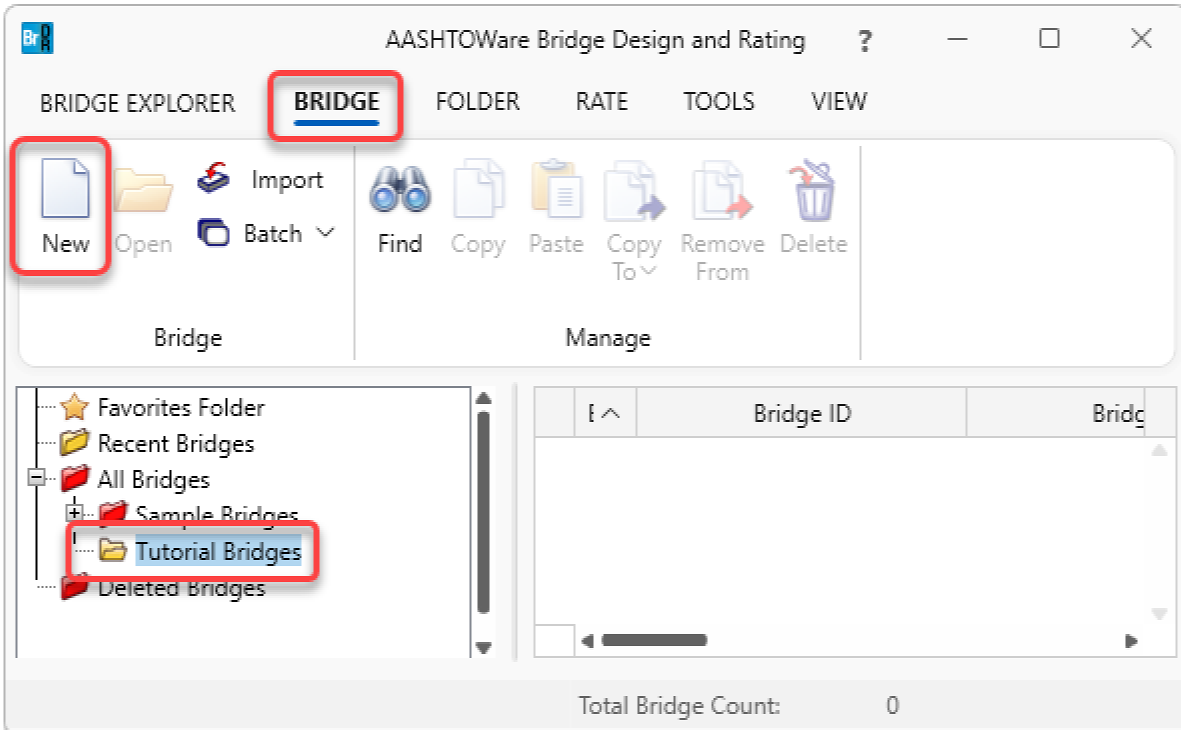
An empty folder named **Tutorial Bridges** has been created in the **Bridge Explorer** tree.



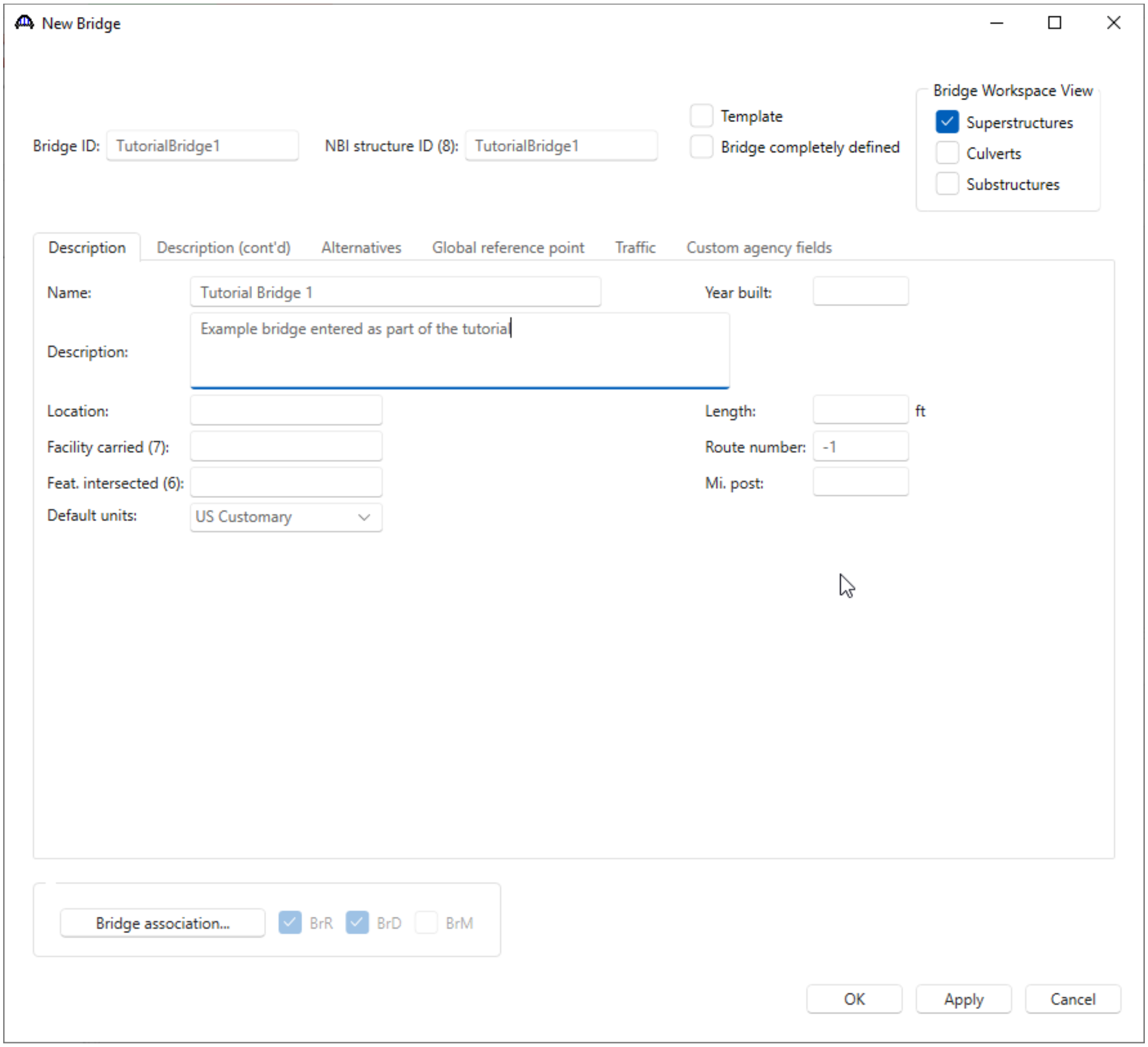
Creating a New Bridge

Now add a new bridge to the folder just created.

Select **Tutorial Bridges** folder and from the **Bridge** tab in the ribbon click the **New** button.

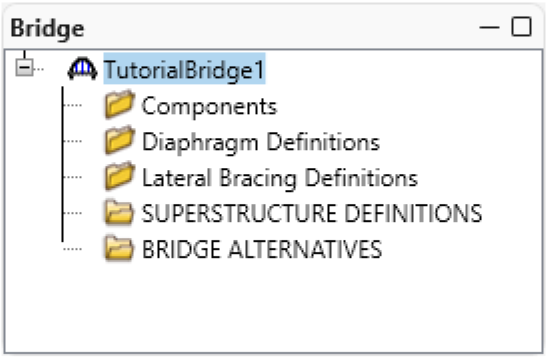


The following window will be displayed.



Enter the information shown above to describe the bridge and select **OK**. This will apply the new bridge data and close the window.

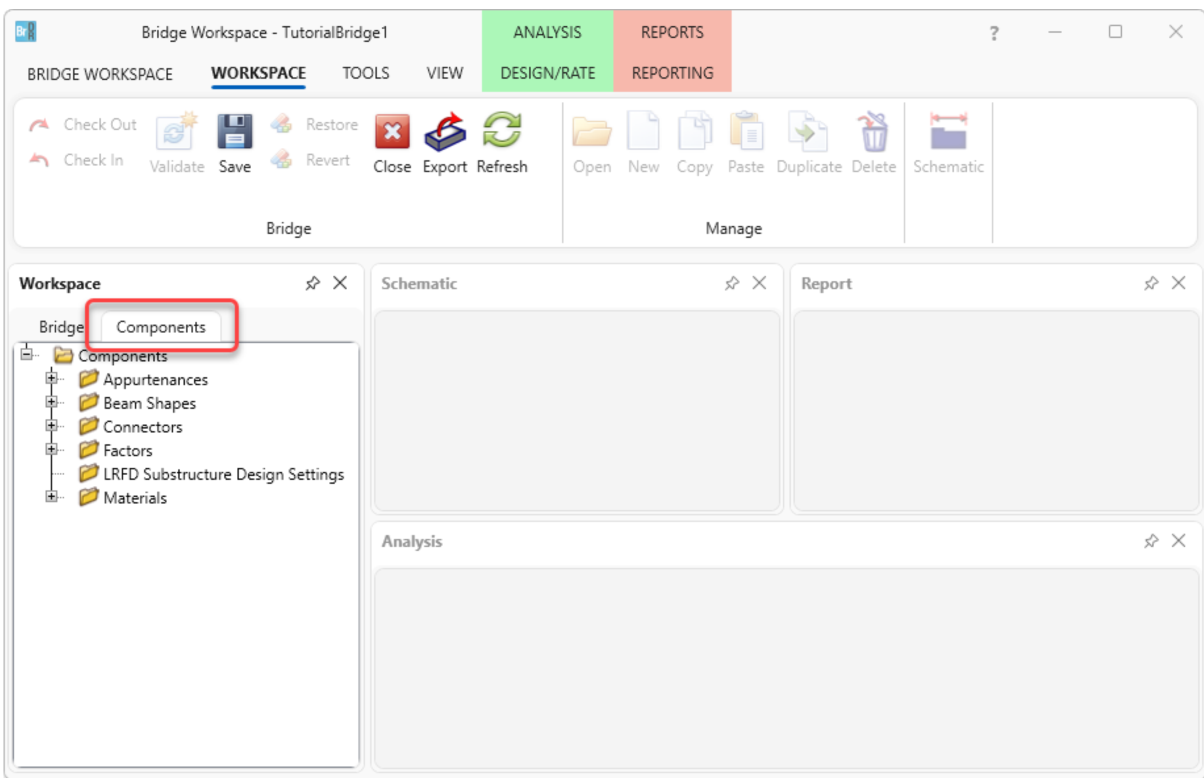
The **Bridge Workspace** tree after the bridge was created is shown below.



The tree is organized according to the definition of a bridge with data shared by many of the bridge components shown in the upper part of the tree. A bridge can be described by working from top to bottom within the tree.

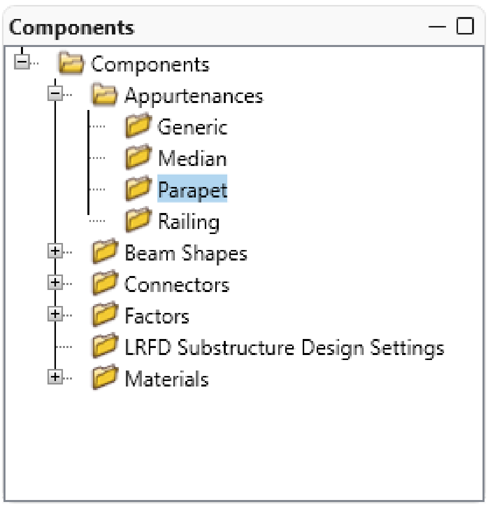
Enter Bridge Components

Now enter components to be used by members of the bridge. All components to build the bridge are found here. Click on the **Component**s tab to view the tree as shown below.

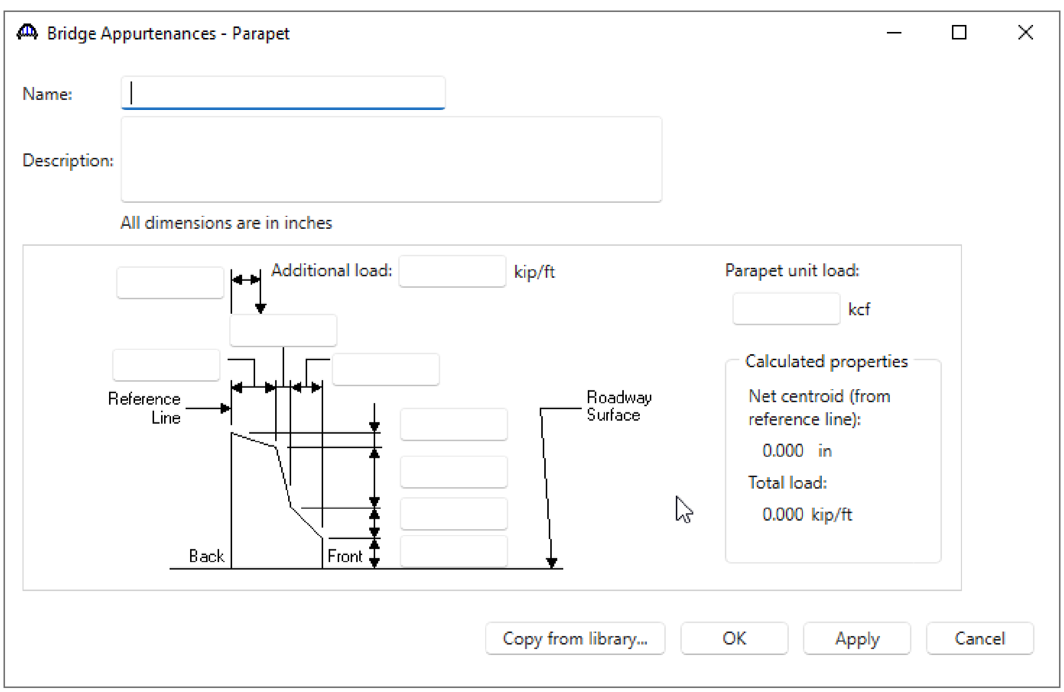


Enter Bridge Appurtenances

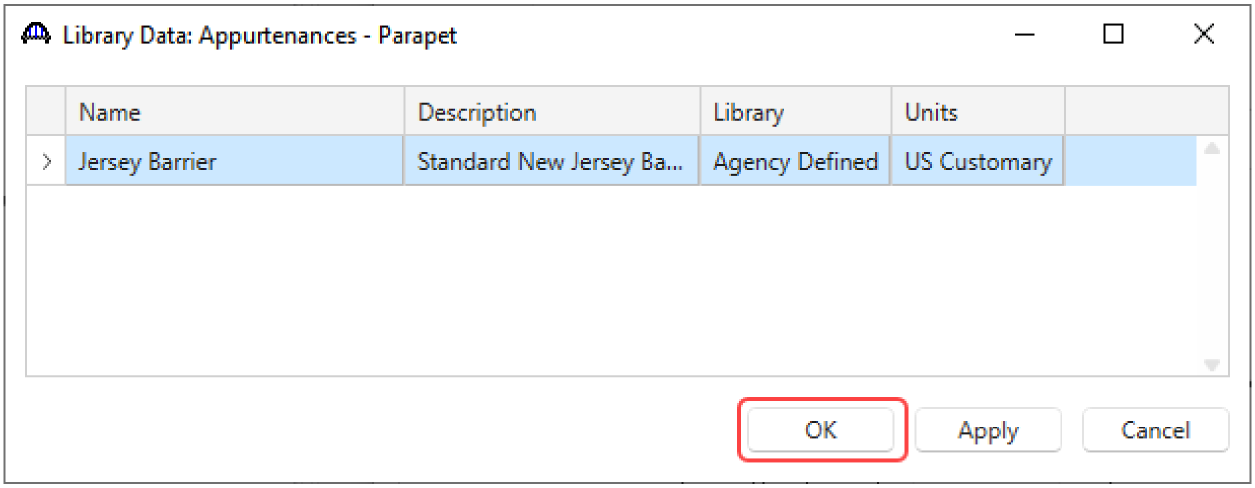
Appurtenances such as parapets, medians, and railings can be entered for the bridge. These items are useful when entering the total cross section for the structure including all the beams and the total out-to-out deck width. The appurtenances have dimensions and loads associated with them. Specify where the appurtenances are in the structure typical section. This will define where the travel lanes can exist, and the loads of the appurtenances will be applied to the structure. If only entering a single girder for the structure, the bridge appurtenances are not needed.



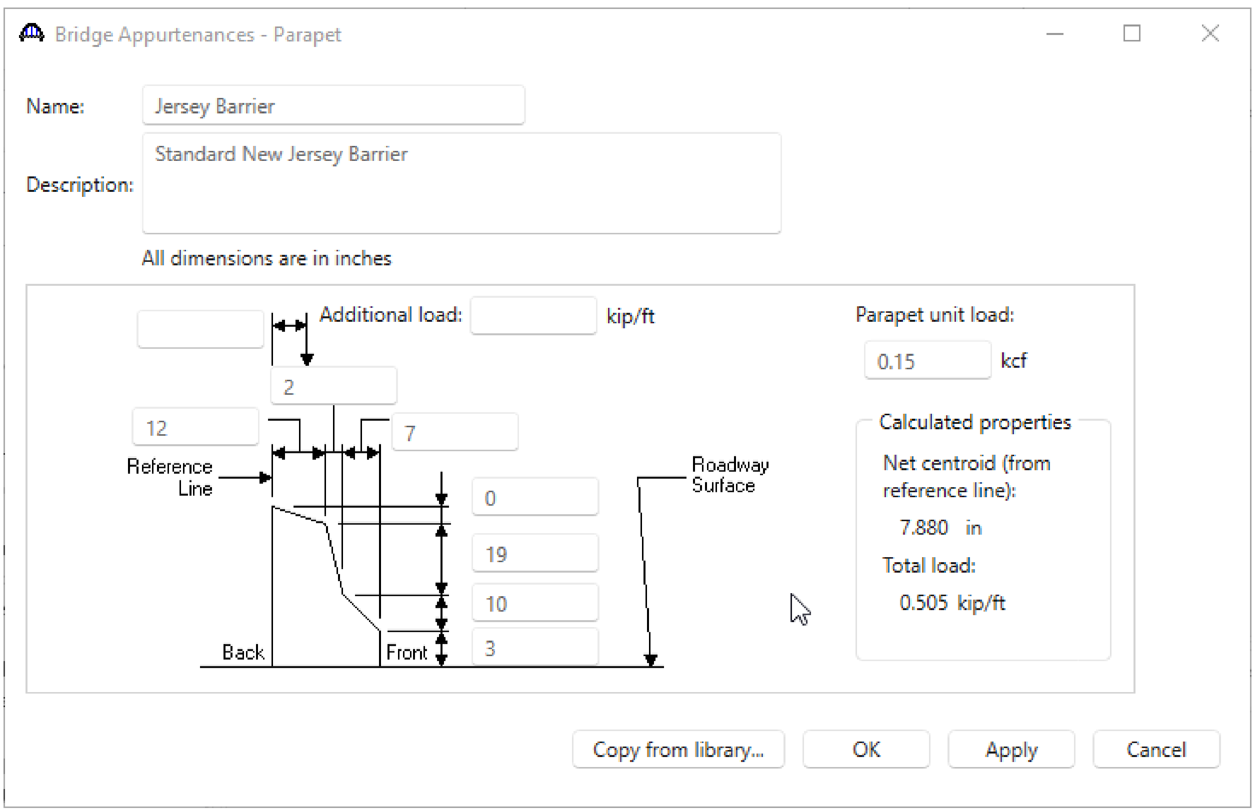
Click on the ⊞ to expand the tree for **Appurtenances**. Any of these four methods can be used to open windows in the tree. Double click on **Parapet**, right mouse click on **Parapet** and select **New**, select the **New** button from the **Manage** group or press **Ctrl+V**. The window shown below will open.



Click the **Copy from Library** button and select the **Jersey Barrier** followed by **OK**.



The window is populated with data as shown below.

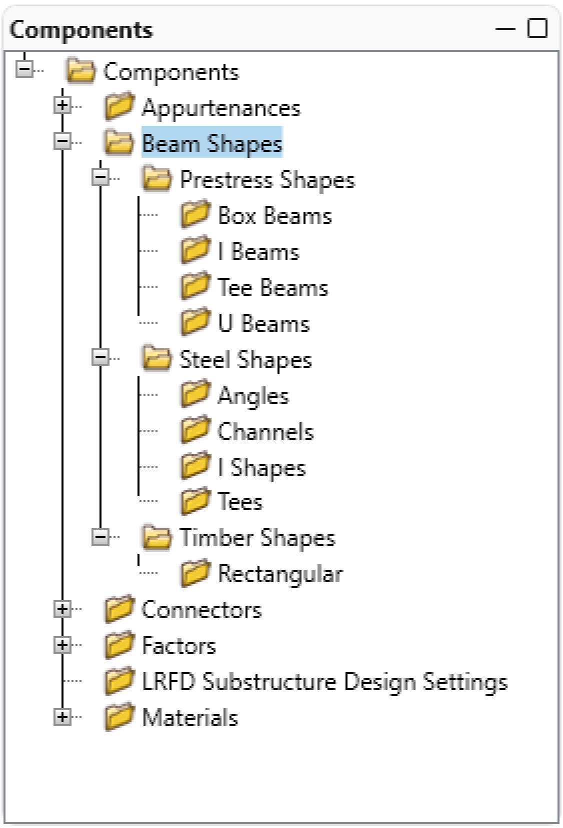


Select **OK** to close the **Bridge Appurtenances – Parapet** window and the data will be saved to memory and will appear in the **Components** tab.

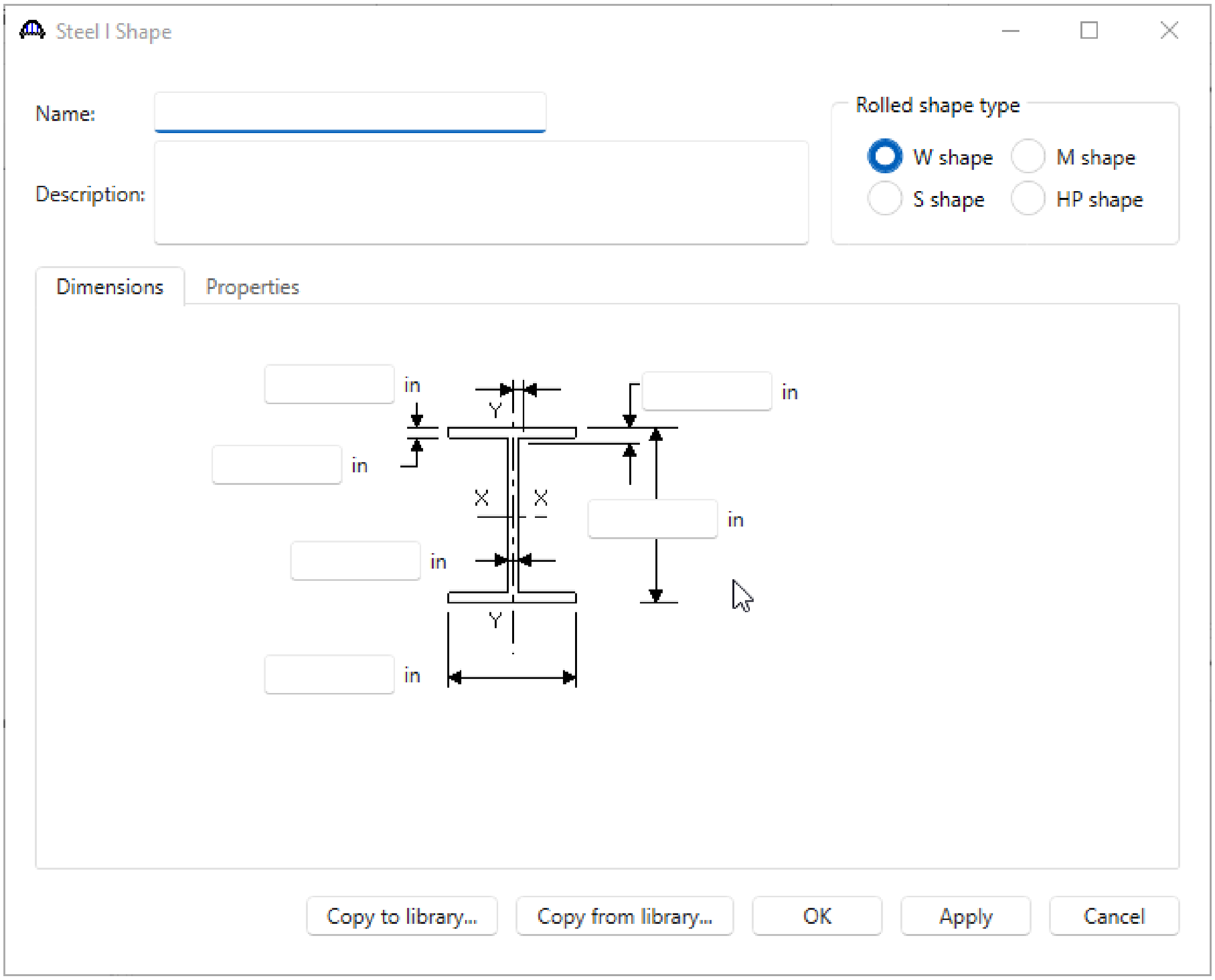
Enter Beam Shapes

Steel, prestressed concrete and timber beam shapes can be added to the **Components** tab and then used throughout the structures.

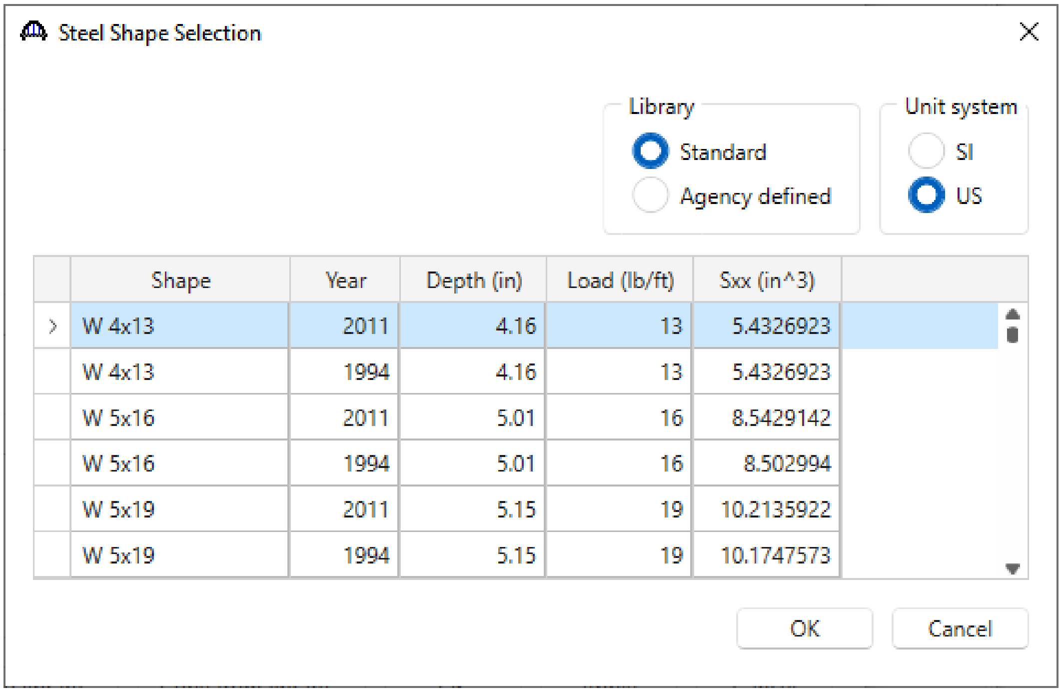
Click on the to expand the tree for **Beam Shapes**. Expand the tree again to show the beam shapes under **Prestress**, **Steel**, and **Timber**.



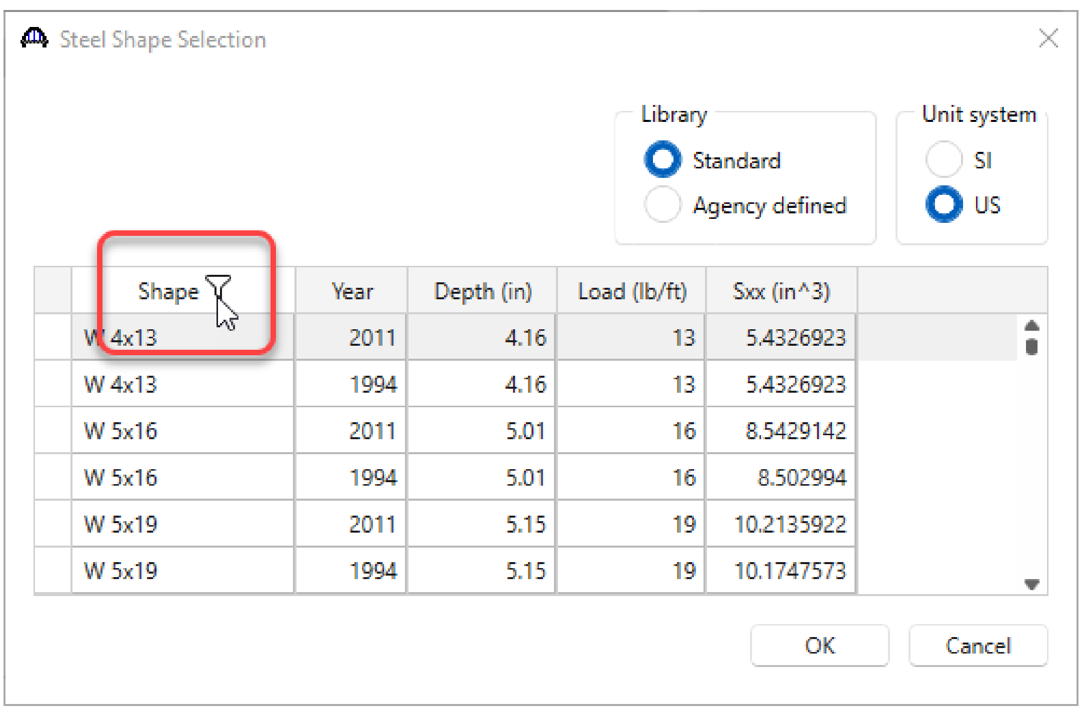
To add a new steel I shape, use one of the four methods described above in **Enter Bridge Appurtenances** section. Using one of the methods, double click on **I Shapes** in the tree. The window shown below will open.



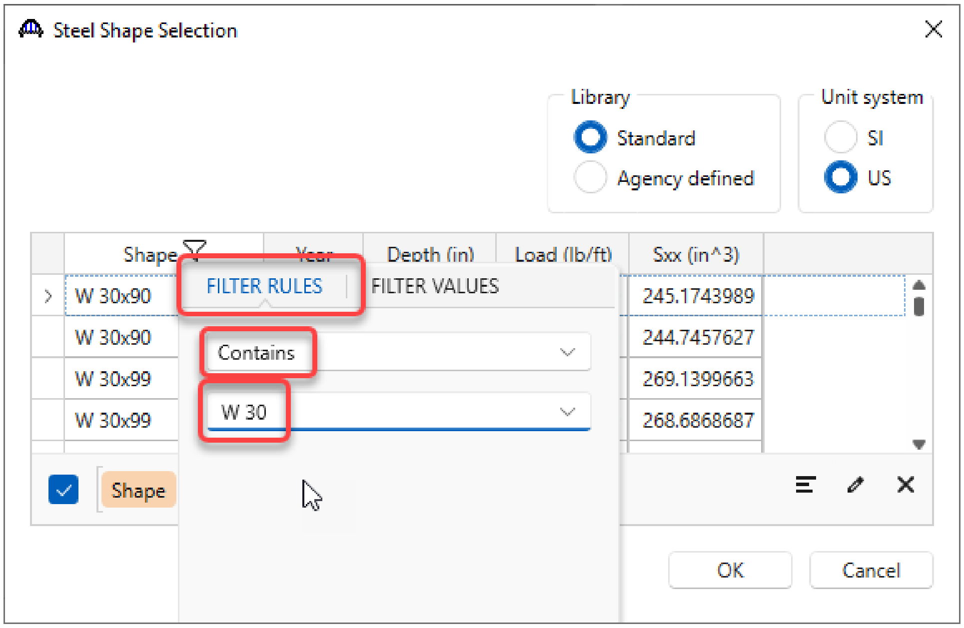
Select the **Copy from Library** button to copy a standard steel I shape from the Library to the Bridge. The **Steel Shape Selection** window shown below will appear.



This window lists the steel shapes stored in the Library. To help narrow the search of shapes in the Library, hover over the **Shape** column header and double click on the **Filter** icon.

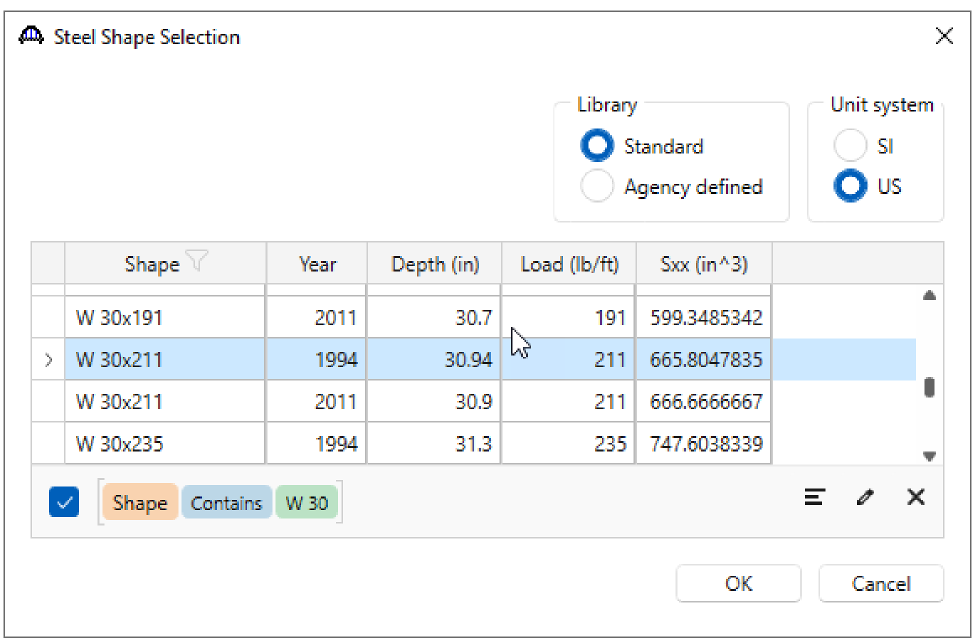


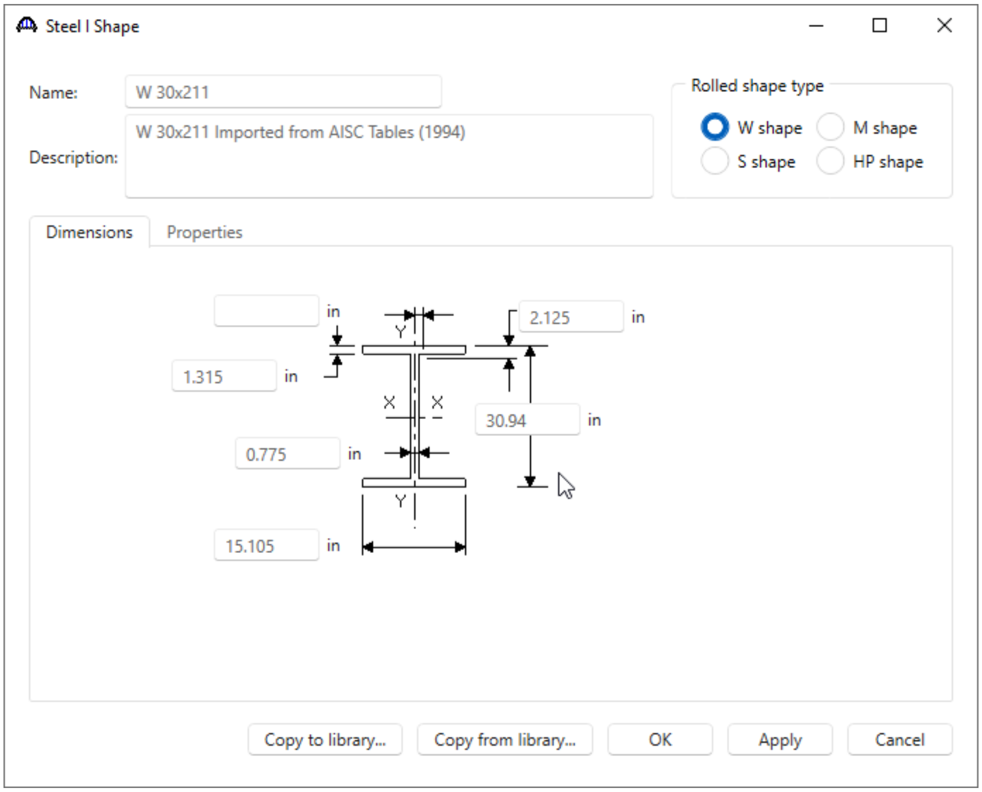
Click the tab for **FILTER RULES**, select **Contains** and enter **W 30** in last field.



The shapes in the list will be filtered as shown below, only the shapes that begin with the **W 30** are shown. Clicking on a column header in the list will sort the shapes in the list based on that column. For example, searching for a shape with a section modulus of at least 500 in³, click on the **Sxx (in^3)** heading to view the shapes sorted in order from the smallest Sxx to largest Sxx value.

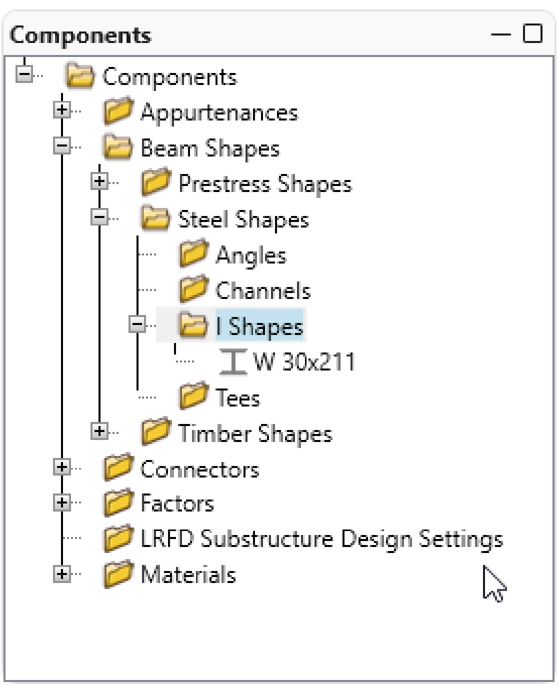
Scroll down and select **W 30x211**. Select **OK** to close the **Library**.





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

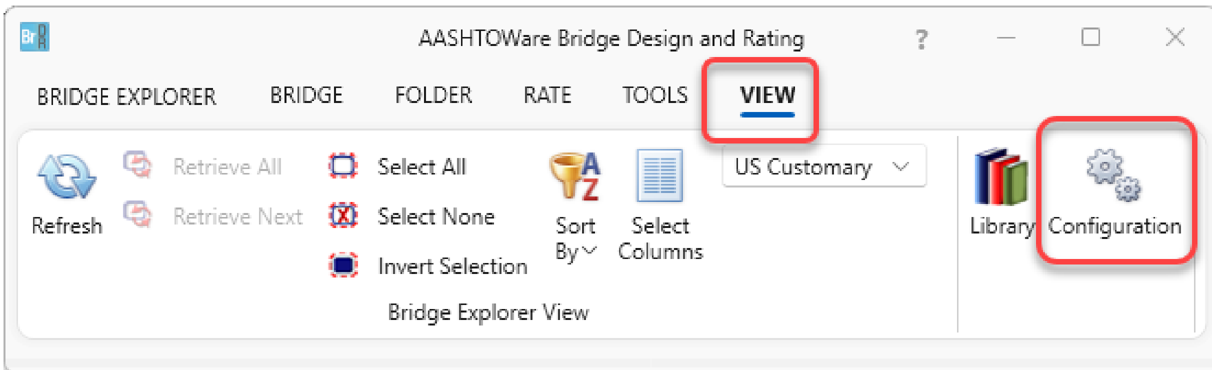
The **Workspace Components** tab now looks as follows.



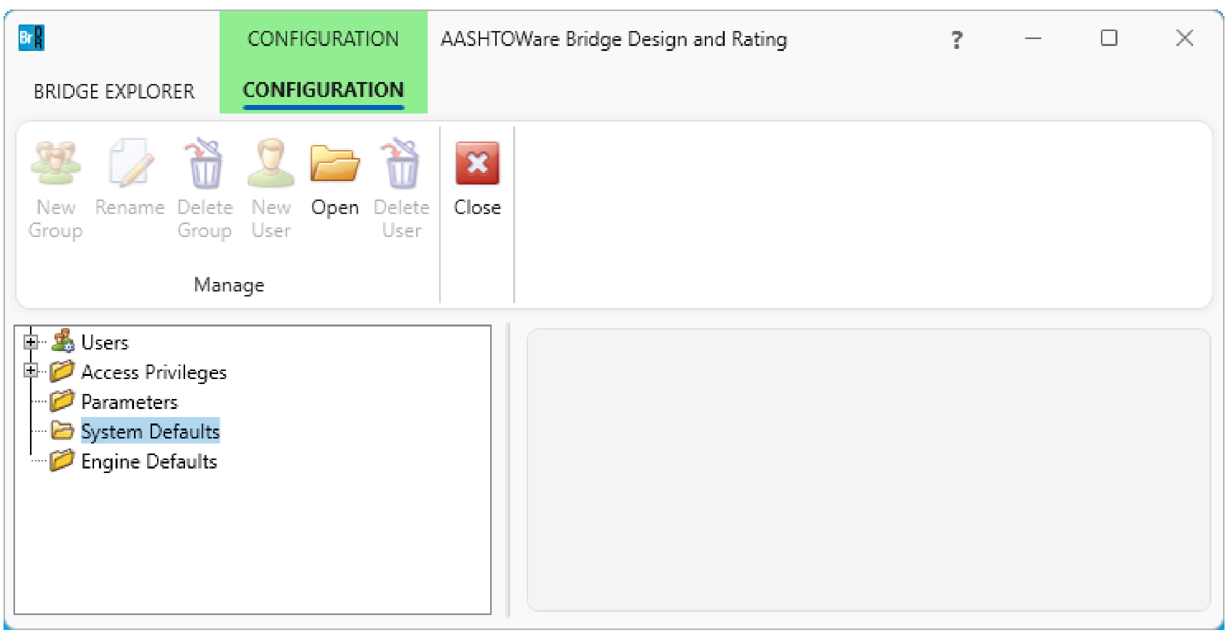
Factors

LFR, LRFD and LRFR factors can be entered to override the system default Library Factors. One reason to enter such override factors may be that a bridge is composed of several structure definitions such as a main span structure and several approach span structures. Using more limiting load factors for the main span structure than those found in the standard AASHTO specifications can be done here. Creating a new set of LFR, LRFR or LRFD Factors and then applying those to the main span structure definition while using the standard AASHTO Factors for the approach span structures is possible.

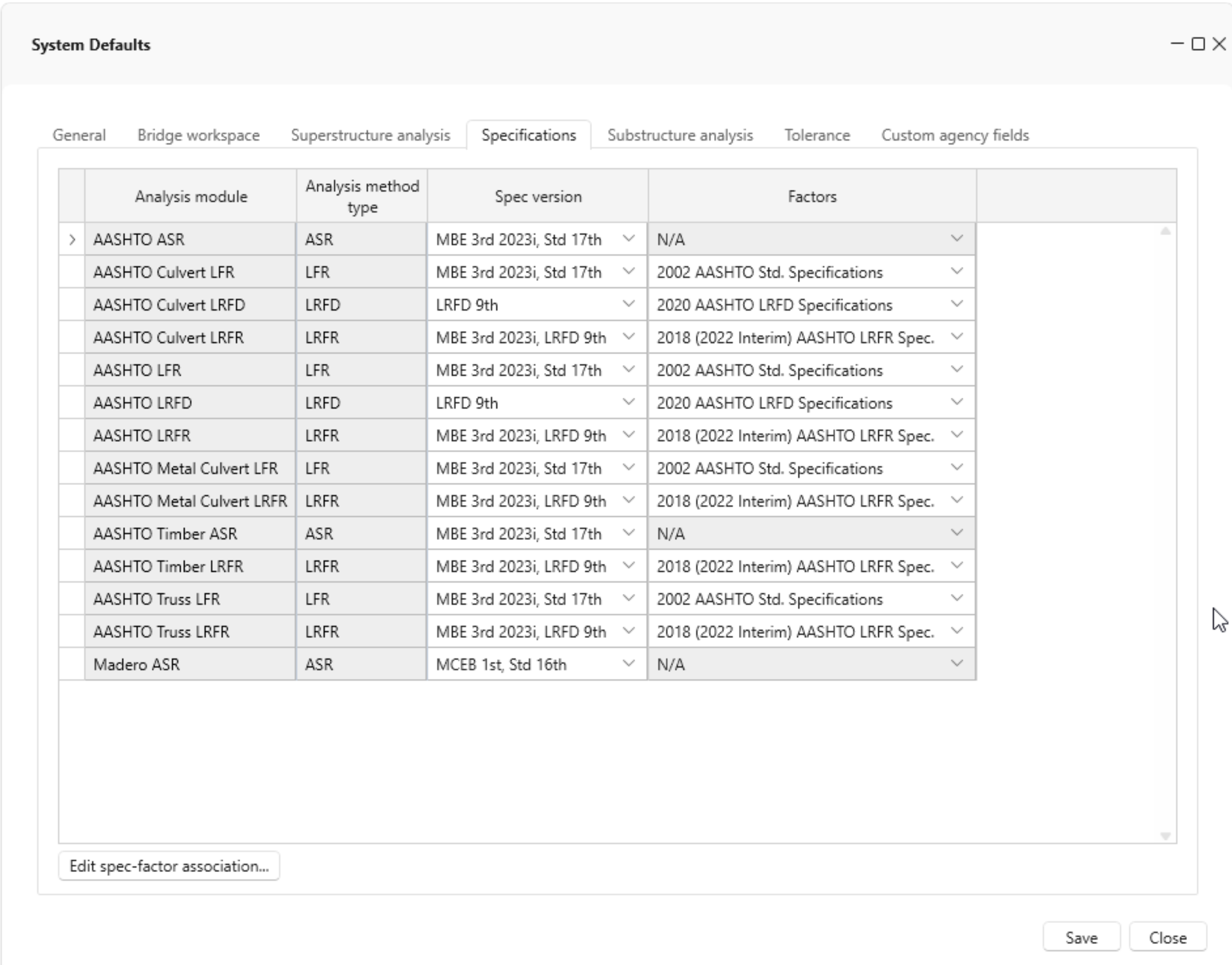
To open the **System Defaults** window, select the **VIEW** tab from the **Bridge Explorer** ribbon and then click the **Configuration** button.



Once the **Configuration** window is open, double click on **System Defaults** near the bottom of the tree.

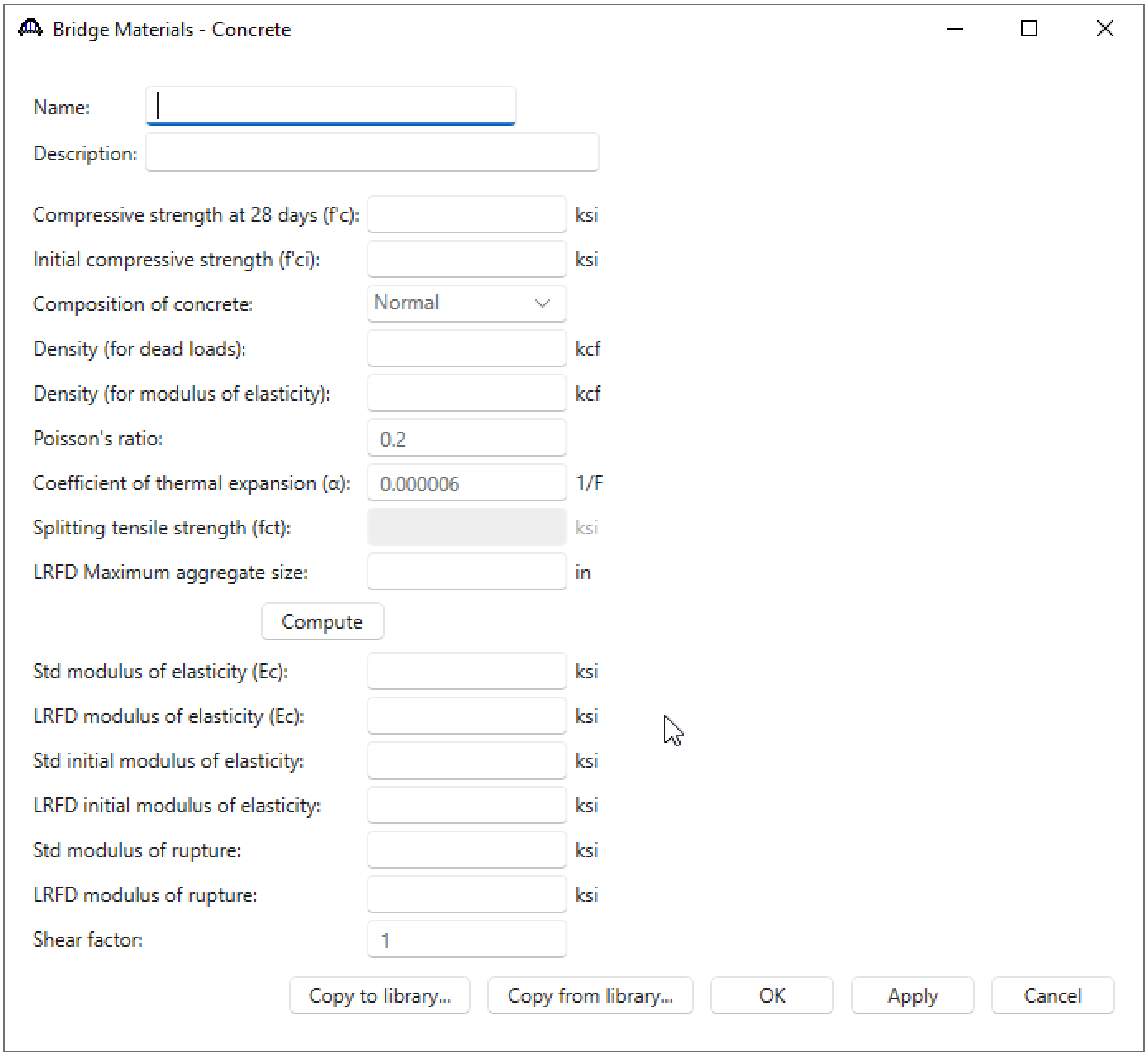


Navigate to the **Specifications** tab. The default specification version and factors are shown above. New items will not be added in this tutorial. Select the **Close** button to close this window. If new factors are required, follow the same procedure used to create the **Bridge Materials** or **Beam Shapes**.



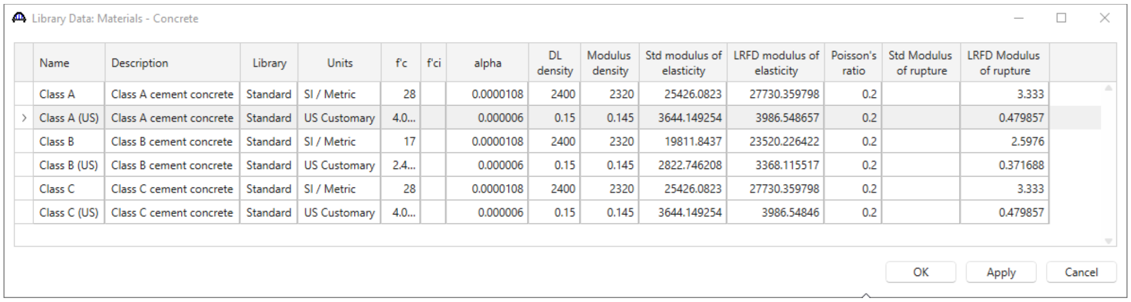
Analysis module	Analysis method type	Spec version	Factors
AASHTO ASR	ASR	MBE 3rd 2023i, Std 17th	N/A
AASHTO Culvert LFR	LFR	MBE 3rd 2023i, Std 17th	2002 AASHTO Std. Specifications
AASHTO Culvert LRFD	LRFD	LRFD 9th	2020 AASHTO LRFD Specifications
AASHTO Culvert LRFR	LRFR	MBE 3rd 2023i, LRFD 9th	2018 (2022 Interim) AASHTO LRFR Spec.
AASHTO LFR	LFR	MBE 3rd 2023i, Std 17th	2002 AASHTO Std. Specifications
AASHTO LRFD	LRFD	LRFD 9th	2020 AASHTO LRFD Specifications
AASHTO LRFR	LRFR	MBE 3rd 2023i, LRFD 9th	2018 (2022 Interim) AASHTO LRFR Spec.
AASHTO Metal Culvert LFR	LFR	MBE 3rd 2023i, Std 17th	2002 AASHTO Std. Specifications
AASHTO Metal Culvert LRFR	LRFR	MBE 3rd 2023i, LRFD 9th	2018 (2022 Interim) AASHTO LRFR Spec.
AASHTO Timber ASR	ASR	MBE 3rd 2023i, Std 17th	N/A
AASHTO Timber LRFR	LRFR	MBE 3rd 2023i, LRFD 9th	2018 (2022 Interim) AASHTO LRFR Spec.
AASHTO Truss LFR	LFR	MBE 3rd 2023i, Std 17th	2002 AASHTO Std. Specifications
AASHTO Truss LRFR	LRFR	MBE 3rd 2023i, LRFD 9th	2018 (2022 Interim) AASHTO LRFR Spec.
Madero ASR	ASR	MCEB 1st, Std 16th	N/A

Navigate back to the bridge. To add a new concrete material, open the **Materials** tree and use one of the four methods described above in **Enter Bridge Appurtenances** section. Using one of the methods, double click on **Concrete** in the tree. The window shown below will open.

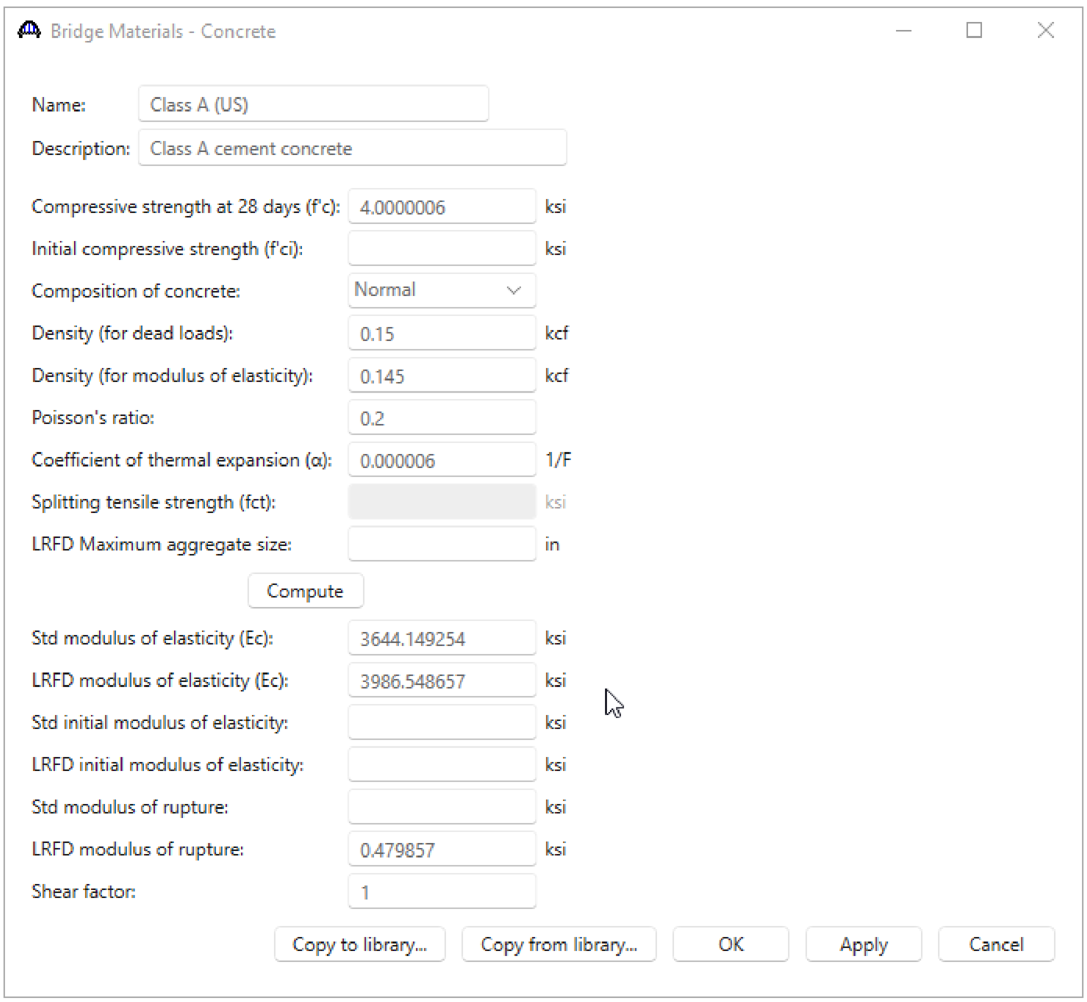


The **Materials Library** contains standard materials and their material properties to minimize the amount of data to be entered.

To select Concrete Material from the Library, click the **Copy from library** button. The following **Library Data: Material - Concrete** window shown below will open.



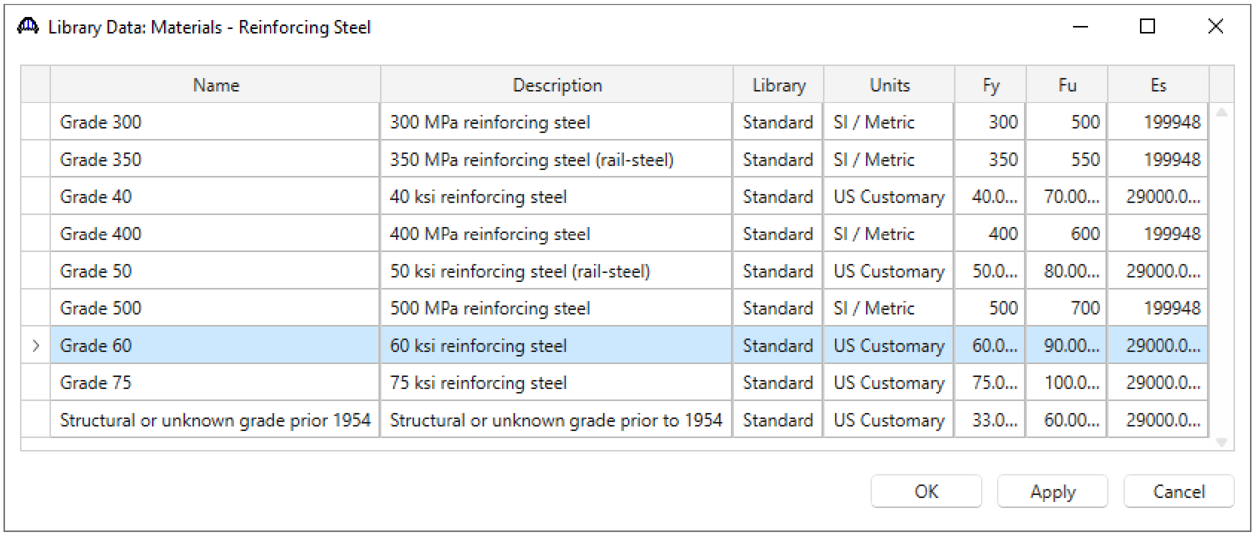
Select the highlighted concrete material and press **OK** and the window gets populated as shown below.



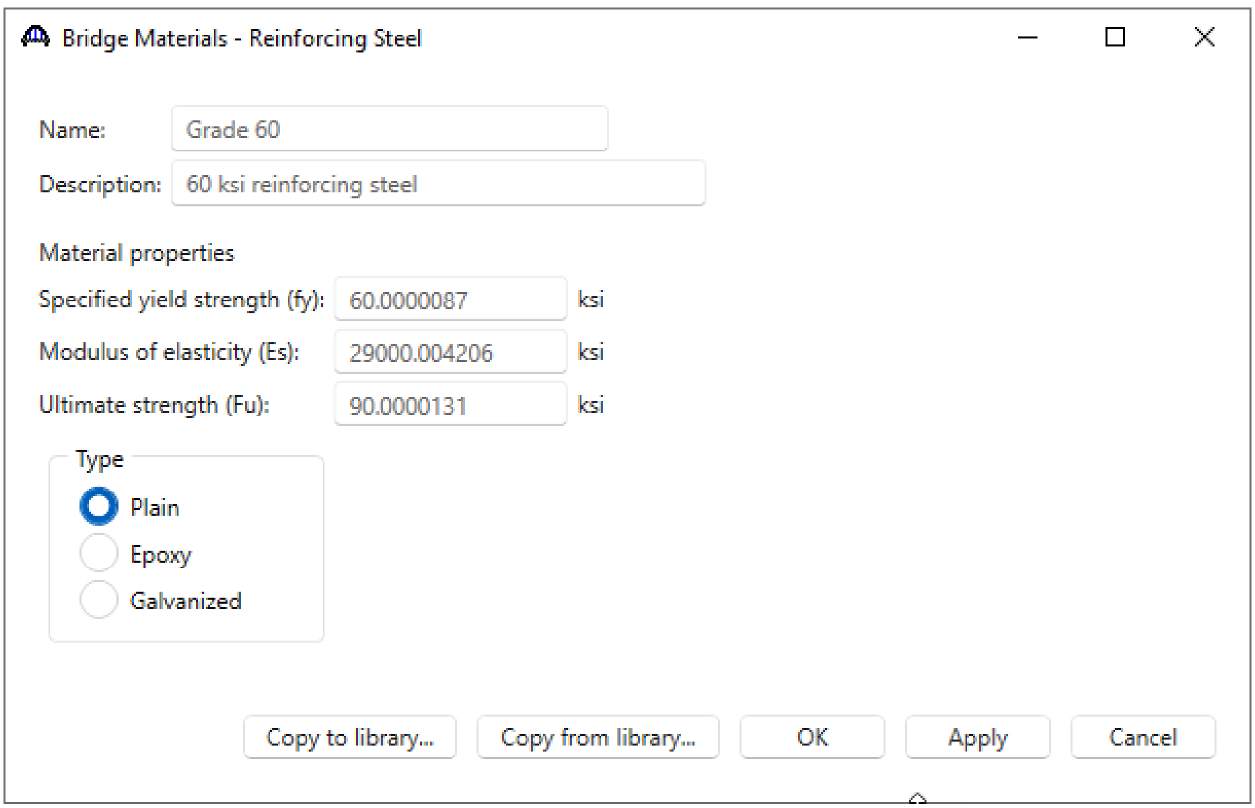
Click **OK** to save the material and close the window.

The same technique can be used to enter reinforcing steel and structural steel material. The **Reinforcing Steel** and **Structural Steel** material windows are shown below.

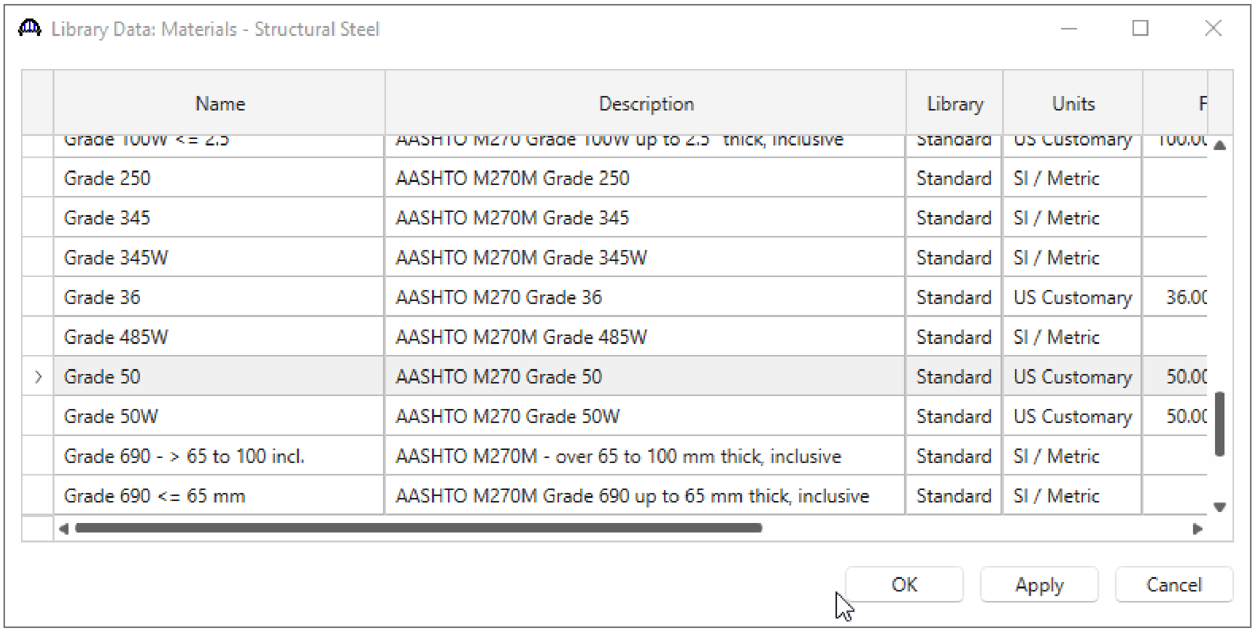
Reinforcing Steel

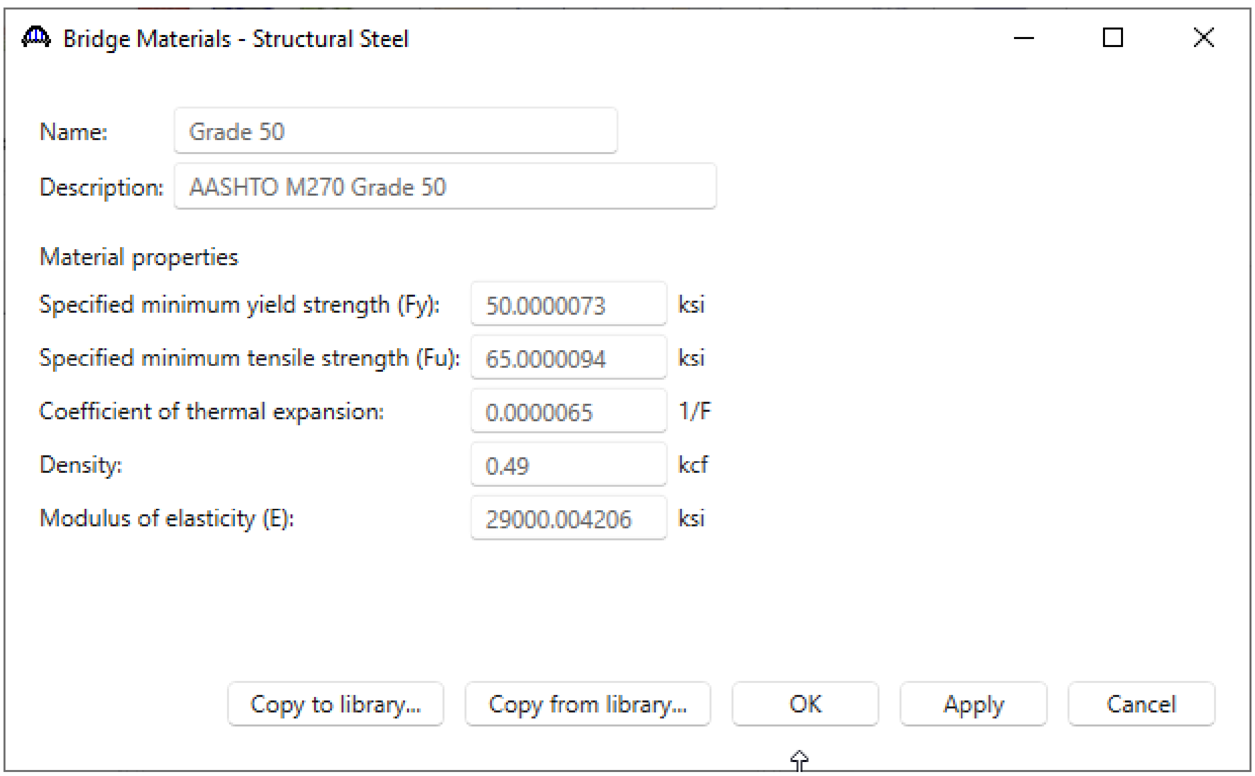


Name	Description	Library	Units	Fy	Fu	Es
Grade 300	300 MPa reinforcing steel	Standard	SI / Metric	300	500	199948
Grade 350	350 MPa reinforcing steel (rail-steel)	Standard	SI / Metric	350	550	199948
Grade 40	40 ksi reinforcing steel	Standard	US Customary	40.0...	70.00...	29000.0...
Grade 400	400 MPa reinforcing steel	Standard	SI / Metric	400	600	199948
Grade 50	50 ksi reinforcing steel (rail-steel)	Standard	US Customary	50.0...	80.00...	29000.0...
Grade 500	500 MPa reinforcing steel	Standard	SI / Metric	500	700	199948
Grade 60	60 ksi reinforcing steel	Standard	US Customary	60.0...	90.00...	29000.0...
Grade 75	75 ksi reinforcing steel	Standard	US Customary	75.0...	100.0...	29000.0...
Structural or unknown grade prior 1954	Structural or unknown grade prior to 1954	Standard	US Customary	33.0...	60.00...	29000.0...



Structural Steel

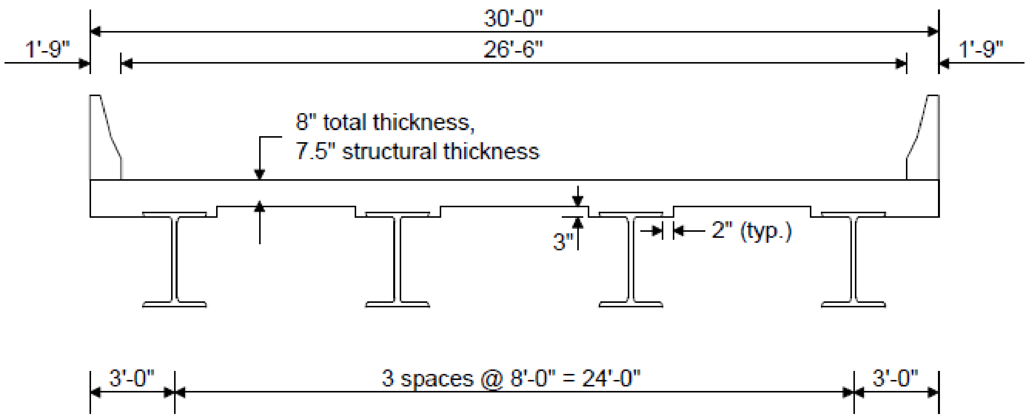




Creating a New Superstructure Definition Using the Wizard

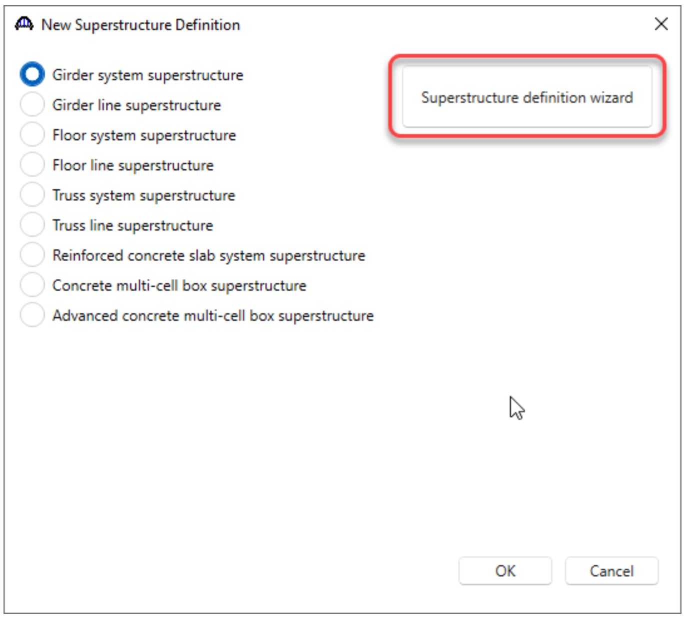
A **wizard** is available to help quickly create a new structure definition. This **wizard** will create the **superstructure definition** including all members and member alternatives based on the data entered. The **wizard** is primarily geared to a new design, with input for LRFD data not LFR data. If the wizard is used to create a new structure definition that needs to be analyzed with LFR several windows would have to be visited.

Use the wizard to create the following structure definition:

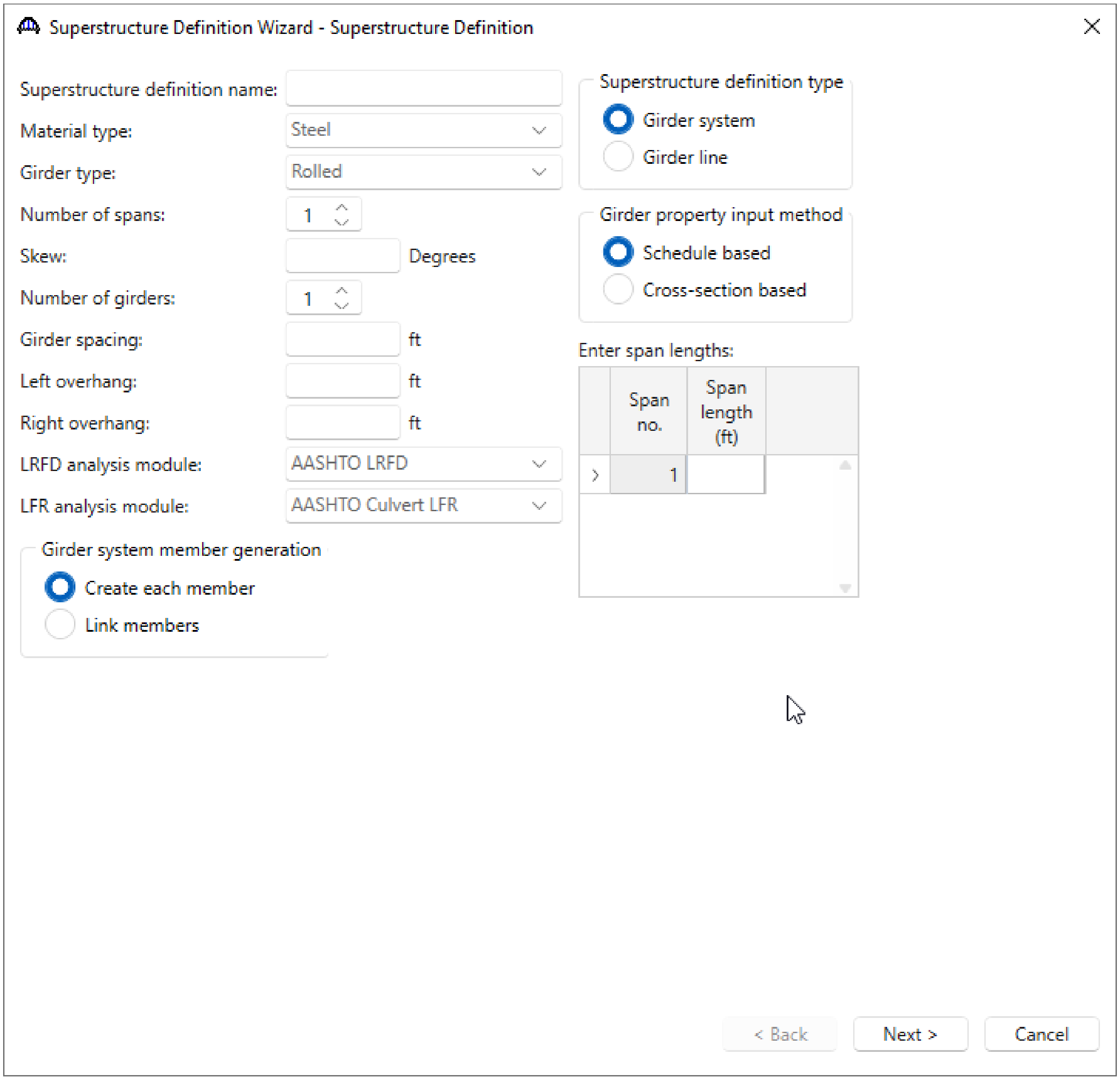


- 50'-0" single span, composite
- 15 psf stay-in-place forms

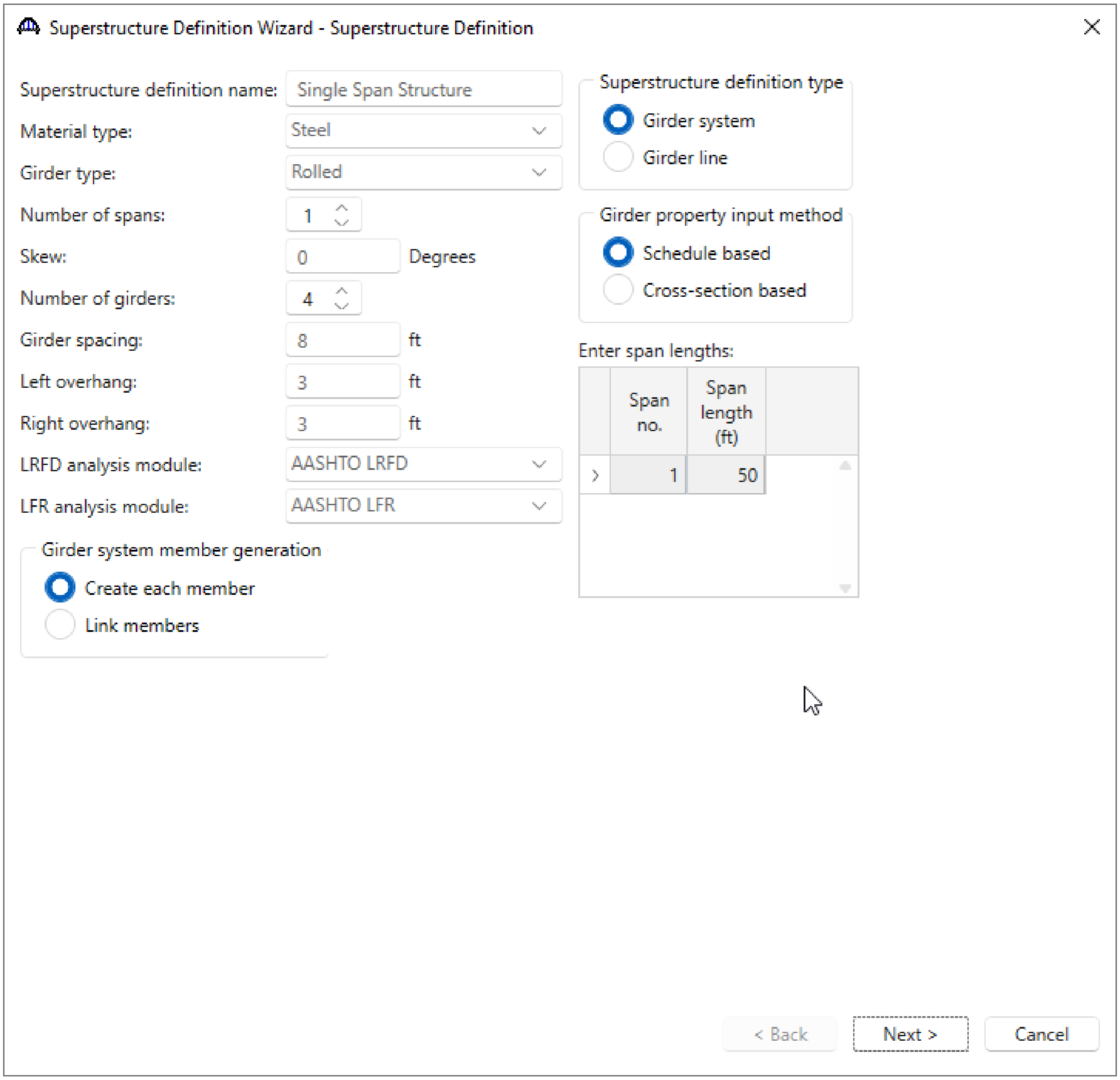
To access the wizard, double click on the **SUPERSTRUCTURE DEFINITIONS** node in the **Bridge Workspace** tree and click the **Superstructure definition Wizard** button.



The following window will appear.

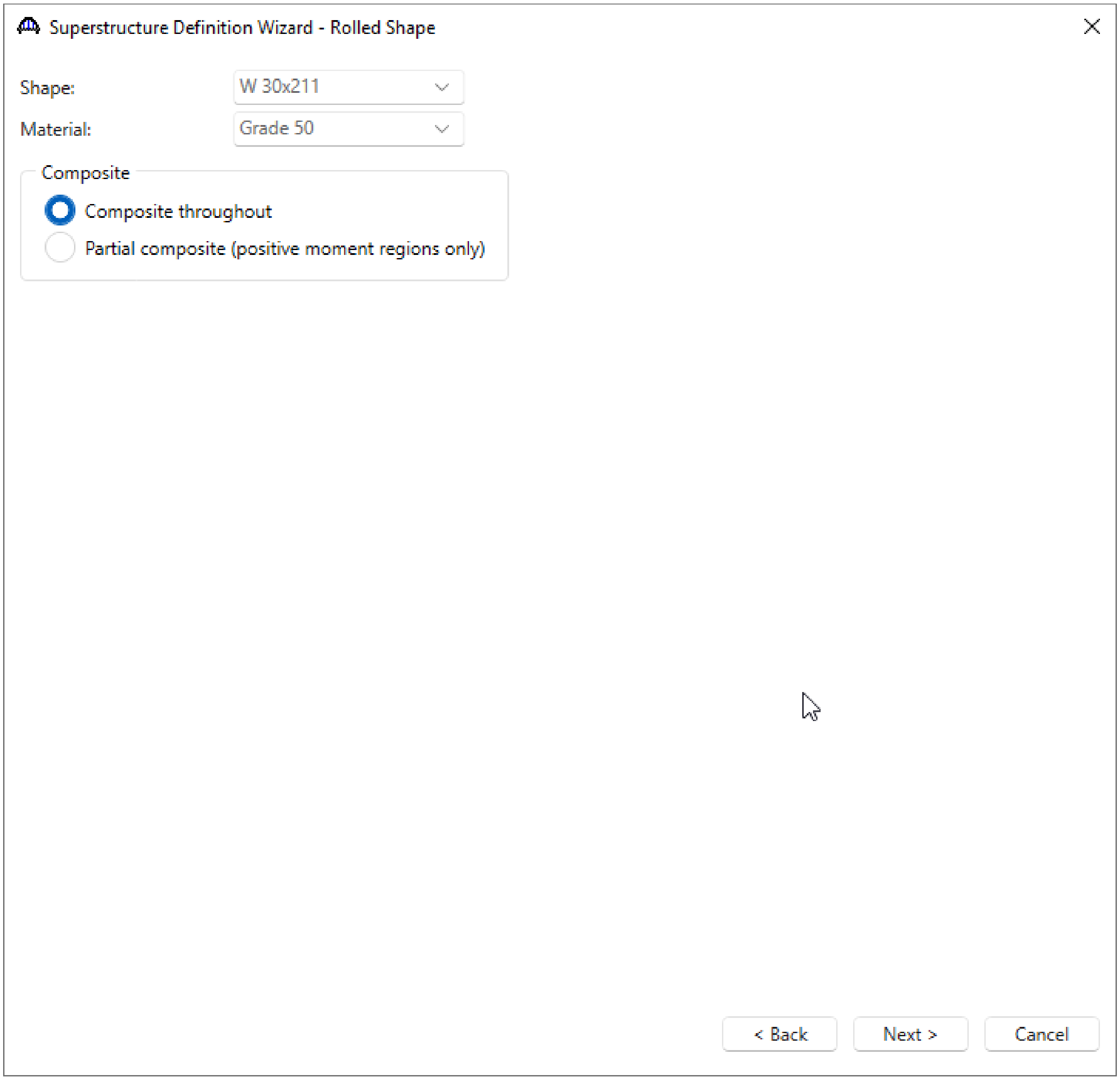


Enter the following information into the **wizard**.



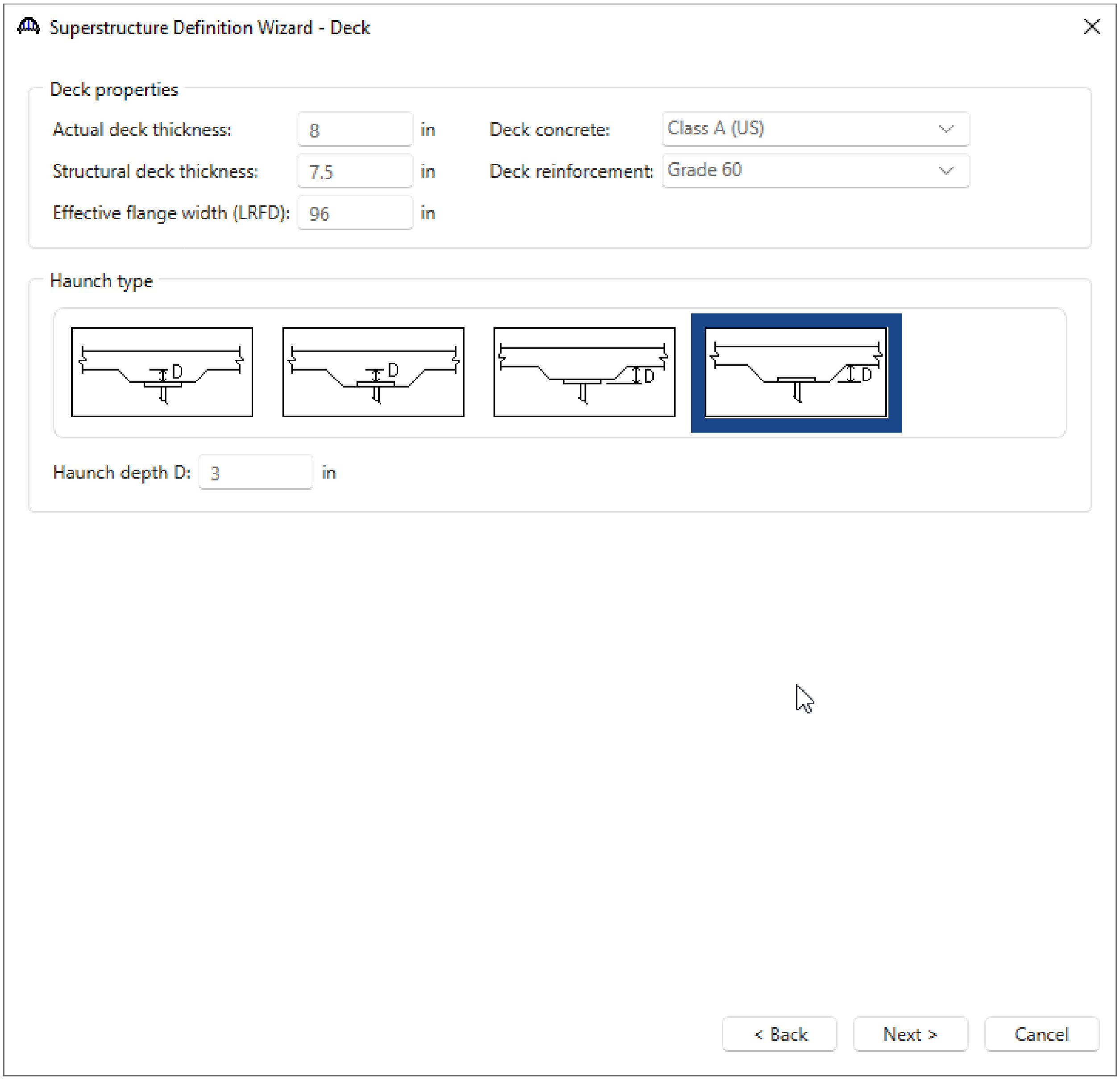
The Superstructure definition type is selected as **Girder system** since the entire typical section of the structure including all four girders will be entered in this example. If only one of the girders is required, select the **Girder line** Superstructure definition type. The **Girder property input method** is selected as **Schedule based** since the components of the members will be described individually. The wizard will create individual schedules for each member component such as the rolled shape and the concrete deck. This method gives more flexibility, member components later if needed. If the **cross-section based** input method is used, the wizard would create a cross section based on input and apply that cross section to a range over the length of the member. **Girder system member generation** is selected as **Create each member**. Linking of a member to another member should only be done if all member properties, loads, spacing, and distribution factors are identical.

Select the **Next** button to advance to the next screen in the **wizard**. Enter the following information into that screen.



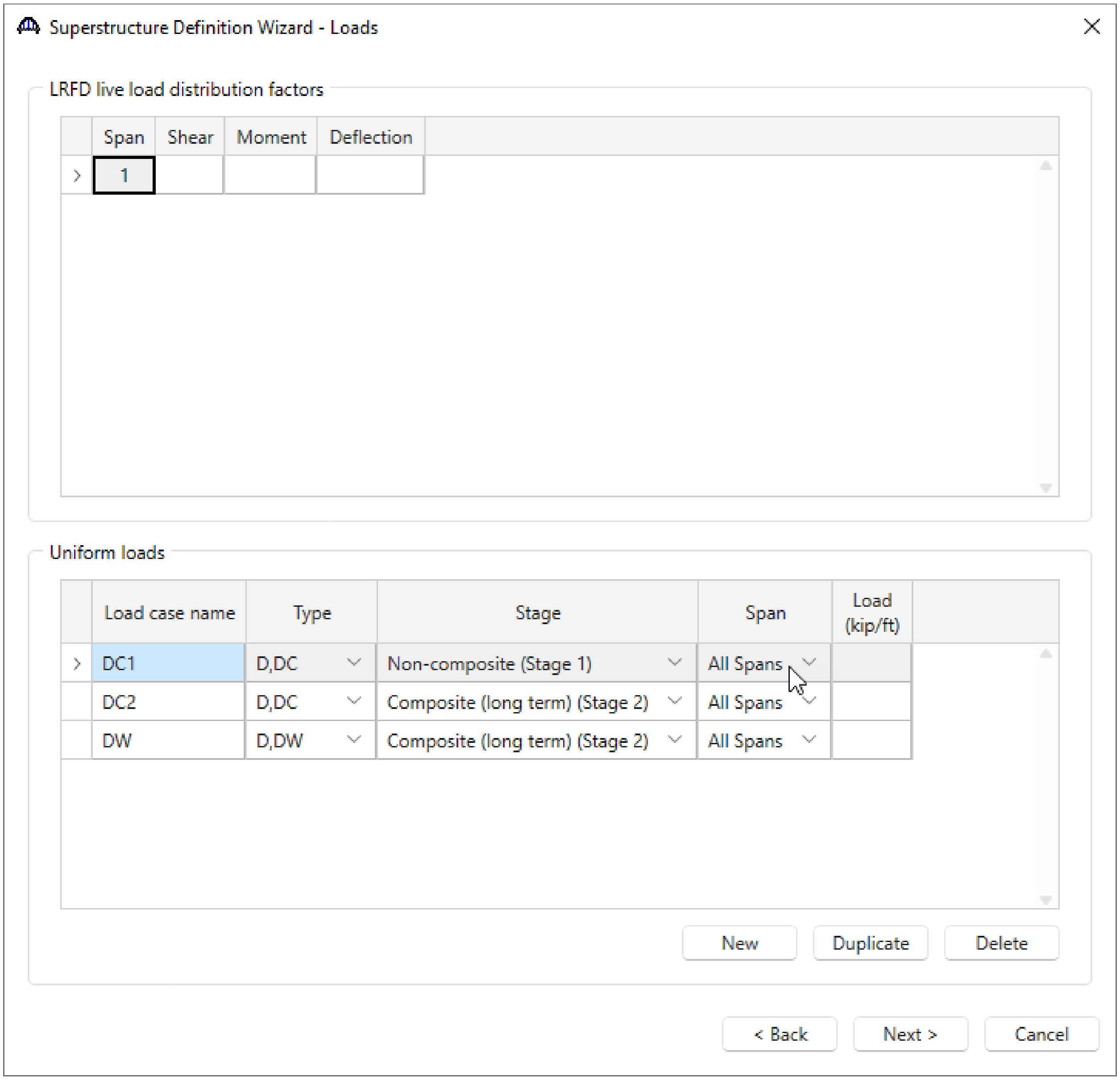
If the steel shape or structural steel material defined at the bridge level didn't exist, use the **"-Copy from Library-"** selection in the list boxes in this window to copy a shape or material from the **Library** as done earlier.

Select the **Next** button to advance to the next **wizard** screen. Enter the following information into that screen.

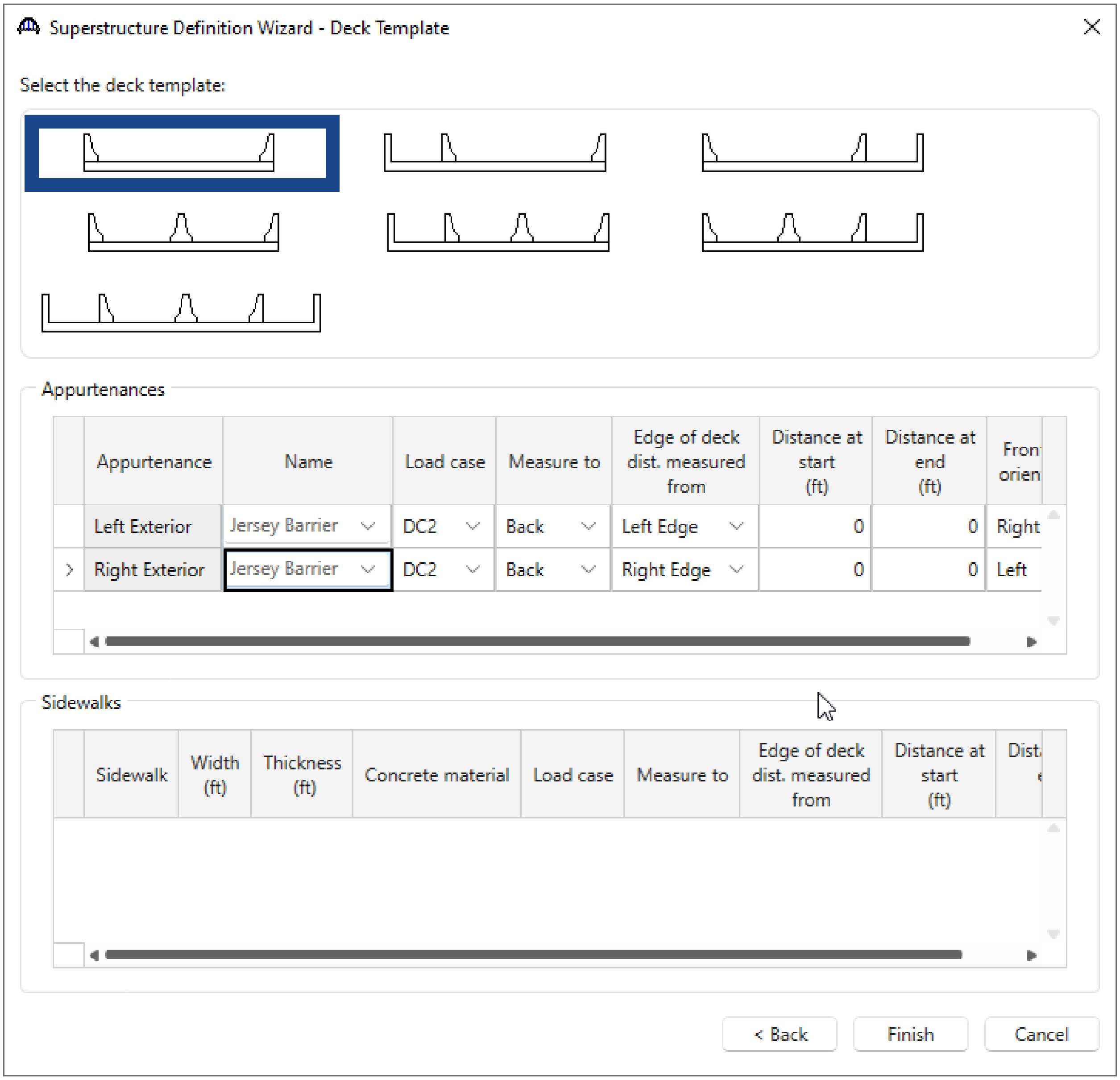


The **effective slab width** entered above will be applied to all the girders in this structure definition. It is not the correct effective slab width for the exterior girders so the **Deck Profile** windows will be visited later to revise this value. The **Haunch Profile** windows will also need to be visited to revise the haunch dimensions for the exterior girders.

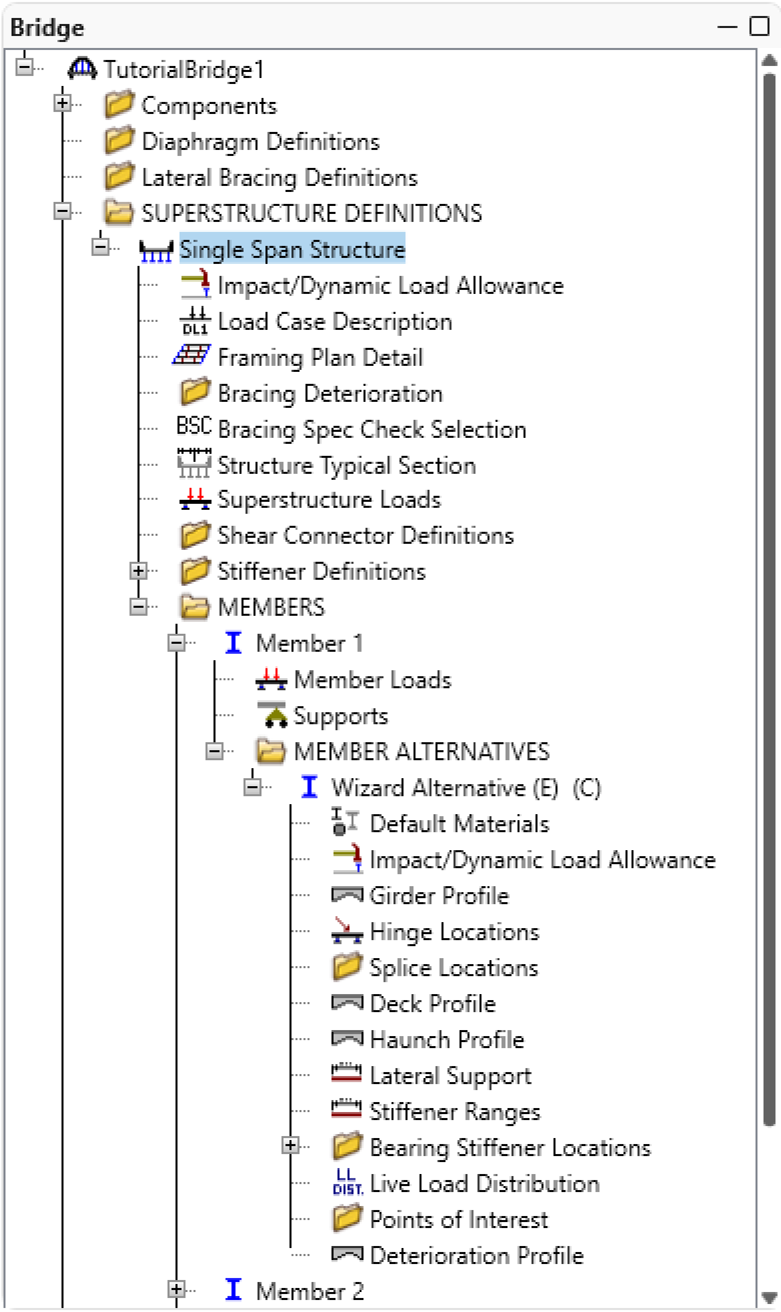
Select the **Next** button to advance to the next **wizard** screen. No information needs to be entered here.



Select the **Next** button to advance to the next **wizard** screen. Enter the following information into that screen.



Select the **Finish** button to close this window and create the new structure definition. The new **Bridge Workspace** tree is shown below partially expanded.



Now that a structure definition has been created, the following windows may need to be visited to revise or enter additional data for both LFR and LRFD analysis:

Steel Bridge:

- Framing Plan Detail: Enter the diaphragm locations.
- Structure Typical Section: Enter wearing surface data.
- Bearing Stiffener Definition: Enter a bearing stiffener definition.

- Deck Profile and Haunch Profile windows (for exterior girders): Enter the appropriate data for exterior girders.
- Lateral Support: Enter the lateral support for the top flange.
- Stiffener Ranges: Revise or enter the transverse stiffener ranges.
- Bearing Stiffener Ranges: Assign bearing stiffener definitions to locations of bearing stiffeners.

Prestressed Concrete Bridge:

- Framing Plan Detail: Enter the diaphragm locations.
- Structure Typical Section: Enter wearing surface data.
- Shear Reinforcement Definitions: Enter a shear reinforcement definition.
- Stress Limit Sets: Enter the final allowable slab compression.
- Deck Profile and Haunch Profile windows (for exterior girders): Enter the appropriate data for exterior girders.
- Strand Layout: Enter the strand layouts for the prestressed beams.
- Interior Diaphragms: Enter the interior diaphragms for prestressed box beams.
- Shear Reinforcement Ranges: Enter the shear reinforcement ranges.

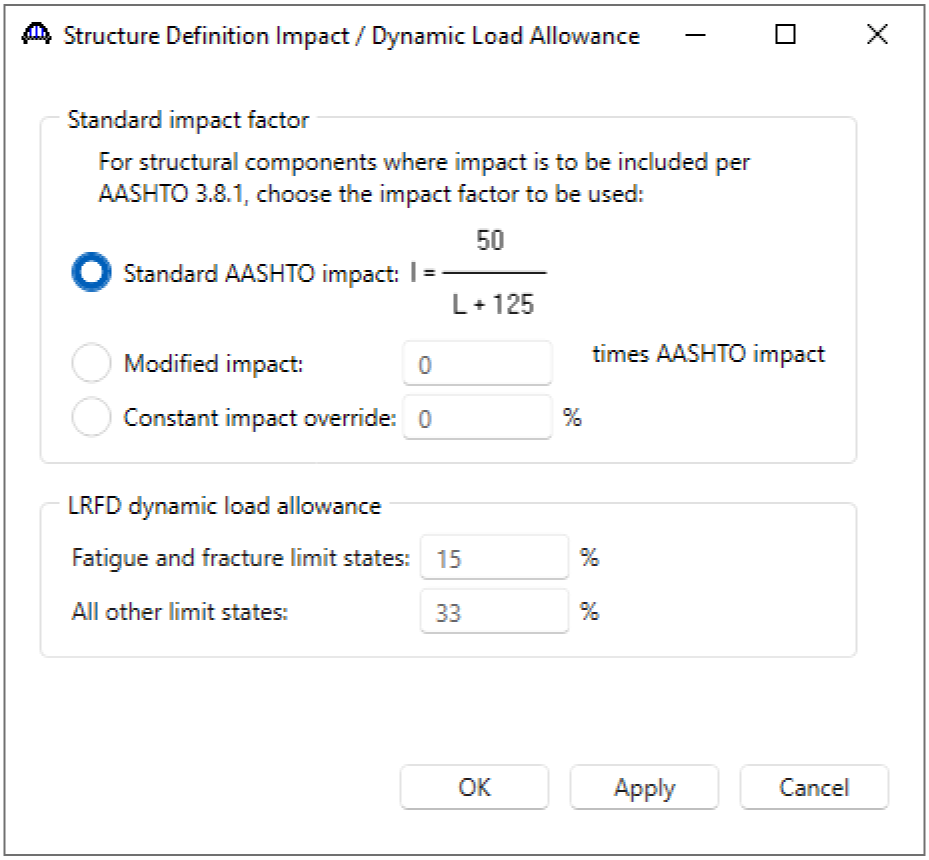
The following windows may need to be visited to enter additional data for an LFR analysis:

- Stress Limit Sets: Enter the LFR allowable stresses for a prestressed concrete bridge.
- Live Load Distribution: Enter the standard (LFR) distribution factors.
- Deck Profile: Enter the standard (LFR) effective slab width.

Structure Impact / Dynamic Load Allowance

Impact and Dynamic Load Allowance can be specified at two levels, **Superstructure Definition** and **Member Alternative** levels. Impact or dynamic allowance entered at the Structure level will be used for all Member Alternatives in that structure unless a different impact is entered for a specific Member Alternative.

Open the **Impact / Dynamic Load Allowance** window for the superstructure by double clicking on the **Impact/Dynamic Load Allowance** node in the **Bridge Workspace** tree or a right click to open a window in the tree. The following window will appear. The word **Structure Definition** will appear in the title to indicate that this is at the Superstructure level.



The default values shown are acceptable for this example, so click the **OK** button to close the window. These values will be used for all Member Alternatives in this bridge unless they are overridden at the Member Alternative level.

Examples of Alternatives Within BrDR

BrDR provides the powerful ability to model different alternatives for bridges, structures, and members. Entering different alternatives can be useful when comparing various alternatives for a preliminary study and when evaluating the benefits of various rehabilitation alternatives. Before exploring this capability, let's review some terminology used in BrDR.

A **bridge** is a structure or a group of structures providing continuity of a highway across an entire crossing.

A **bridge alternative** is a configuration of superstructure and substructure units making up the physical definition of a bridge. BrDR allows to define more than one bridge alternative for the same bridge, a feature useful for comparing design alternatives. For example, you can have a one-span alternative and a two-span alternative for the same bridge.

A **structure** is one or more spans that have the same structural type (such as girder, truss, or frame) and for which a load acting anywhere within the structure affects all spans within that structure. Each bridge alternative may contain one or more structures. The structure screen provides location and identification information about the structure, with one or more structure alternatives providing the assignment to structure definitions.

A **structure alternative** is a means of relating a structure definition to a structure, which serves the purpose of relating a physical description of a structure (the structure definition) to one or more positions in the bridge where the structure definition is used (the structure). This allows a structure to be described just once and used in several different places in a bridge. It also allows more than one structure definition to be evaluated as an alternative for any given structure.

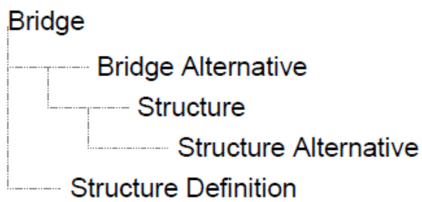
A **structure definition** describes the physical characteristics of a structure.

A **member** is a component of a structure definition, such as a girder. The member screen stores the location and identification information about the member and allows for the assignment of a member alternative to the member.

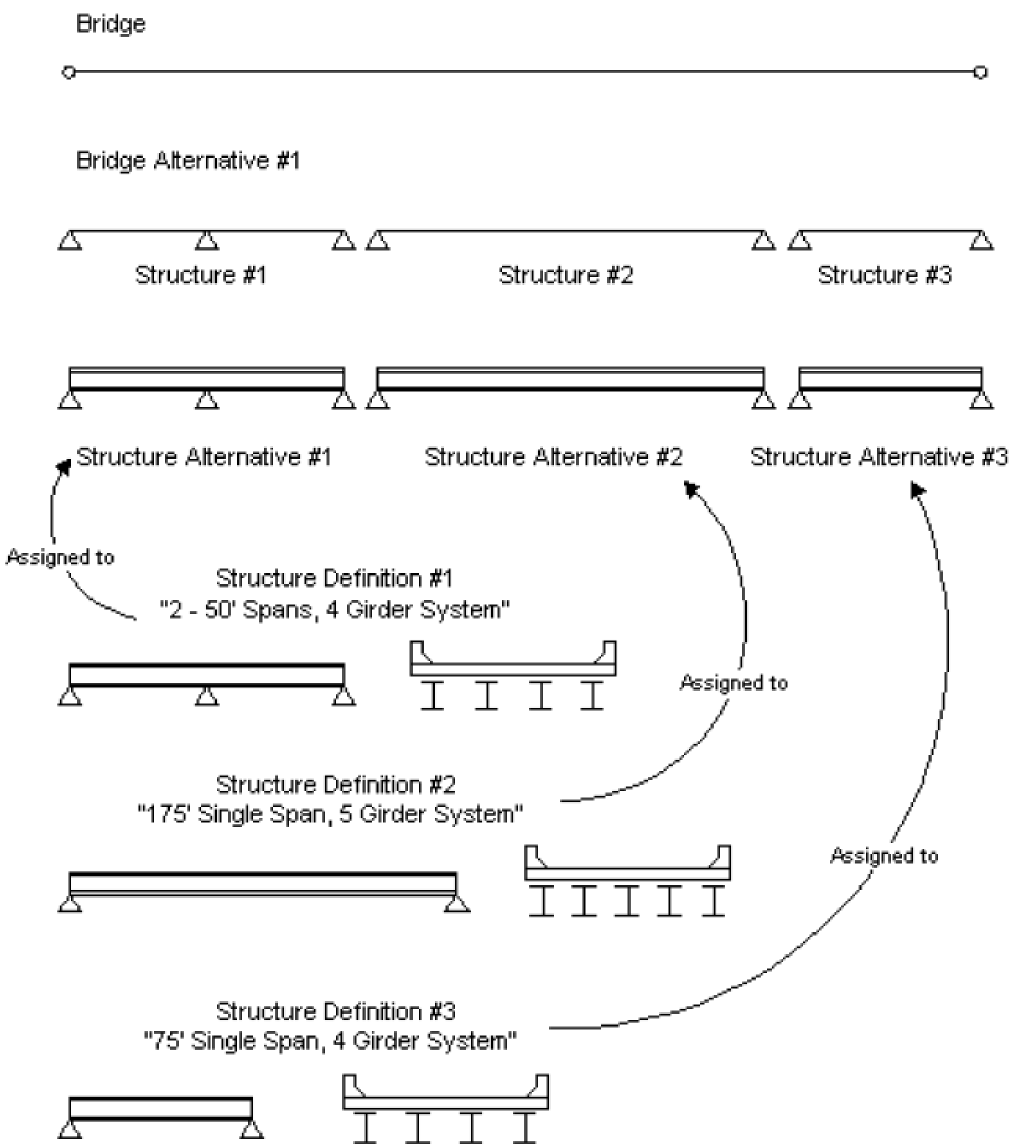
A **member alternative** is a configuration of materials and dimensions making up the physical definition of a member. For the same member, for example, one member alternative may be a transversely stiffened steel plate girder and another member alternative may be a steel plate girder with a slightly thicker web that does not require transverse stiffeners.

Alternative Examples for a Preliminary Study

The following tree shows the structure of the **Bridge Workspace** related to alternatives.

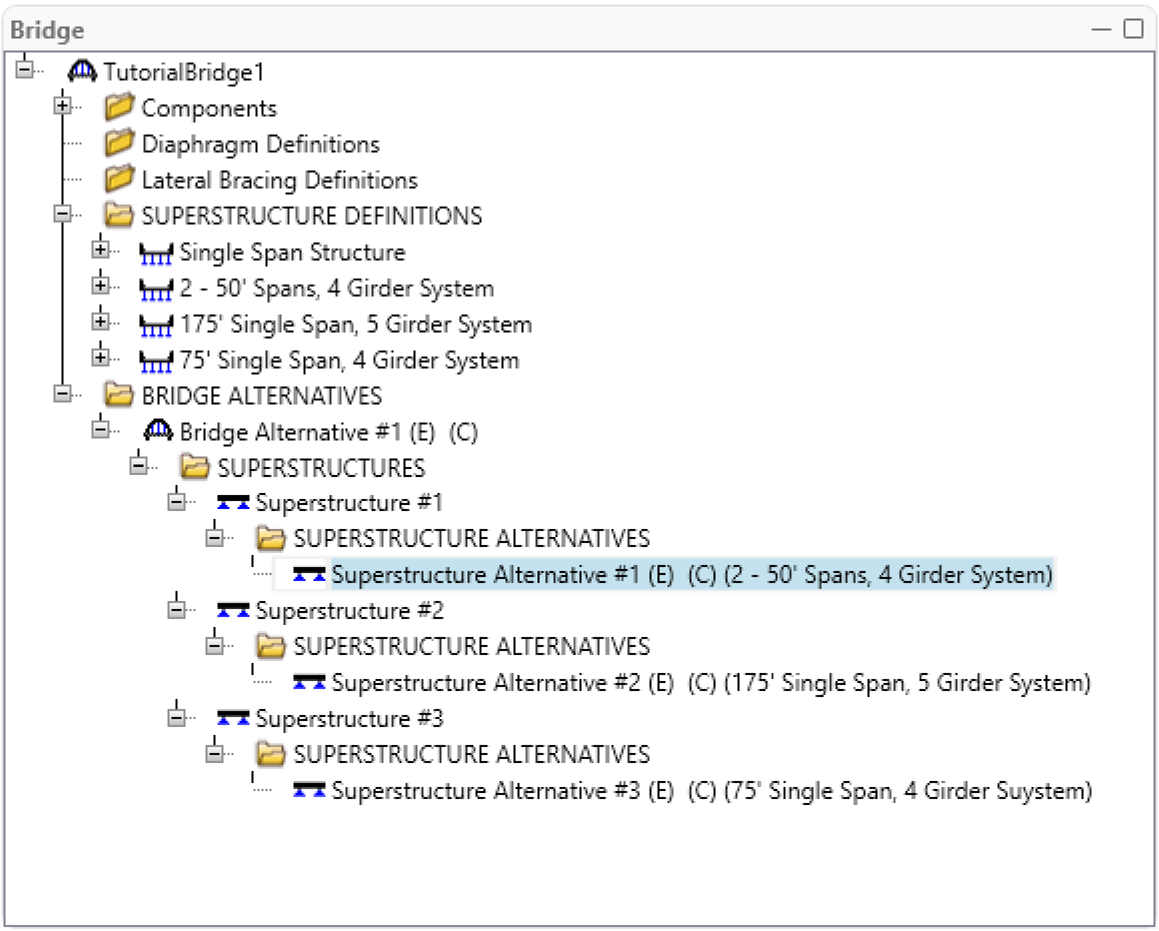


For this example, a preliminary study is being performed for a 350' bridge crossing. The following bridge alternatives are being considered.

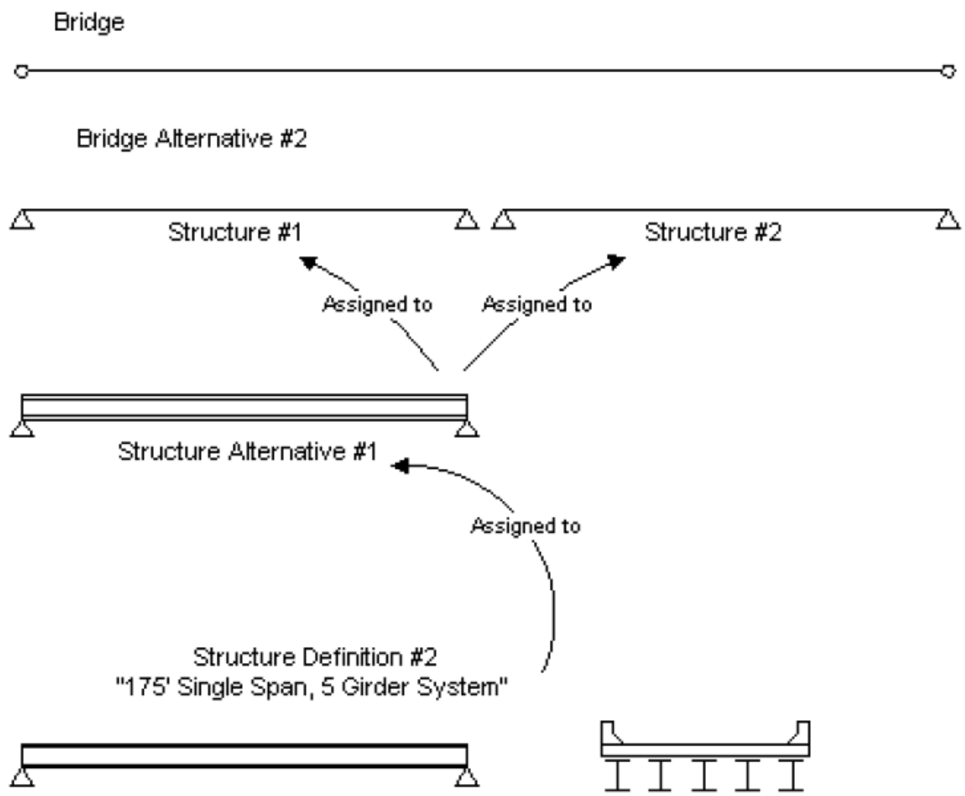


Bridge Alternative #1 consists of three structures. Structure #1 is a 2 span structure. Structure #2 and Structure #3 are each single span structures. Structure Definition #1 is a 2 span, 4 girder system. Structure Definition #1 is assigned to Structure Alternative #1 which itself is assigned to Structure #1.
Structure Definition #2 is a single span, 5 girder system. Structure Definition #2 is assigned to Structure Alternative #2 which itself is assigned to Structure #2.
Structure Definition #3 is a single span, 4 girder system. Structure Definition #3 is assigned to Structure Alternative #3 which itself is assigned to Structure #3.

The following **Bridge Workspace** results from these assignments:

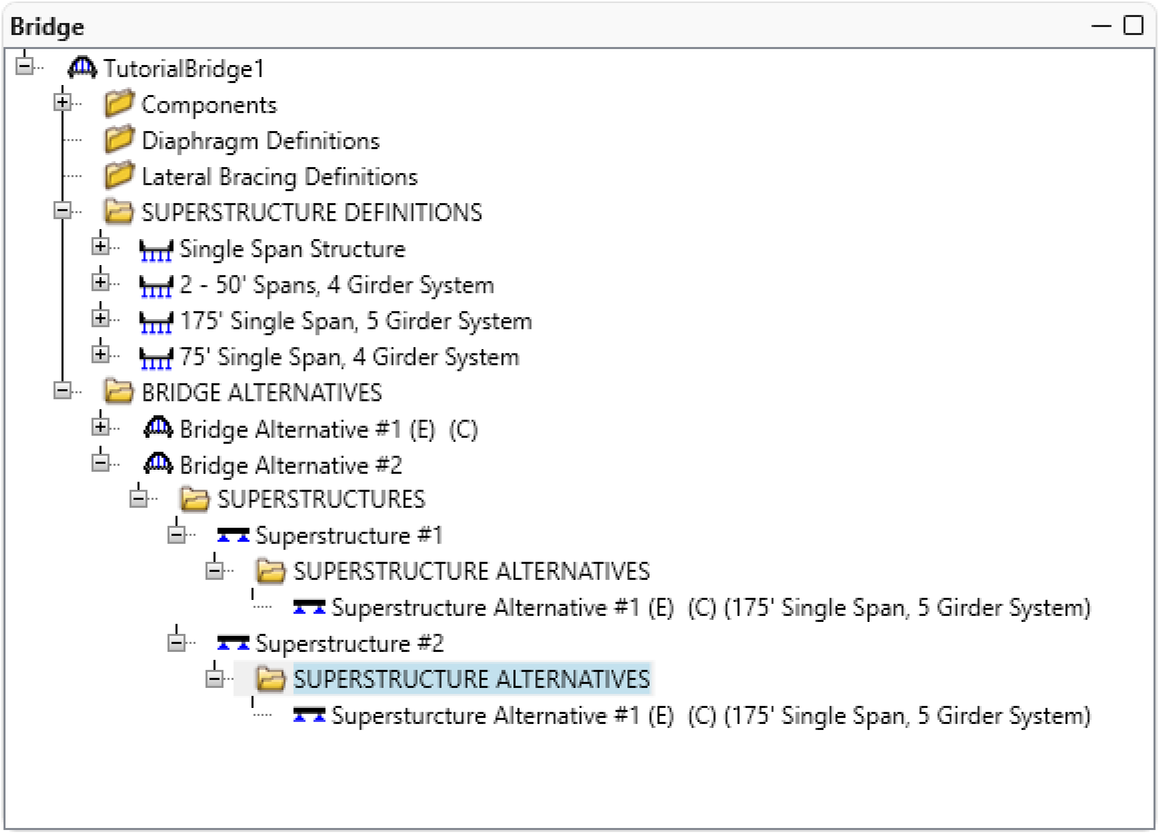


Bridge Alternative #2 is as follows:



Bridge Alternative #2 consists of two structures. Structure #1 and Structure #2 are both single span structures. Structure Definition #2 is a single span, 5 girder system which was defined earlier. Structure Definition #2 is assigned to Structure Alternative #1 which itself is assigned to both Structure #1 and Structure #2.

The **Bridge Workspace** is now as follows:



Member alternatives can now be defined for Member G2 in Structure Definition #1.