

*AASHTOWare BrDR 6.8*

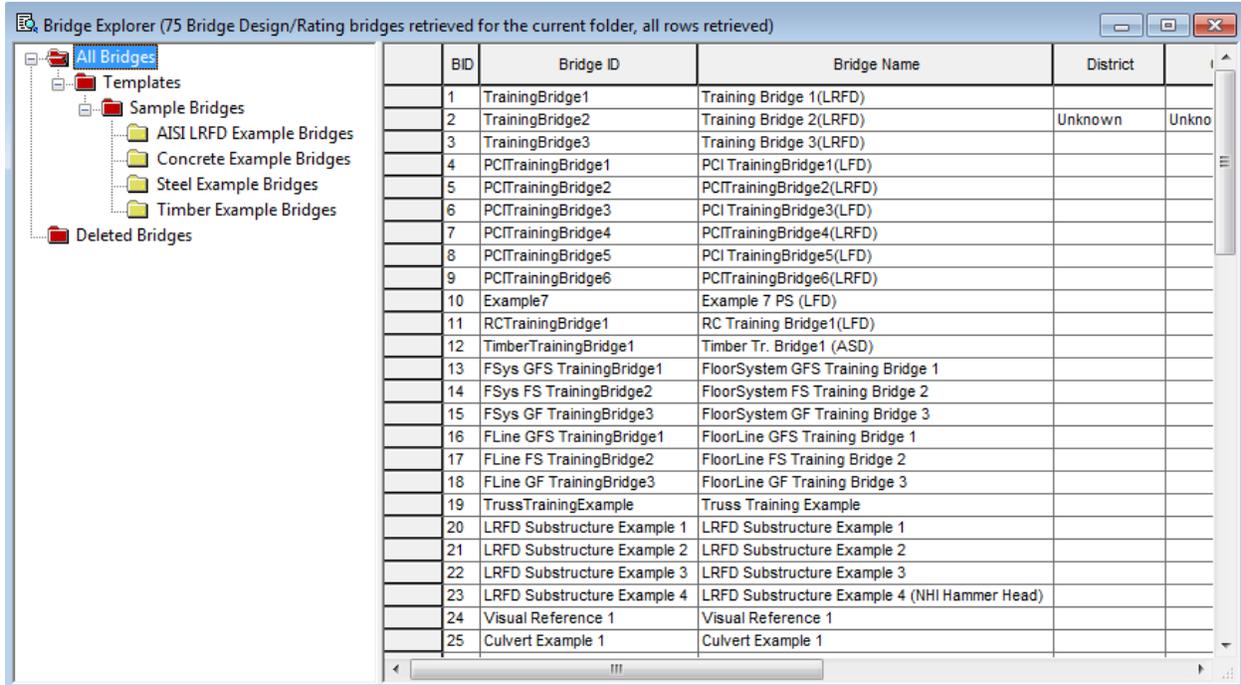
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*Getting Started Tutorial*

*BrD/BrR 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 BrD/BrR 6.8.



The All Bridges folder contains all of 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 you specify when you create the folder. 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.

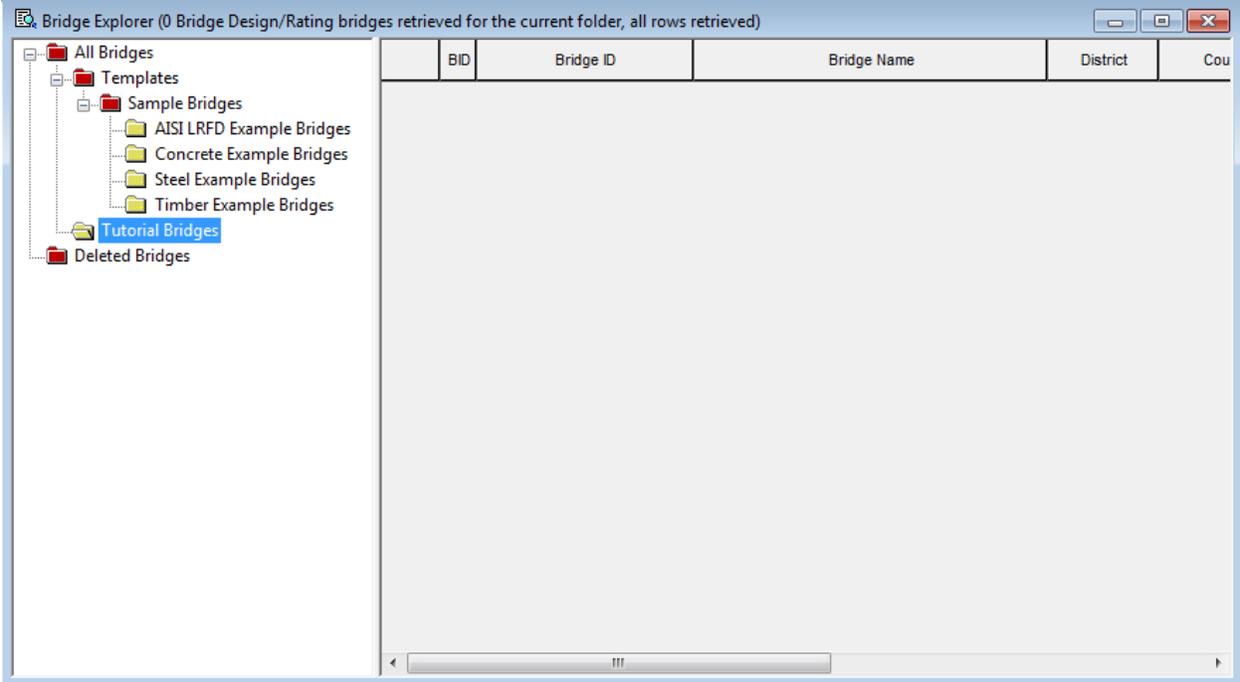
Use the following procedure to create a new folder using the list option.

Select **File | New | New Folder** from the menu. The following window appears.

The screenshot shows a 'New Folder Properties' dialog box. At the top, the title is 'New Folder Properties'. Below the title bar, there are several sections:

- Folder Name:** A text box containing 'Tutorial Bridges'.
- Save Option:** Two radio buttons, 'List' (selected) and 'Filter'.
- Folder Ownership:** Two radio buttons, 'Public' (selected) and 'Private'. Below them, it says 'Owner: (Public Folder)'.
- Description:** A text box with a vertical scrollbar, currently empty.
- Search Criteria:** A tabbed interface with tabs for 'Location Text', 'Location List', 'Attribute Text', 'Attribute List', 'Custom Agency Fields', and 'Advanced'. The 'Location Text' tab is active, showing:
  - Location:** A dropdown menu set to 'Starts With' and an empty text box.
  - Route:** A dropdown menu set to 'Starts With' and an empty text box.
  - mi Post between:** Two empty text boxes separated by the word 'and'.
- Buttons:** A vertical stack of buttons on the right side: 'Find Now', 'Stop', 'New Search', 'Help', 'Save Folder', 'New Folder', and 'Close'.

- Type the name of the new folder in the Folder Name text box. We have used the name “Tutorial Bridges” for our new folder.
- Select the Save Option as “List”.
- Select Folder Ownership as “Public”.
- Select Save Folder to create the folder.



We now have an empty folder named "Tutorial Bridges" in the Bridge Explorer tree.

## Creating a New Bridge

Now we will add a new bridge to the folder we just created.

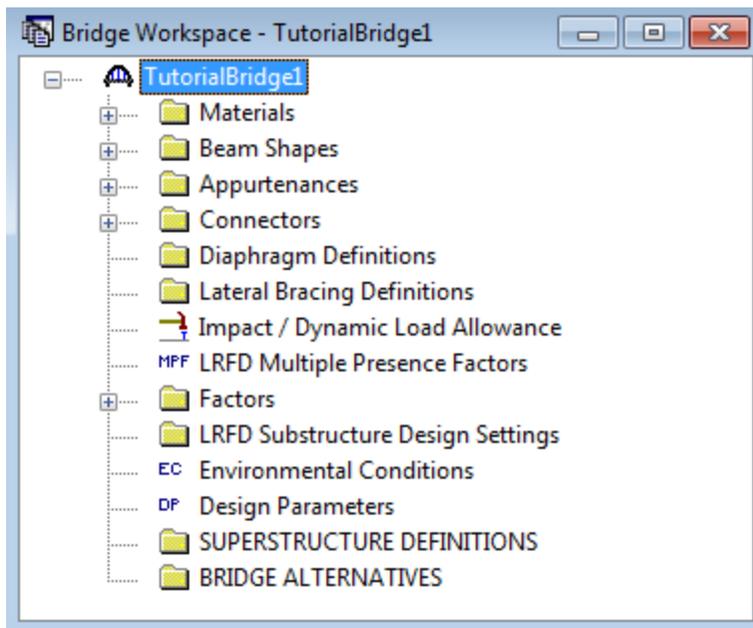
While the “Tutorial Bridges” folder is selected in the Bridge Explorer tree, select **File | New | New Bridge** from the menu. The following window will appear.

The screenshot shows a 'New Bridge' dialog box with the following fields and options:

- Bridge ID: TrainingBridge1
- NBI Structure ID (8): TrainingBridge1
- Template
- Superstructures
- Bridge Completely Defined
- Culverts
- Tabbed interface with 'Description' selected.
- Name: Tutorial Bridge 1
- Year Built: [Empty field]
- Description: Example bridge entered as part of the tutorial
- Location: [Empty field]
- Length: [Empty field] ft
- Facility Carried (7): [Empty field]
- Route Number: -1
- Feat. Intersected (6): [Empty field]
- Mi. Post: [Empty field]
- Default Units: US Customary
- AASHTOWare Association... [Button]
- BrR  BrD  BrM
- OK [Button] Apply [Button] Cancel [Button]

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

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

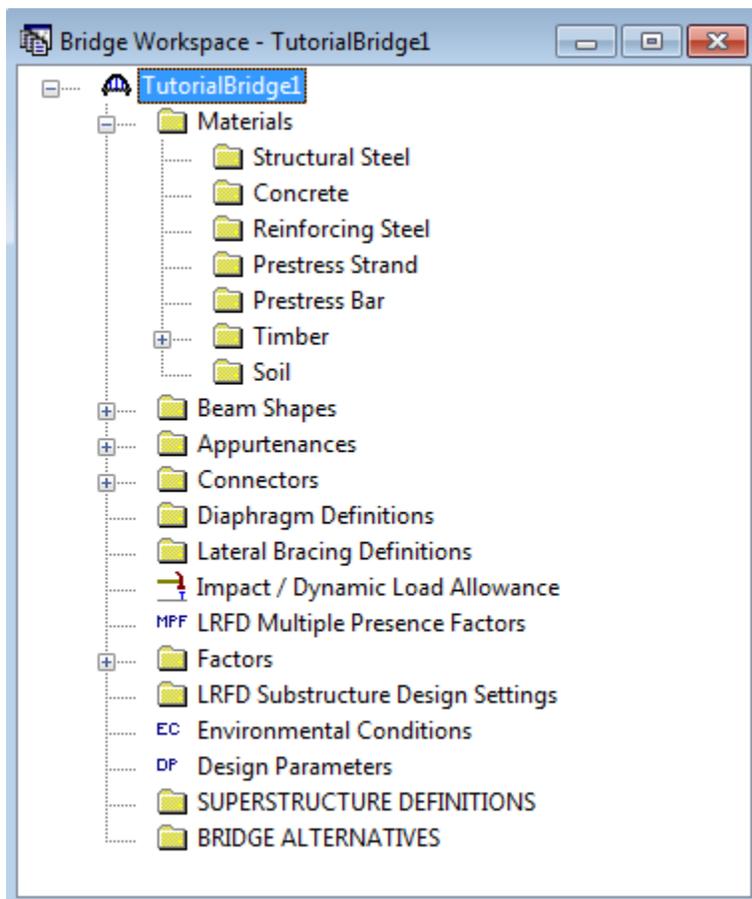


The tree is organized according to the definition of a bridge with data shared by many of the bridge components shown in the upper part of the tree. A bridge can be described by working from top to bottom within the tree.

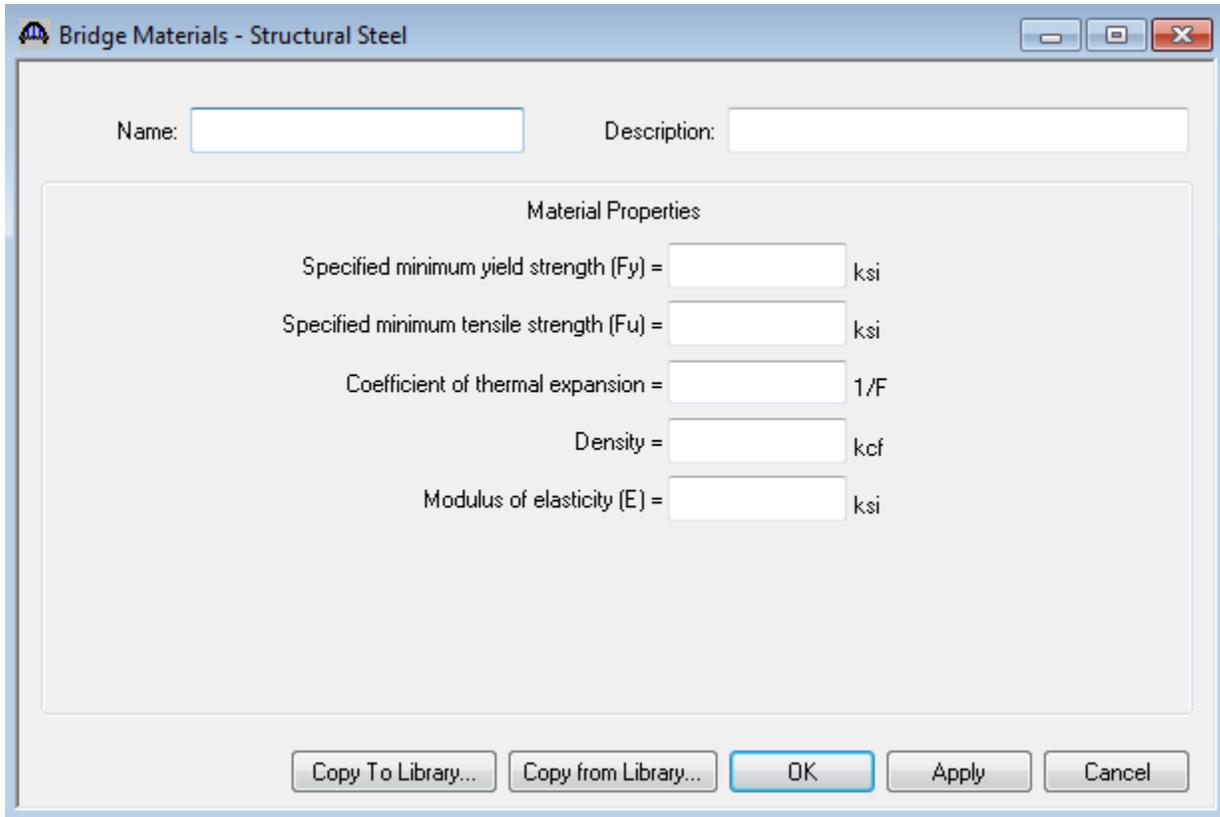
## Enter Bridge Materials

Now we will enter materials to be used by members of the bridge.

Click on the  to expand the tree for Materials. The tree with the expanded Materials branch is shown below.



To add a new structural steel material, click on Structural Steel in the tree and select **File | New** from the menu or right mouse click on Structural Steel and select **New** or double click on Structural Steel in the tree. Any of these three methods can be used to open windows in the tree. The window shown below will open.



Bridge Materials - Structural Steel

Name:  Description:

Material Properties

Specified minimum yield strength (Fy) =  ksi

Specified minimum tensile strength (Fu) =  ksi

Coefficient of thermal expansion =  1/F

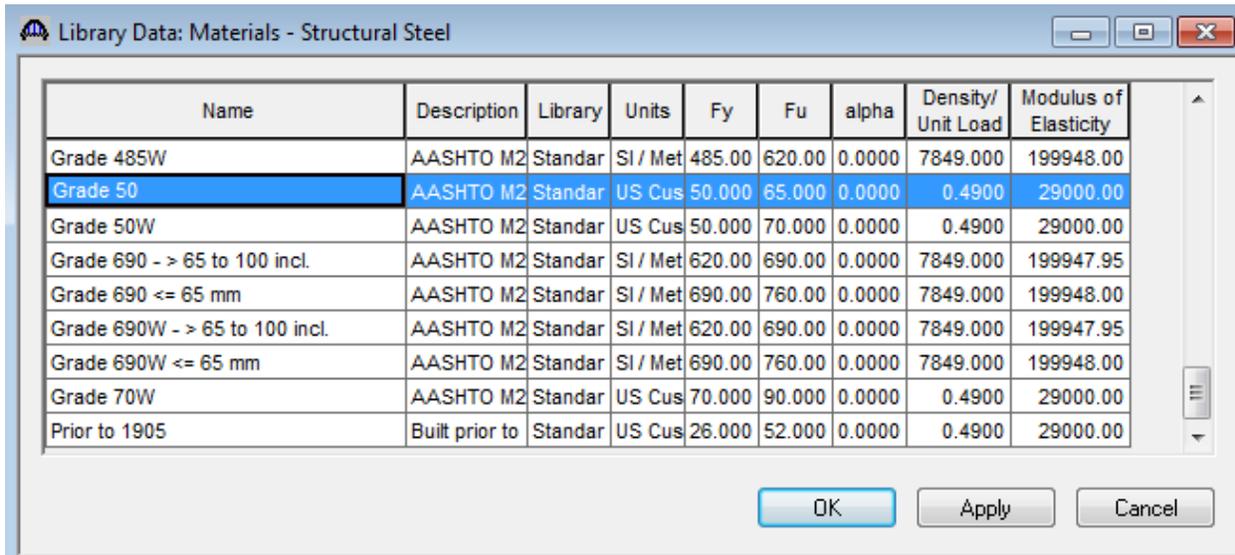
Density =  kcf

Modulus of elasticity (E) =  ksi

Copy To Library... Copy from Library... OK Apply Cancel

The BrD/BrR Materials Library contains standard materials and their material properties to minimize the amount of data that you have to enter.

To select a Structural Steel Material from the BrD/BrR Library, click the **Copy from Library** button. The following Library Data window will appear.

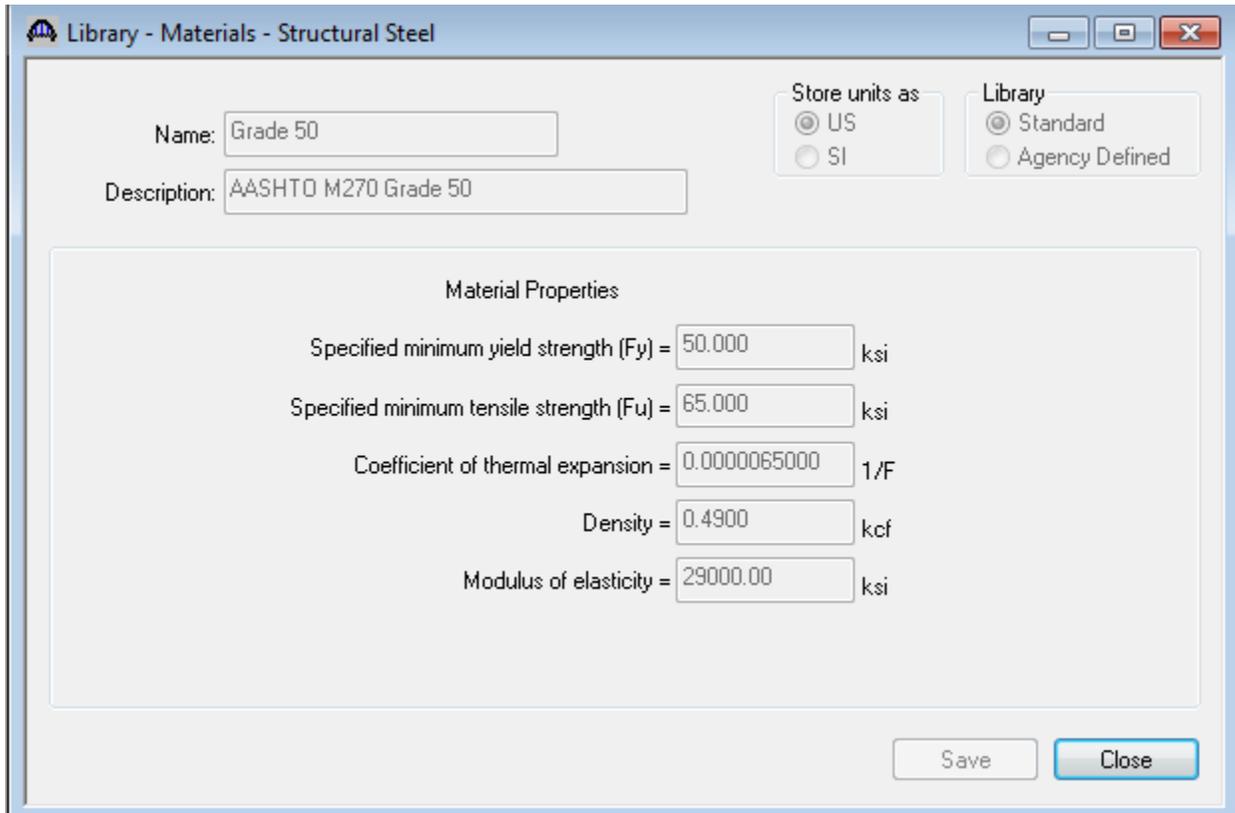


Library Data: Materials - Structural Steel

Name	Description	Library	Units	Fy	Fu	alpha	Density/ Unit Load	Modulus of Elasticity
Grade 485W	AASHTO M2	Standar	SI / Met	485.00	620.00	0.0000	7849.000	199948.00
Grade 50	AASHTO M2	Standar	US Cus	50.000	65.000	0.0000	0.4900	29000.00
Grade 50W	AASHTO M2	Standar	US Cus	50.000	70.000	0.0000	0.4900	29000.00
Grade 690 - > 65 to 100 incl.	AASHTO M2	Standar	SI / Met	620.00	690.00	0.0000	7849.000	199947.95
Grade 690 <= 65 mm	AASHTO M2	Standar	SI / Met	690.00	760.00	0.0000	7849.000	199948.00
Grade 690W - > 65 to 100 incl.	AASHTO M2	Standar	SI / Met	620.00	690.00	0.0000	7849.000	199947.95
Grade 690W <= 65 mm	AASHTO M2	Standar	SI / Met	690.00	760.00	0.0000	7849.000	199948.00
Grade 70W	AASHTO M2	Standar	US Cus	70.000	90.000	0.0000	0.4900	29000.00
Prior to 1905	Built prior to	Standar	US Cus	26.000	52.000	0.0000	0.4900	29000.00

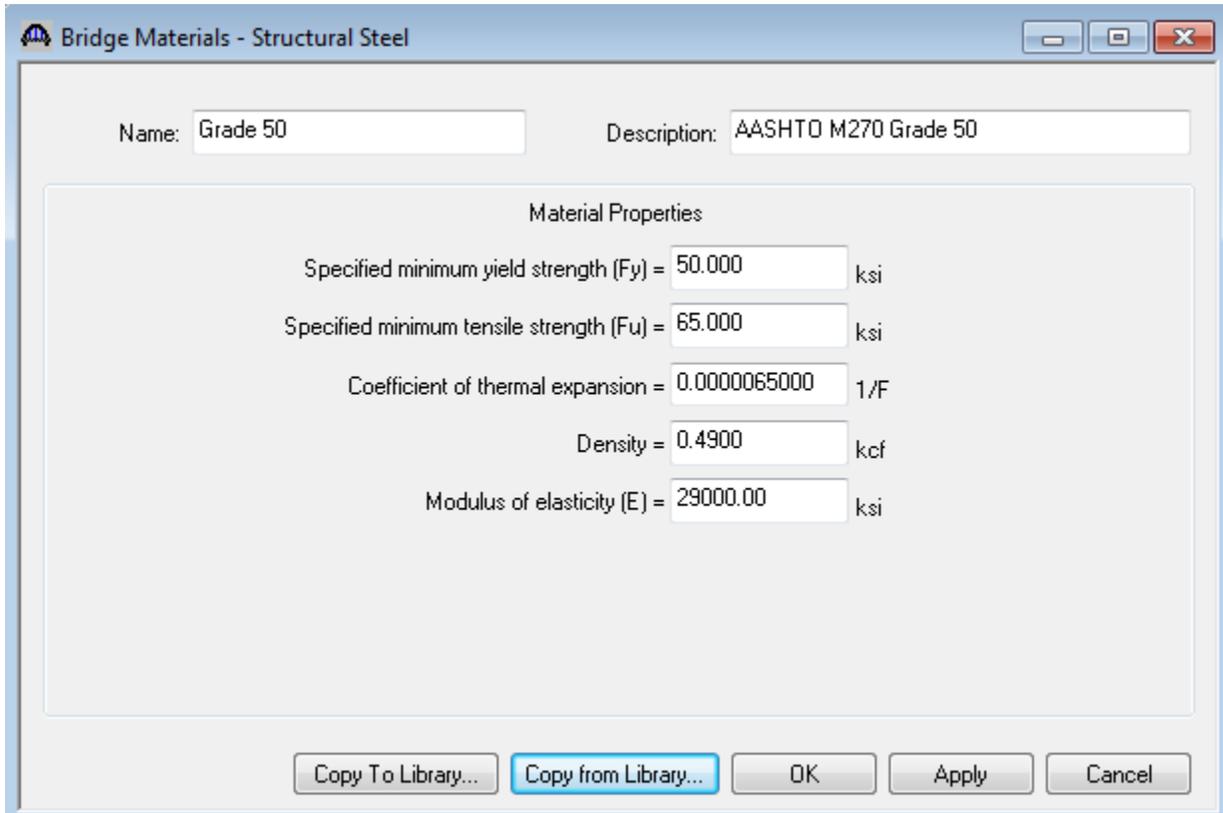
OK Apply Cancel

To view the properties for a material in the library, double click on the material in the list. The following read-only Library window will appear if you double click on “Grade 50”. All of the edit controls in the window except the **Close** button are grayed out signifying that you cannot change any of the data in this window. You must open the window from the Library Explorer to be able to change any of the data.



Select the **Close** button to close the Library – Materials – Structural Steel window.

Select the **OK** button in the Library Data window to copy the Grade 50 material properties to the Bridge Materials – Structural Steel window as shown below.



Select the **OK** button to close this window and save the data to memory. The Grade 50 structural steel material will now be available when we define structure components that are associated with a structural steel material, such as girders and stiffeners.

The same technique can be used to enter a concrete and reinforcing steel material. The concrete and reinforcing steel material windows are shown below.

Bridge Materials - Concrete

Name:  Description:

Compressive strength at 28 days (f'c) =  ksi

Initial compressive strength (f'ci) =  ksi

Coefficient of thermal expansion =  1/F

Density (for dead loads) =  kcf

Density (for modulus of elasticity) =  kcf

Std Modulus of elasticity (Ec) =  ksi

LRFD Modulus of elasticity (Ec) =  ksi

Std Initial modulus of elasticity =  ksi

LRFD Initial modulus of elasticity =  ksi

Poisson's ratio =

Composition of concrete =  ▼

Modulus of rupture =  ksi

Shear factor =

Splitting tensile strength (fct) =  ksi

Bridge Materials - Reinforcing Steel

Name:  Description:

Material Properties

Specified yield strength ( $F_y$ ) =  ksi

Modulus of elasticity ( $E_s$ ) =  ksi

*Ultimate strength ( $F_u$ )* =  ksi

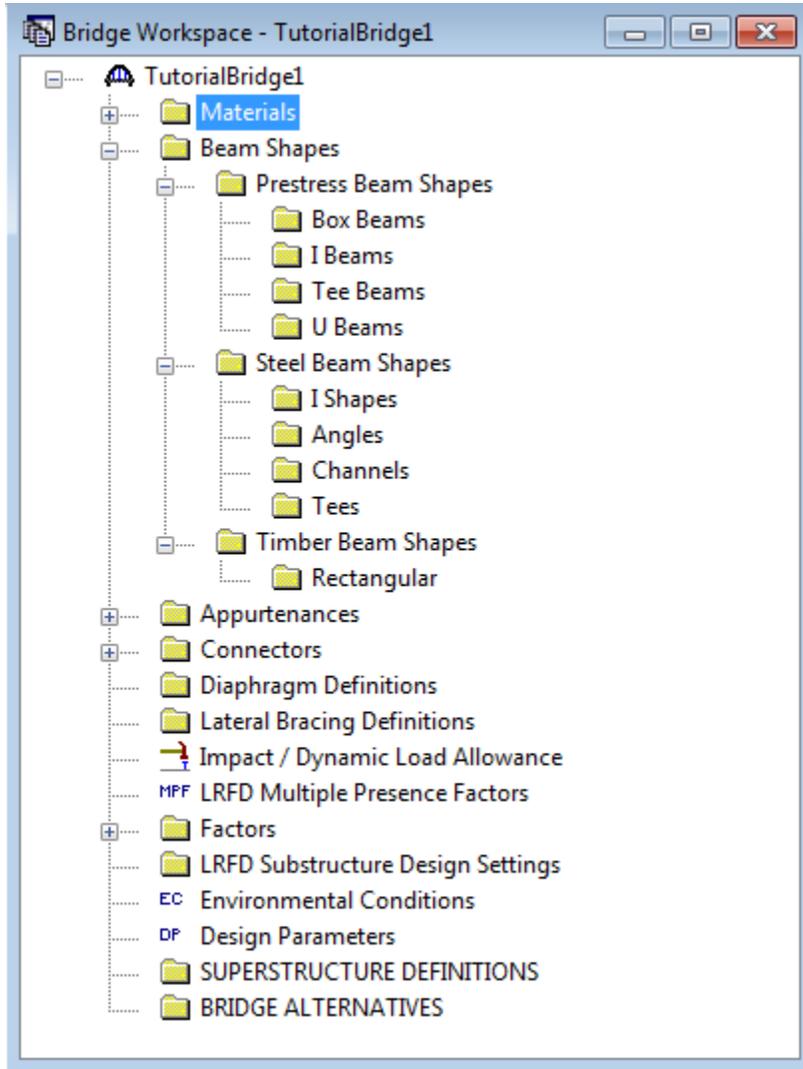
Type

Plain  
 Epoxy  
 Galvanized  
 Other

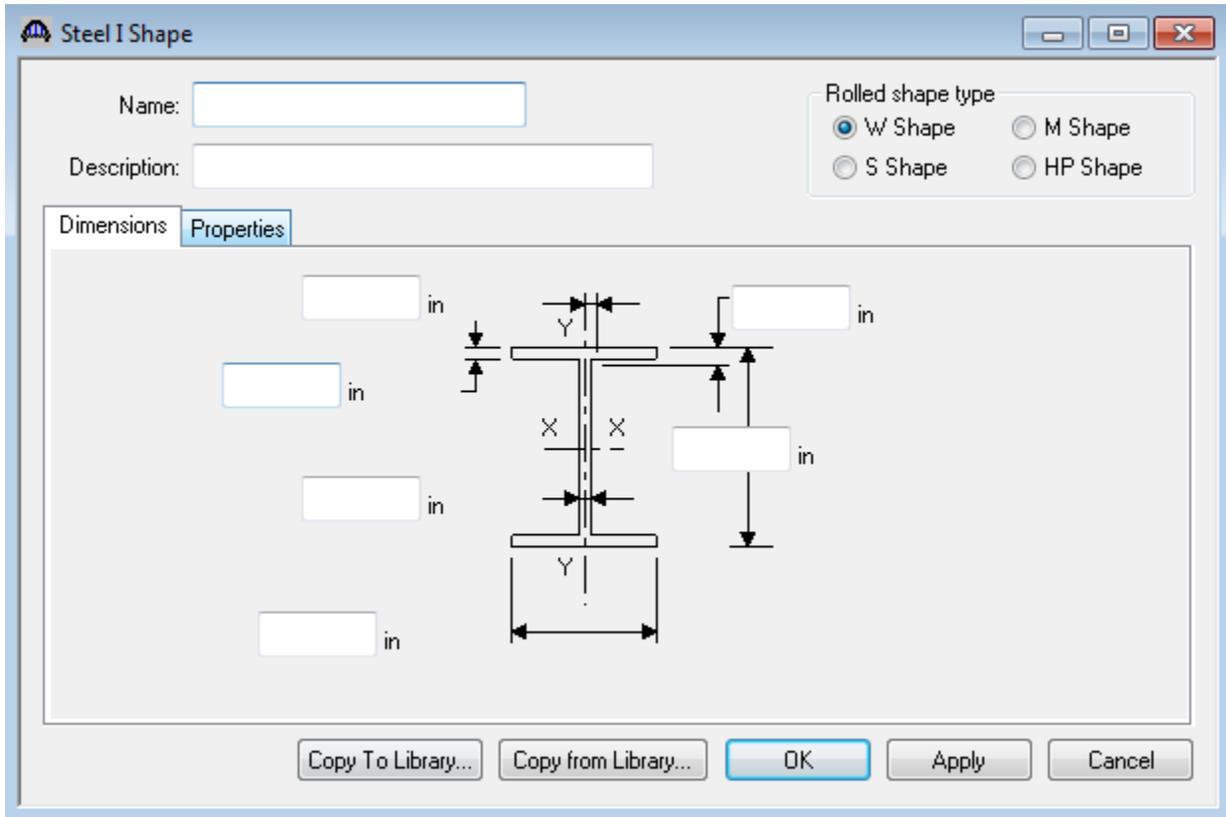
## Enter Beam Shapes

Steel and prestressed concrete beam shapes can be entered at the bridge level and then used throughout the structures.

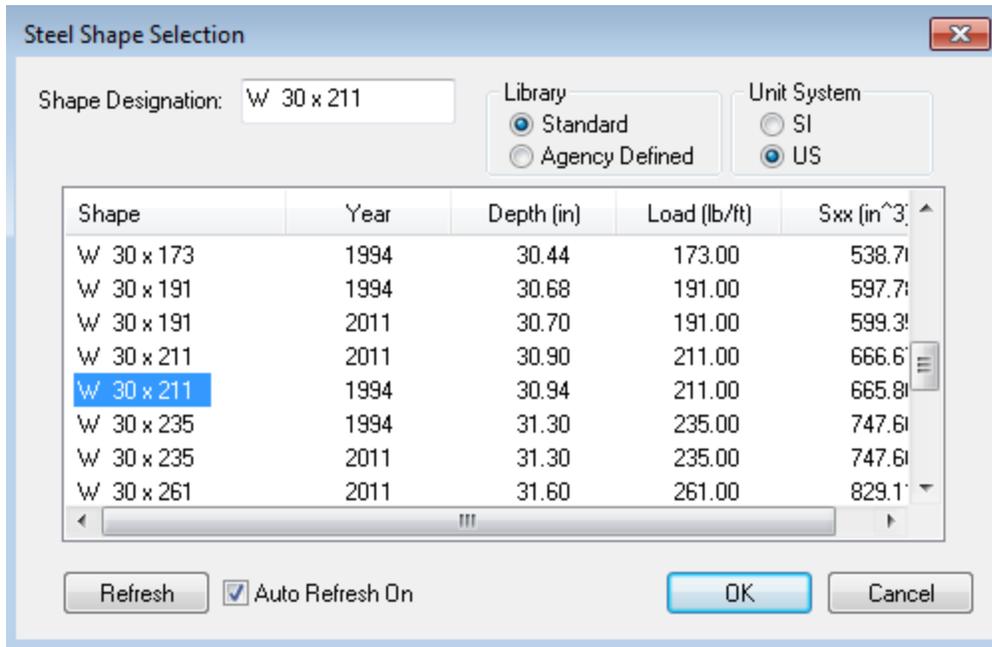
Click on the  to expand the tree for Beam shapes. Expand the tree again to show the beam shapes under Prestress, Steel, and Timber.



To add a new steel I beam shape, click on I Shapes in the tree and select **File | New** from the menu or right mouse click on I Shapes and select **New** or double click on I Shapes in the tree. The window shown below will open.

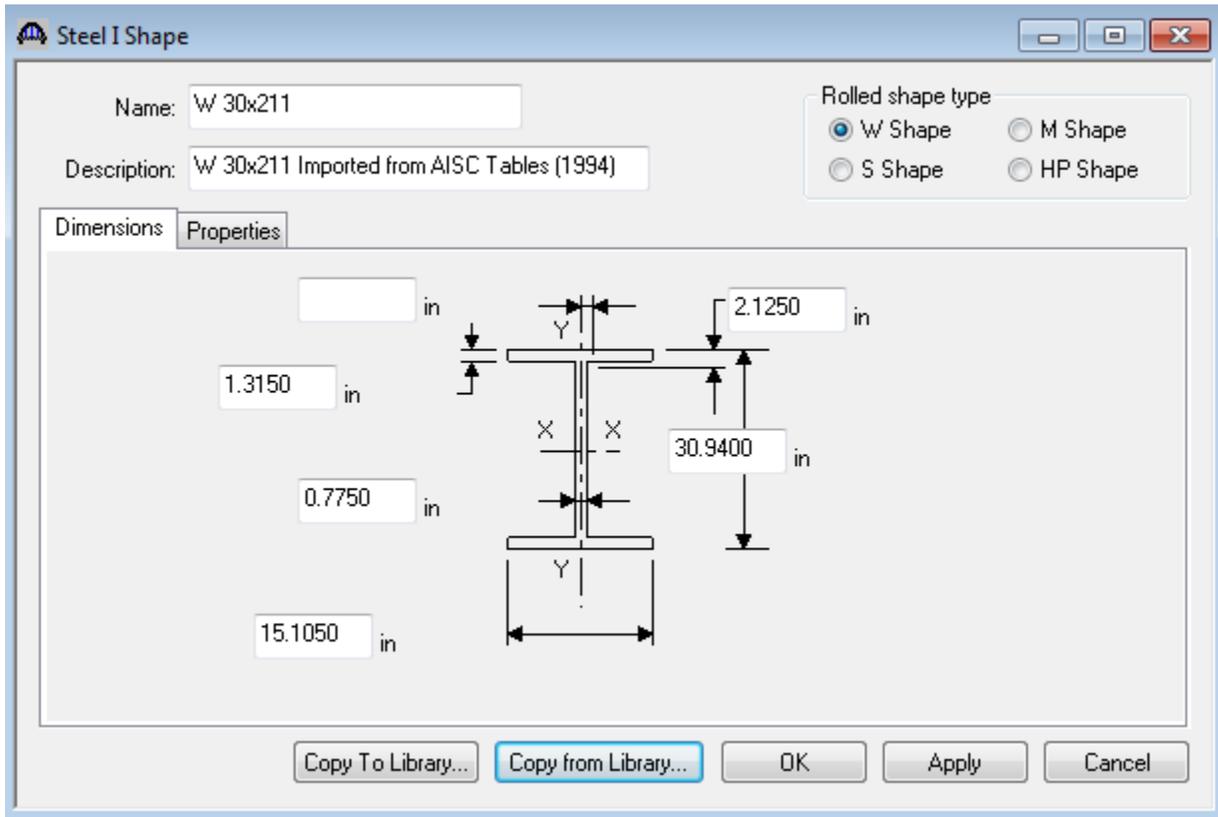


Select the **Copy from Library** button to copy a standard steel I shape from the Library to the Bridge. The Steel Shape Selection window shown below will appear.

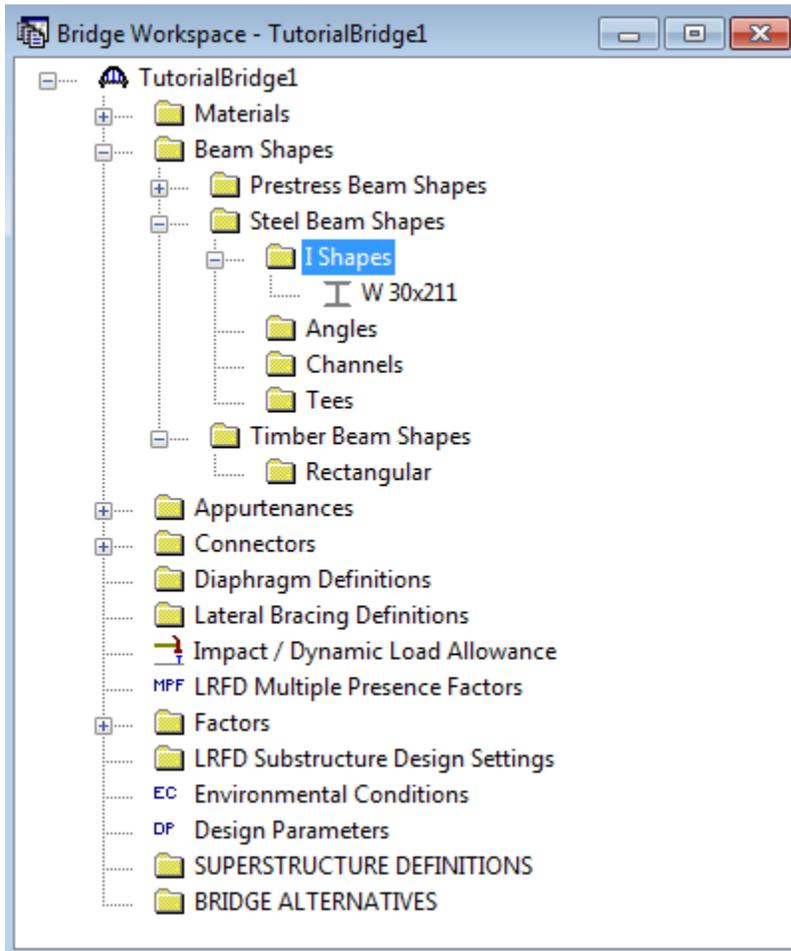


This window lists the steel shapes stored in the Library. To help you narrow your search of shapes in the Library, as you type in a Shape Designation, such as “W30”, the shapes in the list will be filtered so that you are able to view only the shapes that begin with the letters “W30”. Clicking on a column header in the list will sort the shapes in the list based on that column. For example, if you are searching for a shape with a section modulus of at least 500 in<sup>3</sup>, click on the Sxx heading to view the shapes sorted in order from the largest Sxx to smallest Sxx value.

Select **OK** to close the window and save the data to memory. The Bridge Workspace now looks as follows.



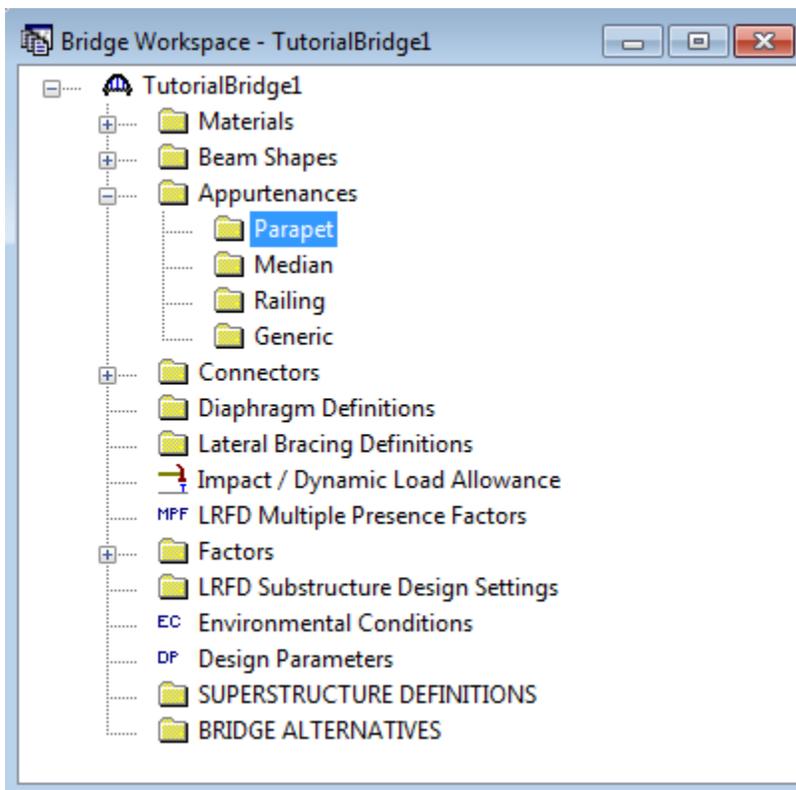
Select **OK** to close the window and save the data to memory. The Bridge Workspace now looks as follows.



## Enter Bridge Appurtenances

Appurtenances such as parapets, medians, and railings can be entered for the bridge. These items are useful when you are going to input the total cross section for the structure including all of the beams and the total out-to-out deck width. The appurtenances have dimensions and loads associated with them. You can 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 you are going to enter only a single girder for the structure, the Bridge Appurtenances are not needed.

Click on the  to expand the tree for Appurtenances.



Use the same technique to copy a parapet from the Library that we used to copy a material from the Library. Click on Parapet in the tree and select **File | New** from the menu or right mouse click on Parapet and select **New** or double click on Parapet in the tree. Click the **Copy from Library** button and select the Jersey Barrier from the Library. Select OK to close the Bridge Appurtenances – Parapet window and save the data to memory.

Bridge Appurtenances - Parapet

Name: Jersey Barrier  
Description: Standard New Jersey Barrier  
All dimensions are in inches

Additional Load =  kip/ft

2.0000

12.0000 7.0000

Reference Line

0.0000

19.0000

10.0000

3.0000

Back Front

Roadway Surface

Parapet unit load = 0.1500 kcf

Calculated Properties

Net centroid (from reference line) = 7.880 in

Total load = 0.505 kip/ft

Copy from Library... OK Apply Cancel

## Bridge Impact / Dynamic Load Allowance

Impact and Dynamic Load Allowance can be specified at three levels, Bridge, Structure Definition, and Member Alternative levels. Impact or dynamic allowance entered at the Bridge level will be used for all Structures and Member Alternatives unless a different impact is entered at the Structure or Member Alternative level. 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 using any of the three previously mentioned techniques to open a window in the tree. The following window will appear. The word “Bridge” will appear in the title to let you know that you are defining impact at the Bridge level.

Bridge Impact / Dynamic Load Allowance

Standard Impact Factor  
For structural components where impact is to be included per AASHTO 3.8.1, choose the impact factor to be used:

Standard AASHTO impact  $I = \frac{50}{L + 125}$

Modified impact =  times AASHTO impact

Constant impact override =  %

LRFD Dynamic Load Allowance

Fatigue and fracture limit states:  %

All other limit states:  %

OK Apply Cancel

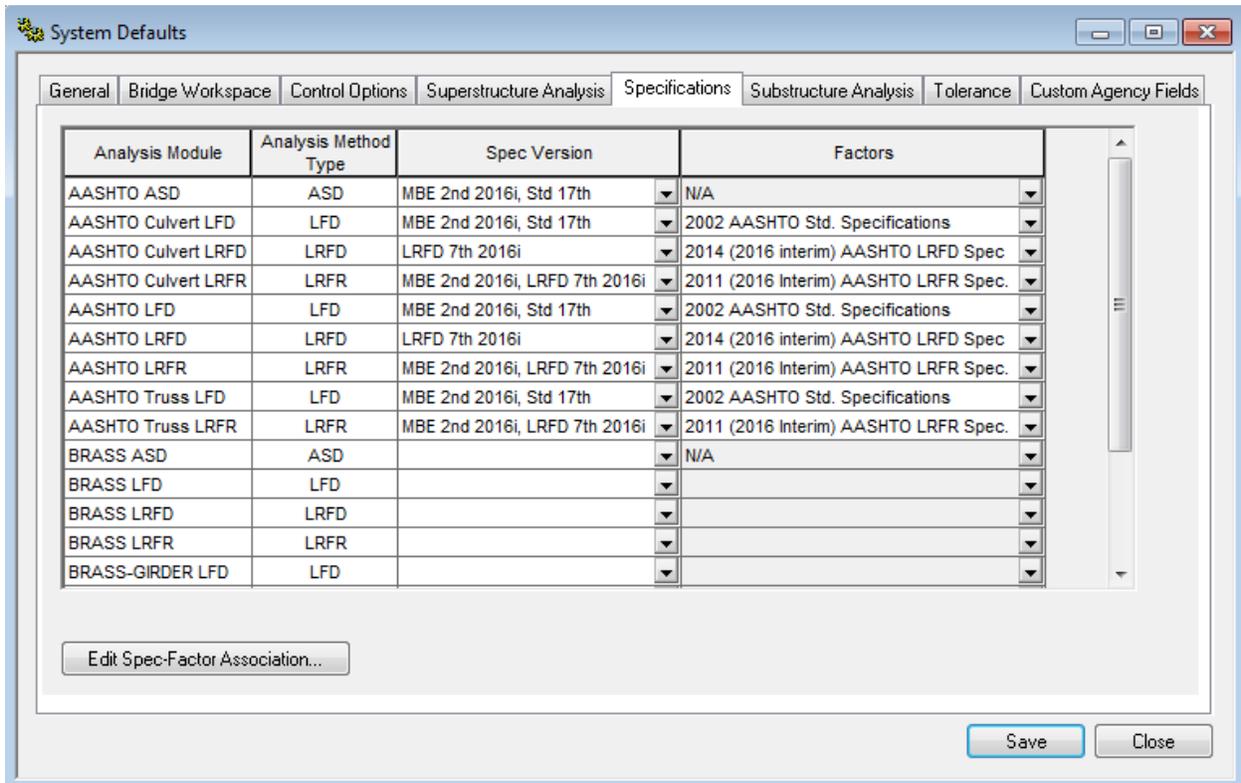
The default values shown are acceptable for our bridge, so click the **OK** button to close the window and save the data to memory. These values will be used for all Member Alternatives in this bridge unless we override these values at the Structure Definition or Member Alternative level.

## Factors

Both LFD and LRFD Factors can be entered at the Bridge level 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. We may wish to use more limiting load factors for the main span structure than those found in the standard AASHTO specifications. We can create a new set of LFD or LRFD Factors at the Bridge level and then apply those to the main span structure definition while using the standard AASHTO Factors for the approach span structures.

To open the System Defaults window, select Window | Configuration Browser from the menu or select the Configuration Browser button, , from the Explorer Toolbar.

Select the Specifications tab and the following window appears.

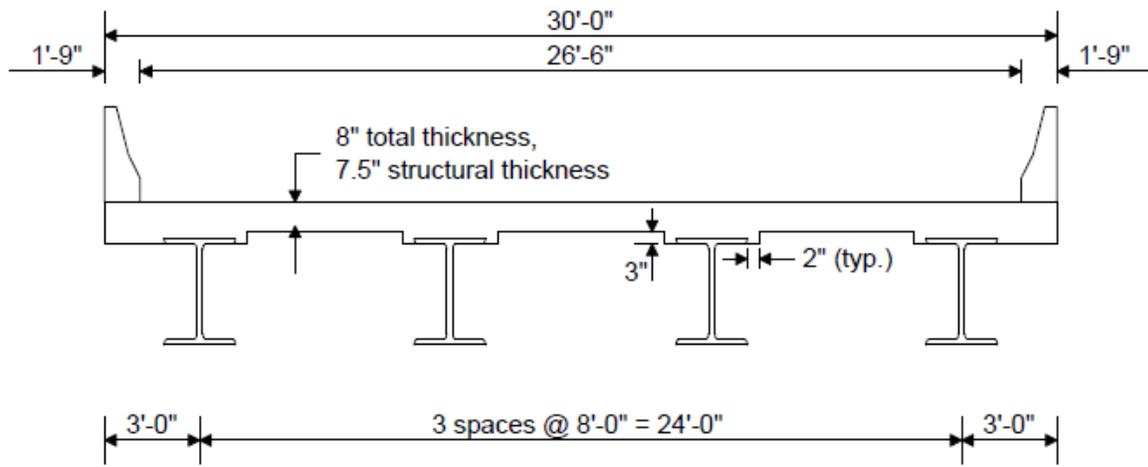


The default specification version and factors are shown above. They are okay for our bridge so we will not create any new item in the Bridge Workspace tree. Select the Close button to close this window. If we wanted to create new Factors, we would follow the same procedure we used to create the Bridge Materials or Beam Shapes.

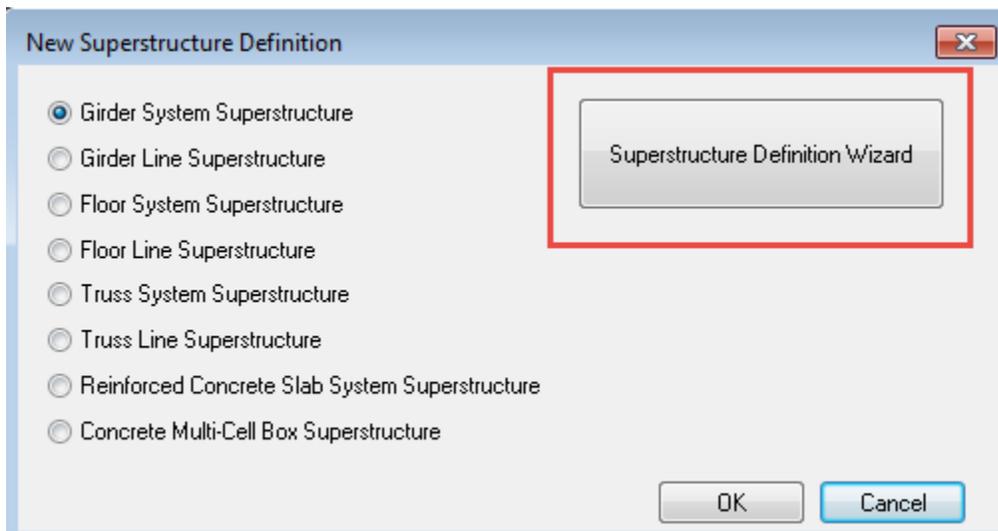
## Creating a New Structure Definition Using the Wizard

A wizard is available to help you quickly create a new structure definition. This wizard will create the structure definition including all members and member alternatives for you based on the data you enter. The wizard is primarily geared to a new design, with input for LRFD data not LFD data. If we use the wizard to create a new structure definition that we wish to analyze with LFD we would have to visit various windows to input LFD data.

We will use the wizard to create the following structure definition:



- 50'-0" single span, composite
- 15 psf stay-in-place forms
- To access the wizard, select STRUCTURE DEFINITIONS in the Bridge Workspace tree and click the Wizard button.



The following window will appear.

Superstructure definition name:

Material type:

Girder type:

Number of spans:

Skew:  Degrees

Number of girders:

Girder spacing =  ft

Left overhang =  ft

Right overhang =  ft

LRFD analysis module:

LFD analysis module:

Girder System Member Generation  
 Create each member  Link members

Superstructure Definition Type  
 Girder System  
 Girder Line

Girder Property Input Method  
 Schedule based  
 Cross-section based

Enter span lengths:

Span No.	Span Length (ft)
1	

< Back   Next >   Cancel   Help

Enter the following information into the wizard.

Superstructure Definition Wizard - Superstructure Definition

Superstructure definition name: Single Span Structure

Material type: Steel

Girder type: Rolled

Number of spans: 1

Skew: 0.0000 Degrees

Number of girders: 4

Girder spacing = 8.0000 ft

Left overhang = 3.0000 ft

Right overhang = 3.0000 ft

LRFD analysis module: AASHTO LRFD

LFD analysis module: AASHTO LFD

Girder System Member Generation

Create each member  Link members

Superstructure Definition Type

Girder System  Girder Line

Girder Property Input Method

Schedule based  Cross-section based

Enter span lengths:

Span No.	Span Length (ft)
1	50.0000

< Back Next > Cancel Help

The Structure Definition Type is selected as “Girder System” since we are going to input the entire typical section of the structure including all four girders. If we were only interested in one of the girders, we would create a Girder Line Structure Definition. The Girder Property Input Method is selected as “Schedule based” since we want to describe the components of the members individually. The wizard will create individual schedules for each member component such as the rolled shape and the concrete deck. This method gives us more flexibility if we need to modify the member components later. If we were to use the cross-section based input method, the wizard would create a cross section for us based on our 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.

The image shows a software dialog box titled "Superstructure Definition Wizard - Rolled Shape". It contains the following elements:

- A "Shape:" dropdown menu with "W 30x211" selected.
- A "Material:" dropdown menu with "Grade 50" selected.
- A "Composite" section with two radio button options:
  - Composite throughout
  - Partial composite (positive moment regions only)
- Four buttons at the bottom: "< Back", "Next >" (highlighted in blue), "Cancel", and "Help".

If we did not already have a steel shape or structural steel material defined at the bridge level, we could use the “- Copy from Library-” selection in the list boxes in this window to copy a shape or material from the Library as we did earlier.

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

Superstructure Definition Wizard - Deck

Deck Properties

Actual deck thickness = 8.0000 in

Deck concrete: Class A (US)

Structural deck thickness = 7.5000 in

Deck reinforcement: Grade 60

Effective flange width (LRFD) = 96.0000 in

Haunch Type

Haunch depth D = 3.0000 in

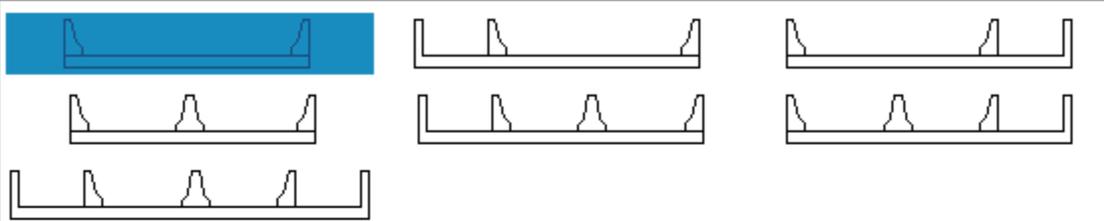
< Back   Next >   Cancel   Help

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

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

Superstructure Definition Wizard - Deck Template ✕

Select the deck template:



Appurtenances

Appurtenance	Name	Load Case	Measure To	Edge of Deck Dist. Measured From	Distance At Start (ft)	Distance At End (ft)	Front Face Orientation
Left Exterior	Jersey Barrier	DC2	Back	Left Edge	0.00	0.00	Right
Right Exterior	Jersey Barrier	DC2	Back	Right Edge	0.00	0.00	Left

Sidewalks

Sidewalk	Width (in)	Thickness (in)	Concrete Material	Load Case	Measure To	Edge of Deck Dist. Measured From	Distance At Start (ft)	Distance At End (ft)



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

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

## Examples of Alternatives Within BrD/BrR

BrD/BrR 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 we explore this capability, we should review some terminology used in BrD/BrR.

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. BrD/BrR allows you 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.

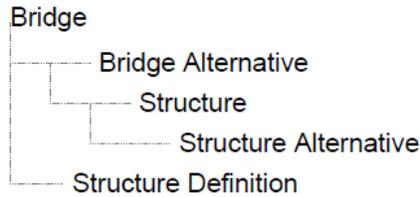
A **structure definition** describes the physical characteristics of a structure.

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.

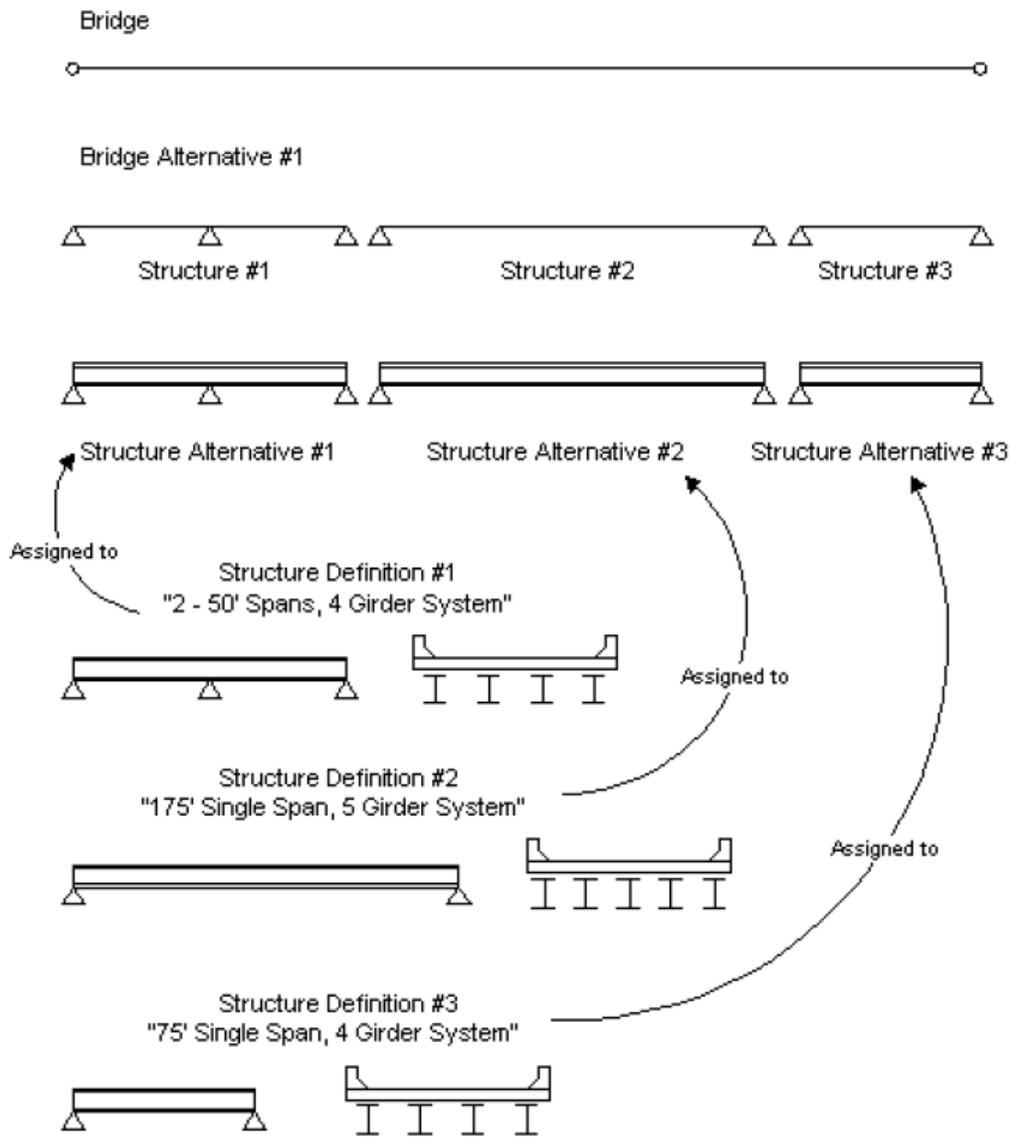
A **member alternative** is a configuration of materials and dimensions making up the physical definition of a member. For the same member, for example, one member alternative may be a transversely stiffened steel plate girder and another member alternative may be a steel plate girder with a slightly 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.

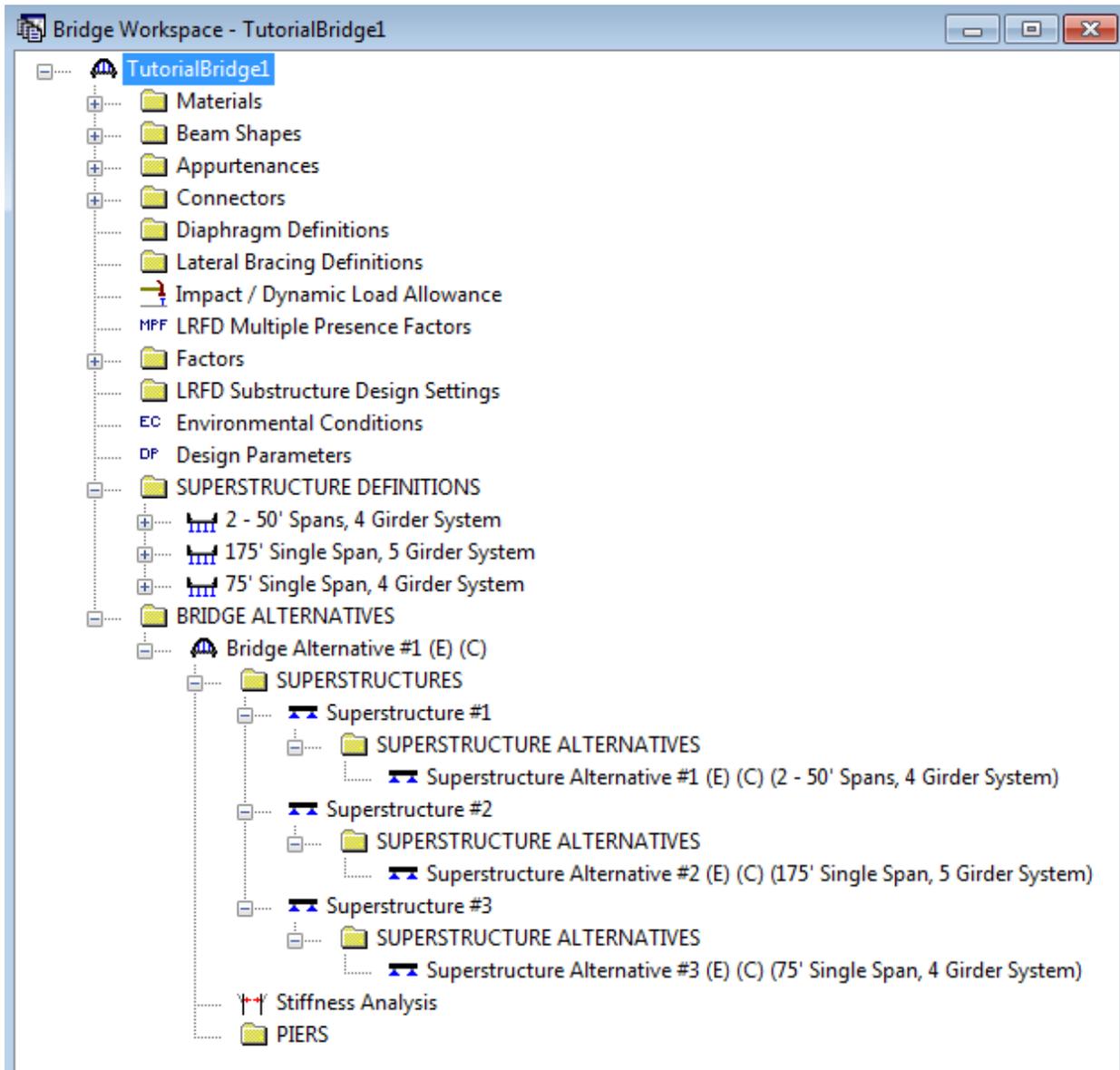


Bridge Alternative #1 consists of three structures. Structure #1 is a 2 span structure. Structure #2 and Structure #3 are each single span structures. Structure Definition #1 is a 2 span, 4 girder system. Structure Definition #1 is assigned to Structure Alternative #1 which itself is assigned to Structure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

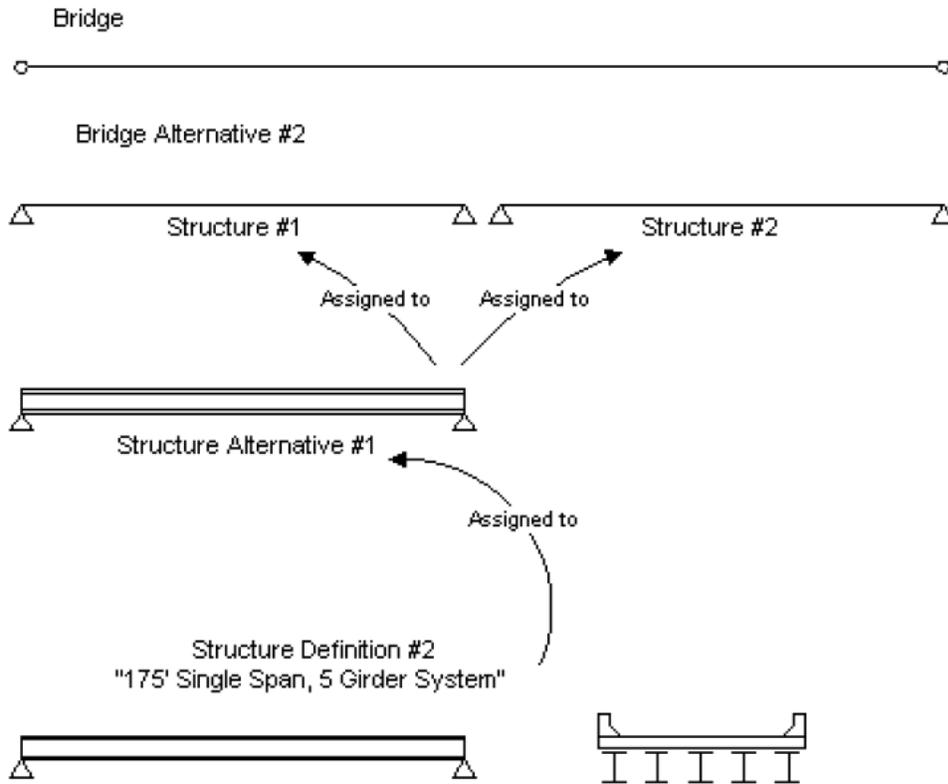
Structure Definition #2 is a single span, 5 girder system. Structure Definition #2 is assigned to Structure Alternative #2 which itself is assigned to Structure #2.

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:

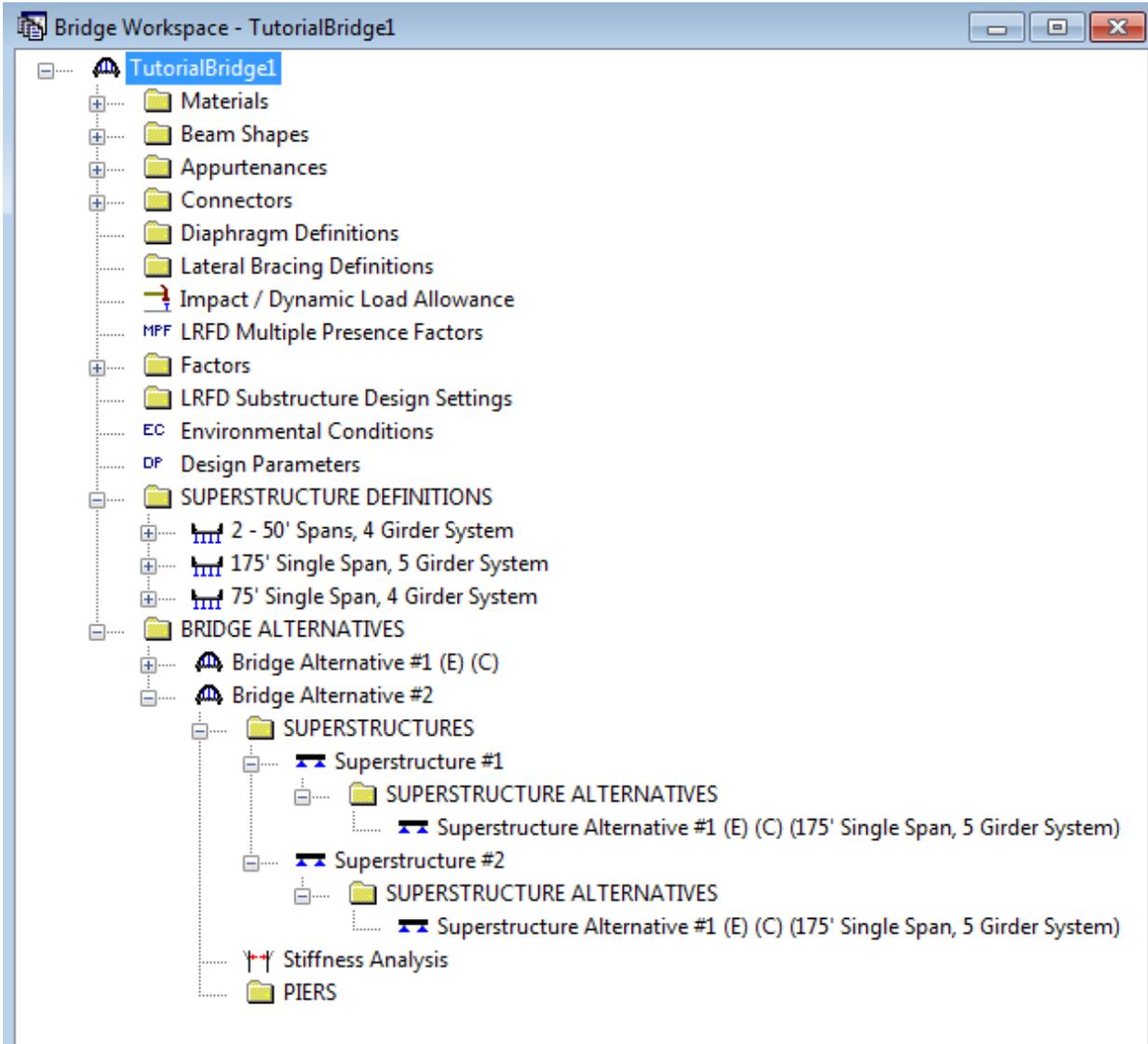


Bridge Alternative #2 is as follows:

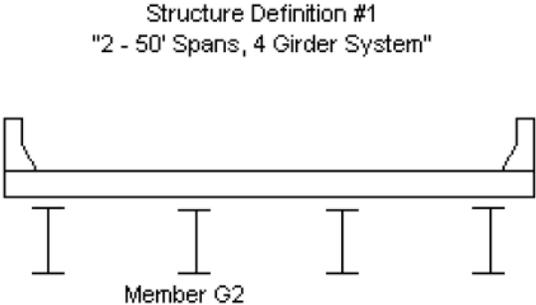


Bridge Alternative #2 consists of two structures. Structure #1 and Structure #2 are both single span structures. Structure Definition #2 is a single span, 5 girder system which was defined earlier. Structure Definition #2 is assigned to Structure Alternative #1 which itself is assigned to both Structure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

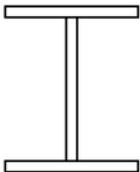
The Bridge Workspace is now as follows:



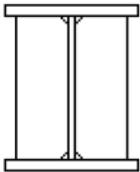
Member alternatives can now be defined for Member G2 in Structure Definition #1.



Member Alternative #1  
Unstiffened Plate Girder



Member Alternative #2  
Stiffened Plate Girder



Member Alternative #3  
Rolled Beam with Cover Plates

