

*AASHTOWare BrDR 7.5.0*

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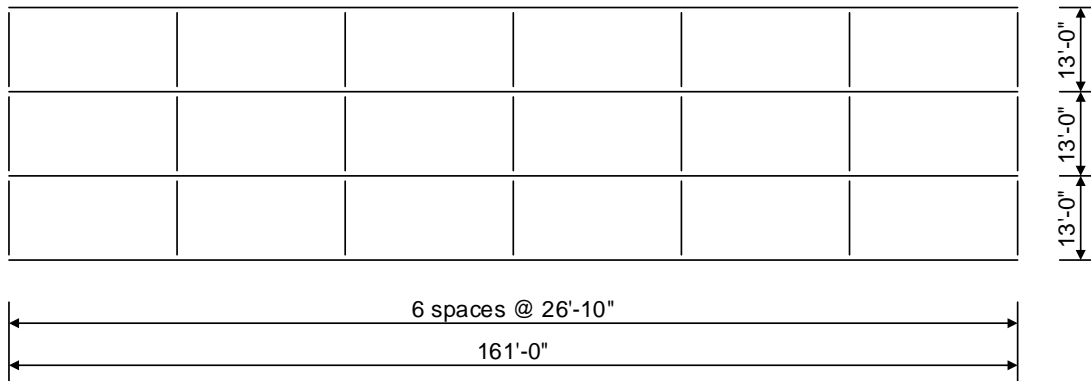
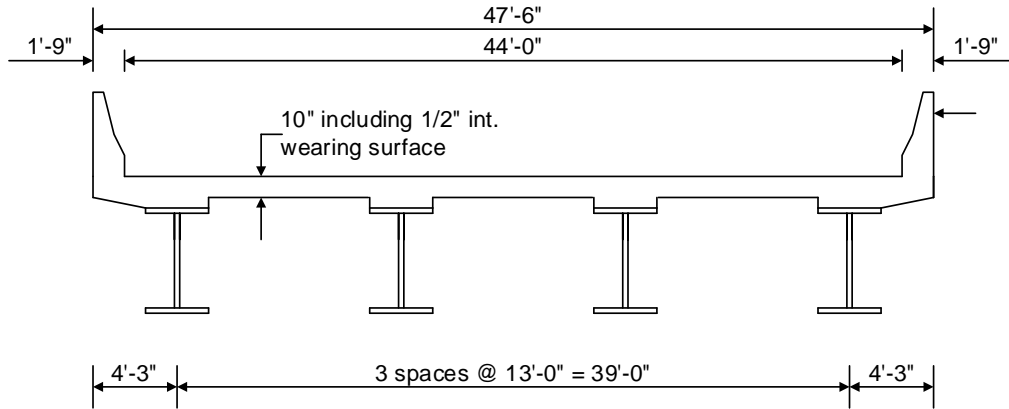
*Steel Tutorial*

*STL1-Simple Span Plate Girder Example*

## STL1-Simple Span Plate Girder Example

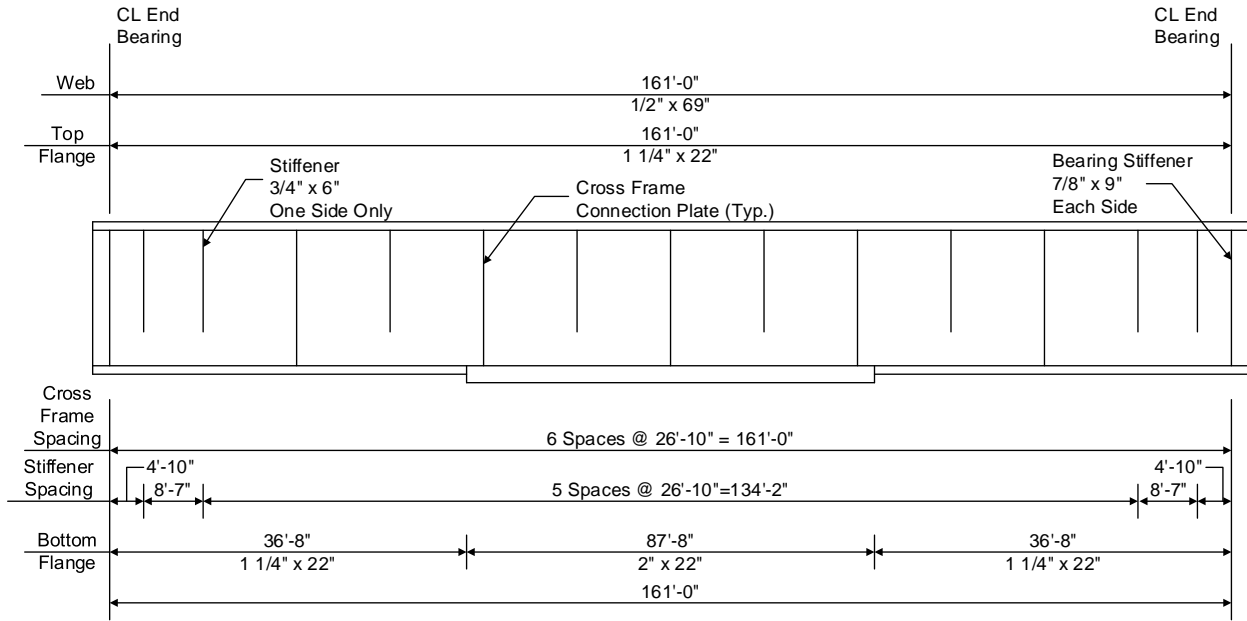
This example bridge is modeled after Example 1 from "Four LRFD Design Examples of Steel Highway Bridges", Volume II, Chapter 1B of the Highway Structures Design Handbook produced by the American Iron and Steel Institute except this example bridge is not skewed like the one in the handbook.

### STL1 - Simple Span Plate Girder Example



**Framing Plan**

# STL1-Simple Span Plate Girder Example



Elevation of Interior Girder

## Material Properties

Structural Steel: AASHTO M270, Grade 50W uncoated weathering steel with  $F_y = 50$  ksi

Deck Concrete:  $f'_c = 4.5$  ksi, modular ratio  $n = 8$

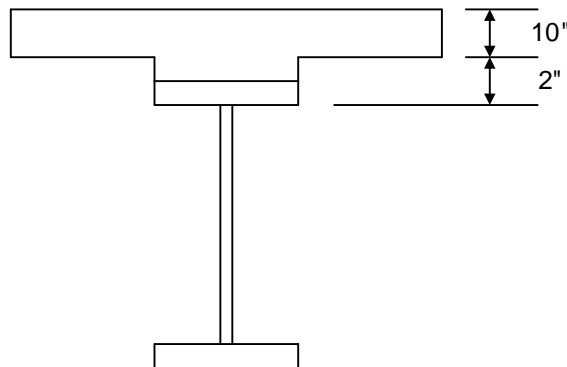
Slab Reinforcing Steel: AASHTO M31, Grade 60 with  $F_y = 60$  ksi

Transverse Stiffener Plates:  $3/4" \times 6"$

Cross Frame Connection Plates:  $3/4" \times 6"$

Bearing Stiffener Plates:  $7/8" \times 9"$

## Haunch Detail



# STL1-Simple Span Plate Girder Example

## BrDR Tutorial

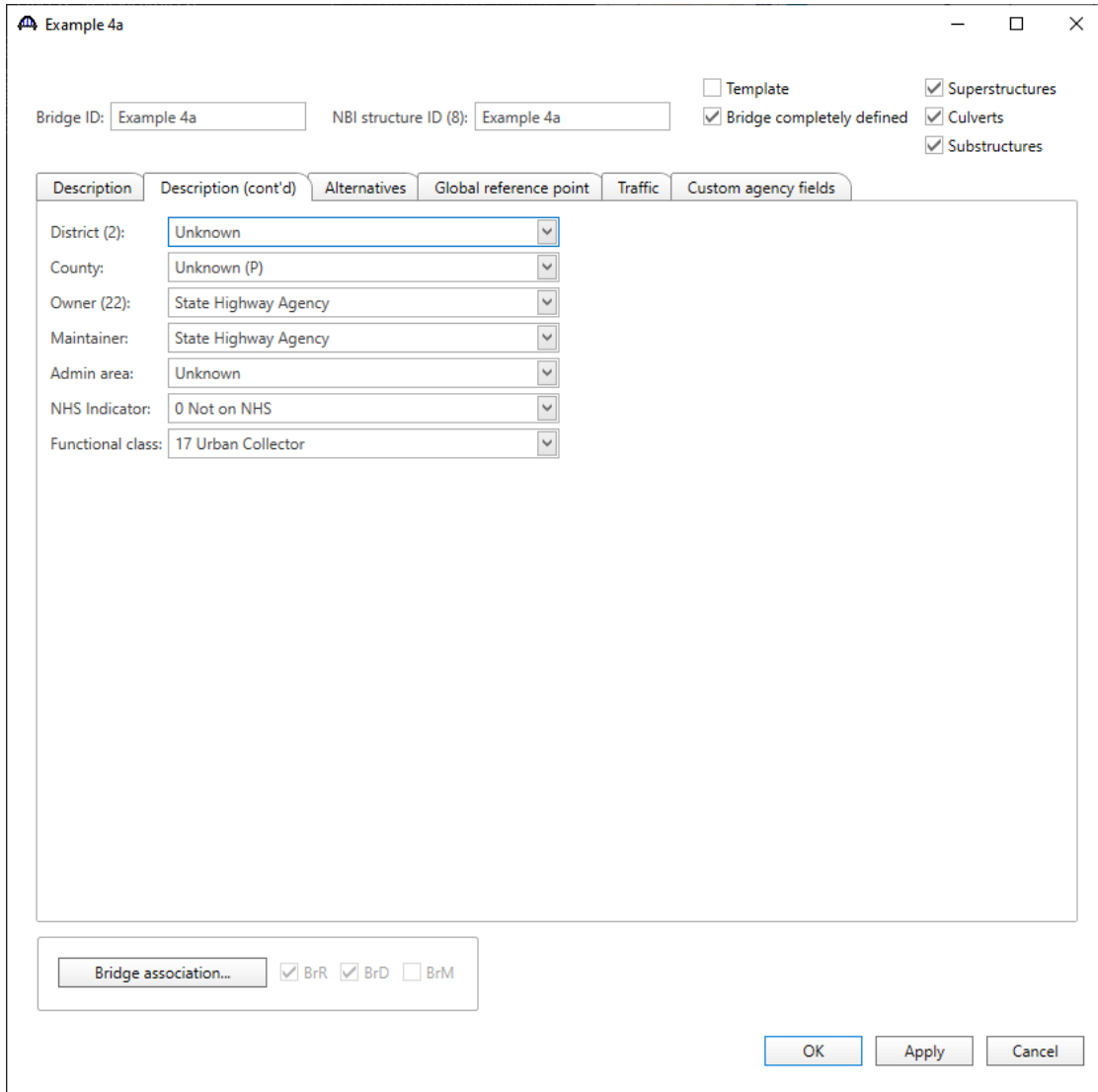
From the **Bridge Explorer** create a **New** bridge and enter the following description data.

The screenshot shows a software dialog box titled "Example 4a" with standard window controls (minimize, maximize, close). The dialog is used for entering bridge data. At the top, there are two text input fields: "Bridge ID:" containing "Example 4a" and "NBI structure ID (8):" containing "Example 4a". To the right of these fields are several checkboxes: "Template" (unchecked), "Bridge completely defined" (checked), "Superstructures" (checked), "Culverts" (checked), and "Substructures" (checked). Below this is a tabbed interface with five tabs: "Description" (selected), "Description (cont'd)", "Alternatives", "Global reference point", "Traffic", and "Custom agency fields". The "Description" tab contains the following fields:

- "Name:" text box with "Example 4a" entered.
- "Year built:" empty text box.
- "Description:" large empty text area.
- "Location:" text box with "Sample" entered.
- "Length:" text box with "161.00" entered, followed by "ft".
- "Facility carried (7):" text box with "Sample" entered.
- "Route number:" text box with "76" entered.
- "Feat. intersected (6):" text box with "Sample" entered.
- "Mi. post:" text box with "2.00" entered.
- "Default units:" dropdown menu showing "US Customary".

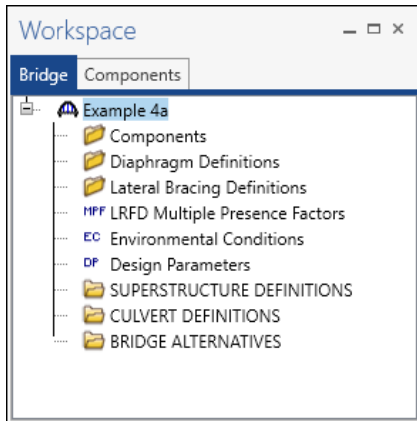
At the bottom of the dialog, there is a "Bridge association..." button and three checkboxes: "BrR" (checked), "BrD" (checked), and "BrM" (unchecked). At the very bottom right are three buttons: "OK", "Apply", and "Cancel".

# STL1-Simple Span Plate Girder Example



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

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



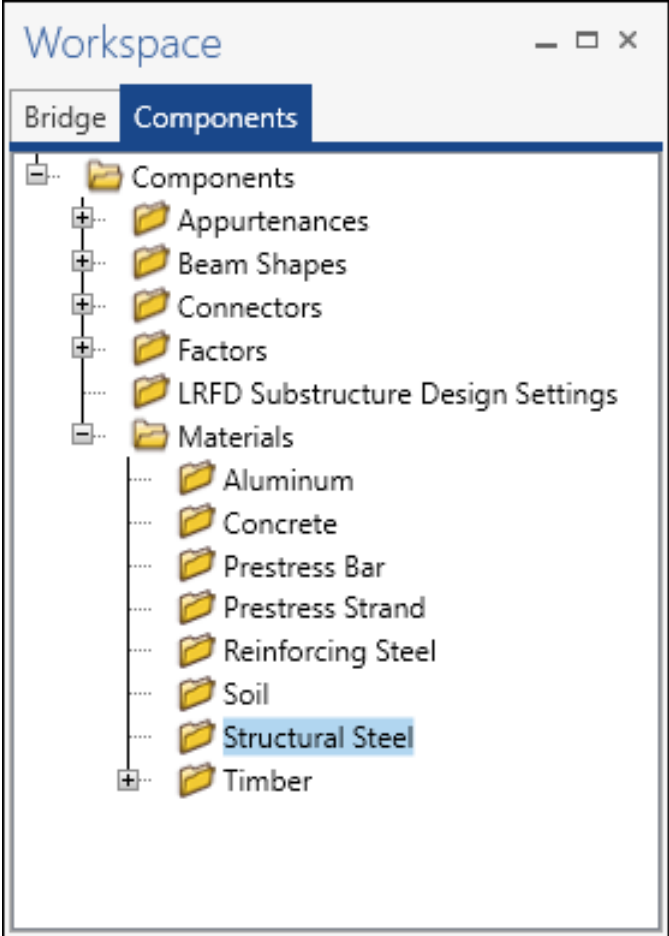
# STL1-Simple Span Plate Girder Example

The **Bridge Workspace** 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 **Bridge Workspace** tree.

## Bridge Components

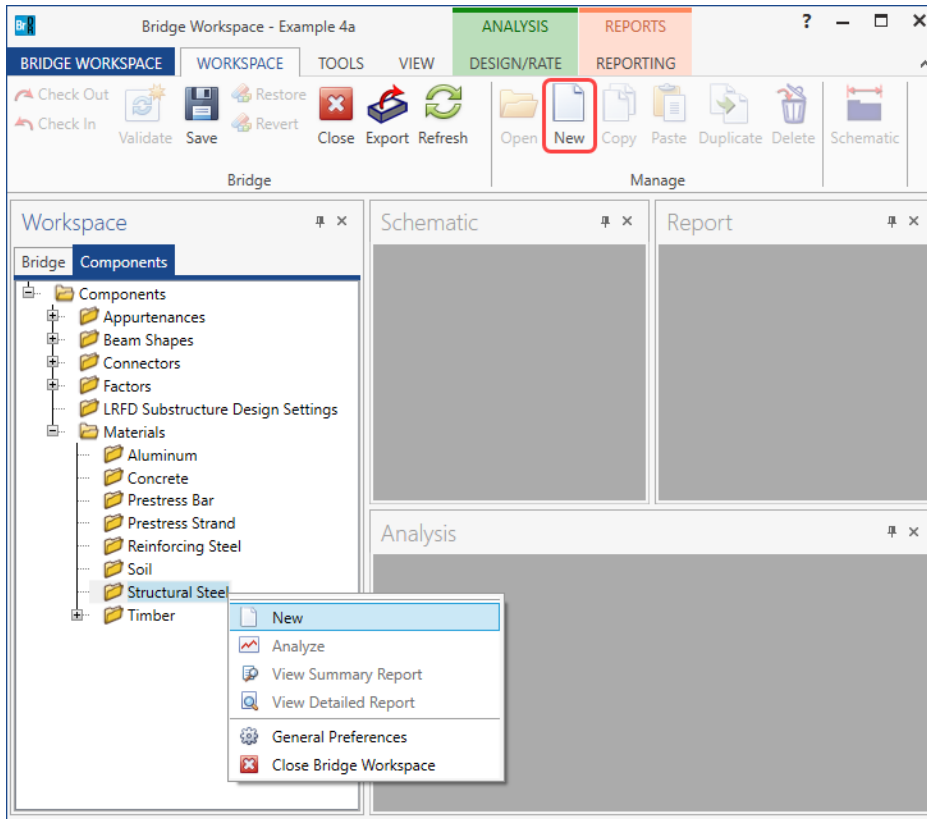
To enter the materials to be used by members of the bridge, in the **Components** tab of the **Bridge Workspace**, click on the **+** button to expand the tree for **Materials**.

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



## STL1-Simple Span Plate Girder Example

To add a new 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.

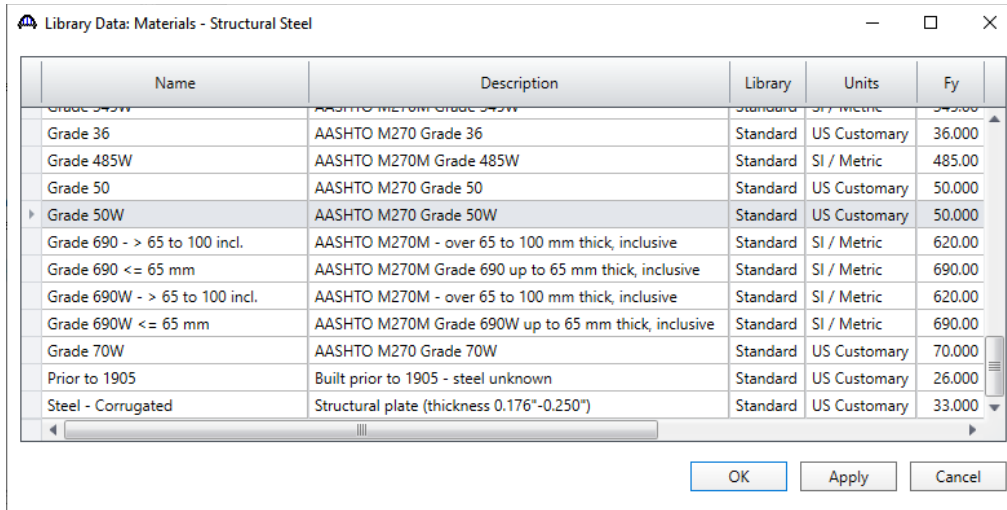


The 'Bridge Materials - Structural Steel' dialog box is shown. It has the following fields and options:

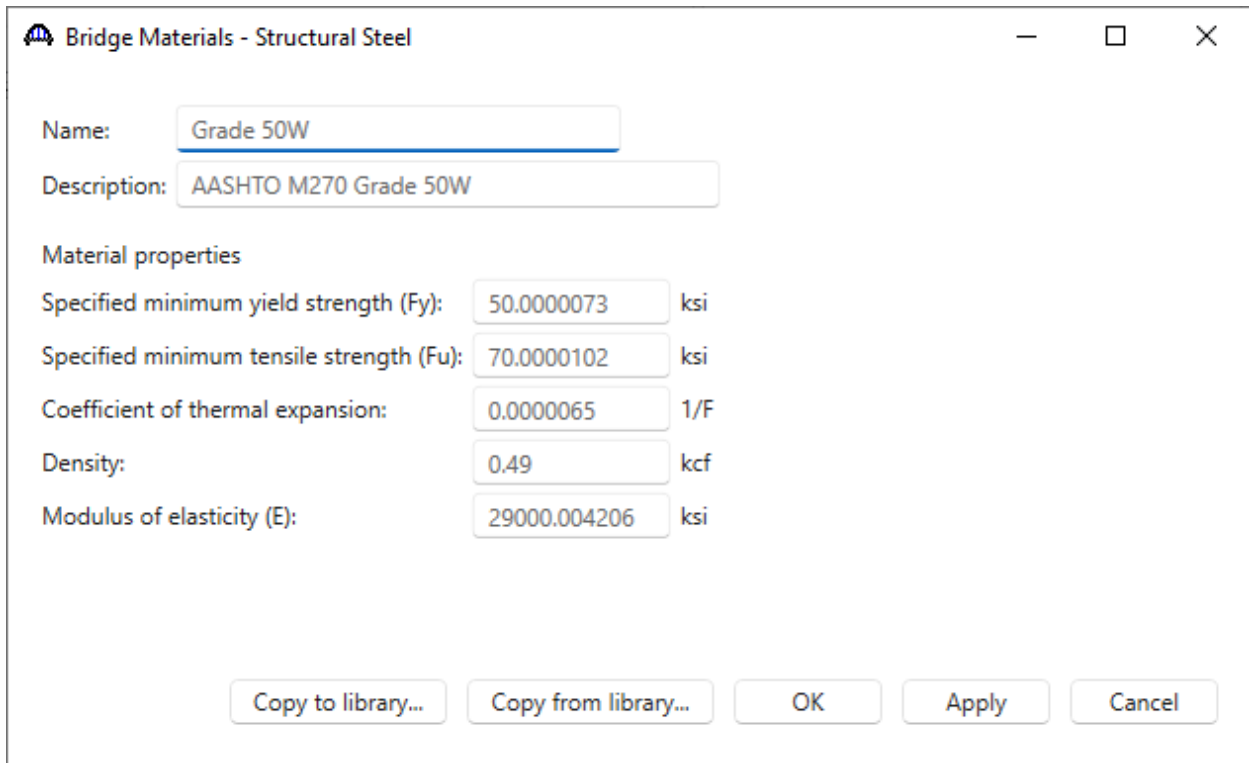
- Name:
- Description:
- Material properties:
  - Specified minimum yield strength (fy):  ksi
  - Specified minimum tensile strength (Fu):  ksi
  - Coefficient of thermal expansion:  1/F
  - Density:  kcf
  - Modulus of elasticity (E):  ksi
- Buttons: Copy to library..., Copy from library..., OK, Apply, Cancel

## STL1-Simple Span Plate Girder Example

Add the structural steel material by clicking the **Copy from library...** button. The following window opens.



Select the **AASHTO M270 Grade 50W** material 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.



## STL1-Simple Span Plate Girder Example

Add the following reinforcement material using the same techniques.

Bridge Materials - Reinforcing Steel

Name:

Description:

Material properties

Specified yield strength (fy):  ksi

Modulus of elasticity (Es):  ksi

Ultimate strength (Fu):  ksi

Type

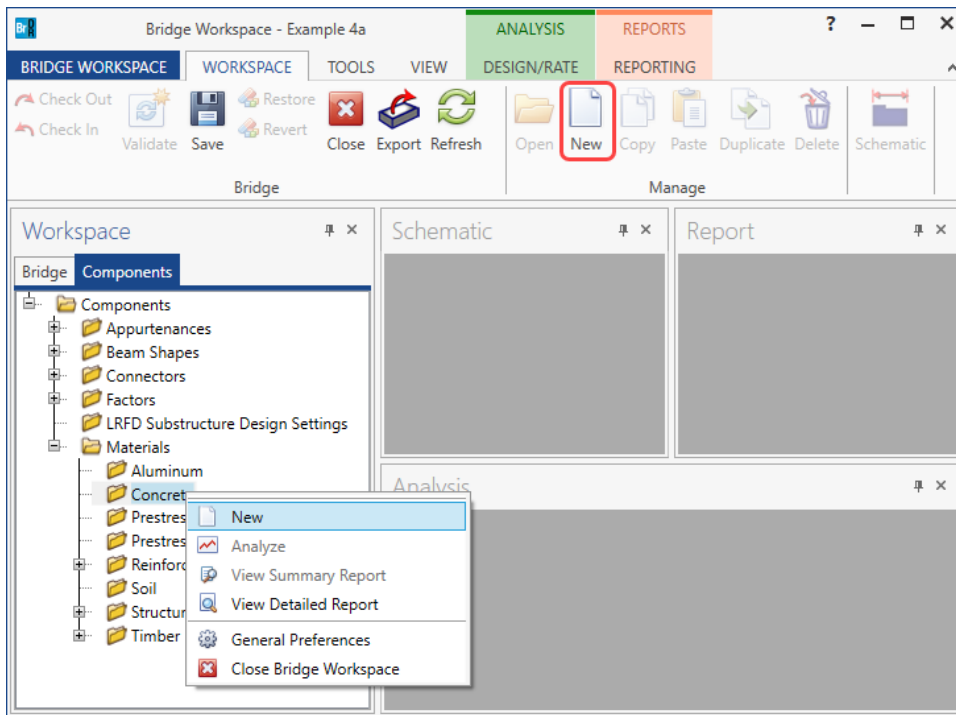
Plain

Epoxy

Galvanized

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

Add a new deck concrete material, by selecting 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.



## STL1-Simple Span Plate Girder Example

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

Bridge Materials - Concrete

Name:

Description:

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

Initial compressive strength (f'ci):  ksi

Composition of concrete:  ▾

Density (for dead loads):  kcf

Density (for modulus of elasticity):  kcf

Poisson's ratio:

Coefficient of thermal expansion ( $\alpha$ ):  1/F

Splitting tensile strength (fct):  ksi

LRFD Maximum aggregate size:  in

Std modulus of elasticity (Ec):  ksi

LRFD modulus of elasticity (Ec):  ksi

Std initial modulus of elasticity:  ksi

LRFD initial modulus of elasticity:  ksi

Std modulus of rupture:  ksi

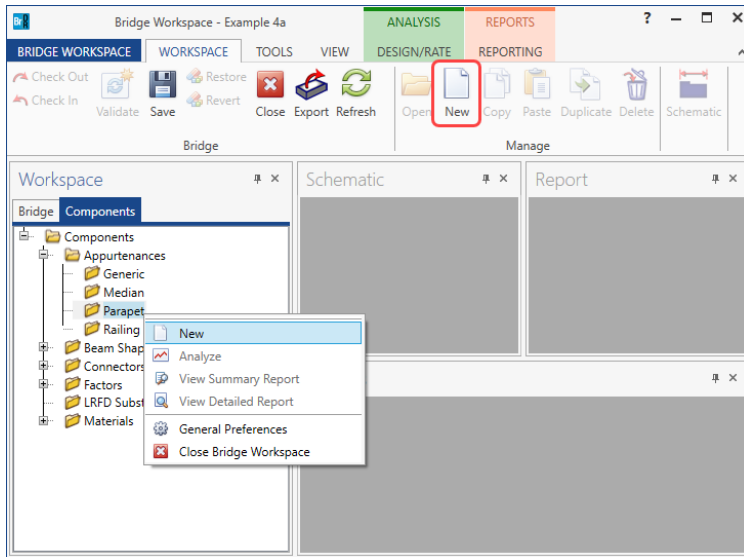
LRFD modulus of rupture:  ksi

Shear factor:

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

## STL1-Simple Span Plate Girder Example

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 (or double click on **Parapet** in the **Components** tree).



Enter the parapet details as shown below.

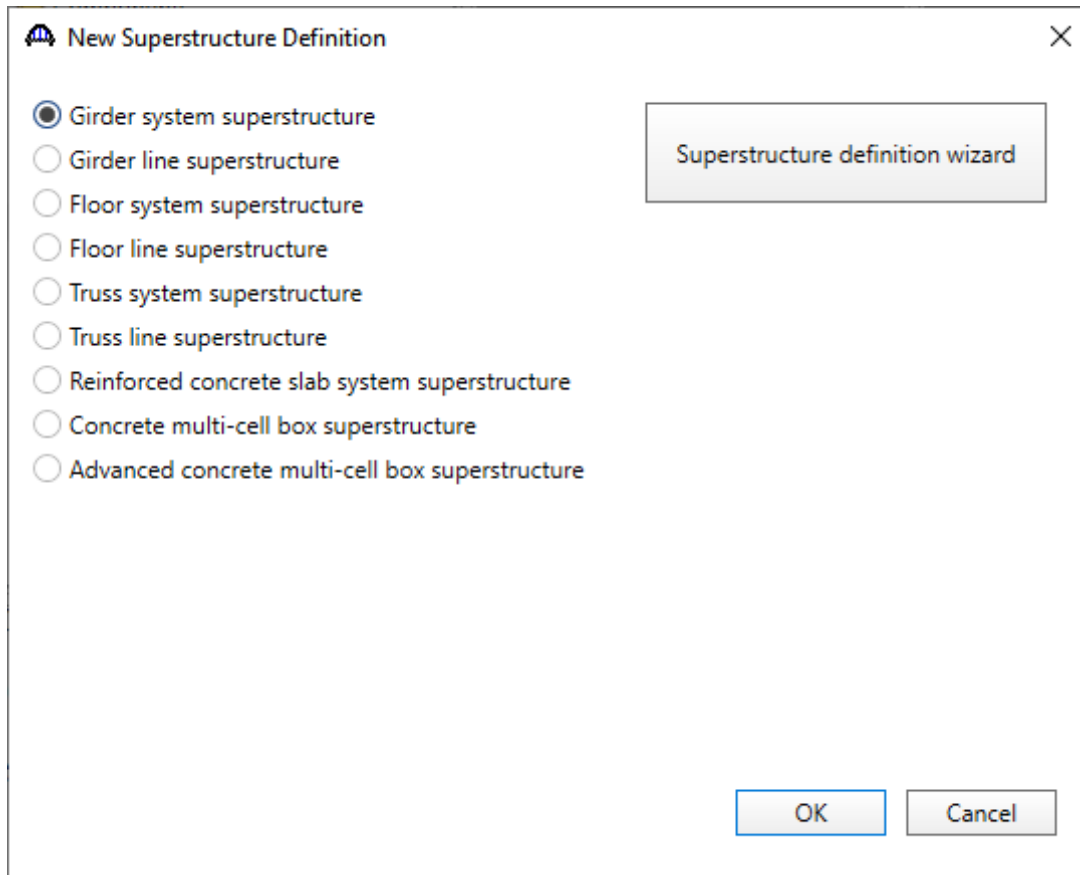
Click **OK** to apply the data and close the window.

The default standard LRFD and LFR factors will be used. Bridge Alternatives will be added after entering the Structure Definition.

## STL1-Simple Span Plate Girder Example

### 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 **Girder System Superstructure Definition** window will open. Enter the data as shown below.

# STL1-Simple Span Plate Girder Example

**Girder System Superstructure Definition**

Definition | Analysis | Specs | Engine

Name: SD1

Description:

Default units: US Customary

Number of spans: 1

Number of girders: 4

Enter span lengths along the reference line:

Span	Length (ft)
1	161.00

Modeling

Multi-girder system  MCB

With frame structure simplified definition

Deck type: Concrete Deck

For PS/PT only

Average humidity: %

Member alt. types

Steel

P/S

R/C

Timber

P/T

Horizontal curvature along reference line

Horizontal curvature

Distance from PC to first support line: ft

Superstructure alignment

Curved

Tangent, curved, tangent

Tangent, curved

Curved, tangent

Start tangent length: ft

Radius: ft

Direction: Left

End tangent length: ft

Distance from last support line to PT: ft

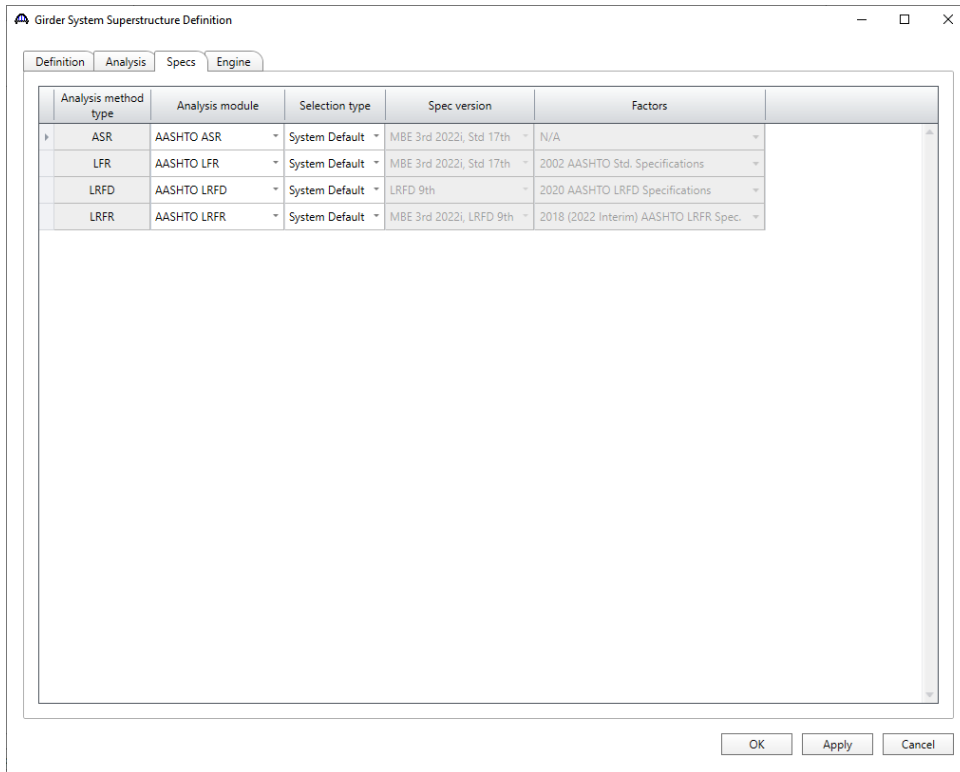
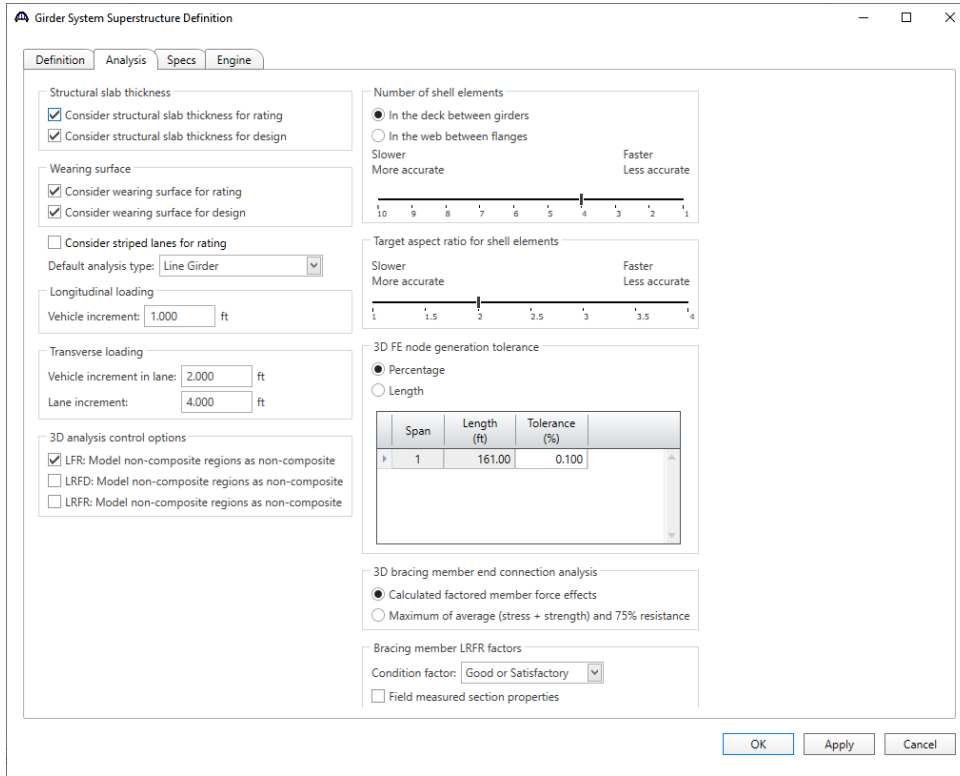
Design speed: mph

Superelevation: %

OK Apply Cancel

# STL1-Simple Span Plate Girder Example

The **Analysis** tab and the **Specs** tab are shown below with the default selections. For this example, the default values will not be overridden. No changes are required on these tabs.

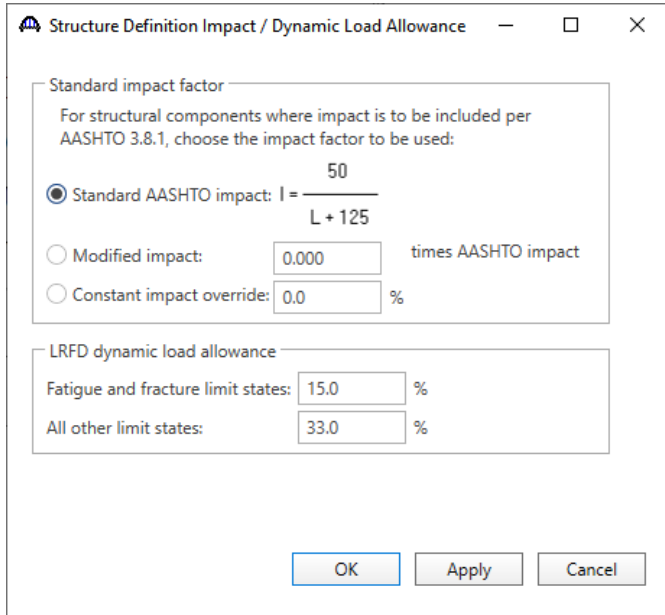


Click **OK** to apply the data and close the window.

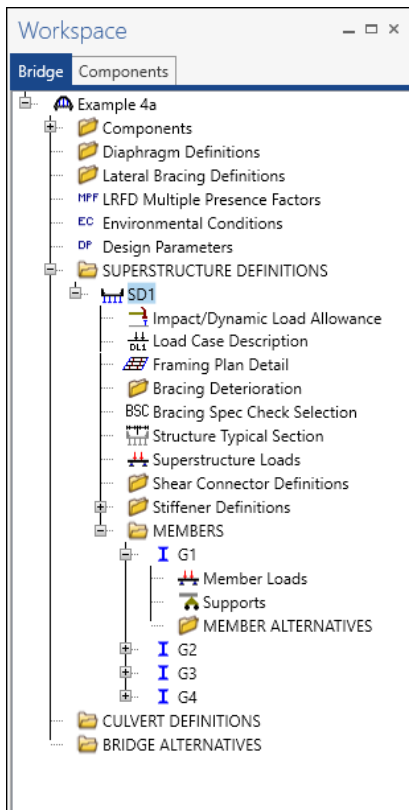
# STL1-Simple Span Plate Girder Example

## 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.



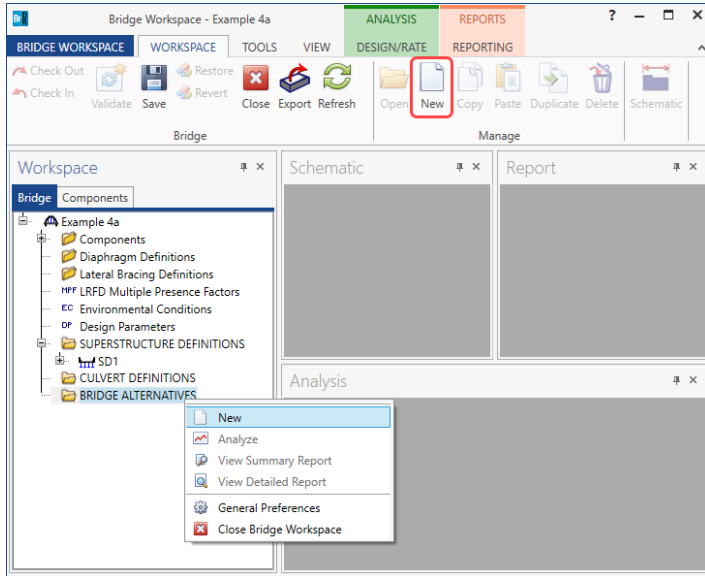
The partially expanded **Bridge Workspace** tree is shown below.



# STL1-Simple Span Plate Girder 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).



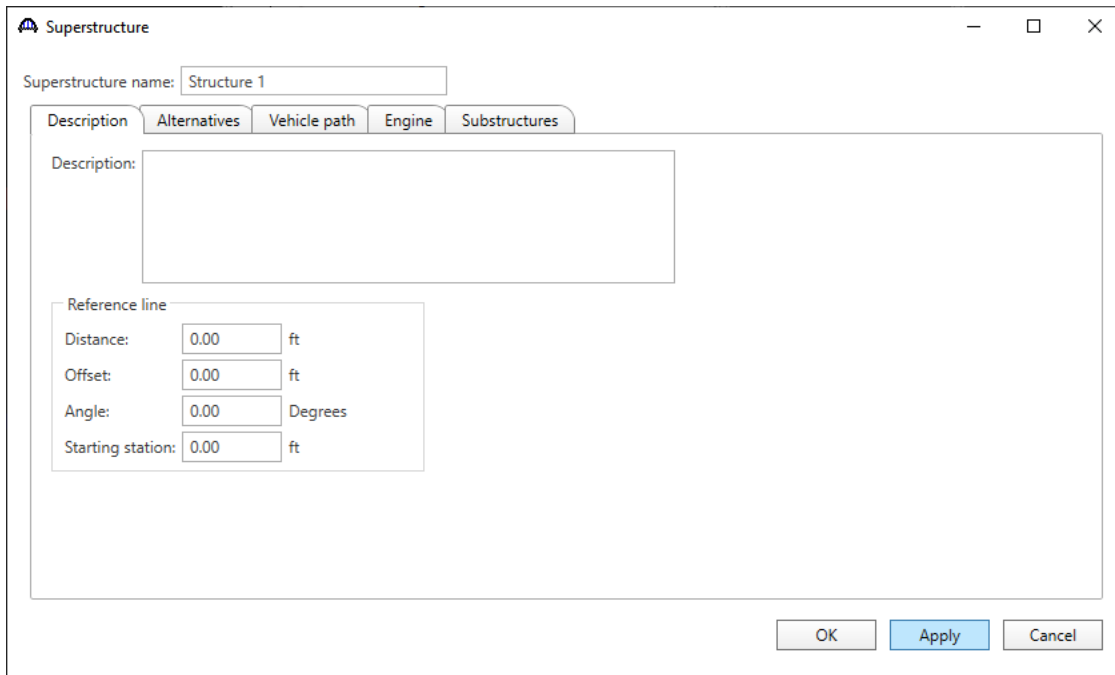
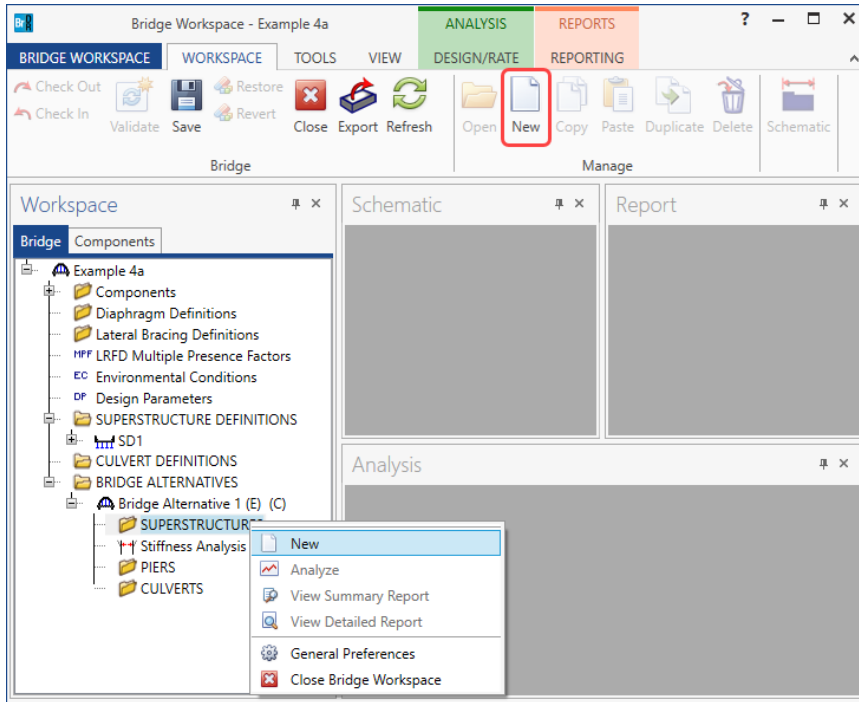
Enter the following data.

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



## STL1-Simple Span Plate Girder Example

Expand the **Bridge Alternative 1** 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.



Superstructure

Superstructure name:

Description Alternatives Vehicle path Engine Substructures

Description:

Reference line

Distance:  ft

Offset:  ft

Angle:  Degrees

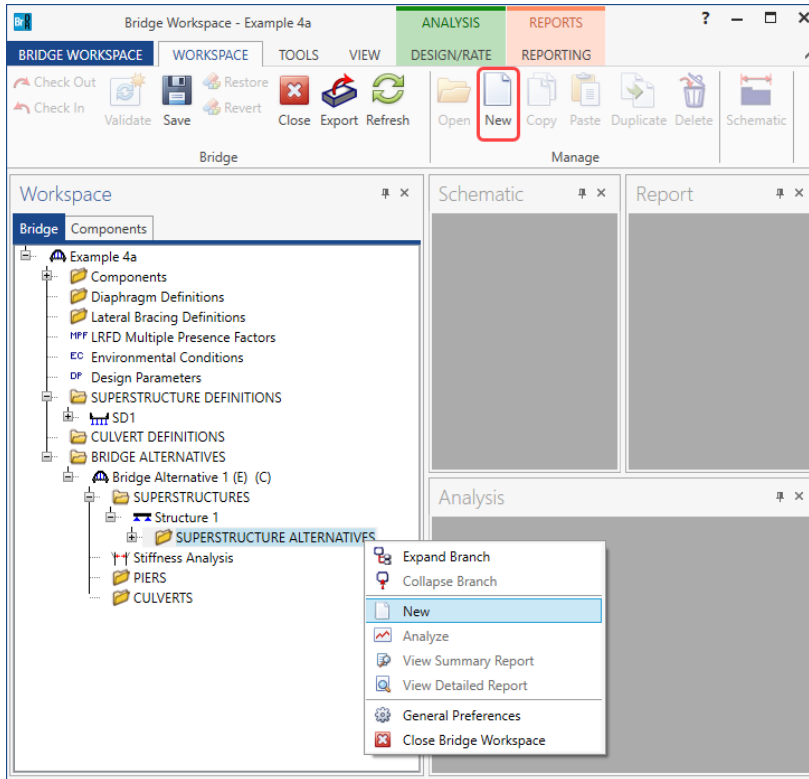
Starting station:  ft

OK Apply Cancel

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

## STL1-Simple Span Plate Girder Example

Expand the **Structure 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.



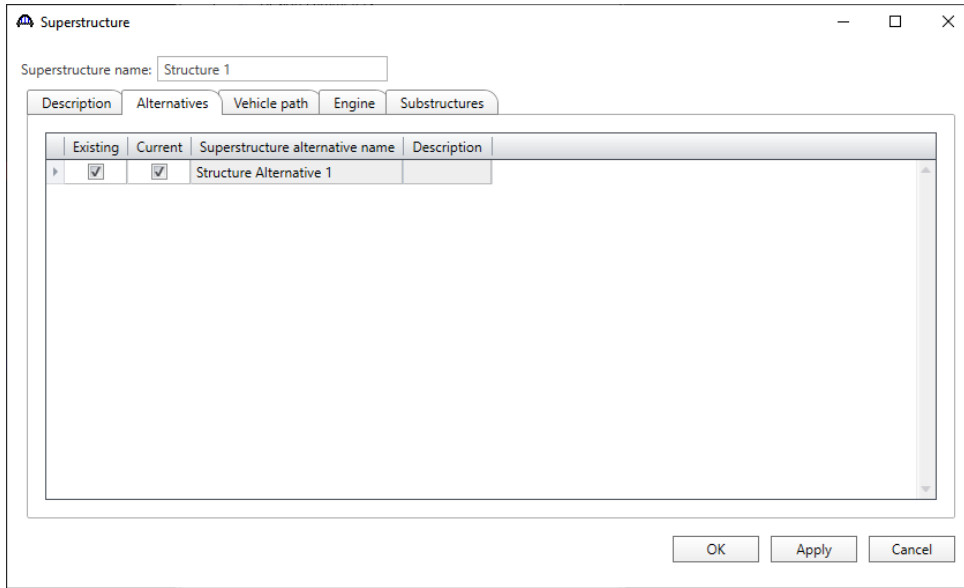
Select the **Superstructure definition SD1** as the current superstructure definition for this Superstructure Alternative.

The screenshot shows the Superstructure Alternative dialog box. The 'Alternative name' is 'Structure Alternative 1'. The 'Description' field is empty. The 'Superstructure definition' dropdown is set to 'SD1'. The 'Superstructure type' is 'Girder'. The 'Number of main members' is '4'. A table shows one span with a length of 161.00 ft.

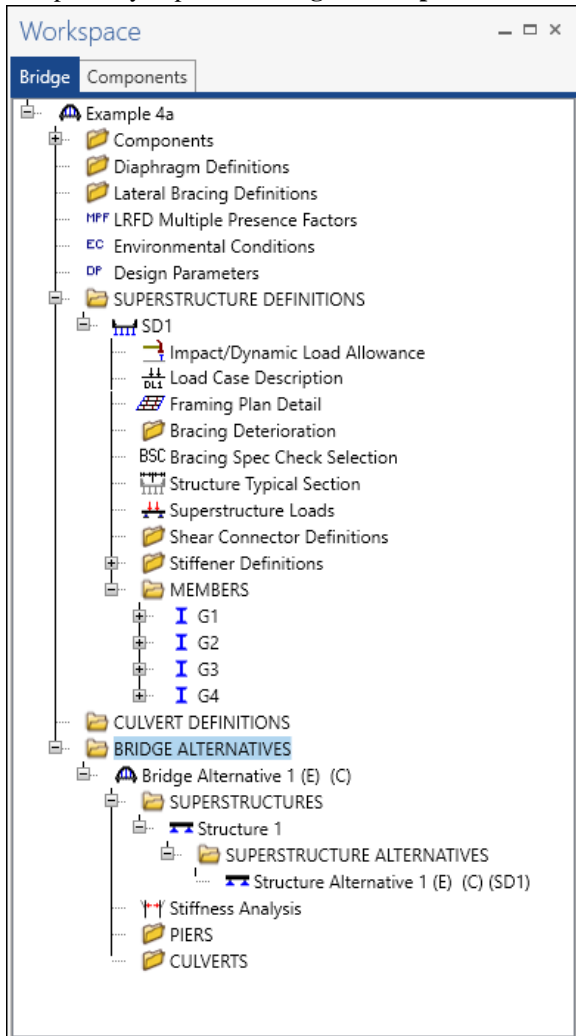
Span	Length (ft)
1	161.00

Re-open the **Structure 1** window and navigate to the **Alternatives** tab. The **Structure Alternative 1** will be shown as the **Existing** and **Current** alternative for **Structure 1**.

# STL1-Simple Span Plate Girder Example



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



## STL1-Simple Span Plate Girder Example

### Load Case Description

Navigate to the **SD1** 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.

Load case name	Description	Stage	Type	Time* (days)
DC1	DC acting on non-composite section	Non-composite (Stage 1)	D,DC	
DC2	DC acting on long-term composite section	Composite (long term) (Stage 2)	D,DC	
DW	DW (acts on long-term composite section)	Composite (long term) (Stage 2)	D,DW	
SIP Forms	Weight due to stay-in-place forms	Non-composite (Stage 1)	D,DC	

\*Prestressed members only

Add default load case descriptions

New Duplicate Delete

OK Apply Cancel

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

### Structure Framing Plan Detail – Layout

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

Number of spans: 1 Number of girders: 4

Layout Diaphragms Lateral bracing ranges

Girder spacing orientation

Perpendicular to girder  
 Along support

Support	Skew (degrees)
1	0.000
2	0.000

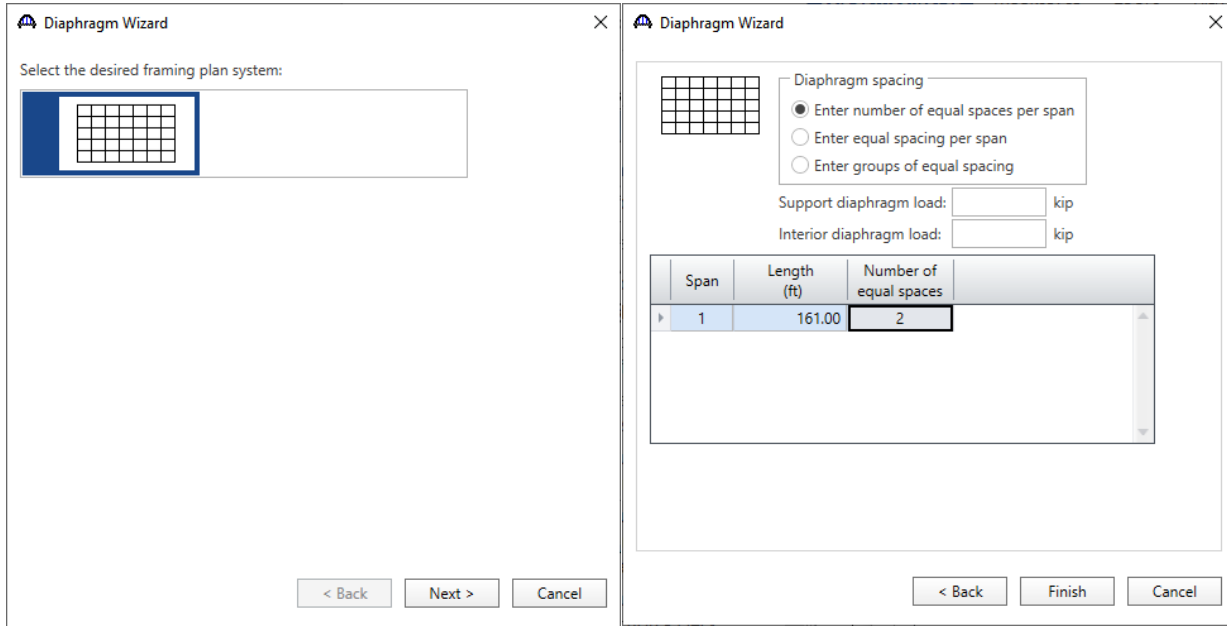
Girder bay	Girder spacing (ft)	
	Start of girder	End of girder
1	13.00	13.00
2	13.00	13.00
3	13.00	13.00

OK Apply Cancel

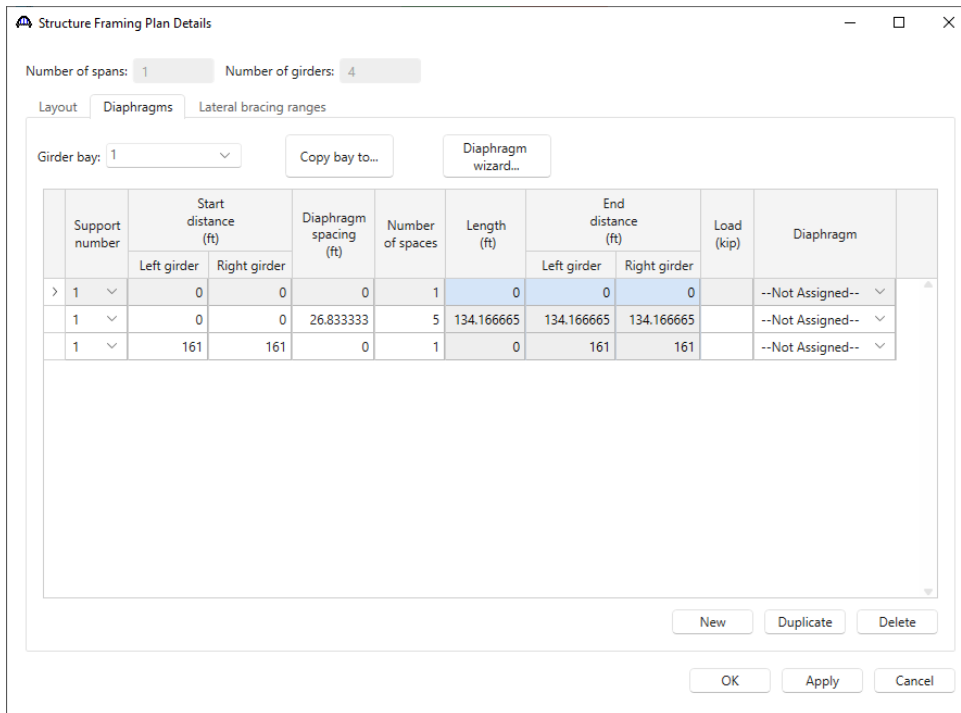
# STL1-Simple Span Plate Girder Example

## Structure Framing Plan Detail – Diaphragms

Switch to the **Diaphragms** tab to enter diaphragm spacing. Click the **Diaphragm wizard...** button to add diaphragms for the entire structure. **Select the desired framing plan system** and click the **Next** button. Enter the following data on the window shown below.



Click the **Finish** button to add the diaphragms. The **Diaphragm Wizard** will create diaphragms for all the girder bays in the structure. The diaphragms created for **Girder bay 1** are shown below.



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

# STL1-Simple Span Plate Girder Example

## Structure Typical Section - Deck

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

Structure Typical Section

Distance from left edge of deck to superstructure definition ref. line: 23.75 ft

Distance from right edge of deck to superstructure definition ref. line: 23.75 ft

Left overhang: 4.25 ft

Computed right overhang: 4.25 ft

Superstructure definition reference line is within the bridge deck.

Start: 23.75 ft End: 23.75 ft

OK Apply Cancel

## Structure Typical Section – Deck (cont'd)

The **Deck (cont'd)** tab is used to enter information about the **Deck concrete** and the **Total deck thickness**. The material to be used for the deck concrete is selected from the list of bridge materials. Enter the data as shown below.

Structure Typical Section

Distance from left edge of deck to superstructure definition ref. line: 23.75 ft

Distance from right edge of deck to superstructure definition ref. line: 23.75 ft

Left overhang: 4.25 ft

Computed right overhang: 4.25 ft

Deck concrete: Deck Concrete

Total deck thickness: 10.0000 in

Load case: Engine Assigned

Deck crack control parameter: 130.000 kip/in

Sustained modular ratio factor: 3.000

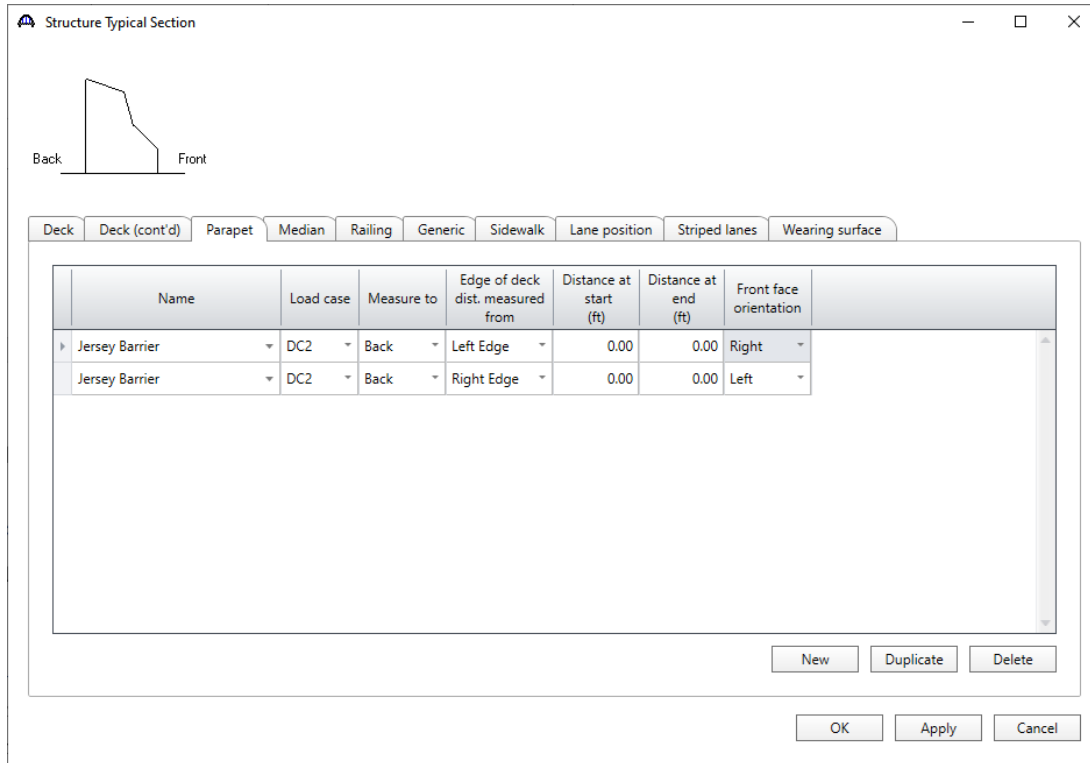
Deck exposure factor:

OK Apply Cancel

# STL1-Simple Span Plate Girder Example

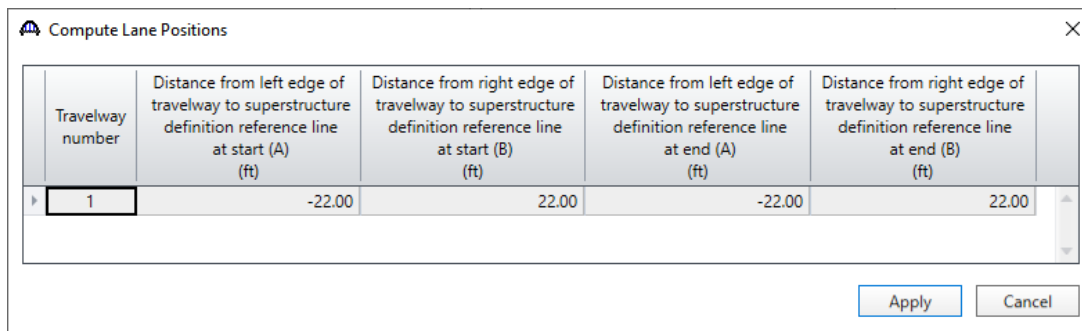
## Structure Typical Section – Parapets

Click the **New** button 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 **DC2** and select **Back** in the **Measure to** column (in this example, locate 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**. Enter another parapet in the similar way as shown below. The completed tab is shown below.



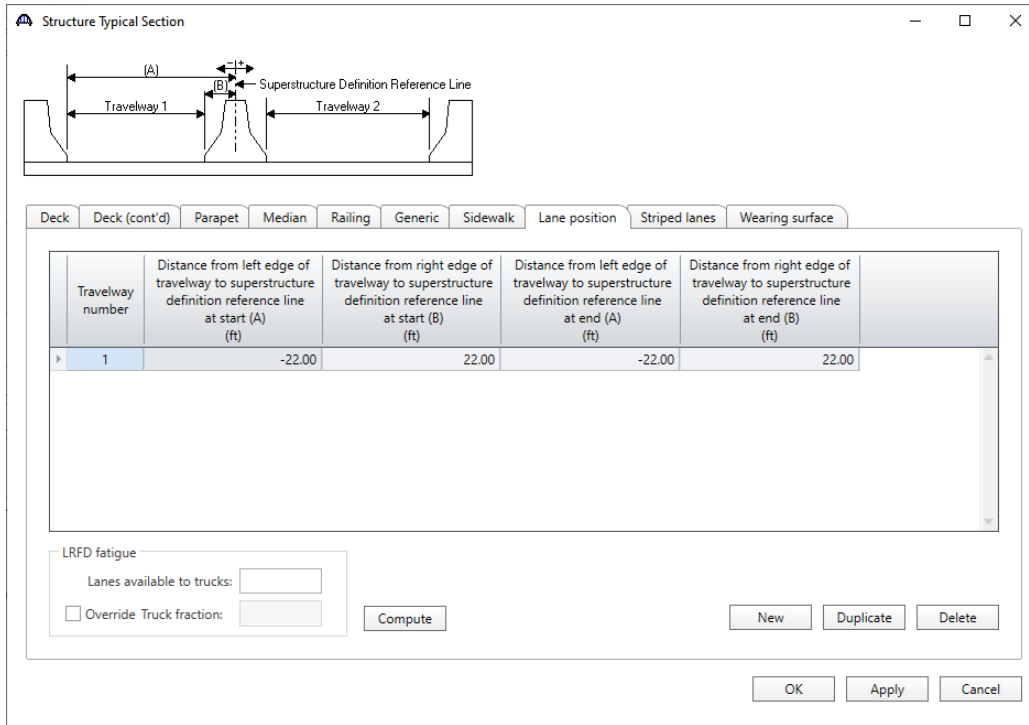
## Structure Typical Section – Lane Positions

Select the **Lane position** tab and use the **Compute...** button to compute the lane positions. A window showing the results of the computation opens. Click **Apply** to apply the computed values.



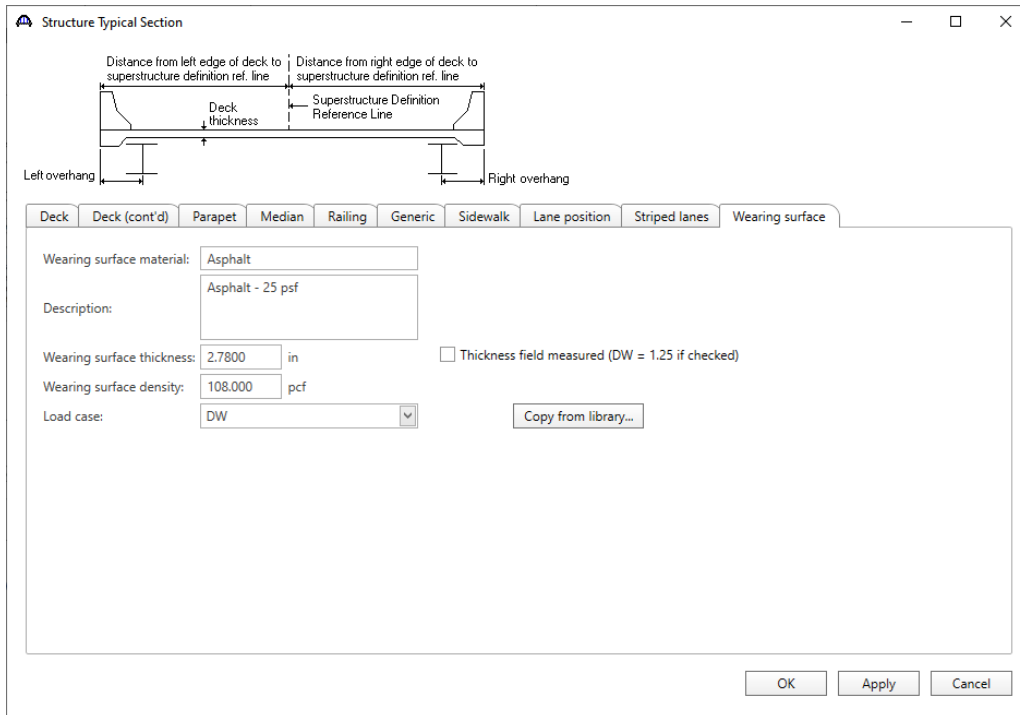
# STL1-Simple Span Plate Girder Example

The **Lane Position** tab is populated as shown below.



## Structure Typical Section – Wearing surface

Enter the data shown below.



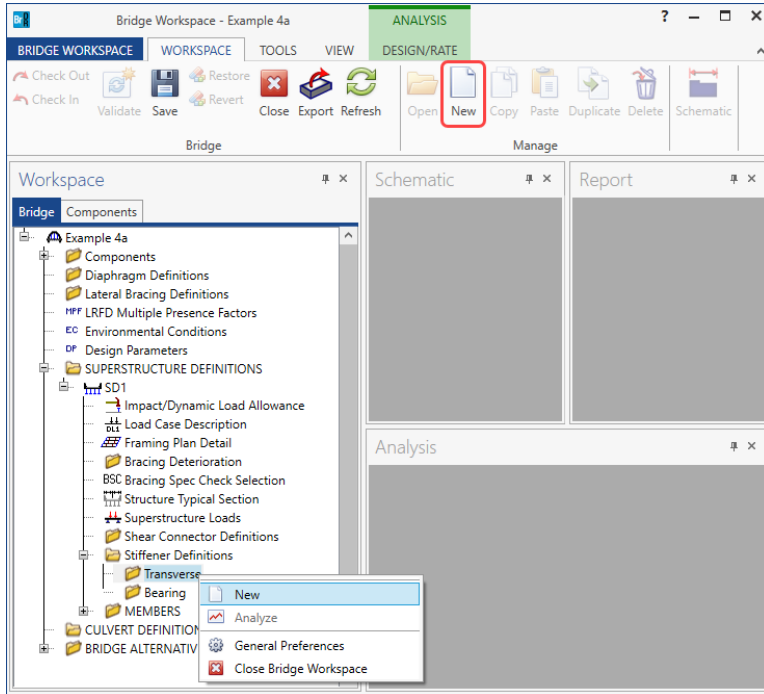
Click **OK** to apply the data and close the window.



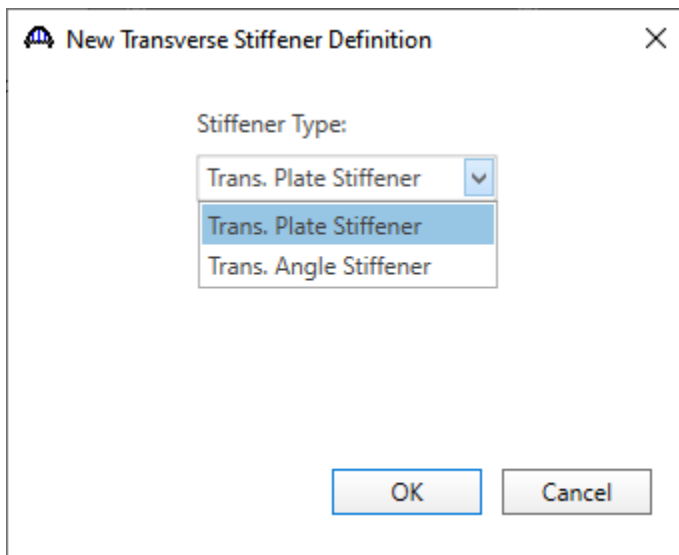
# STL1-Simple Span Plate Girder Example

## Stiffener Definitions – Transverse

Define the transverse stiffeners to be used by the girders. Expand the **Stiffener Definitions** node in the **Bridge Workspace** tree, select **Transverse** and click on the **New** button from the **Manage** group of the **WORKSPACE** ribbon (or right click and select **New** from the drop-down menu) as shown below.



Select **Trans. Plate Stiffener** for **Stiffener Type** in the **New Transverse Stiffener Definition** window and click **OK** to open the **Transverse Stiffener Definition** window as shown below.



## STL1-Simple Span Plate Girder Example

Define the stiffener as shown below.

**Transverse Stiffener Definition**

Name:

Stiffener type:  
 Single  
 Pair

Plate:  
Thickness:  in  
Material:

Welds:  
Top:   
Web:   
Bottom:

Top gap:  in  
Width:  in  
Bottom gap:  in

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

Repeat this process to define the other two stiffeners as shown below.

**Transverse Stiffener Definition**

Name:

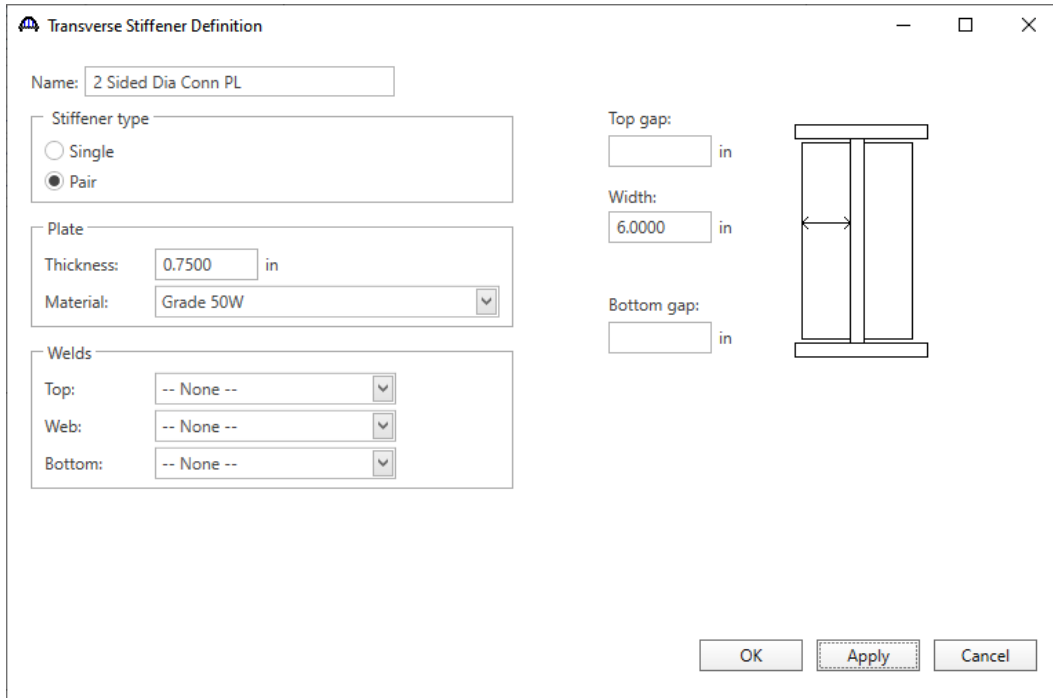
Stiffener type:  
 Single  
 Pair

Plate:  
Thickness:  in  
Material:

Welds:  
Top:   
Web:   
Bottom:

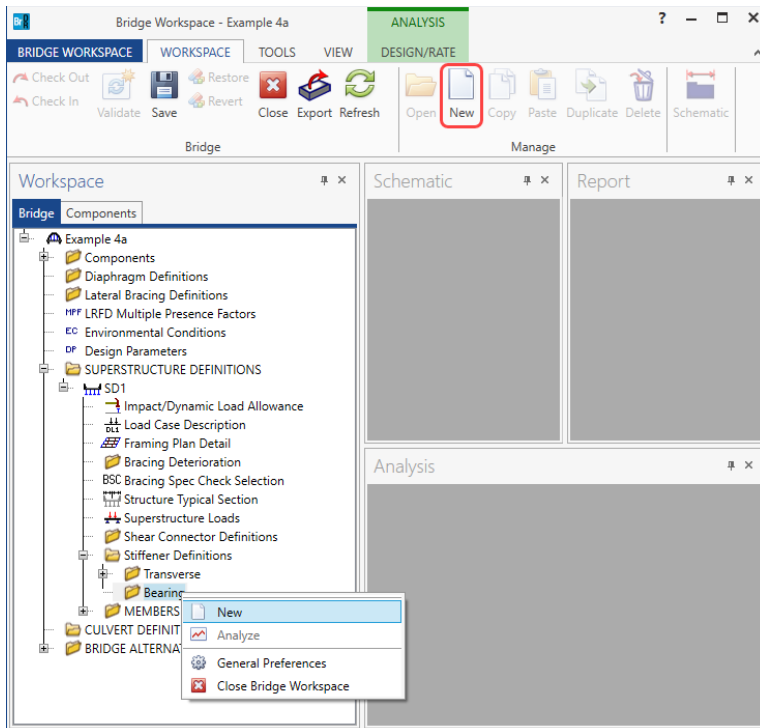
Top gap:  in  
Width:  in  
Bottom gap:  in

## STL1-Simple Span Plate Girder Example



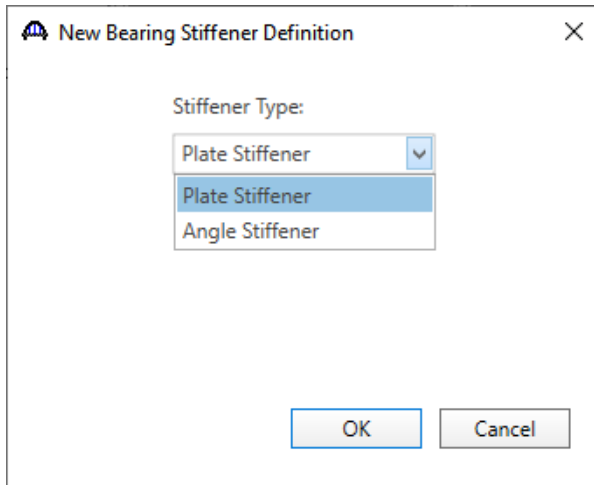
### Stiffener Definitions – Bearing

Define the bearing stiffeners to be used by the girders. Expand the **Stiffener Definitions** node in the **Bridge Workspace** tree, select **Bearing** and click on the **New** button from the **Manage** group of the **WORKSPACE** ribbon (or right click and select **New** from the drop-down menu) as shown below.

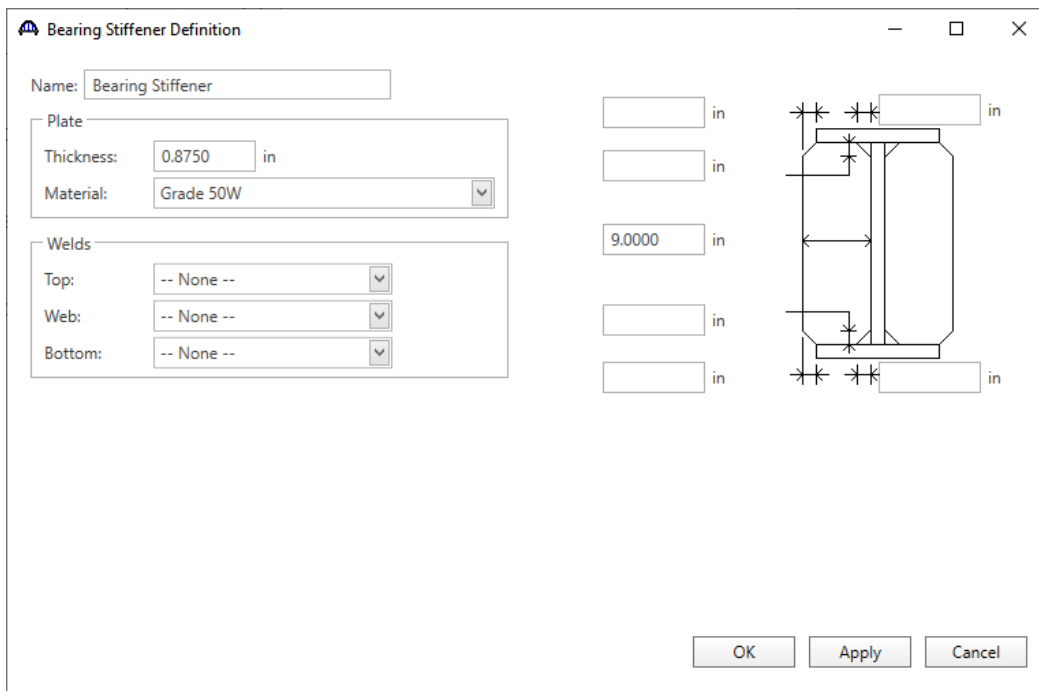


## STL1-Simple Span Plate Girder Example

Select **Plate Stiffener** for **Stiffener type** in the **New Transverse Stiffener Definition** window and click **OK** to open the **Transverse Stiffener Definition** window as shown below.



Define the stiffener as shown below.



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

## STL1-Simple Span Plate Girder Example

### Describing a member

The **Member** window shows the data that was generated when the structure definition was created. No changes are required in this window. The first member alternative created will automatically be assigned as the **Existing** and **Current member alternative** for this member.

The Member window displays the following information:

- Member name: G2
- Link with: -- None --
- Description: (empty text box)
- Number of spans: 1
- Table of spans:

Span no.	Span length (ft)
1	161.00

Buttons: OK, Apply, Cancel

### Member Loads

Double-click on the **Member Loads** node in the **Bridge Workspace** tree for member **G2** to open the **Girder Member Loads** window. Select **SIP Forms** from the options for **Load case name**. Enter the **Uniform load** due to the stay-in-place forms as shown below.

The Girder Member Loads window displays the following information:

- Diagram: A horizontal line with downward arrows representing a uniform load.
- Pedestrian load: (empty text box) lb/ft
- Load case selection: Uniform (selected), Distributed, Concentrated, Settlement
- Table of load cases:

Load case name	Span	Uniform load (kip/ft)	Description
SIP Forms	All Spans	0.078	

Buttons: New, Duplicate, Delete, OK, Apply, Cancel

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

## STL1-Simple Span Plate Girder Example

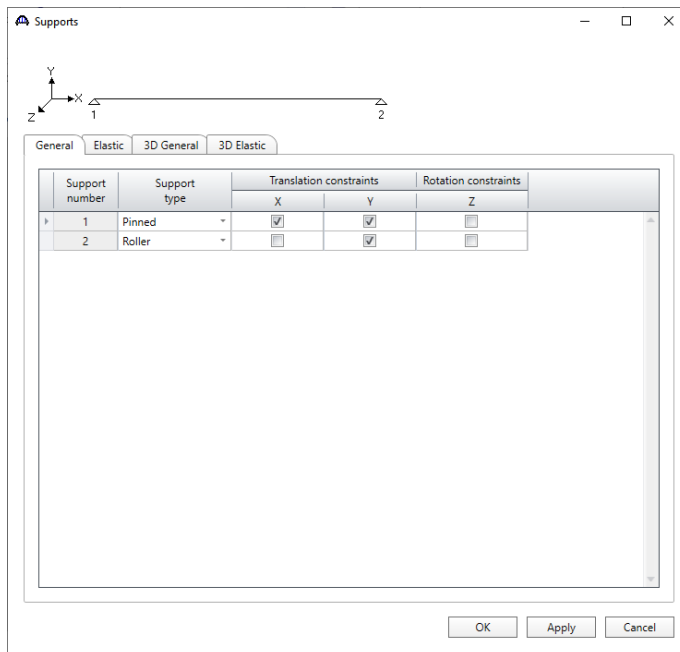
Member loads for this tutorial.

Example	Struct Def	Member Definition	Loads(Interior beam, Exterior beam)
a	GS	Schedule-based	SIP (0.078, 0.039)
b	GL	Schedule-based	SIP (0.078,0.039) Barrier (DC2) (0.253, 0.253) WS (DW) (0.275, 0.275)
c	GL	Cross-section based	SIP (0.078, 0.078) Barrier (DC2) (0.253, 0.253) WS (DW) (0.275, 0.275) Haunch (DC1) (0.017, 0.059)
d	GS	Cross-section based	SIP (0.078, 0.078) Haunch (DC1) (0.017, 0.059)

The **Engine help** for the help topic **Dead Loads** summarizes for each type of structure definition and member modeling method which dead load components are computed automatically by the engine and which must be entered by the user.

### Supports

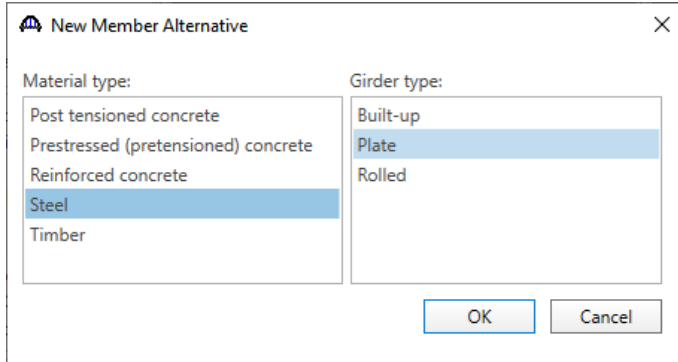
Double click on the **Supports** node in the **Bridge Workspace** tree for member **G2** to open the **Supports** window. Support constraints were generated when the structure definition was created and are shown below. No changes are required.



## STL1-Simple Span Plate Girder Example

### Defining a Member Alternative

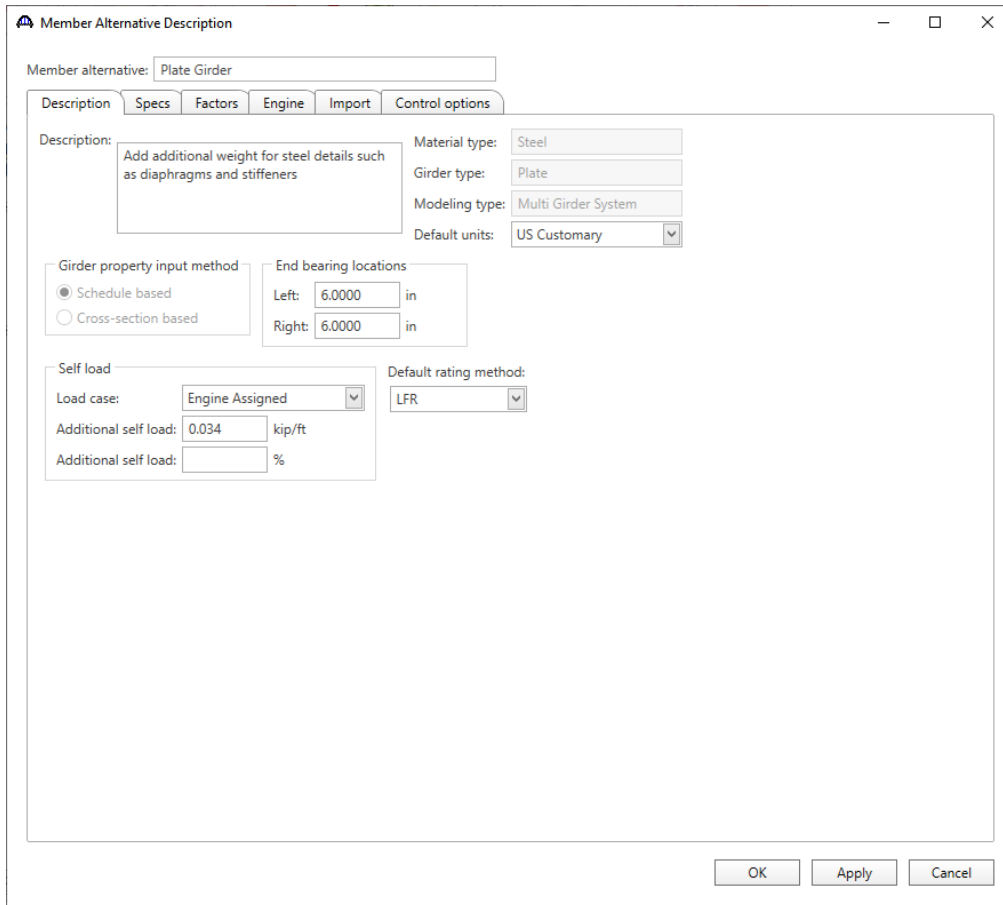
Double-click on **MEMBER ALTERNATIVES** in the **Bridge Workspace** tree for member **G2** to create a new member alternative. The **New Member Alternative** window shown below will open. Select **Steel** for the **Material type** and **Plate** for the **Girder Type**.



The 'New Member Alternative' dialog box contains two list boxes. The 'Material type' list includes: Post tensioned concrete, Prestressed (pretensioned) concrete, Reinforced concrete, **Steel**, and Timber. The 'Girder type' list includes: Built-up, **Plate**, and Rolled. At the bottom are 'OK' and 'Cancel' buttons.

Click **OK** to close the window and create a new member alternative.

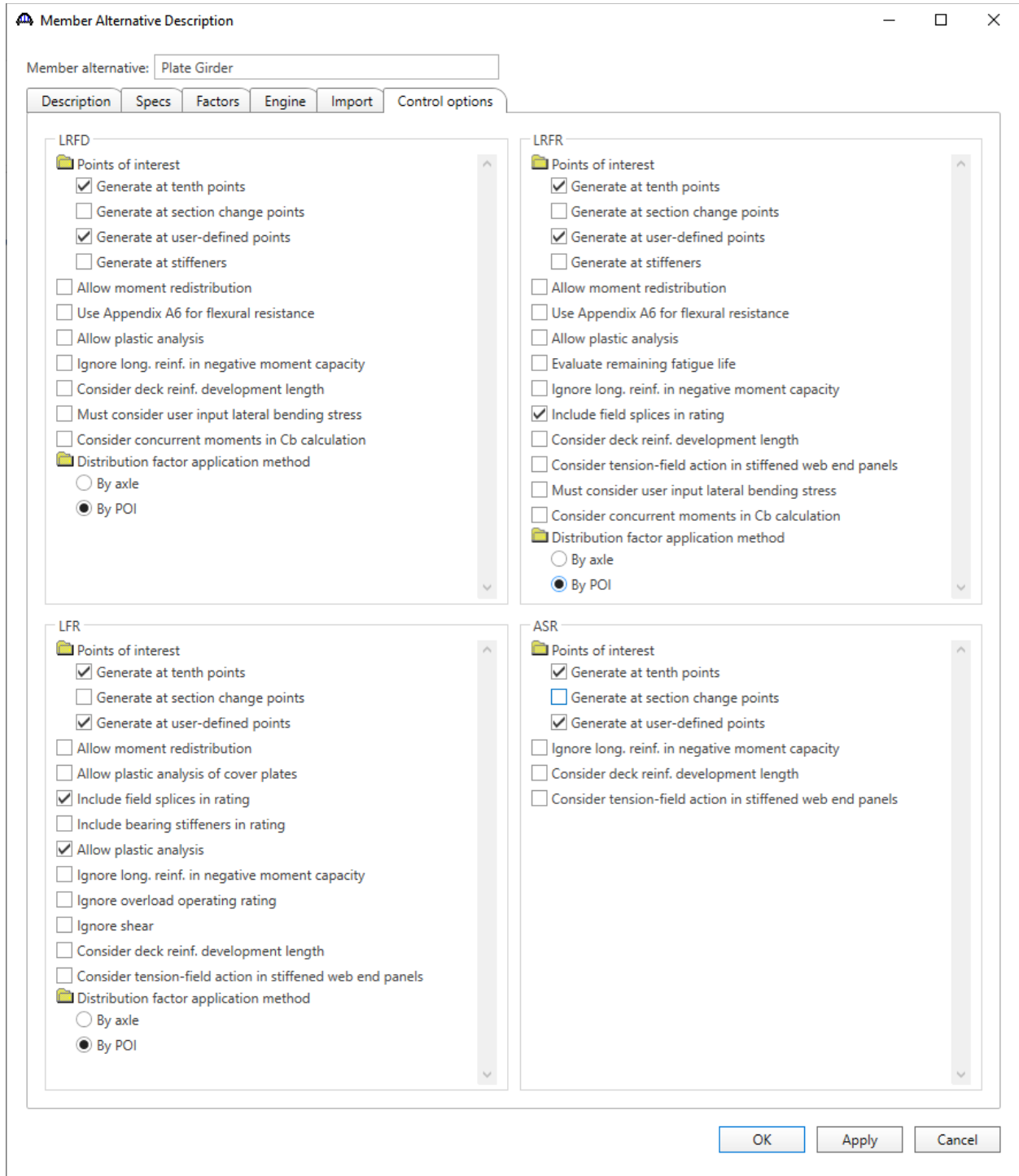
The **Member Alternative Description** window will open. Enter the data as shown below.



The 'Member Alternative Description' dialog box has a title bar with a minus, maximize, and close button. The 'Member alternative' field contains 'Plate Girder'. There are five tabs: Description, Specs, Factors, Engine, Import, and Control options. The 'Description' tab is selected. The 'Description' field contains the text: 'Add additional weight for steel details such as diaphragms and stiffeners'. To the right are fields for: Material type: Steel, Girder type: Plate, Modeling type: Multi Girder System, and Default units: US Customary. Below these are 'Girder property input method' options:  Schedule based and  Cross-section based. To the right are 'End bearing locations' fields: Left: 6.0000 in and Right: 6.0000 in. At the bottom left are 'Self load' fields: Load case: Engine Assigned, Additional self load: 0.034 kip/ft, and an empty field for percentage. To the right is 'Default rating method: LFR'. At the bottom are 'OK', 'Apply', and 'Cancel' buttons.

# STL1-Simple Span Plate Girder Example

Navigate to the **Control options** tab of this window and select the options as shown below.



Click **OK** to close the window and create a new member alternative.



## STL1-Simple Span Plate Girder Example

Reopen the member **G2** window. The newly added member alternative will be automatically assigned as the **Existing** and **Current** member alternative for this member.

Member name:  Link with:

Description:

Existing	Current	Member alternative name	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Plate Girder	Add addi...

Number of spans:

Span no.	Span length (ft)
1	161.00

OK Apply Cancel

### Girder Profile

Next describe the girder profile by double clicking on the **Girder Profile** node in the **Bridge Workspace** tree. Enter the data in each tab of the **Girder Profile** window as shown below.

#### Web

Type:

Web Top flange Bottom flange

Begin depth (in)	Depth vary	End depth (in)	Thickness (in)	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld at right
69.0000	None	69.0000	0.5000	1	0.00	161.00	161.00	Grade 50W	-- None --

New Duplicate Delete

OK Apply Cancel

# STL1-Simple Span Plate Girder Example

## Top flange

Begin width (in)	End width (in)	Thickness (in)	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld	Weld at right
22.0...	22.0000	1.2500	1	0.00	161.00	161.00	Grade 50W	-- None --	-- None --

## Bottom flange

Enter the following starting distance and length to the bottom flange tab.

starting distance	bottom flange
0	36.666
36.666	87.667
124.333	36.667

## STL1-Simple Span Plate Girder Example

Girder Profile

Type: Plate Girder

Web | Top flange | Bottom flange

Begin width (in)	End width (in)	Thickness (in)	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld	Weld at right
22.0...	22.0000	1.2500	1	0.00	36.67	36.67	Grade 50W	-- None --	-- None --
22.0...	22.0000	2.0000	1	36.67	87.67	124.33	Grade 50W	-- None --	-- None --
22.0...	22.0000	1.2500	1	124.33	36.67	161.00	Grade 50W	-- None --	-- None --

Copy to top flange

New Duplicate Delete

OK Apply Cancel

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 and enter the data describing the structural properties of the deck. The window is shown below.

Deck Profile

Type: Plate

Deck concrete | Reinforcement | Shear connectors

Material	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Structural thickness (in)	Start effective flange width (Std) (in)	End effective flange width (Std) (in)	Start effective flange width (LRFD) (in)	End effective flange width (LRFD) (in)	n
Deck Concrete	1	0.00	161.00	161.00	9.5000	114.0000	114.0000	125.0000	125.0000	8.000

Compute from typical section...

New Duplicate Delete

OK Apply Cancel

## STL1-Simple Span Plate Girder Example

No reinforcement is described. Composite regions are described in the **Shear connectors** tab as shown below.

The screenshot shows the 'Deck Profile' dialog box with the 'Shear connectors' tab selected. The 'Type' is set to 'Plate'. The table below contains one row of data for a composite connector.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Connector ID	Number of spaces	Number per row	Transverse spacing (in)
1	0.00	161.00	161.00	Composite			

Buttons at the bottom include 'Shear stud design tool', 'View calcs', 'New', 'Duplicate', 'Delete', 'OK', 'Apply', and 'Cancel'.

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

### Haunch Profile

The haunch profile is defined by double-clicking on the **Haunch Profile** node in the **Bridge Workspace** tree. Enter data as shown below for the interior girder **G2**.

The screenshot shows the 'Steel Haunch Profile' dialog box. The 'Haunch type' section has an 'Embedded flange' checkbox. A diagram shows a haunched girder cross-section with dimensions Z1, Z2, and Y1. The table below contains one row of data for the haunch profile.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)
1	0.00	161.00	161.00	11.0000	11.0000	2.0000

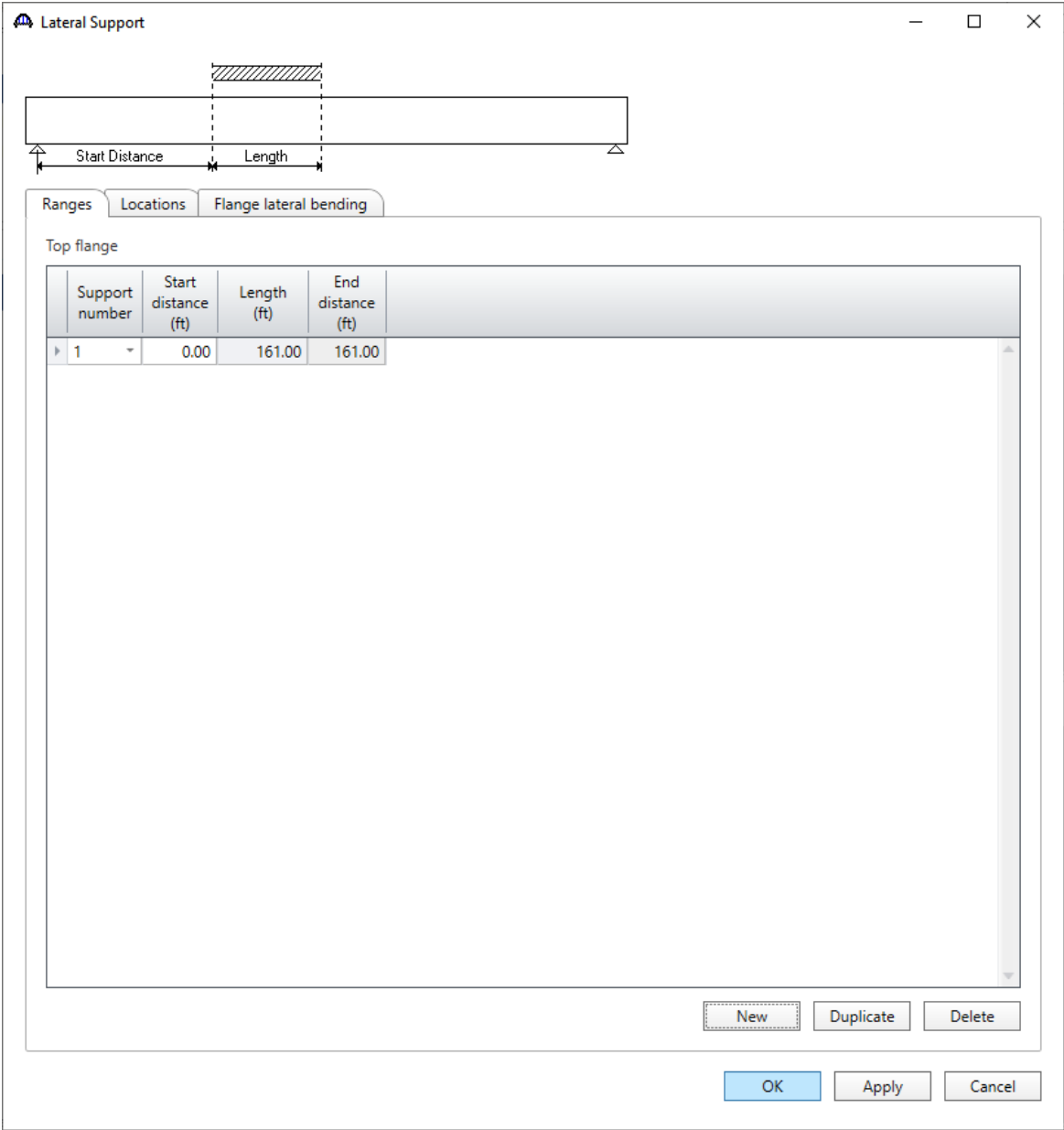
Buttons at the bottom include 'New', 'Duplicate', 'Delete', 'OK', 'Apply', and 'Cancel'.

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

# STL1-Simple Span Plate Girder Example

## Lateral Support

Open the **Lateral Support** window by double clicking on the **Lateral Support** node in the **Bridge Workspace** tree. Regions where the slab is considered to provide lateral support for the top flange are defined as shown below.

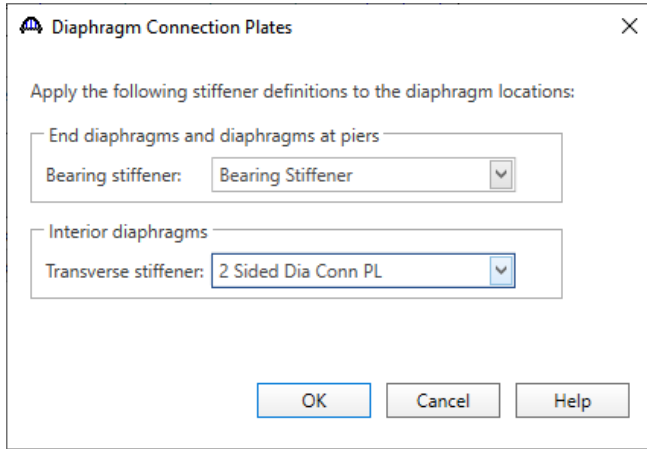


Click **OK** to apply the data and close the window.

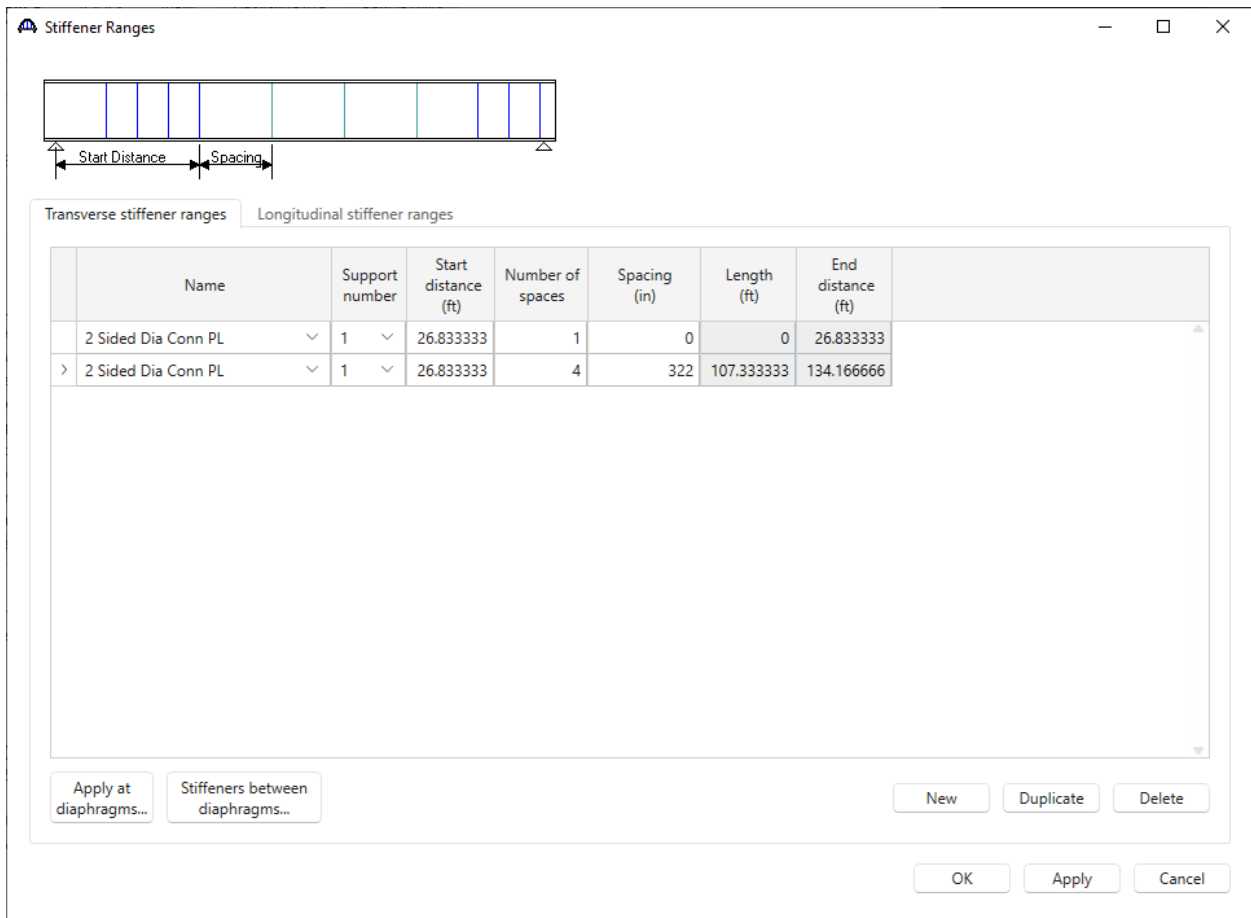
# STL1-Simple Span Plate Girder Example

## Stiffener Ranges

Double click on the **Stiffener Ranges** node in the **Bridge Workspace** to open the **Stiffener Ranges** window. Click the **Apply at diaphragms...** button to open the **Diaphragm Connection Plates** window. Select the **2 Sided Conn PL** as the **Transverse Stiffener** to be applied at the interior diaphragms and click **OK**.



The **Stiffener Ranges** window will be updated as shown below.



## STL1-Simple Span Plate Girder Example

The intermediate transverse stiffeners are now located. Note that a range does not include a stiffener at the beginning of the range. The range that begins at the left end of the beam with one space and a spacing of 58 inches locates the first stiffener. The remaining intermediate stiffeners are located as follows.

Stiffener Ranges

Transverse stiffener ranges    Longitudinal stiffener ranges

Name	Support number	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> Stiffener	1	0	1	58	4.833333	4.833333
Stiffener	1	0	1	161	13.416667	13.416667
Stiffener	1	13.42	5	322	134.166667	147.586667
2 Sided Dia Conn PL	1	26.833333	1	0	0	26.833333
2 Sided Dia Conn PL	1	26.833333	4	322	107.333333	134.166666
Stiffener	1	147.5888	1	103	8.583333	156.172133

Apply at diaphragms...    Stiffeners between diaphragms...    New    Duplicate    Delete

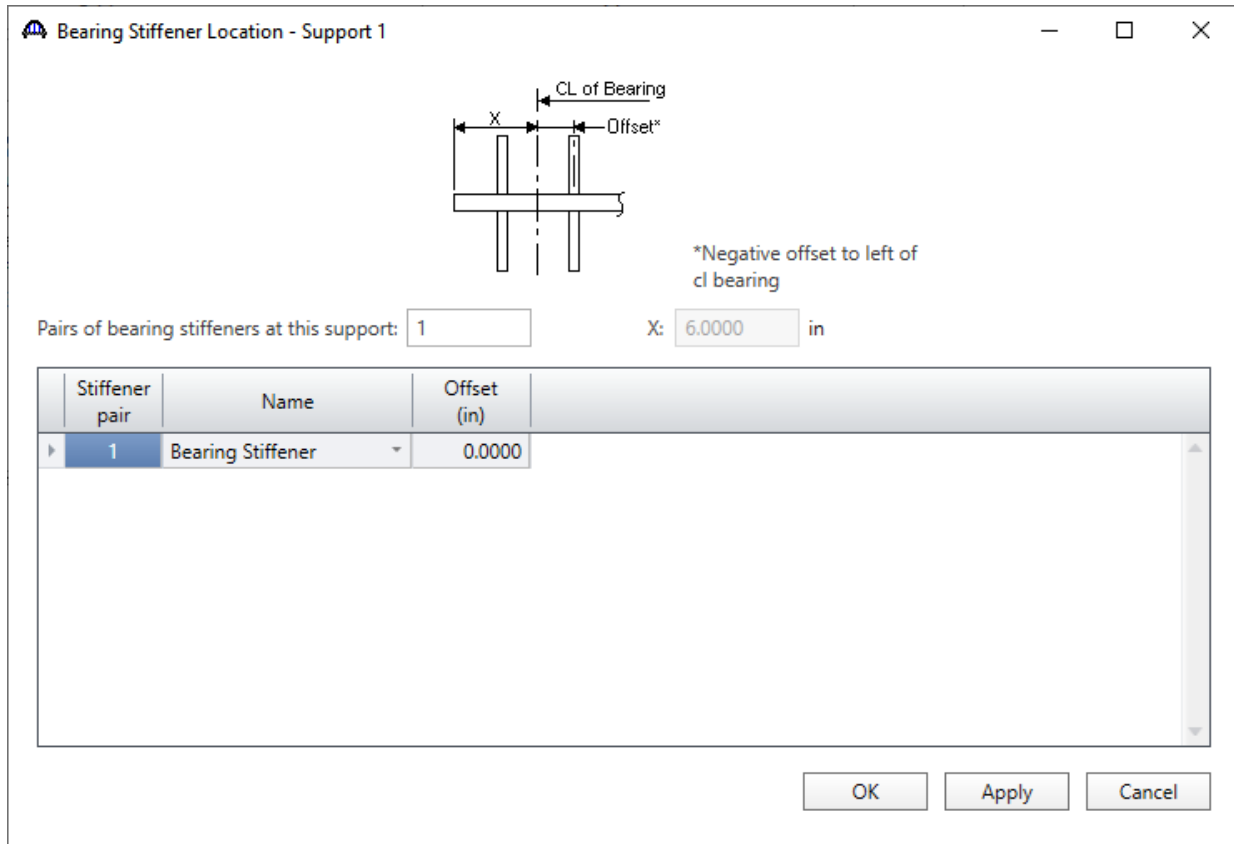
OK    Apply    Cancel

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

## STL1-Simple Span Plate Girder Example

### Bearing Stiffener Locations

Bearing stiffener definitions were assigned to locations when the **Apply at diaphragms...** option was used on the **Stiffener Ranges** window. The **Bearing Stiffener Location – Support 1** window is opened by expanding the **Bearing Stiffener Locations** node in the **Bridge Workspace** tree and double clicking on the **Support 1** node. The assignment for support 1 is shown below. No changes are required.

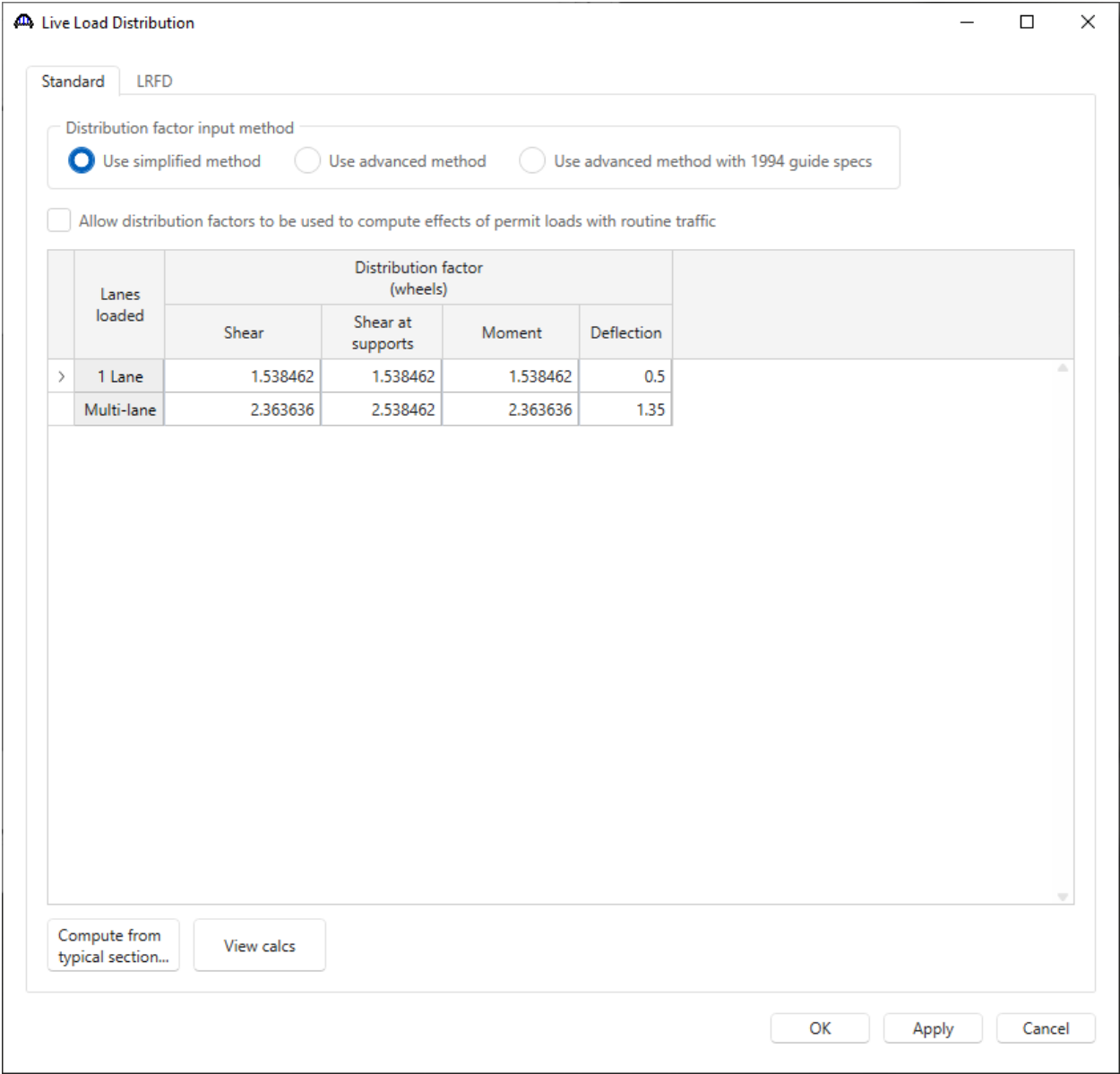




# STL1-Simple Span Plate Girder Example

## Live Load Distribution

Open the **Live Load Distribution** window from the **Bridge Workspace** tree. Click the **Compute from typical section...** button to compute the standard live load distribution factors.



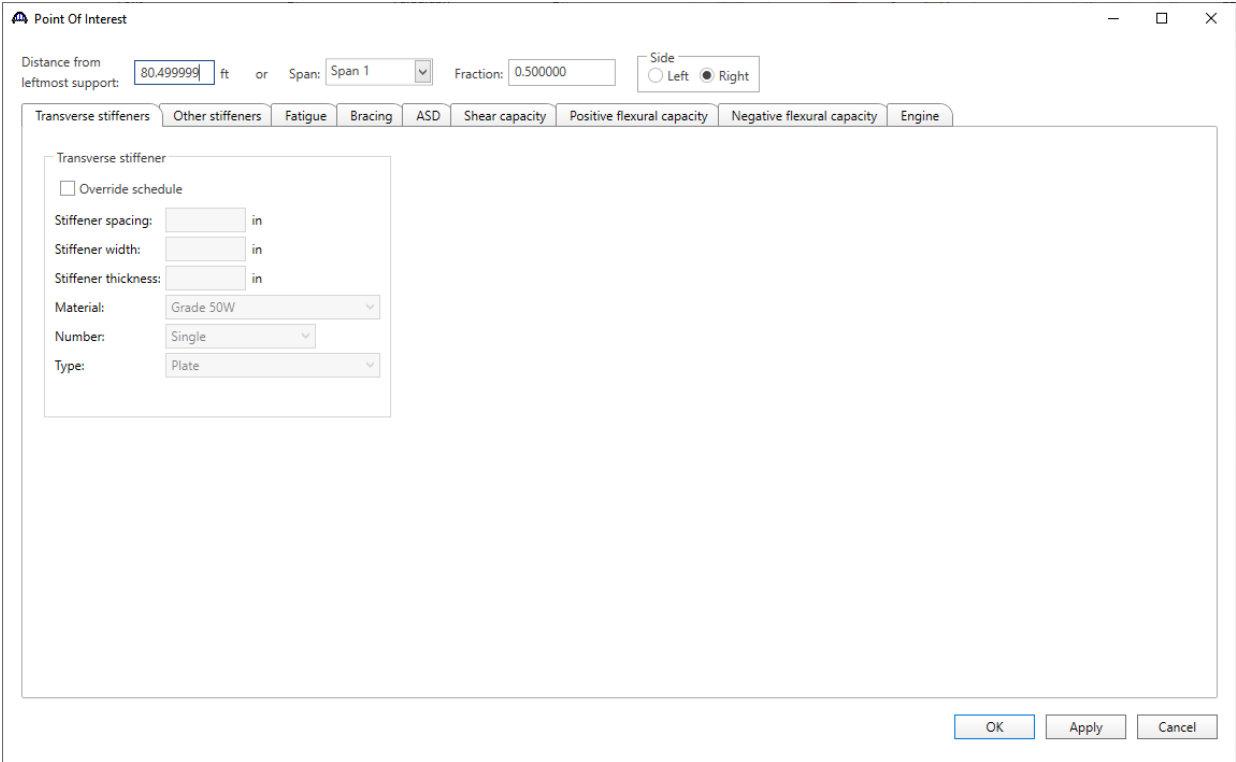
Live load distribution factor calculation details can be viewed by clicking **View Calcs** button.

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

# STL1-Simple Span Plate Girder Example

## Points of Interest

Double click on the **Points of Interest** node in the **Bridge Workspace** tree to open the **Point of Interest** window. Define the point of interest as shown below.



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

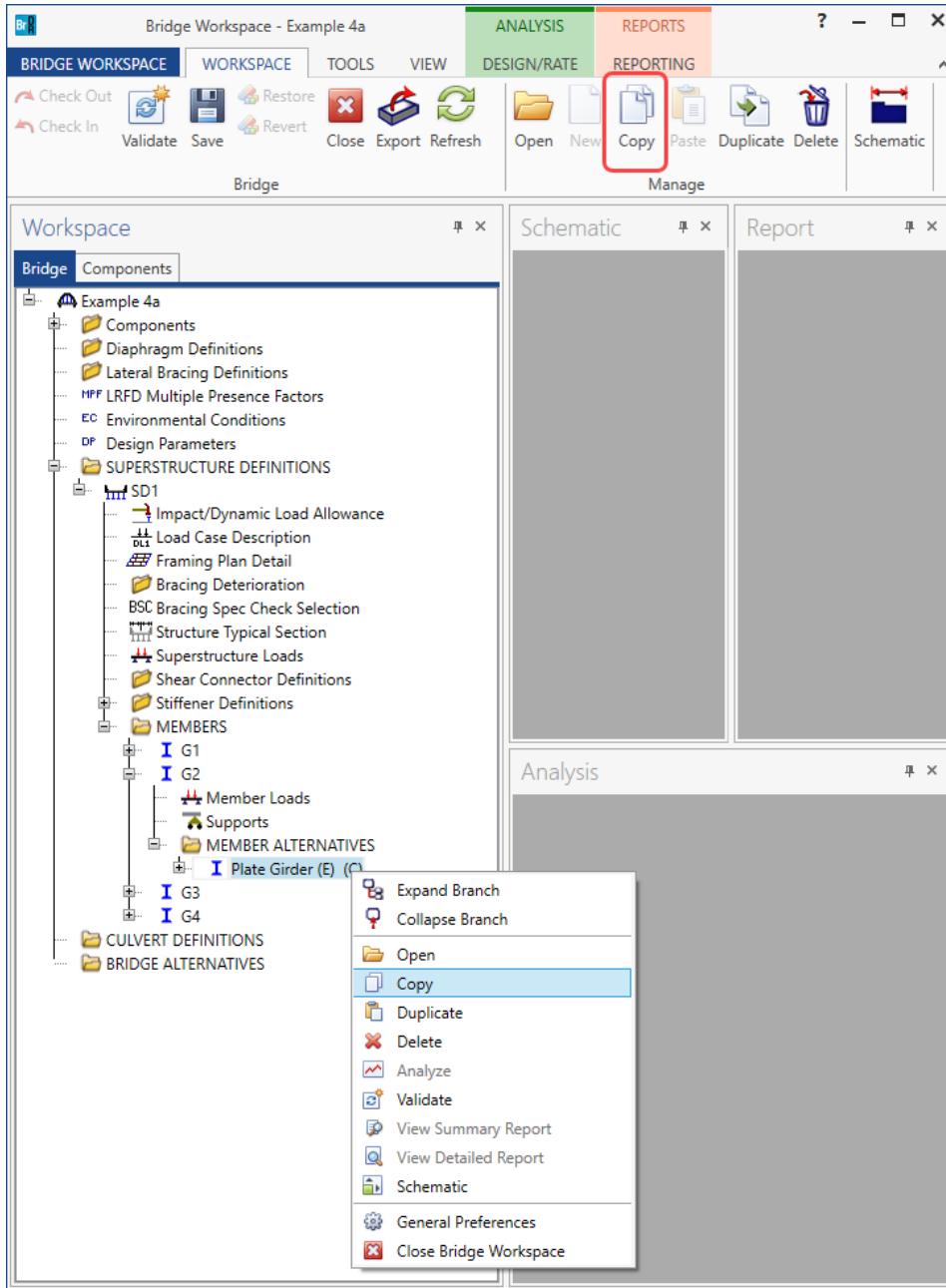
The description of an interior beam for the structure definition is complete.

# STL1-Simple Span Plate Girder Example

## Exterior Girder Member – G1

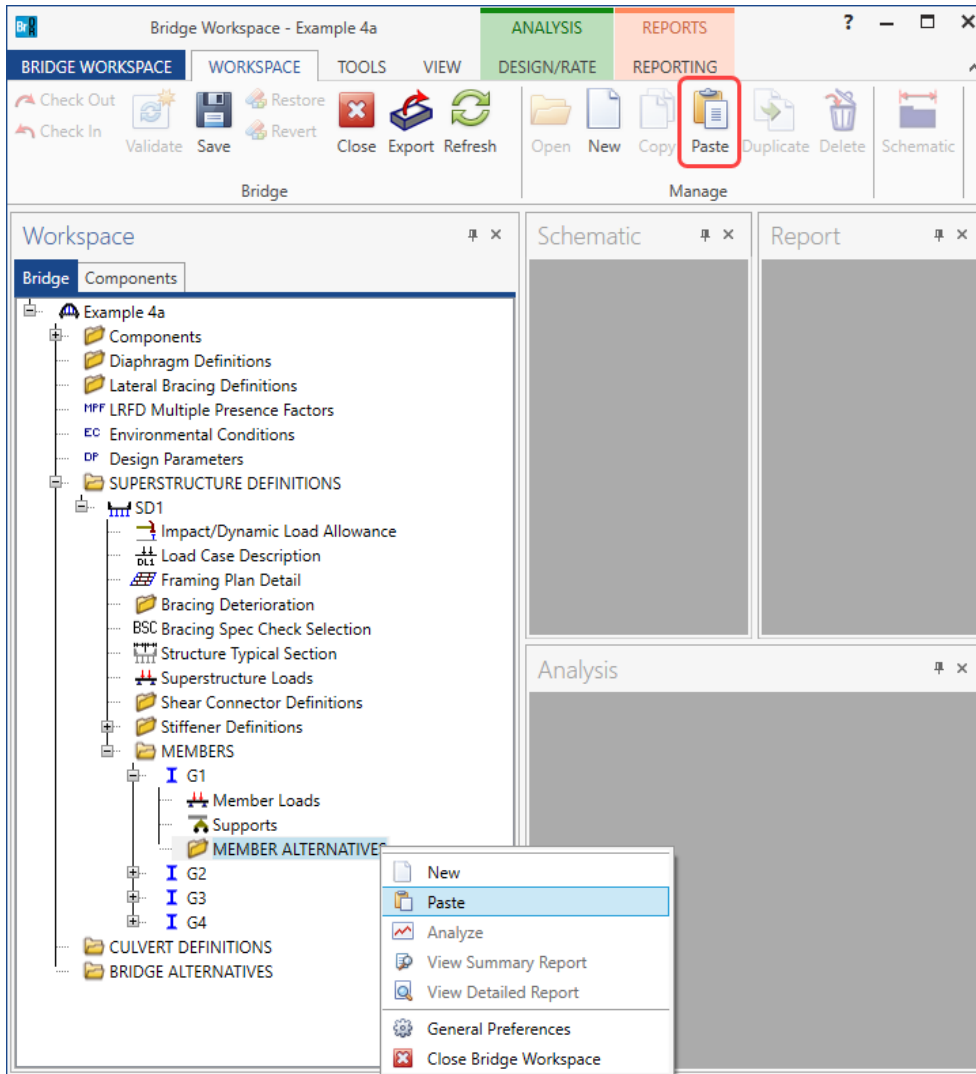
Copy the above member alternative added for member **G2** to member **G1**, by following these steps.

Select the **Plate Girder** member alternative for member **G2** and click the **Copy** button from the **Manage** group of the **WORKSPACE** ribbon (or right click and select **Copy** from the drop down menu).



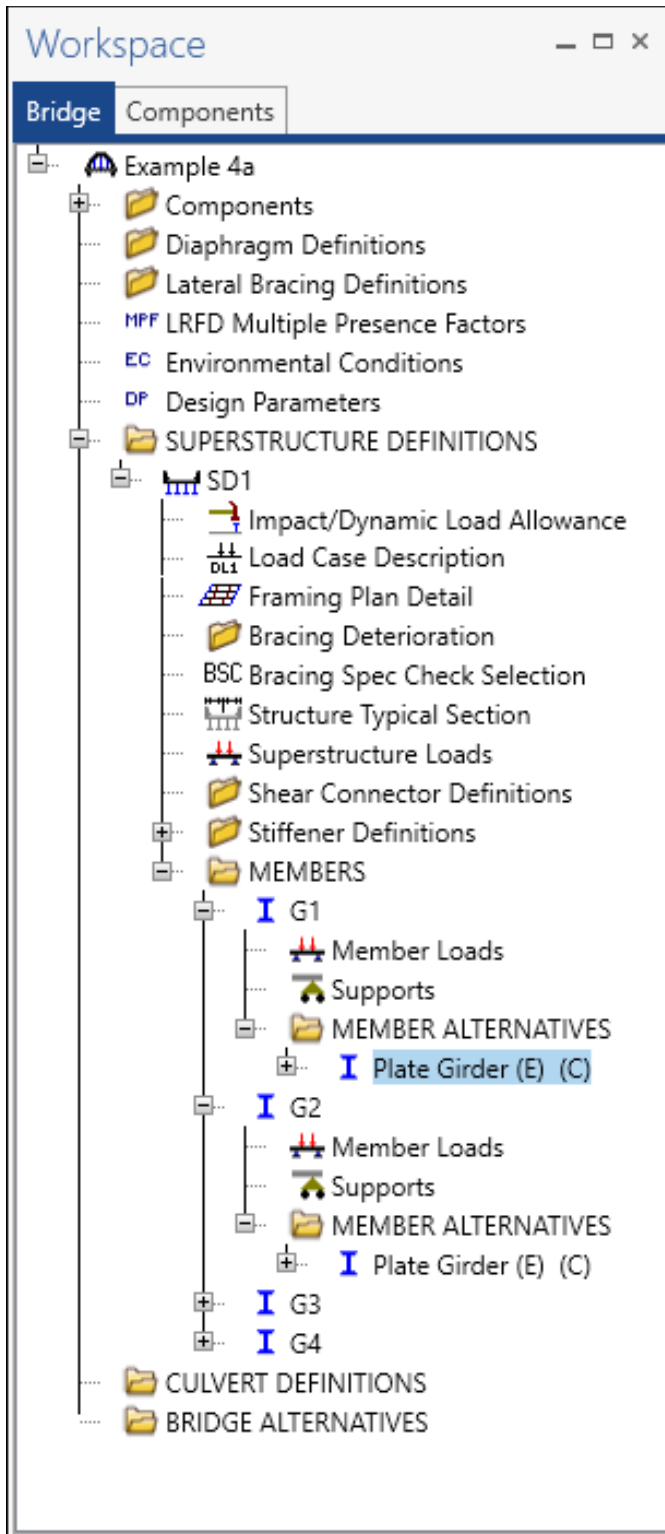
## STL1-Simple Span Plate Girder Example

Select the **MEMBER ALTERNATIVE** node for member **G1** in the **Bridge Workspace** tree and click the **Paste** button from the **Manage** group of the **WORKSPACE** ribbon (or right click and select **Paste** from the drop-down menu).



# STL1-Simple Span Plate Girder Example

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

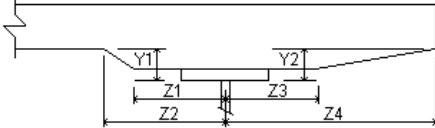


# STL1-Simple Span Plate Girder Example

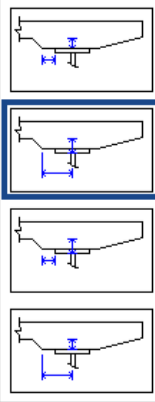
Navigate to the **Haunch Profile** window for member **G1** and define the following haunch profile for the exterior girder **G1**.

**Steel Haunch Profile** \_ □ ×

Haunch type:  Embedded flange



Haunch type:



Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Z3 (in)	Z4 (in)	Y1 (in)	Y2 (in)
1	0.00	161.00	161.00	11.0000	11.0000	11.0000	51.0000	2.0000	2.0000

New Duplicate Delete

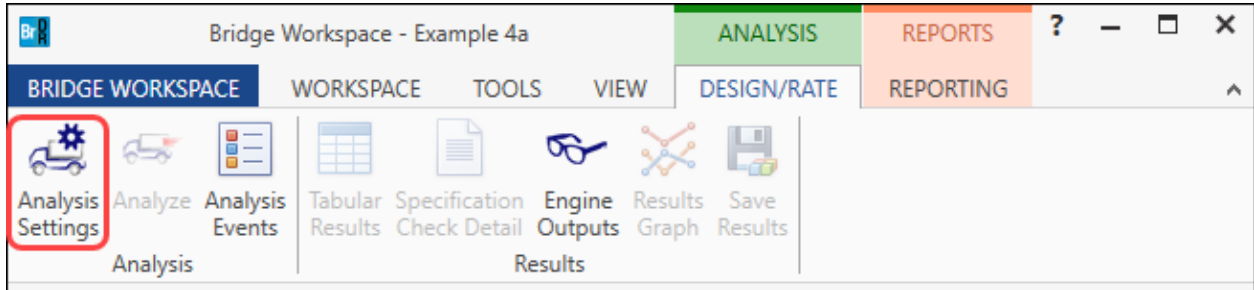
OK Apply Cancel

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

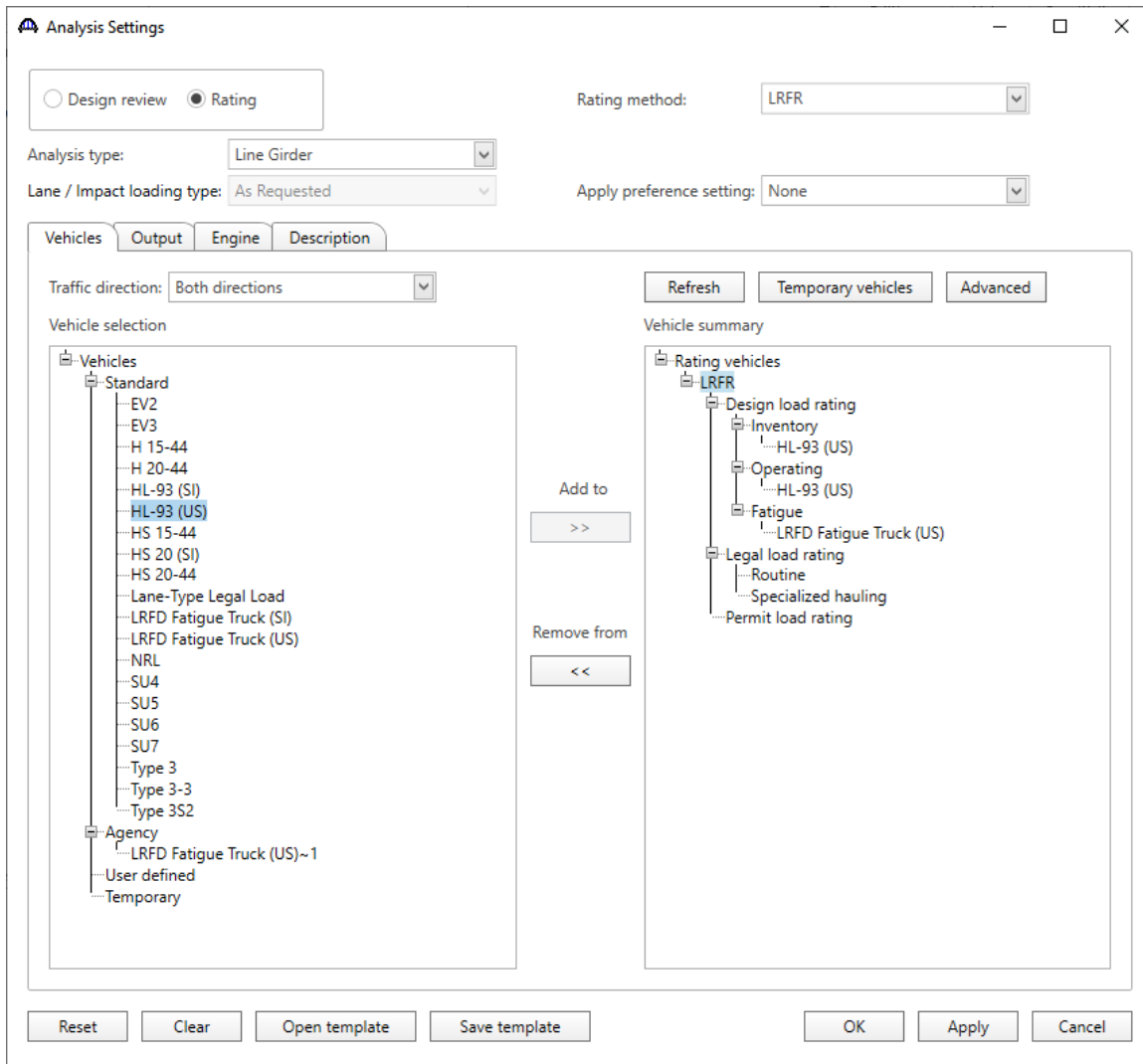
# STL1-Simple Span Plate Girder Example

## LRFR Analysis

The interior member alternative can now be analyzed. To perform an **LRFR** rating, select the **Analysis Settings** button on the **Analysis** group of the **DESIGN/RATE** ribbon. The window shown below opens.



Select the vehicles to be used in the analysis as shown below.

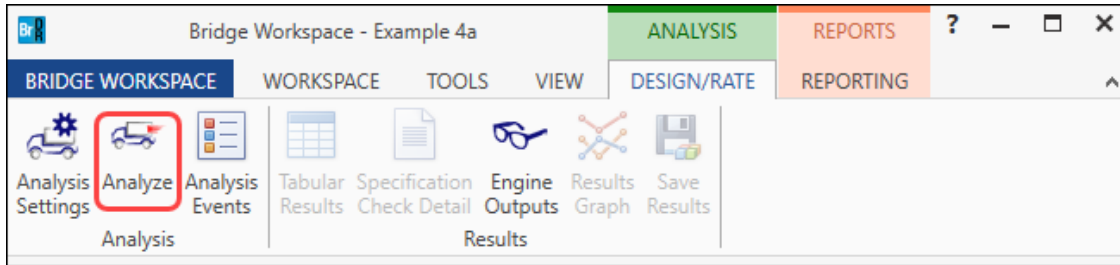


Click **OK** to apply the analysis settings and close the window.

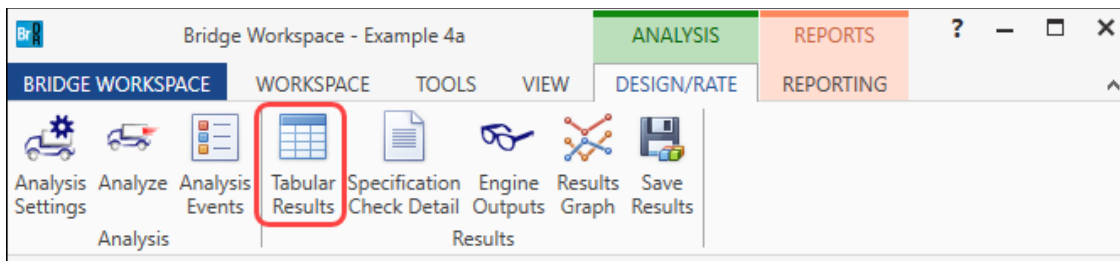
# STL1-Simple Span Plate Girder Example

## Tabular Results

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



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**

Print

Report type: Rating Results Summary

Lane/Impact loading type:  As requested  Detailed

Display Format: Single rating level per row

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HL-93 (US)	Truck + Lane	LRFR	Inventory	16.49	0.458	80.50	1 - (50.0)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested
HL-93 (US)	Truck + Lane	LRFR	Operating	21.37	0.594	80.50	1 - (50.0)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested
HL-93 (US)	Tandem + Lane	LRFR	Inventory	19.56	0.543	80.50	1 - (50.0)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested
HL-93 (US)	Tandem + Lane	LRFR	Operating	25.35	0.704	80.50	1 - (50.0)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested

AASHTO LRFR Engine Version 7.5.0.3001  
Analysis preference setting: None

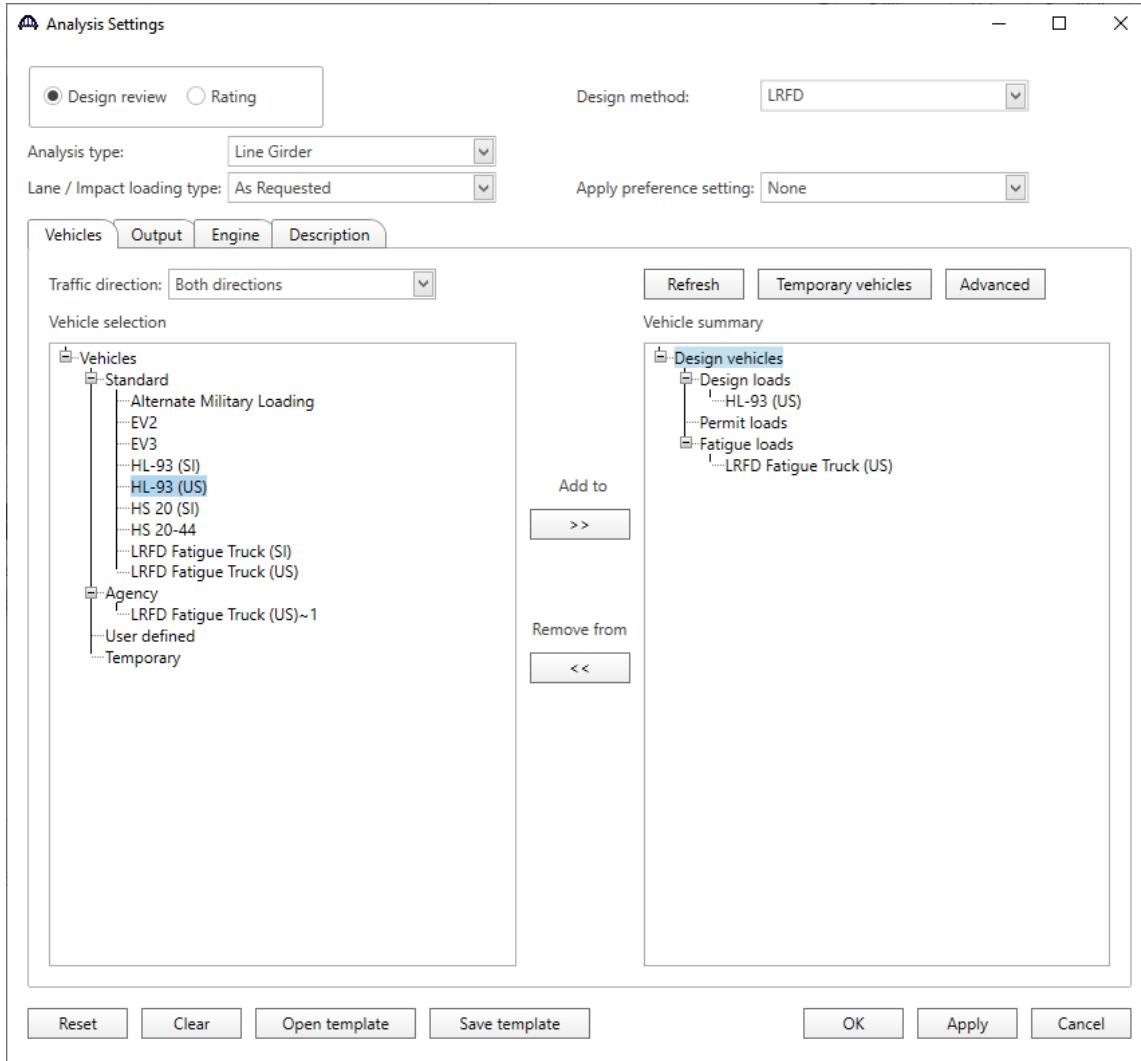
Close



# STL1-Simple Span Plate Girder Example

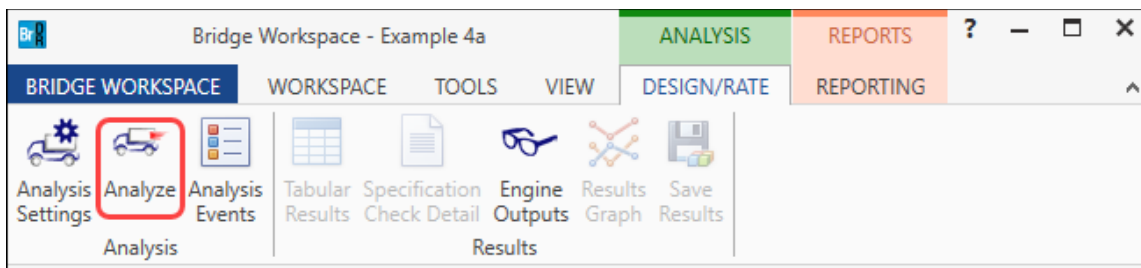
## LRFD Design Review

An LRFD design review of this girder for **HL93** loading can be performed by AASHTO LRFD. To do LRFD design review, enter the **Analysis Settings** window as shown below.



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

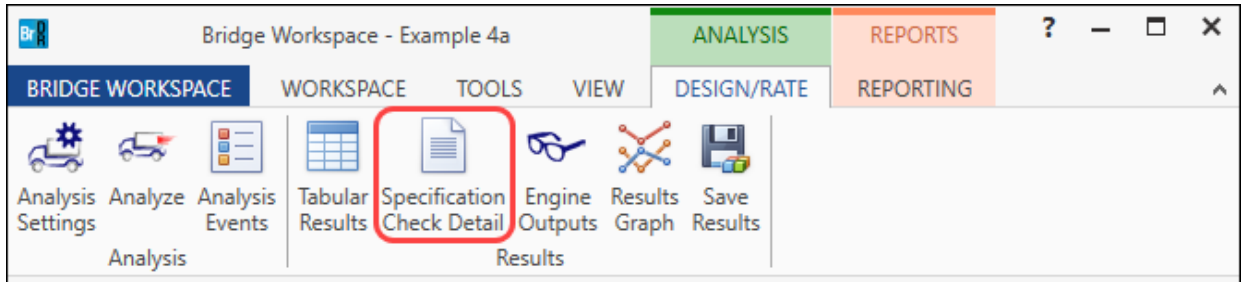
Next click the **Analyze** button on the **Analysis** group of the **DESIGN/RATE** ribbon to perform the design review.



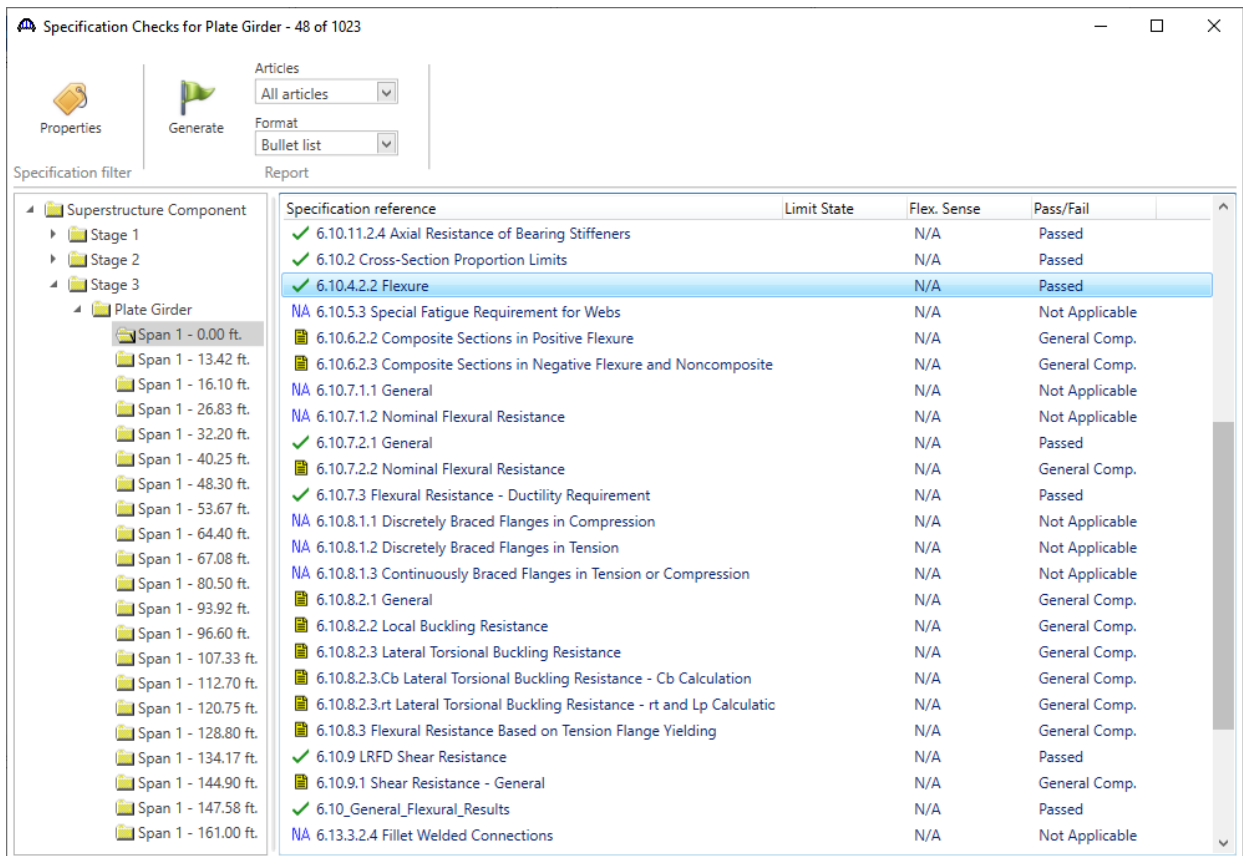
# STL1-Simple Span Plate Girder Example

## Specification Check Detail

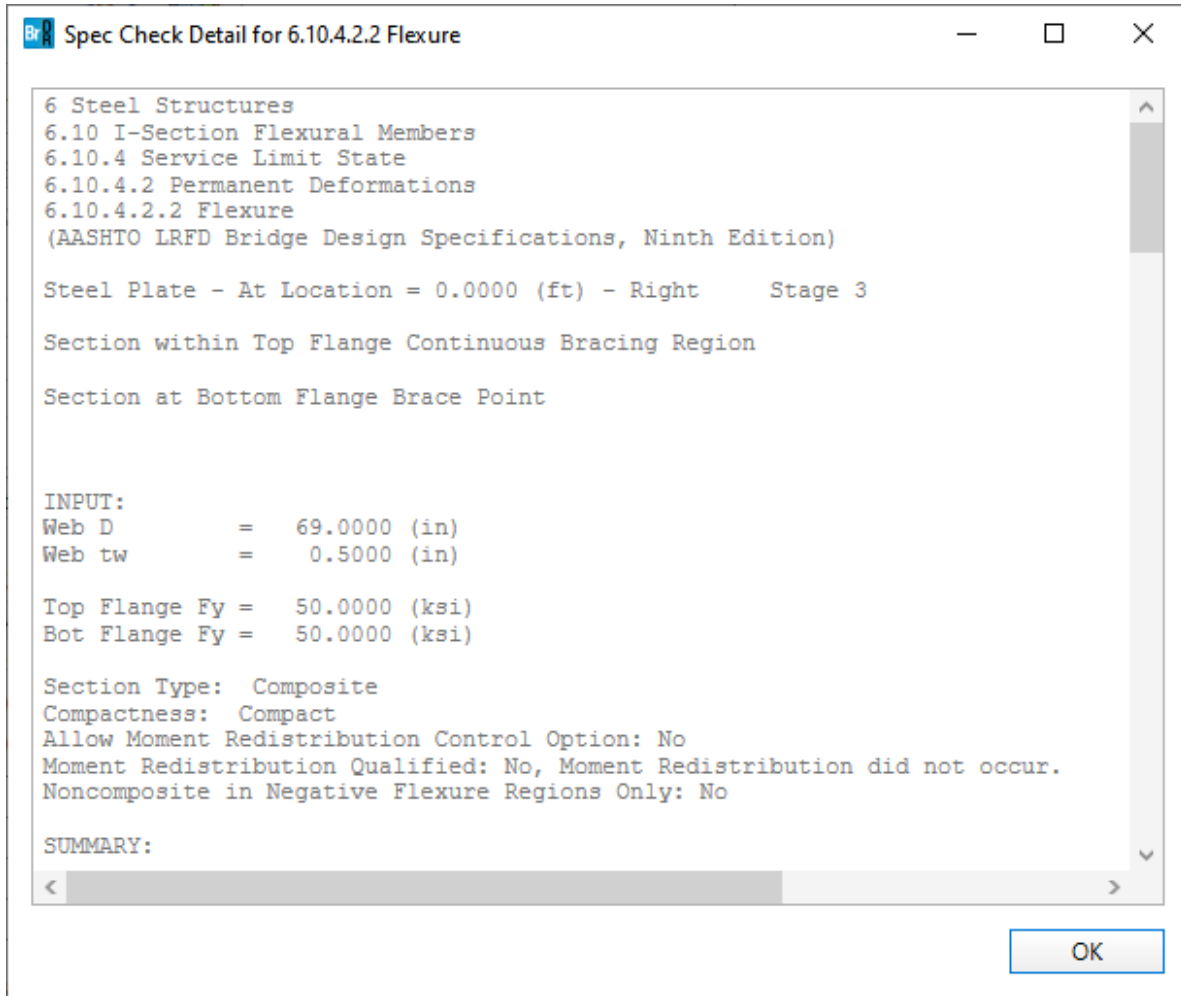
The specification checks can be viewed by selecting the **Specification Check Detail** button from the **Results** group of the **DESIGN/RATE** ribbon.



Select the **6.10.4.2.2 Flexure** article for **Stage 3** at **Span 1 – 0.00 ft.**

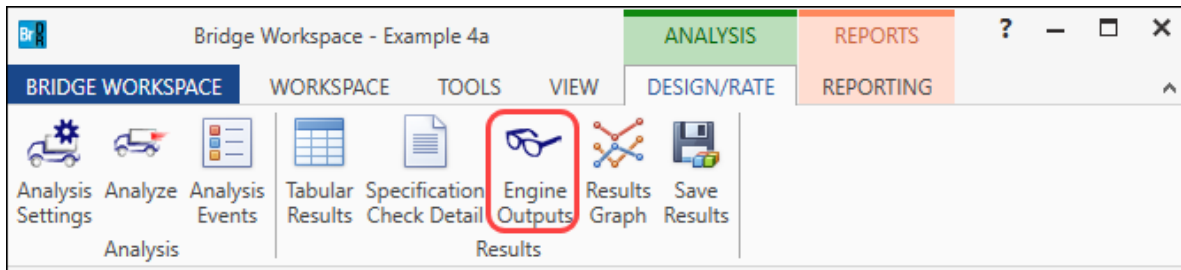


## STL1-Simple Span Plate Girder Example



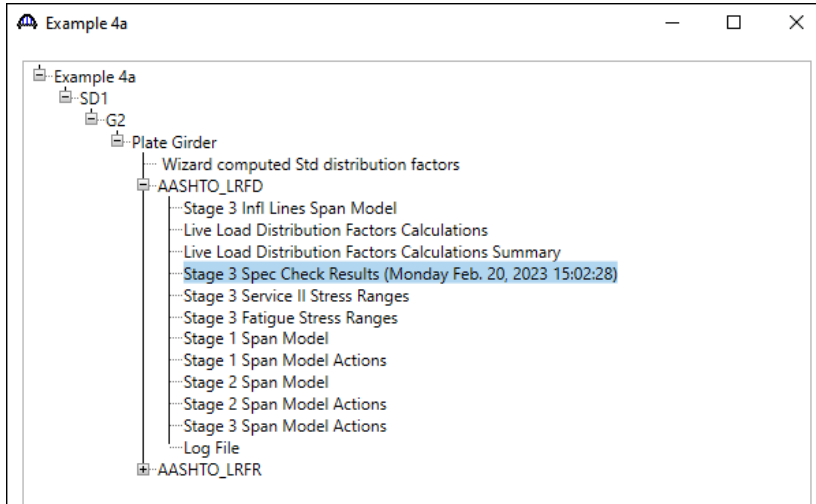
### Engine Outputs

AASHTO LRFD analysis will generate a spec check results file. Click the **Engine Outputs** button from the **Results** group of the **DESIGN/RATE** ribbon to open the following window.



# STL1-Simple Span Plate Girder Example

To view the LRFD spec check results (shown below), double click on the **Stage 3 Spec Check Results** under the AASHTO\_LRFD branch in this window.



The following file opens.

Bridge ID : Example 4a  
 Bridge : Example 4a  
 Superstructure Def : SD1  
 Member : G2  
 Analysis Preference Setting :

NBI Structure ID : Example 4a  
 Bridge Alt :  
 Member Alt : Plate Girder

[AASHTO LRFD Specification, Edition 9, Interim 0](#)

### Specification Check Summary

Article	Status
Flexure (6.10.7.1.1, 6.10.7.2.1)	Fail
Shear (6.10.9)	Pass
Fatigue (6.10.5.3, 6.6.1.2.2)	Fail
Serviceability (6.10.4.2.2)	Fail
Constructability (6.10.3.2.1, 6.10.3.2.2, 6.10.3.2.3)	Pass
Transverse Stiffeners (6.10.11.1.2, 6.10.11.1.3)	Pass
Longitudinal Stiffeners (6.10.11.3.1, 6.10.11.3.2, 6.10.11.3.3)	NA
Bearing Stiffeners (6.10.11.2.2, 6.10.11.2.3, 6.10.11.2.4)	Pass
Shear Connector (6.10.10.1, 6.10.10.4)	NA
Field Splice (6.13.2.6, 6.13.2.7, 6.13.5.3, 6.13.6.1.3a, 6.13.6.1.3b, 6.13.6.1.3c)	NA
Minimum Negative Flexure Concrete Deck Reinforcement (6.10.1.7)	Pass
Deflection (2.5.2.6.2)	Pass

### Girder Member Proportions and Compactness (Stage 3)

Location (ft)	Composite	Proportion Code	Code Check	Compact	Code Check
0.000	Yes	Pass	---	Compact	E
16.100	Yes	Pass	---	Compact	E
32.200	Yes	Pass	---	Compact	E
48.300	Yes	Pass	---	Compact	E
64.400	Yes	Pass	---	Compact	E
80.500	Yes	Pass	---	Compact	E
96.600	Yes	Pass	---	Compact	E
112.700	Yes	Pass	---	Compact	E
128.800	Yes	Pass	---	Compact	E
144.900	Yes	Pass	---	Compact	E
161.000	Yes	Pass	---	Compact	E

Proportion Code check legend: