AASHTOWare BrDR 7.5.0

Prestress Tutorial 11

PS-11 Bridge Over Shoal Creek

BrDR Superstructure Training

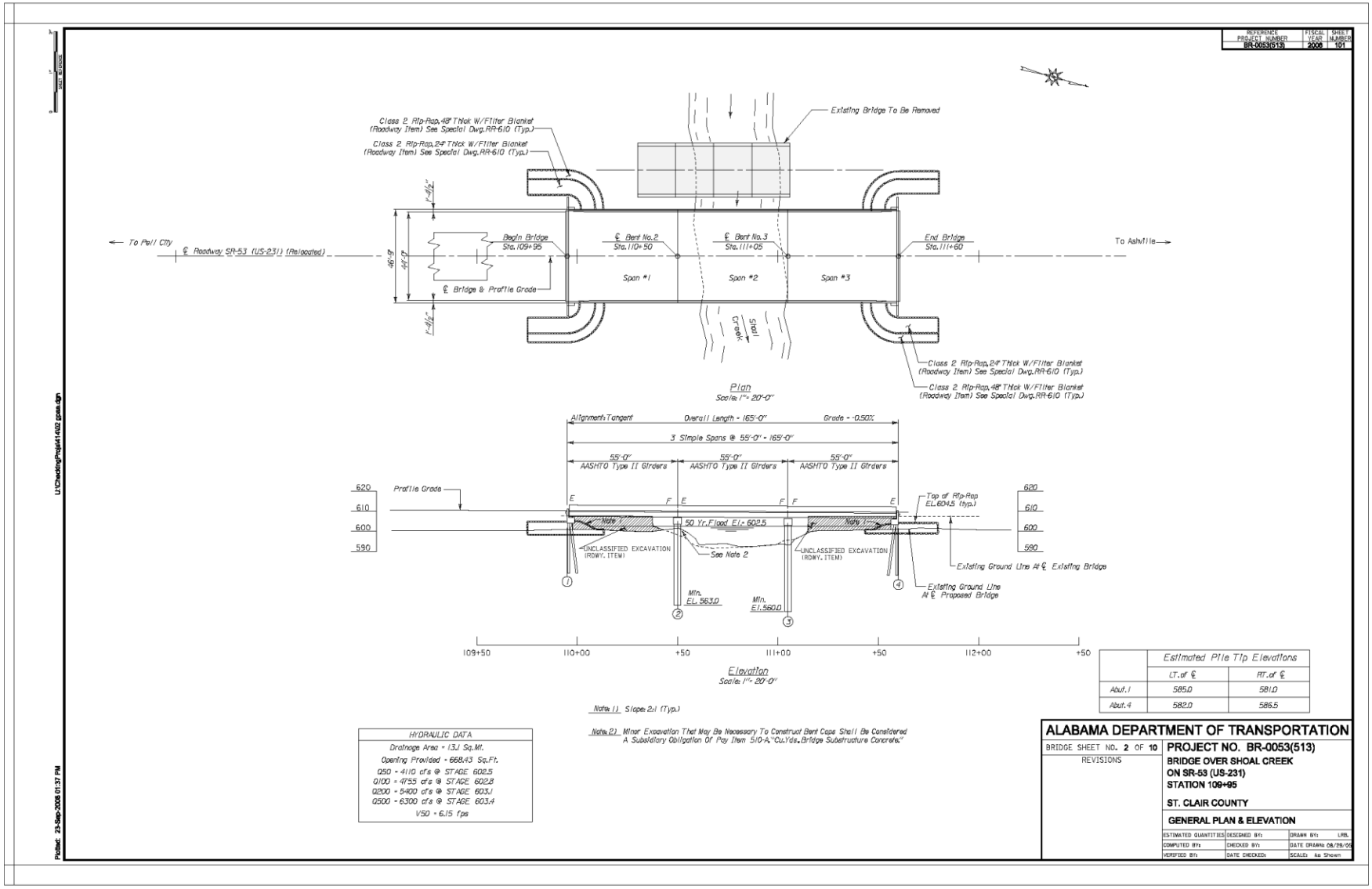
PS11 - Bridge Over Shoal Creek

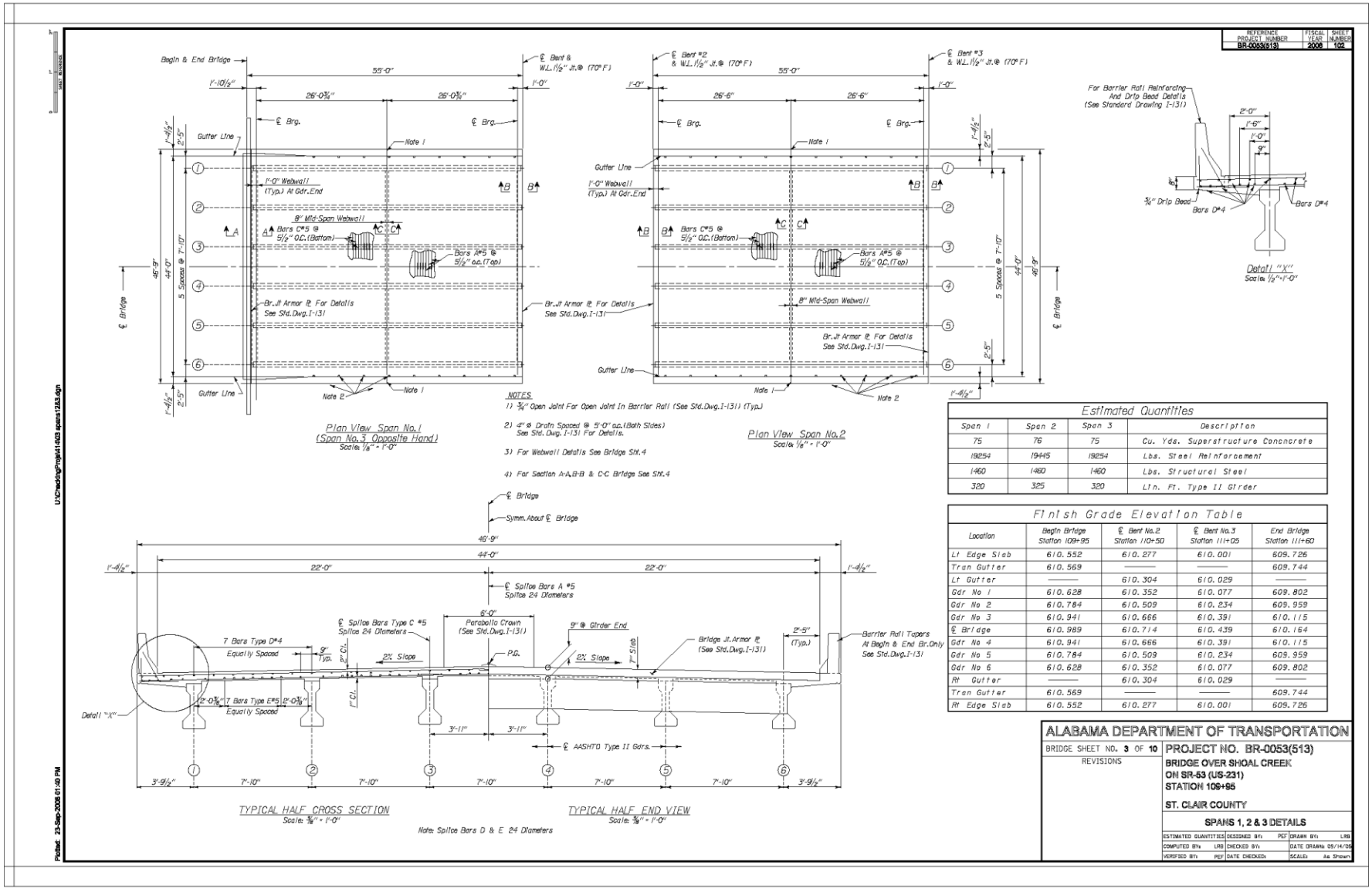
Bridge Over Shoal Creek

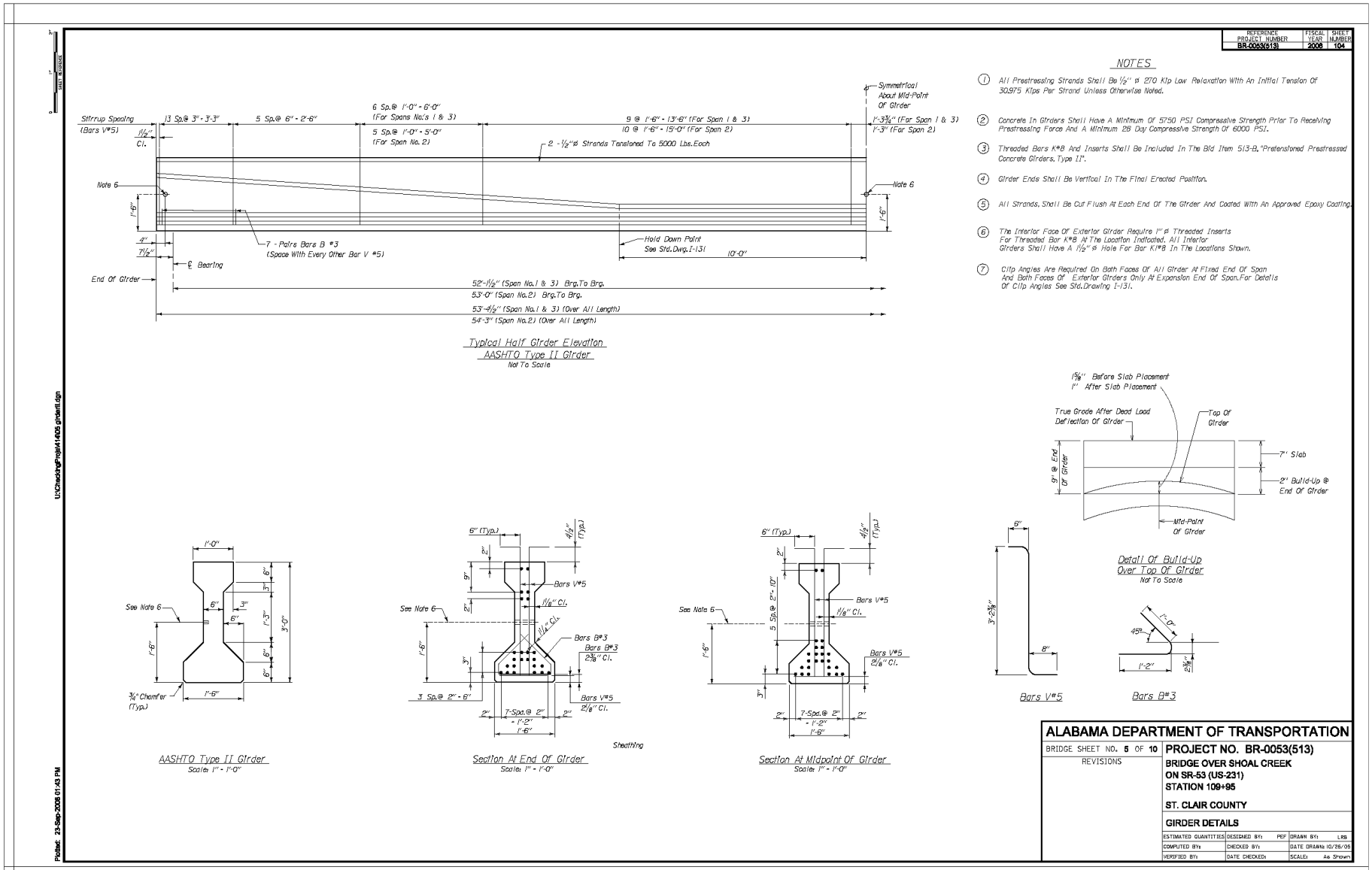
- Bridge Sheet No. 2 - General Plan and Elevation
- Bridge Sheet No. 3 - Span No's. 1, 2, & 3 Details
- Bridge Sheet No. 5 - Girder Details - Span No's. 1, 2, & 3

BrDR Modeling Strategy

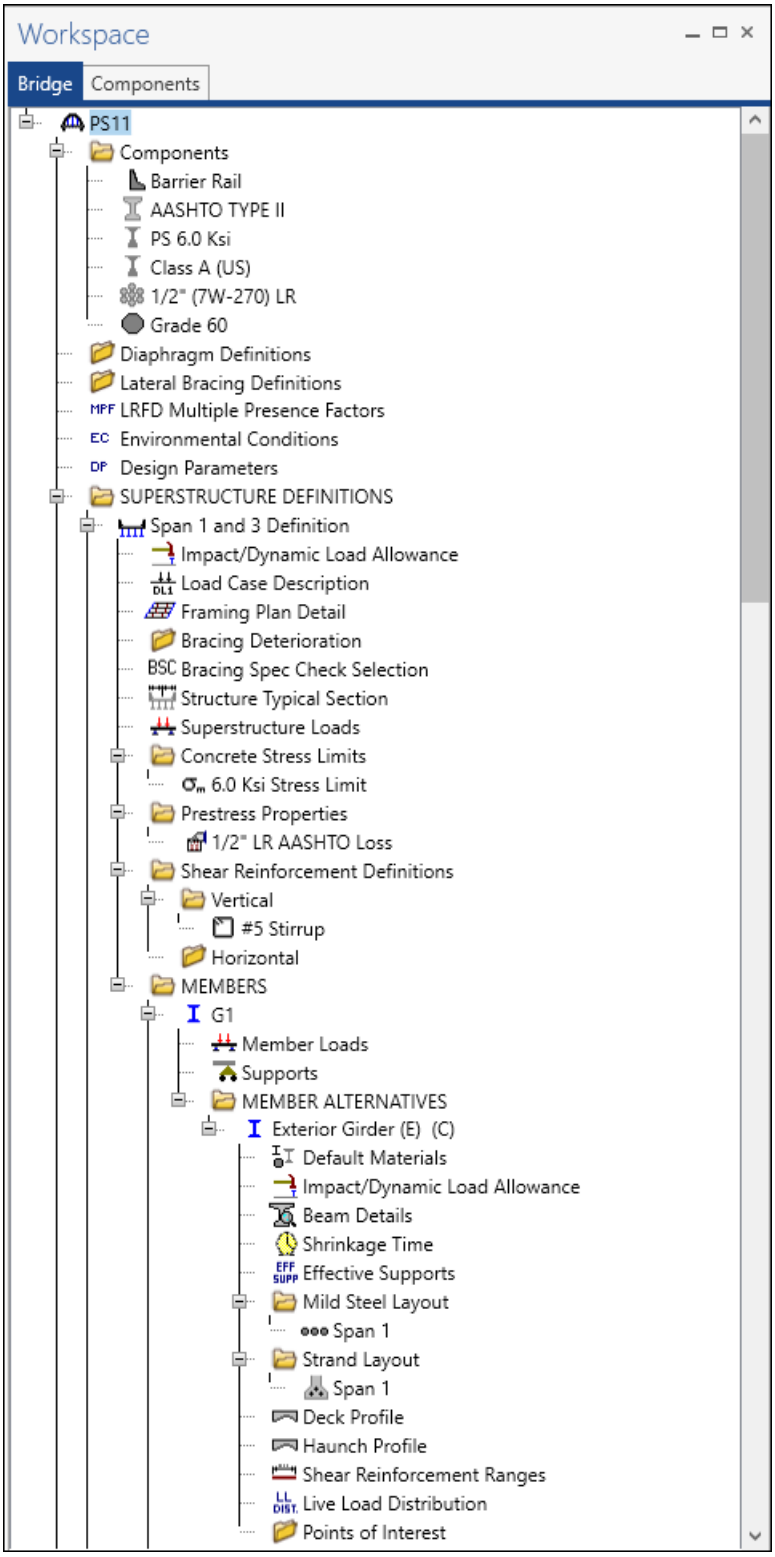
1. Create one BrDR superstructure definition (Span 1 and Span 3 Definition) for Span No. 1 and Span No. 3
    - Complete one exterior girder (G1)
    - Copy the exterior girder to an interior girder (G2) and check the Deck Profile and Haunch Profile.
    - Link all other interior girders (G3, G4 and G5) to G2.
    - Link the other exterior girder (G6) to G1.
2. Create another BrDR Superstructure Definition (Span 2 Definition) for Span No. 2 by copying Span 1 and 3 Definition.
    - Modify the span length in Superstructure Definition.
    - Repopulate the diaphragm spacing using the Diaphragm Wizard.
    - Modify the length of the range in Beam Details, Deck Profile and Haunch Profile.
    - Modify the harp point distance in Strand Layout.
    - Reenter Shear Reinforcement Ranges.
3. Create one Bridge Alternative and three superstructures. The first superstructure is for Span No. 1, the second superstructure is for Span No. 2 and the third superstructure is for Span No. 3.
4. Assign Span 1 and 3 Definition to the first and third superstructure and assign Span 2 definition to the second superstructure.

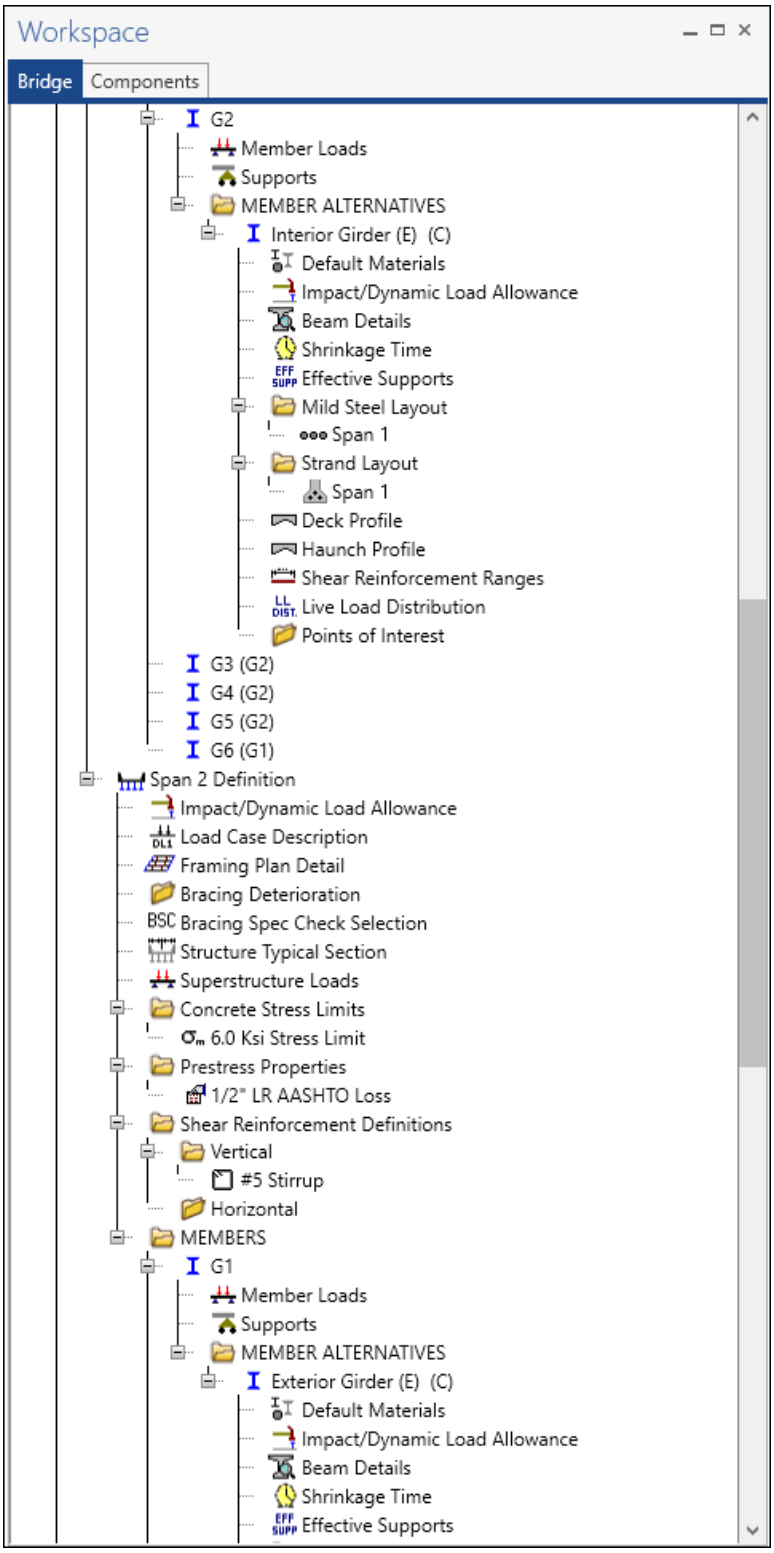

Existing Bridge To Be Removed
Class 2 Rip-Rap, 48" Thick W/Filter Blanket (Roadway Item) See Special Dwg. RR-610 (Typ.)
Class 2 Rip-Rap, 24" Thick W/Filter Blanket (Roadway Item) See Special Dwg. RR-610 (Typ.)
To Pell City
℄ Roadway SR-53 (US-231) (Relocated)
Begin Bridge Sta. 109+95
℄ Bent No. 2 Sta. 110+50
℄ Bent No. 3 Sta. 111+05
End Bridge Sta. 111+60
To Ashville
Span #1
Span #2
Span #3
℄ Bridge & Profile Grade
Shoal Creek
Plan
Scale: 1"= 20'-0"
Alignment-Tangent
Overall Length = 165'-0"
Grade = -0.50%
3 Simple Spans @ 55'-0" = 165'-0"
55'-0" AASHTO Type II Girders
Profile Grade
Top of Rip-Rap El. 604.5 (typ.)
50 Yr. Flood El.= 602.5
Note 1
UNCLASSIFIED EXCAVATION (RDWY. ITEM)
See Note 2
Existing Ground Line At ℄ Existing Bridge
Existing Ground Line At ℄ Proposed Bridge
Min. El. 563.0
Min. El. 560.0
109+50
110+00
+50
111+00
112+00
Elevation
Scale: 1"= 20'-0"
Note 1) Slopes 2:1 (Typ.)
Note 2) Minor Excavation That May Be Necessary To Construct Bent Caps Shall Be Considered A Subsidiary Obligation Of Pay Item 510-A "Cu. Yds. Bridge Substructure Concrete."
HYDRAULIC DATA
Drainage Area = 13.1 Sq. Mi.
Opening Provided = 668.43 Sq. Ft.
Q50 = 4110 cfs @ STAGE 602.5
Q100 = 4755 cfs @ STAGE 602.8
Q200 = 5400 cfs @ STAGE 603.1
Q500 = 6300 cfs @ STAGE 603.4
V50 = 6.15 fps
Estimated Pile Tip Elevations
LT. of ℄
RT. of ℄
Abut. 1 585.0 581.0
Abut. 4 582.0 586.5
ALABAMA DEPARTMENT OF TRANSPORTATION
BRIDGE SHEET NO. 2 OF 10
REVISIONS
PROJECT NO. BR-0053(513)
BRIDGE OVER SHOAL CREEK
ON SR-53 (US-231)
STATION 109+95
ST. CLAIR COUNTY
GENERAL PLAN & ELEVATION
REFERENCE PROJECT NUMBER BR-0053(513)
FISCAL YEAR 2006
SHEET NUMBER 101

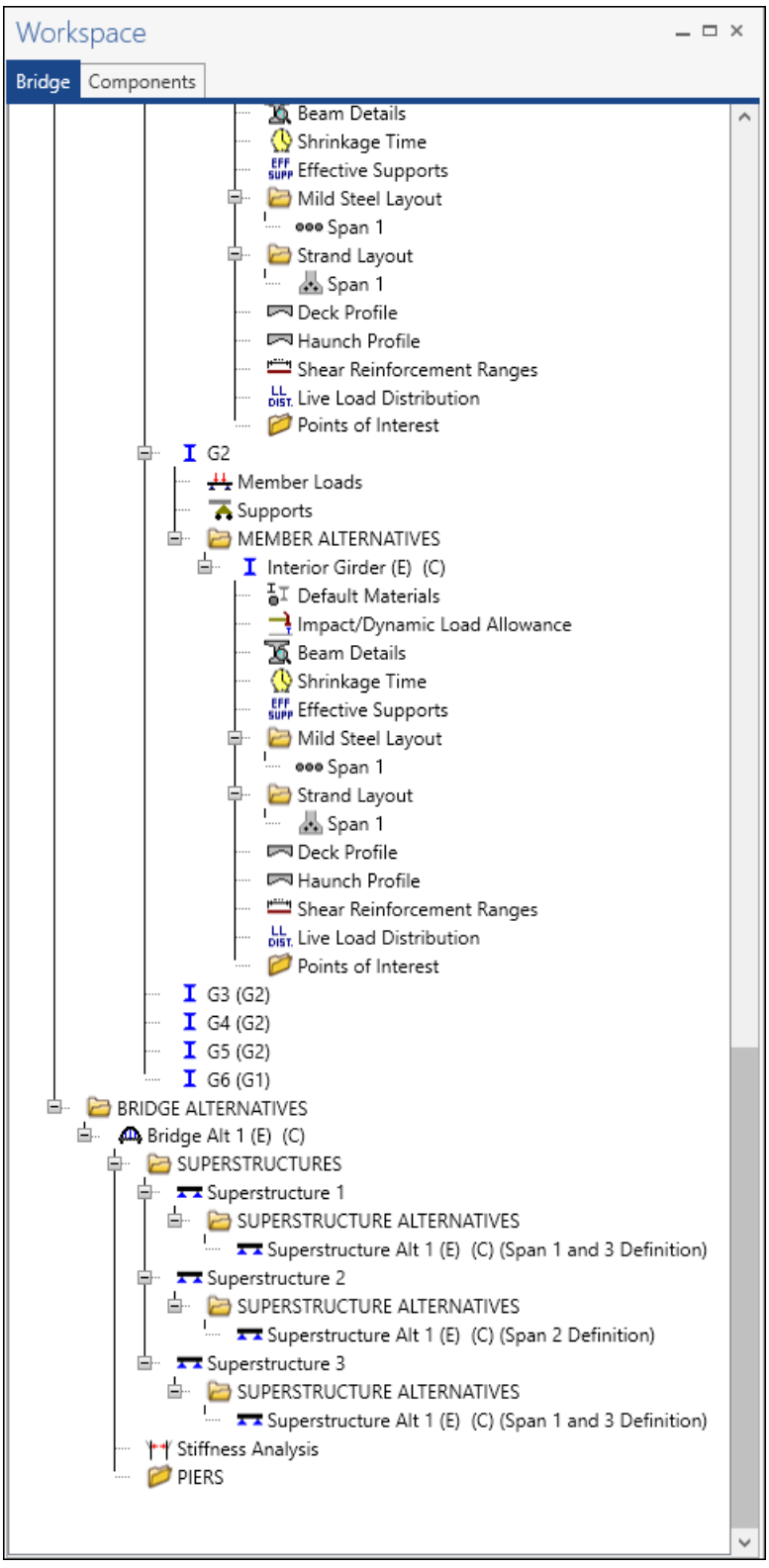

REFERENCE PROJECT NUMBER BR-0053(513)
FISCAL YEAR 2008
SHEET NUMBER 102
Begin & End Bridge
℄ Bent #1 & W.L. 1½" Jt.@ (70° F)
℄ Bent #2 & W.L. 1½" Jt.@ (70° F)
℄ Bent #3 & W.L. 1½" Jt.@ (70° F)
55'-0"
26'-0¾"
26'-6"
℄ Brg.
Gutter Line
Note 1
Note 2
1'-0" Webwall (Typ.) At Gdr. End
8" Mid-Span Webwall
Bars C#5 @ 5½" OC. (Bottom)
Bars A#5 @ 5½" OC. (Top)
Br. Jt Armor ℞ For Details See Std. Dwg. I-131
5 Spaces @ 7'-10"
44'-0"
46'-9"
℄ Bridge
Plan View Span No. 1 (Span No. 3 Opposite Hand)
Scale: ⅛" = 1'-0"
Plan View Span No. 2
Scale ⅛" = 1'-0"
For Barrier Rail Reinforcing And Drip Bead Details (See Standard Drawing I-131)
¾" Drip Bead
Bars D#4
Detail "X"
Scale: ½" = 1'-0"
NOTES
1) ¾" Open Joint For Open Joint In Barrier Rail (See Std. Dwg. I-131) (Typ.)
2) 4" ⌀ Drain Spaced @ 5'-0" oc. (Both Sides) See Std. Dwg. I-131 For Details.
3) For Webwall Details See Bridge Sht. 4
4) For Section A-A, B-B & C-C Bridge See Sht. 4
℄ Bridge
Symm. About ℄ Bridge
46'-9"
44'-0"
22'-0"
℄ Splice Bars A #5 Splice 24 Diameters
6'-0"
Parabolic Crown (See Std. Dwg. I-131)
9" @ Girder End
℄ Splice Bars Type C #5 Splice 24 Diameters
7 Bars Type D#4 Equally Spaced
9" Typ.
2" Cl.
2% Slope
P.G.
7" Slab
Bridge Jt. Armor ℞ (See Std. Dwg. I-131)
2'-5" (Typ.)
Barrier Rail Tapers At Begin & End Br. Only See Std. Dwg. I-131
7 Bars Type E#5 Equally Spaced
1'-0" Cl.
3'-11"
℄ AASHTO Type II Gdrs.
7'-10"
3'-9½"
TYPICAL HALF CROSS SECTION
Scale: ⅜" = 1'-0"
TYPICAL HALF END VIEW
Scale: ⅜" = 1'-0"
Note: Splice Bars D & E 24 Diameters
Estimated Quantities
Span 1 | Span 2 | Span 3 | Description
75 | 76 | 75 | Cu. Yds. Superstructure Concrete
19254 | 19445 | 19254 | Lbs. Steel Reinforcement
1460 | 1480 | 1460 | Lbs. Structural Steel
320 | 325 | 320 | Lin. Ft. Type II Girder
Finish Grade Elevation Table
Location | Begin Bridge Station 109+95 | ℄ Bent No. 2 Station 110+50 | ℄ Bent No. 3 Station 111+05 | End Bridge Station 111+60
Lt Edge Slab | 610.552 | 610.277 | 610.001 | 609.726
Tran Gutter | 610.569 | ——— | ——— | 609.744
Lt Gutter | ——— | 610.304 | 610.029 | ———
Gdr No 1 | 610.628 | 610.352 | 610.077 | 609.802
Gdr No 2 | 610.784 | 610.509 | 610.234 | 609.959
Gdr No 3 | 610.941 | 610.666 | 610.391 | 610.115
℄ Bridge | 610.989 | 610.714 | 610.439 | 610.164
Gdr No 4 | 610.941 | 610.666 | 610.391 | 610.115
Gdr No 5 | 610.784 | 610.509 | 610.234 | 609.959
Gdr No 6 | 610.628 | 610.352 | 610.077 | 609.802
Rt Gutter | ——— | 610.304 | 610.029 | ———
Tran Gutter | 610.569 | ——— | ——— | 609.744
Rt Edge Slab | 610.552 | 610.277 | 610.001 | 609.726
ALABAMA DEPARTMENT OF TRANSPORTATION
BRIDGE SHEET NO. 3 OF 10
REVISIONS
PROJECT NO. BR-0053(513)
BRIDGE OVER SHOAL CREEK
ON SR-53 (US-231)
STATION 109+95
ST. CLAIR COUNTY
SPANS 1, 2 & 3 DETAILS
ESTIMATED QUANTITIES | DESIGNED BY: PEP | DRAWN BY: LRB
COMPUTED BY: LRB | CHECKED BY: | DATE DRAWN: 09/14/05
VERIFIED BY: PEP | DATE CHECKED: | SCALE: As Shown
Plotted: 23-Sep-2005 01:40 PM
U:\Detailing\Projects\41403 exams\1233.dgn


REFERENCE PROJECT NUMBER BR-0053(513)
FISCAL YEAR 2008
SHEET NUMBER 104
NOTES
1. All Prestressing Strands Shall Be ½" ø 270 Klp Low Relaxation With An Initial Tension Of 30,975 Klps Per Strand Unless Otherwise Noted.
2. Concrete In Girders Shall Have A Minimum Of 5750 PSI Compressive Strength Prior To Receiving Prestressing Force And A Minimum 28 Day Compressive Strength Of 6000 PSI.
3. Threaded Bars K*B And Inserts Shall Be Included In The Bid Item 513-B, "Prestressed Prestressed Concrete Girders, Type II".
4. Girder Ends Shall Be Vertical In The Final Erected Position.
5. All Strands, Shall Be Cut Flush At Each End Of The Girder And Coated With An Approved Epoxy Coating.
6. The Interior Face Of Exterior Girder Require 1" ø Threaded Inserts For Threaded Bar K*B At The Location Indicated. All Interior Girders Shall Have A 1½" ø Hole For Bar K1*B In The Locations Shown.
7. Clip Angles Are Required On Both Faces Of All Girder At Fixed End Of Span And Both Faces Of Exterior Girders Only At Expansion End Of Span. For Details Of Clip Angles See Std. Drawing I-131.
Stirrup Spacing (Bars V#5)
13 Sp.@ 3"-3"-3"
5 Sp.@ 6"-2'-6"
6 Sp.@ 1'-0"-6'-0" (For Spans No.'s 1 & 3)
5 Sp.@ 1'-0"-5'-0" (For Span No. 2)
9 @ 1'-6"-13'-6" (For Span 1 & 3)
10 @ 1'-6"-15'-0" (For Span 2)
Symmetrical About Mid-Point Of Girder
1'-3¾" (For Span 1 & 3)
1'-3" (For Span 2)
2 - ½"ø Strands Tensioned To 5000 Lbs. Each
Note 6
7 - Pairs Bars B #3 (Space With Every Other Bar V #5)
Hold Down Point See Std. Dwg. I-131
10'-0"
End Of Girder
℄ Bearing
52'-11½" (Span No.1 & 3) Brg. To Brg.
53'-0" (Span No.2) Brg. To Brg.
53'-4½" (Span No.1 & 3) (Over All Length)
54'-3" (Span No.2) (Over All Length)
Typical Half Girder Elevation
AASHTO Type II Girder
Not To Scale
1⅝" Before Slab Placement
1" After Slab Placement
True Grade After Dead Load Deflection Of Girder
Top Of Girder
9" @ End Of Girder
7" Slab
2" Build-Up @ End Of Girder
Mid-Point Of Girder
Detail Of Build-Up Over Top Of Girder
Not To Scale
AASHTO Type II Girder
Scale: 1" = 1'-0"
Section At End Of Girder
Scale: 1" = 1'-0"
Section At Midpoint Of Girder
Scale: 1" = 1'-0"
Sheathing
Bars V#5
Bars B#3
ALABAMA DEPARTMENT OF TRANSPORTATION
BRIDGE SHEET NO. 5 OF 10
REVISIONS
PROJECT NO. BR-0053(513)
BRIDGE OVER SHOAL CREEK
ON SR-53 (US-231)
STATION 109+95
ST. CLAIR COUNTY
GIRDER DETAILS
ESTIMATED QUANTITIES
DESIGNED BY: PEF
DRAWN BY: LRB
COMPUTED BY:
CHECKED BY:
DATE DRAWN: 10/28/09
VERIFIED BY:
DATE CHECKED:
SCALE: As Shown
Plotted: 23-Sep-2008 01:43 PM
U:\Checking\Proj\41405 girder11.dgn

The completed Bridge Workspace tree for this bridge is as shown below.

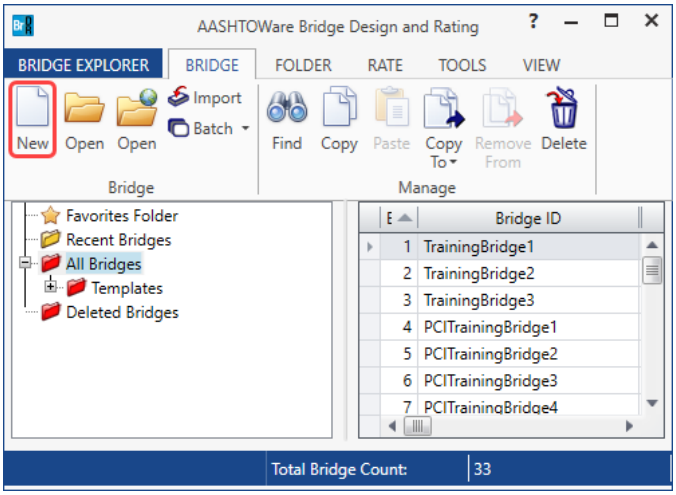



Workspace
Bridge
Components
G2
Member Loads
Supports
MEMBER ALTERNATIVES
Interior Girder (E) (C)
Default Materials
Impact/Dynamic Load Allowance
Beam Details
Shrinkage Time
Effective Supports
Mild Steel Layout
Span 1
Strand Layout
Span 1
Deck Profile
Haunch Profile
Shear Reinforcement Ranges
Live Load Distribution
Points of Interest
G3 (G2)
G4 (G2)
G5 (G2)
G6 (G1)
Span 2 Definition
Impact/Dynamic Load Allowance
Load Case Description
Framing Plan Detail
Bracing Deterioration
Bracing Spec Check Selection
Structure Typical Section
Superstructure Loads
Concrete Stress Limits
6.0 Ksi Stress Limit
Prestress Properties
1/2" LR AASHTO Loss
Shear Reinforcement Definitions
Vertical
#5 Stirrup
Horizontal
MEMBERS
G1
Member Loads
Supports
MEMBER ALTERNATIVES
Exterior Girder (E) (C)
Default Materials
Impact/Dynamic Load Allowance
Beam Details
Shrinkage Time
Effective Supports

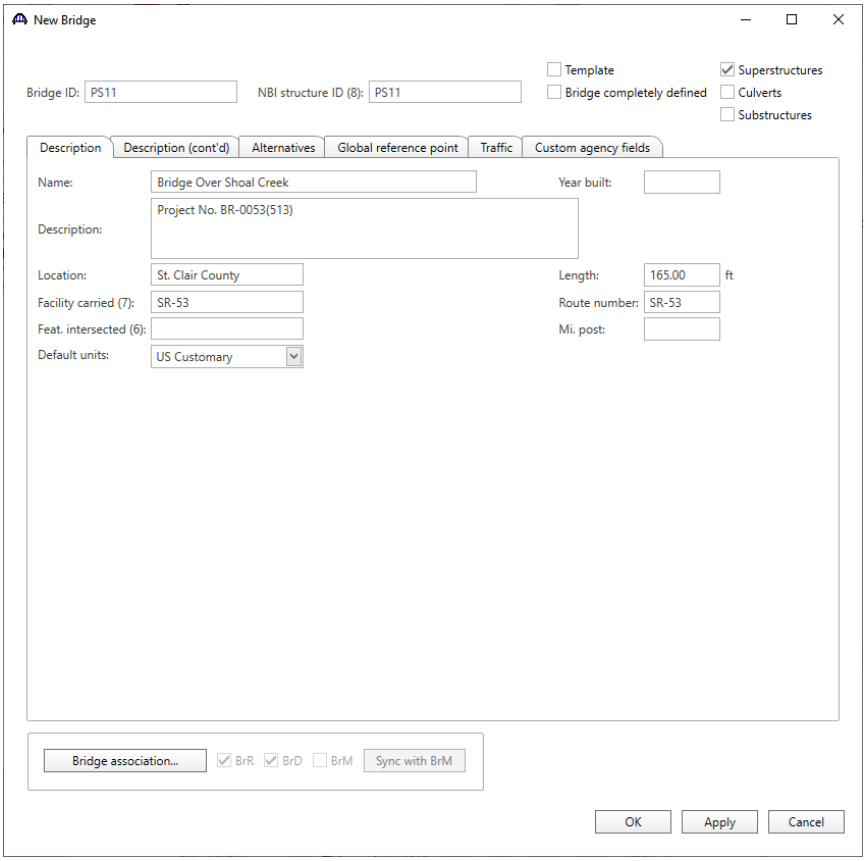

Workspace
Bridge
Components
Beam Details
Shrinkage Time
Effective Supports
Mild Steel Layout
Span 1
Strand Layout
Span 1
Deck Profile
Haunch Profile
Shear Reinforcement Ranges
Live Load Distribution
Points of Interest
G2
Member Loads
Supports
MEMBER ALTERNATIVES
Interior Girder (E) (C)
Default Materials
Impact/Dynamic Load Allowance
Beam Details
Shrinkage Time
Effective Supports
Mild Steel Layout
Span 1
Strand Layout
Span 1
Deck Profile
Haunch Profile
Shear Reinforcement Ranges
Live Load Distribution
Points of Interest
G3 (G2)
G4 (G2)
G5 (G2)
G6 (G1)
BRIDGE ALTERNATIVES
Bridge Alt 1 (E) (C)
SUPERSTRUCTURES
Superstructure 1
SUPERSTRUCTURE ALTERNATIVES
Superstructure Alt 1 (E) (C) (Span 1 and 3 Definition)
Superstructure 2
SUPERSTRUCTURE ALTERNATIVES
Superstructure Alt 1 (E) (C) (Span 2 Definition)
Superstructure 3
SUPERSTRUCTURE ALTERNATIVES
Superstructure Alt 1 (E) (C) (Span 1 and 3 Definition)
Stiffness Analysis
PIERS

Create one BrDR superstructure definition (Span 1 and Span 3 definitions) for Span No. 1 and Span No. 3

From the **Bridge Explorer** create a **new bridge**.



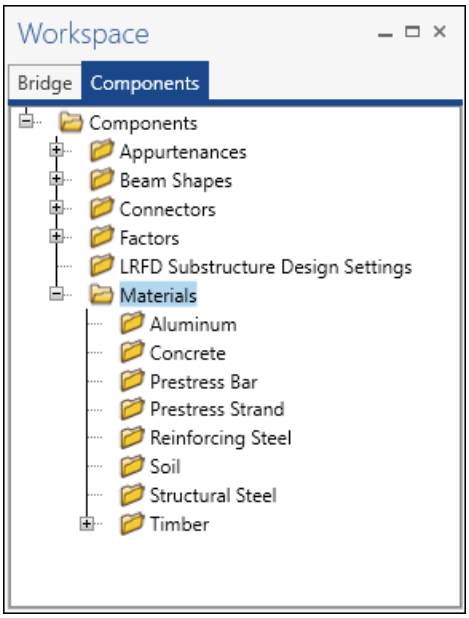
Enter the following bridge description data.



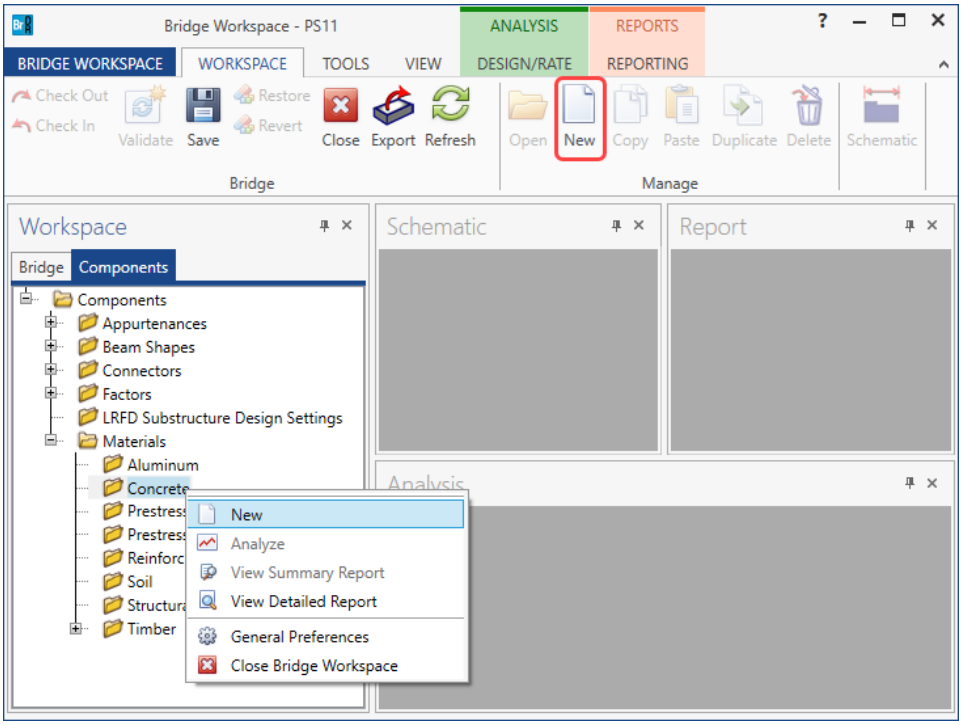
Click **OK** to apply the data and close the window.

Bridge Components

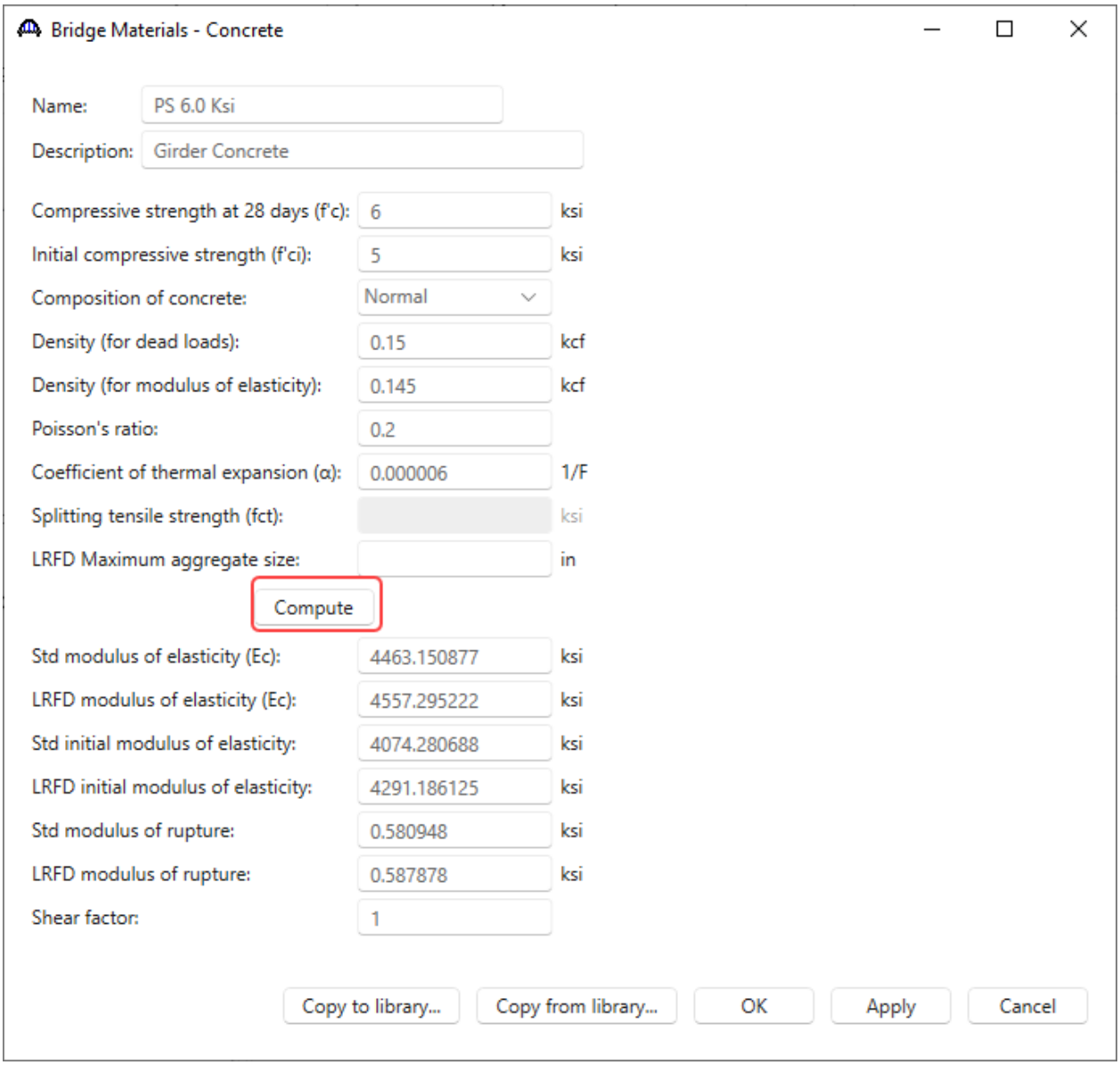
To enter the materials to be used by members of the bridge, open the **Components** tab, and click on the ⊞ button to expand the tree for **Materials**. The tree with the expanded **Materials** branch is shown below.



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

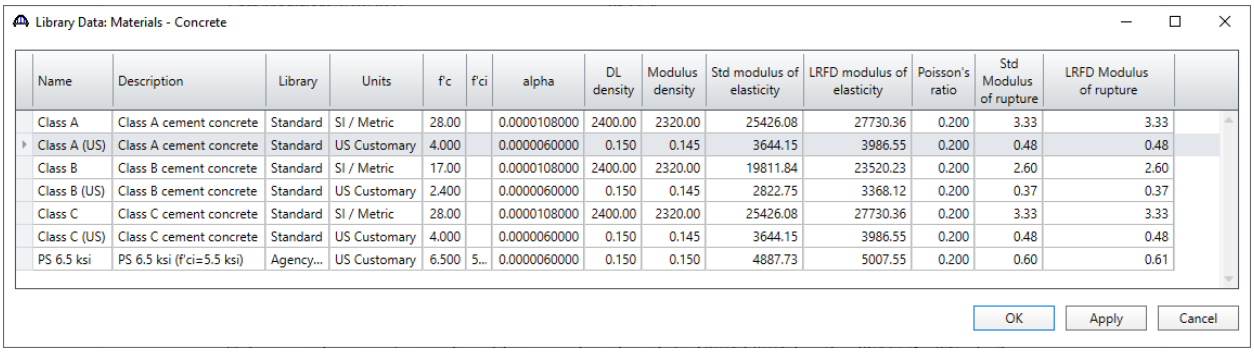


Enter the values shown above the **Compute** button and click the **Compute** button to compute the remaining values below them.

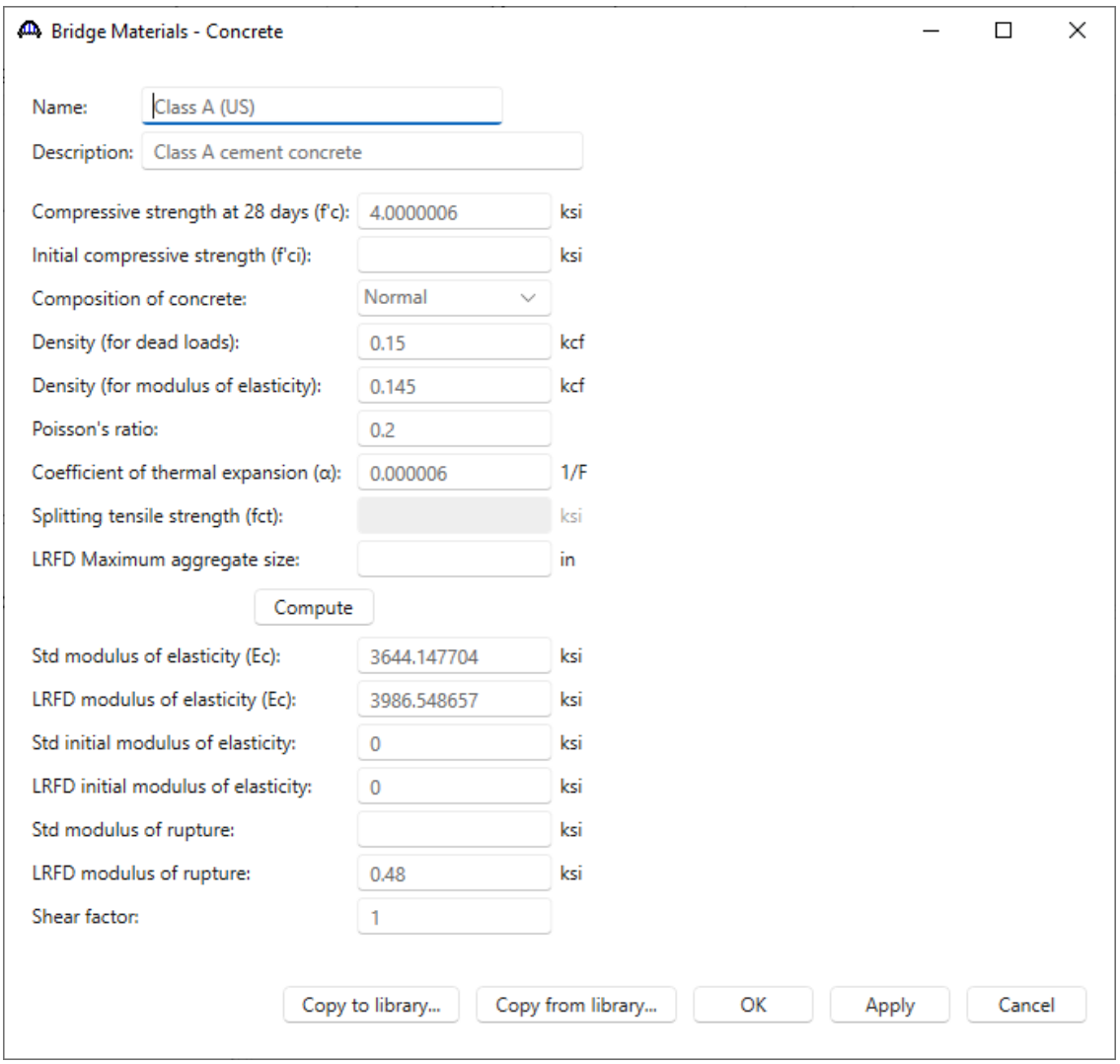


Click **OK** to apply the data and close the window.

Similarly add another concrete material for the deck. Select a library concrete material by clicking on the **Copy from library…** button in the **Bridge Materials – Concrete** window. The following window opens.

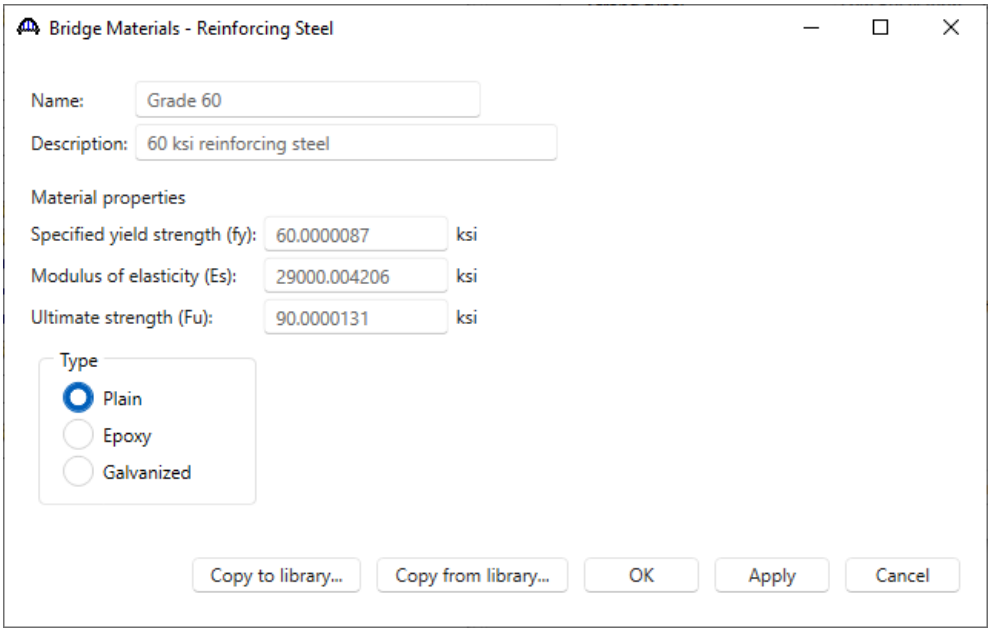


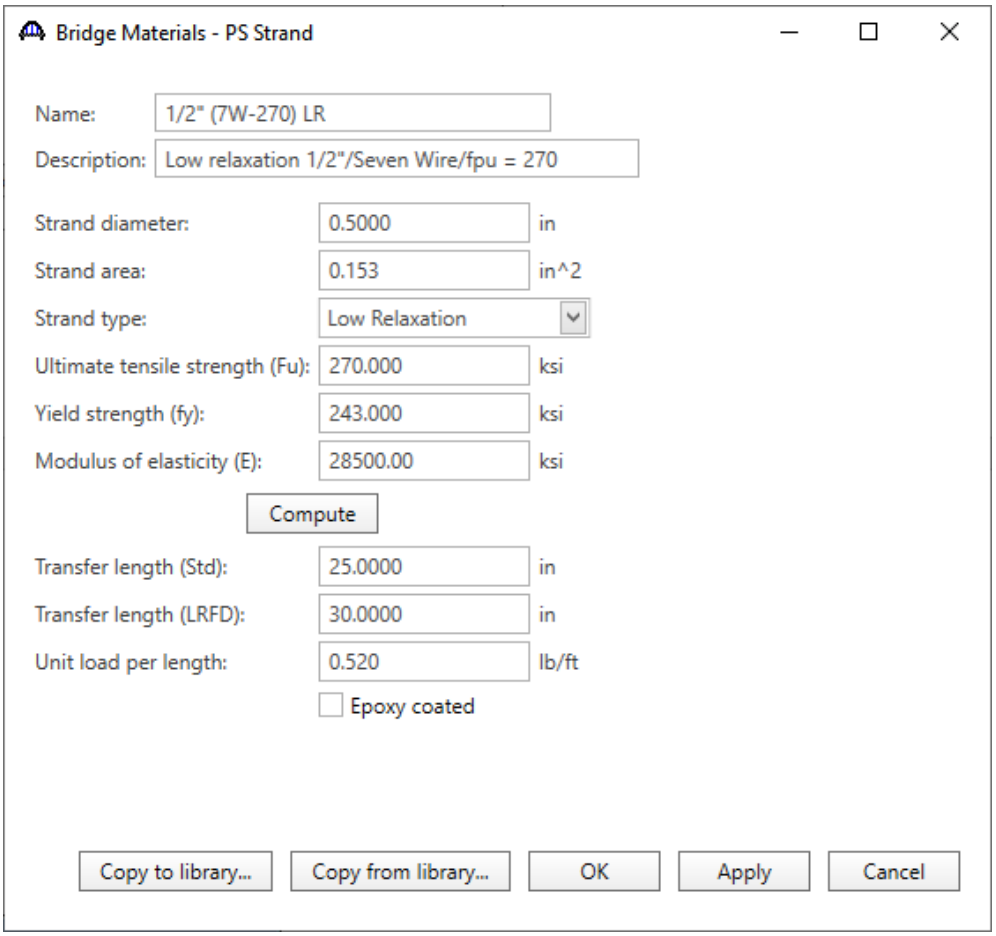
Select the **Class A (US)** material and click **OK**. The selected material properties are copied to the **Bridge Materials - Concrete** window.



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

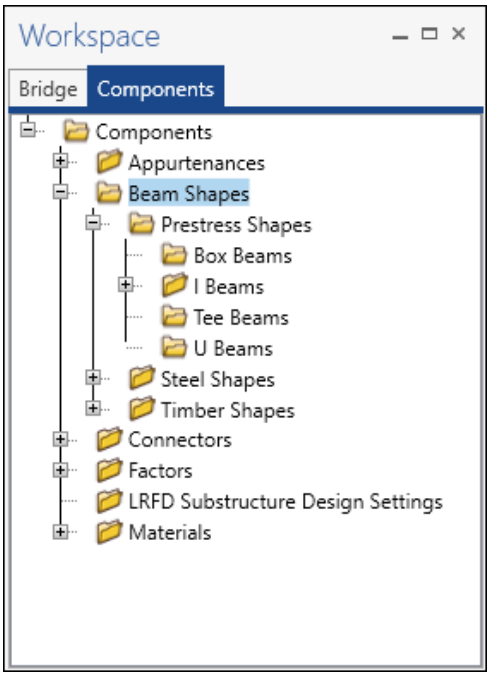
Add the following reinforcement material **(Grade 60)** and prestress strand **(1/2" (7W-270) LR)** using the same **Copy from library** technique. The windows will be populated as shown below.



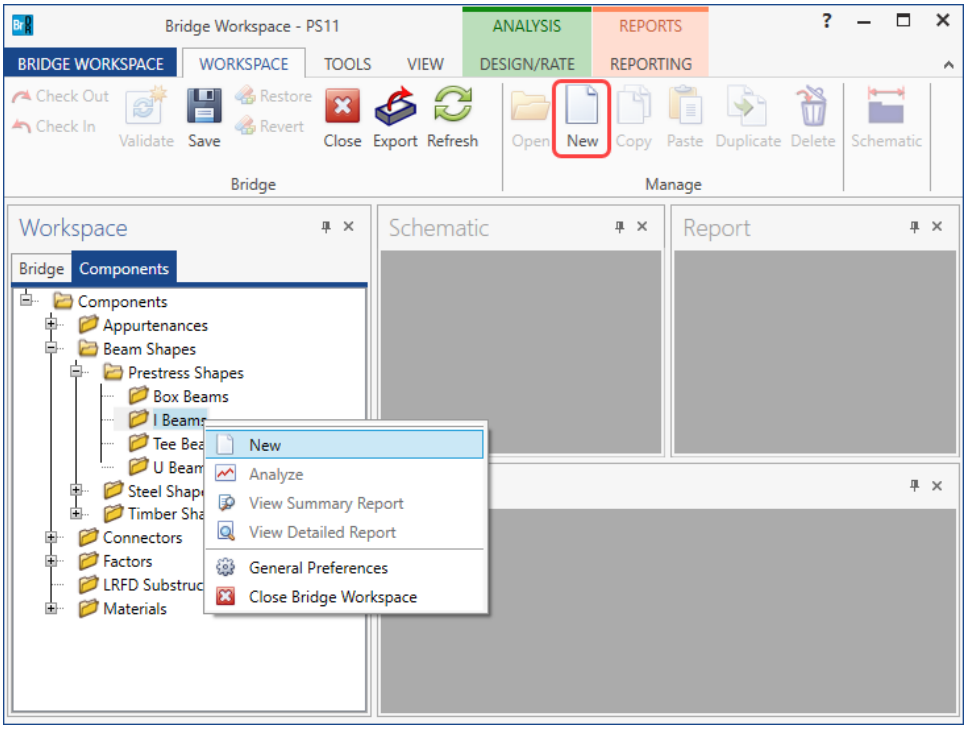


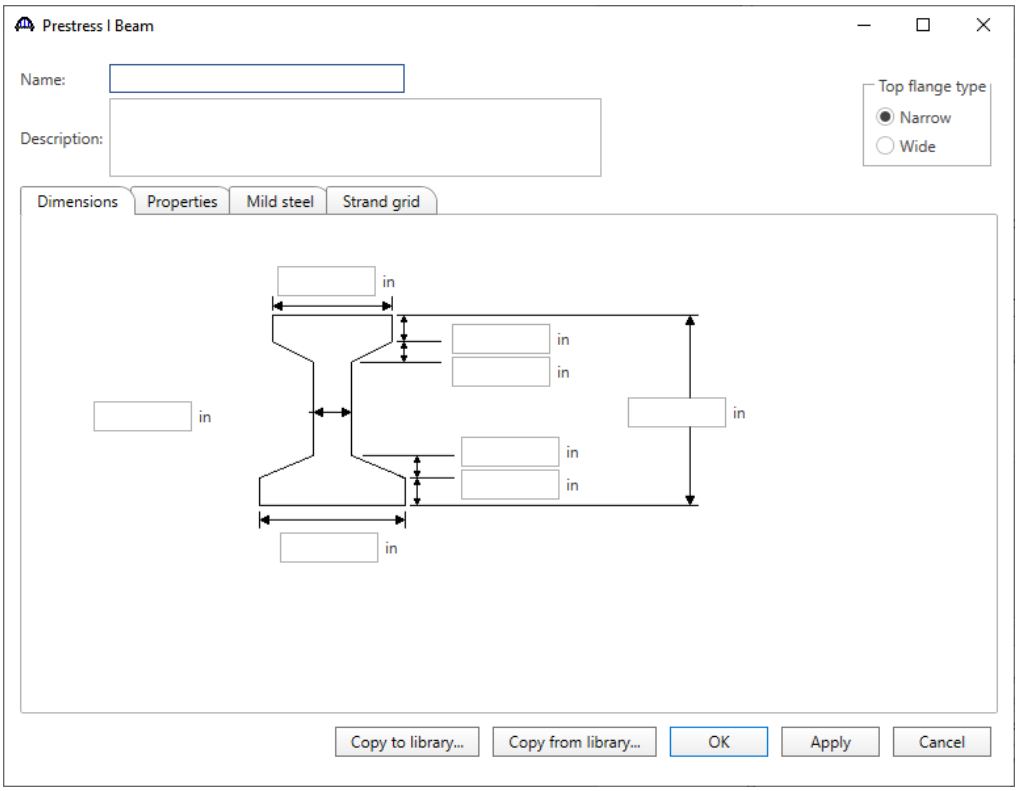
Beam Shapes

To enter a prestress beam shape to be used in this bridge, expand the **Beam Shapes** node and **Prestress Shapes** node in the **Componenets** tree as shown below.

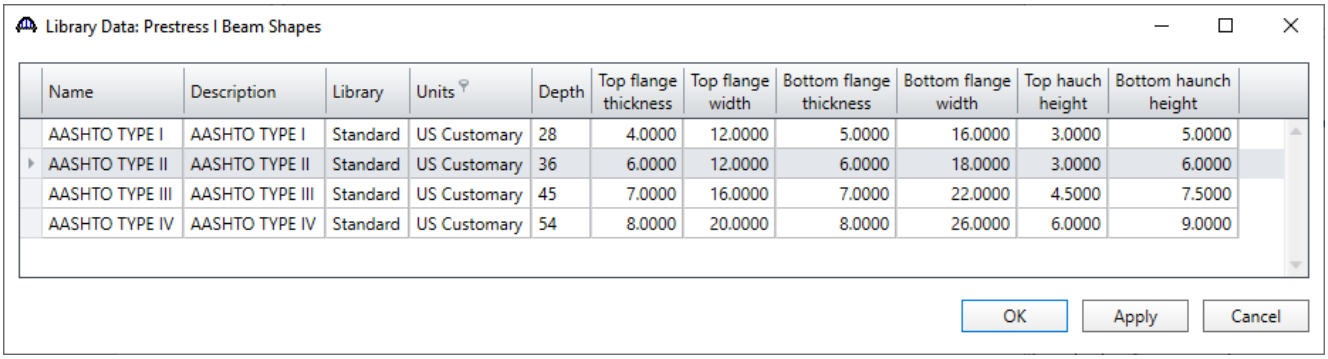


Click on the **I Beams** node in the **Components** tree and select **New** from the **Manage** group of the **WORKSPACE** ribbon (or right mouse click on **I Beams** and select **New** or double click on **I Beams** in the **Components** tree). The window shown below will open.



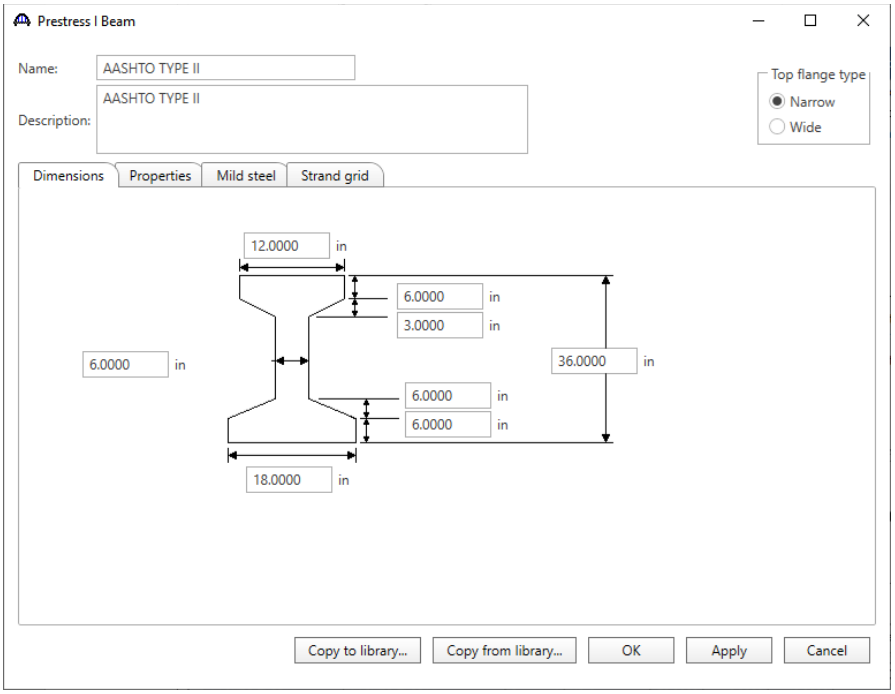


Select the **Top flange type** as **Narrow** and click the **Copy from library…** button. Select **AASHTO Type II** and click **OK**.

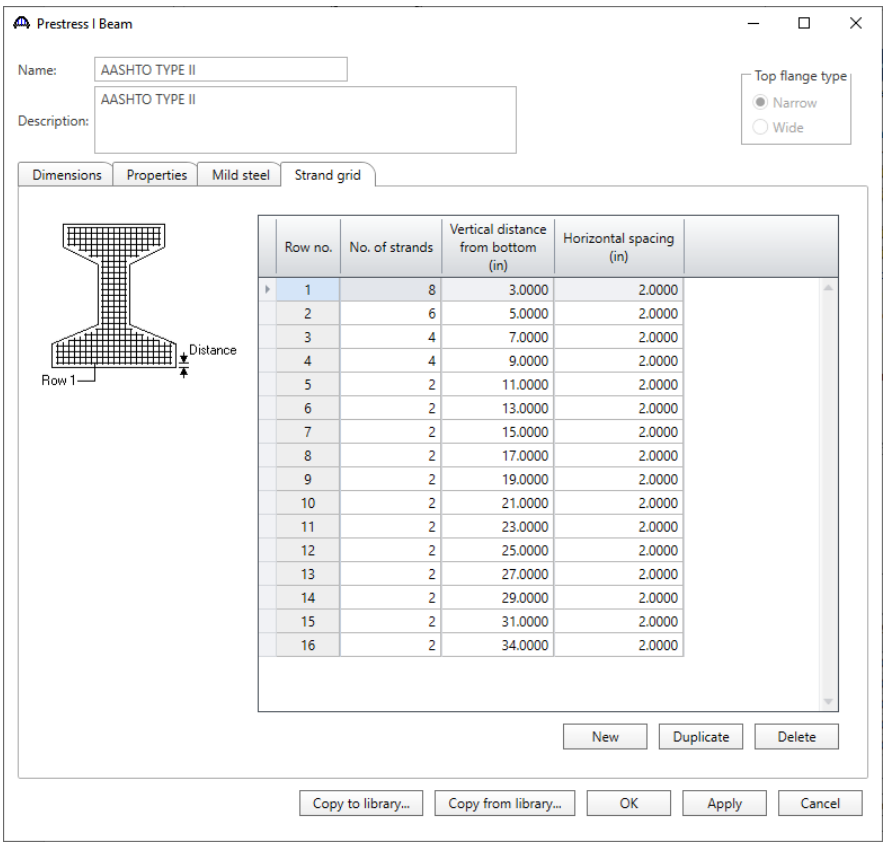


Name	Description	Library	Units	Depth	Top flange thickness	Top flange width	Bottom flange thickness	Bottom flange width	Top hauch height	Bottom haunch height
AASHTO TYPE I	AASHTO TYPE I	Standard	US Customary	28	4.0000	12.0000	5.0000	16.0000	3.0000	5.0000
AASHTO TYPE II	AASHTO TYPE II	Standard	US Customary	36	6.0000	12.0000	6.0000	18.0000	3.0000	6.0000
AASHTO TYPE III	AASHTO TYPE III	Standard	US Customary	45	7.0000	16.0000	7.0000	22.0000	4.5000	7.5000
AASHTO TYPE IV	AASHTO TYPE IV	Standard	US Customary	54	8.0000	20.0000	8.0000	26.0000	6.0000	9.0000

The beam properties are copied to the **PS I Beam** window as shown below.



Select the **Strand grid** tab and modify the possible prestress strand locations as shown below.

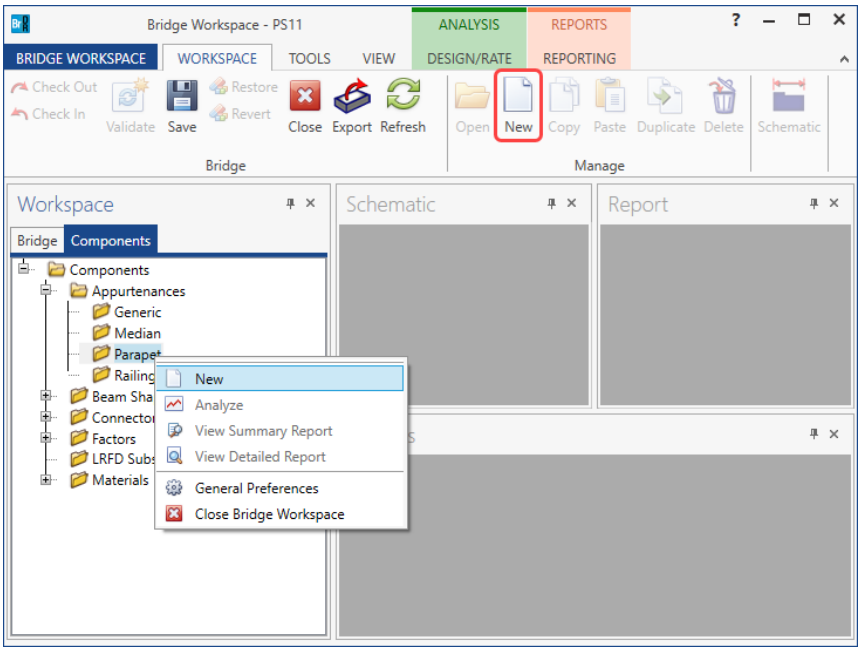


Row no.	No. of strands	Vertical distance from bottom (in)	Horizontal spacing (in)
1	8	3.0000	2.0000
2	6	5.0000	2.0000
3	4	7.0000	2.0000
4	4	9.0000	2.0000
5	2	11.0000	2.0000
6	2	13.0000	2.0000
7	2	15.0000	2.0000
8	2	17.0000	2.0000
9	2	19.0000	2.0000
10	2	21.0000	2.0000
11	2	23.0000	2.0000
12	2	25.0000	2.0000
13	2	27.0000	2.0000
14	2	29.0000	2.0000
15	2	31.0000	2.0000
16	2	34.0000	2.0000

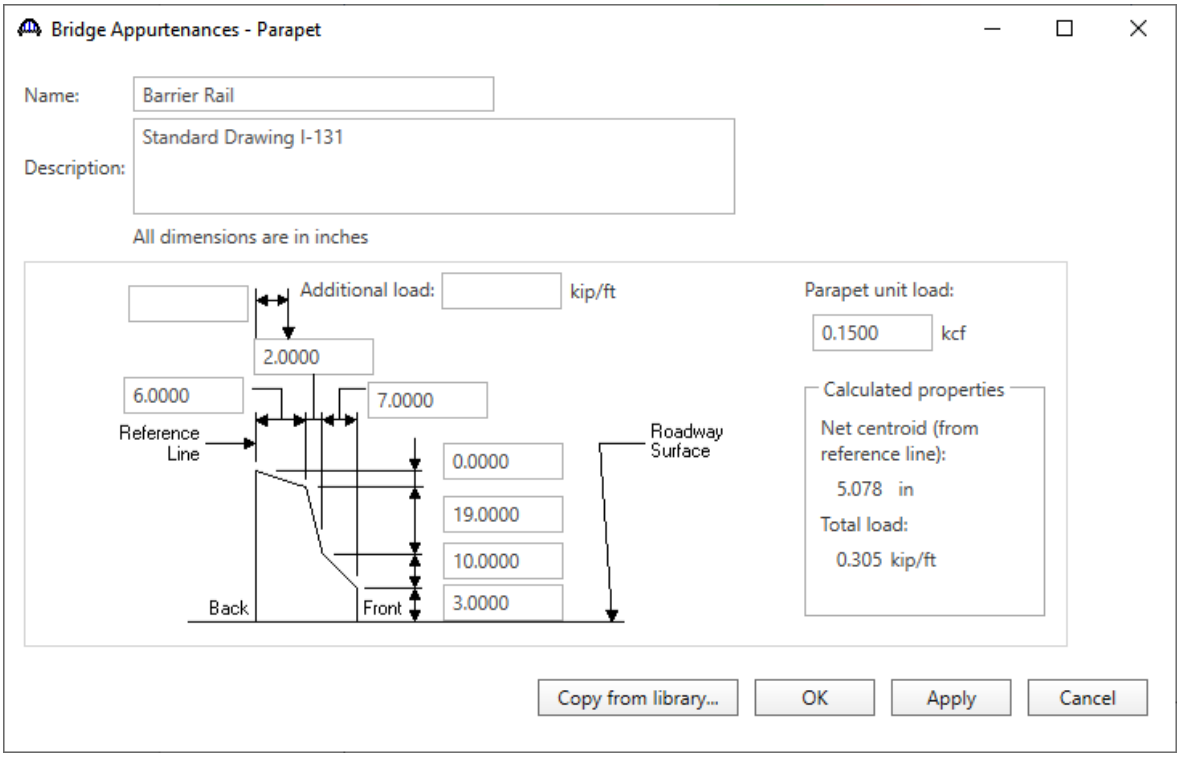
Click **OK** to apply the data and close the window.

Bridge - Appurtenances

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



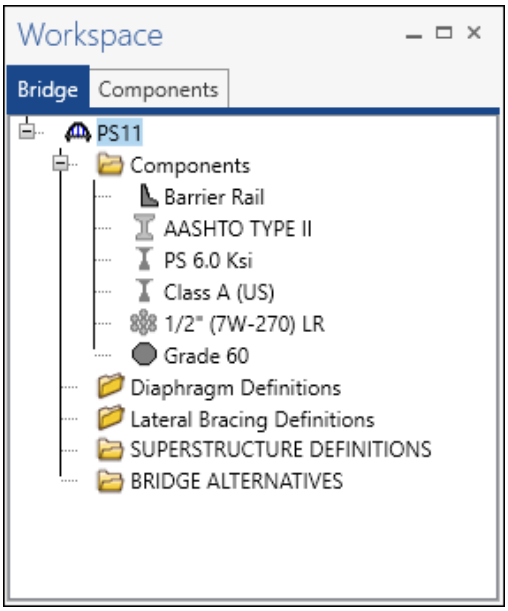
Enter the parapet details as shown below.



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

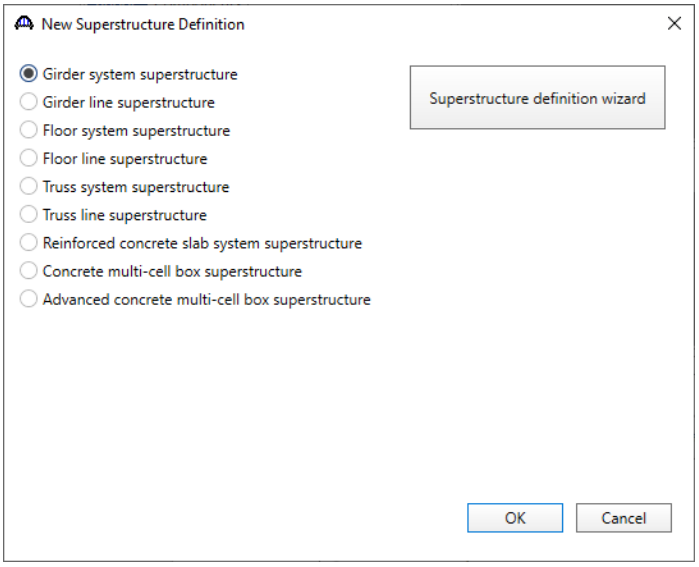
The default LRFD dynamic load allowance and default LRFD factors will be used.

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



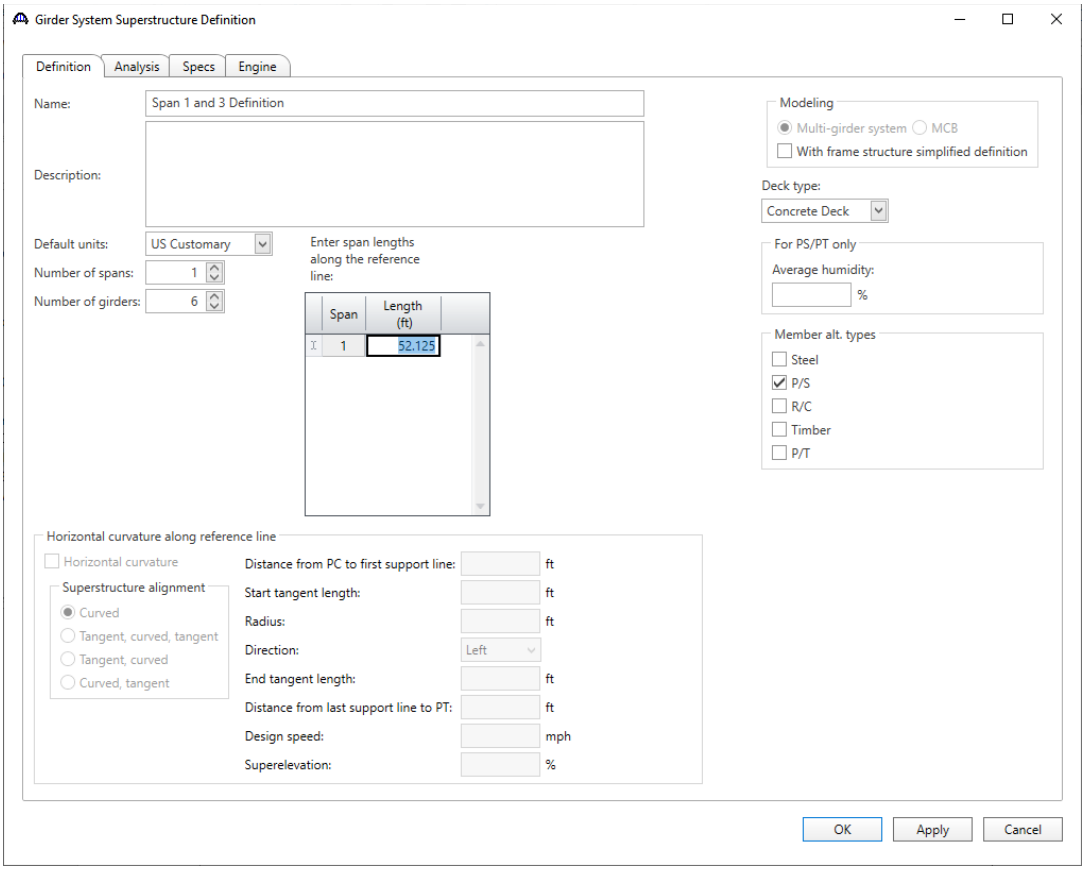
Superstructure Definition

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.



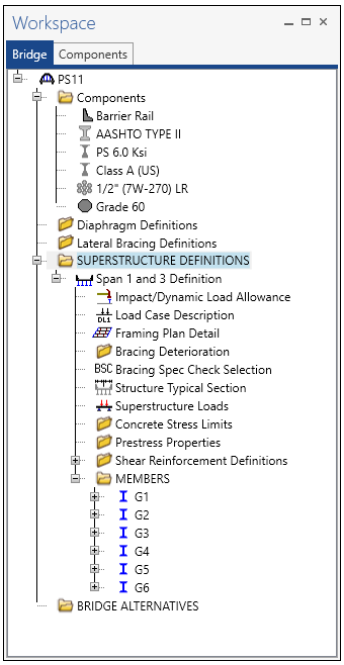
Select **Girder system superstructure**, click **OK** and the **Girder System Superstructure Definition** window will open.

Enter the data as shown below.



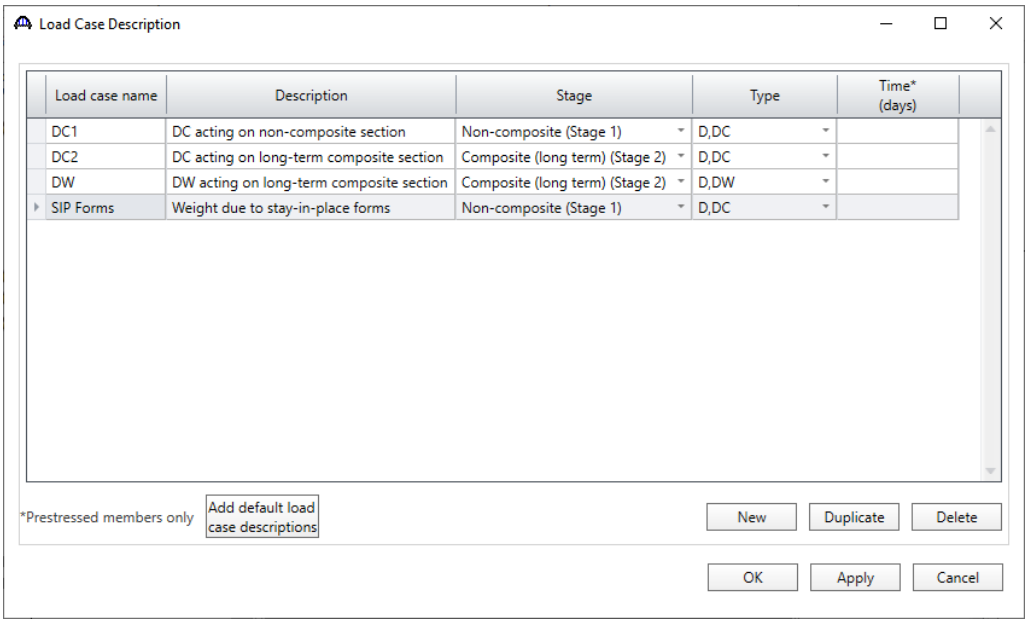
Click **OK** to apply the data and close the window.

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



Load Case Description

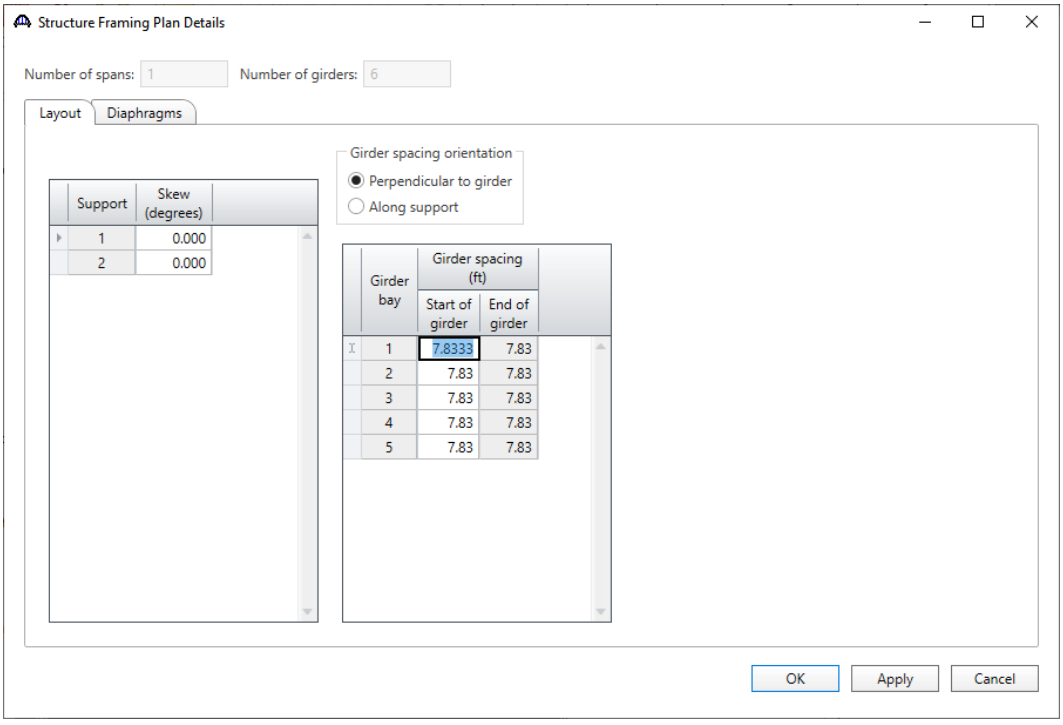
Double-click on the **Load Case Description** node in the **Bridge Workspace** tree to open the **Load Case Description window**. Click on the **Add default load case descriptions** button to create the following load cases.



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

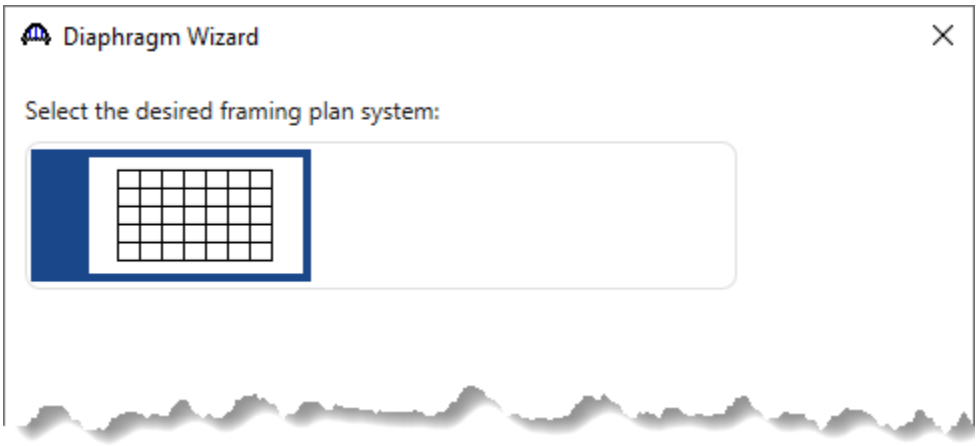
Structure Framing Plan Detail – Layout

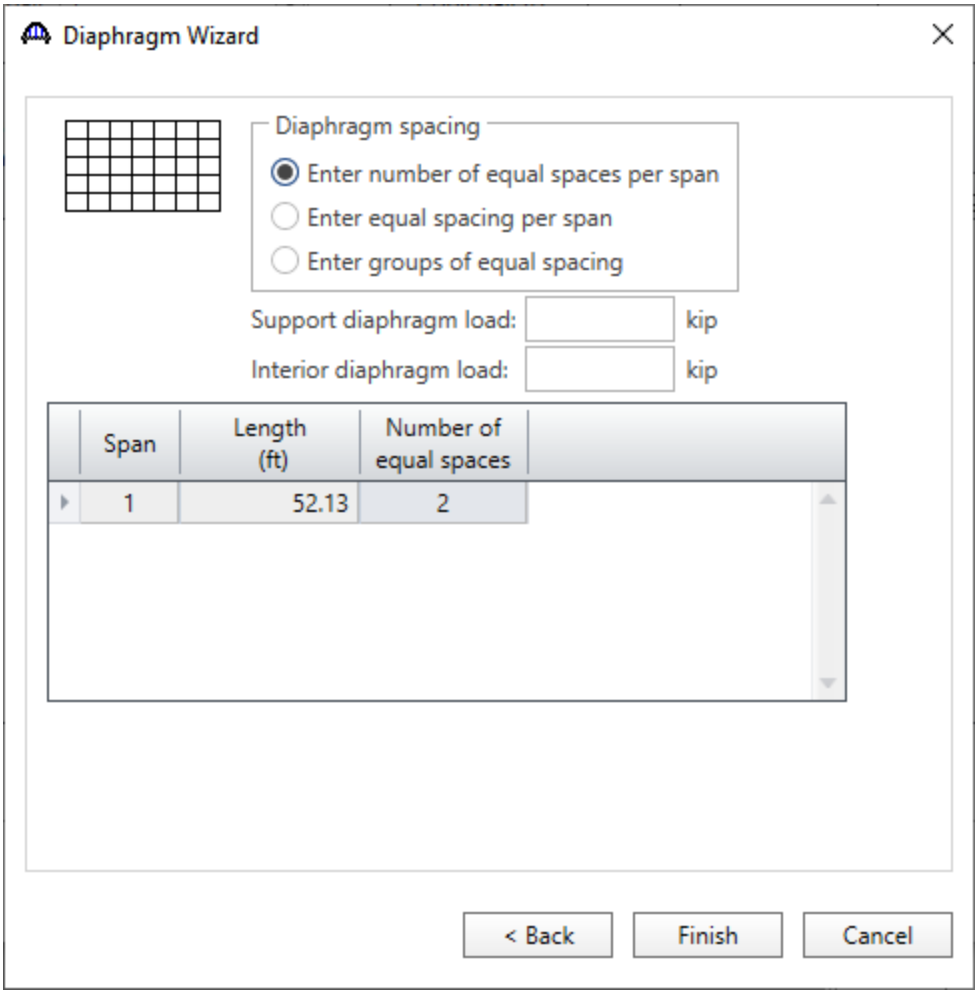
Double-click on **Framing Plan Detail** in the **Bridge Workspace** tree to describe the framing plan in the **Structure Framing Plan Details** window. Enter the data as shown below.



Structure Framing Plan Detail – Diaphragms

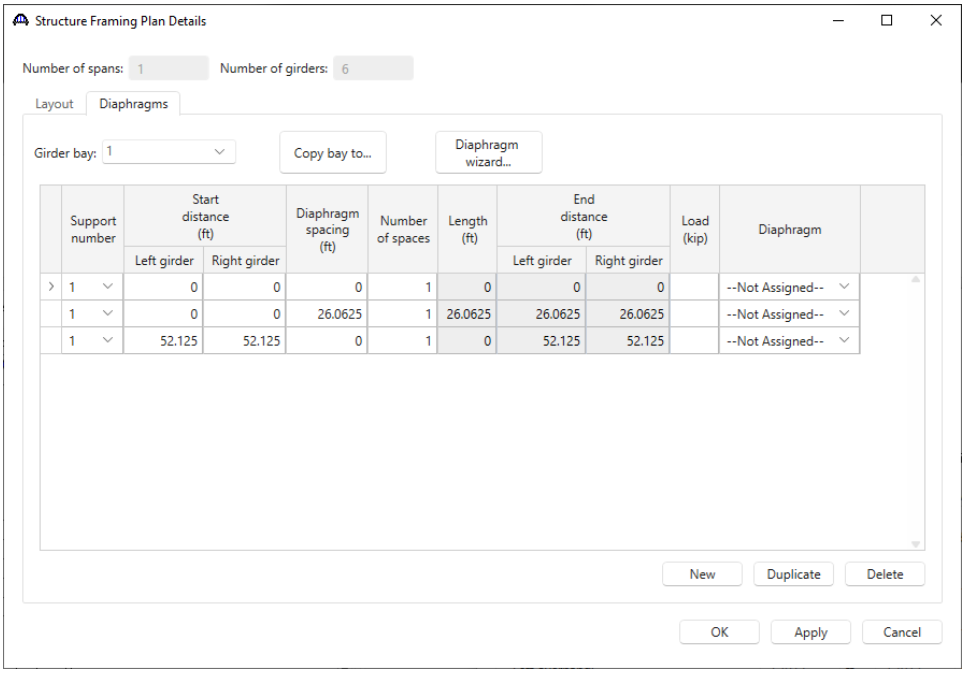
Switch to the **Diaphragms** tab to enter diaphragm spacing. Click the **Diaphragm wizard…** button to add diaphragms for the entire structure. **Select the desired framing plan system** and click the **Next** button. Enter the following data on the window shown below.





Click the **Finish** button to add the diaphragms. The **Diaphragm Wizard** will create diaphragms for all the girder bays in the structure.

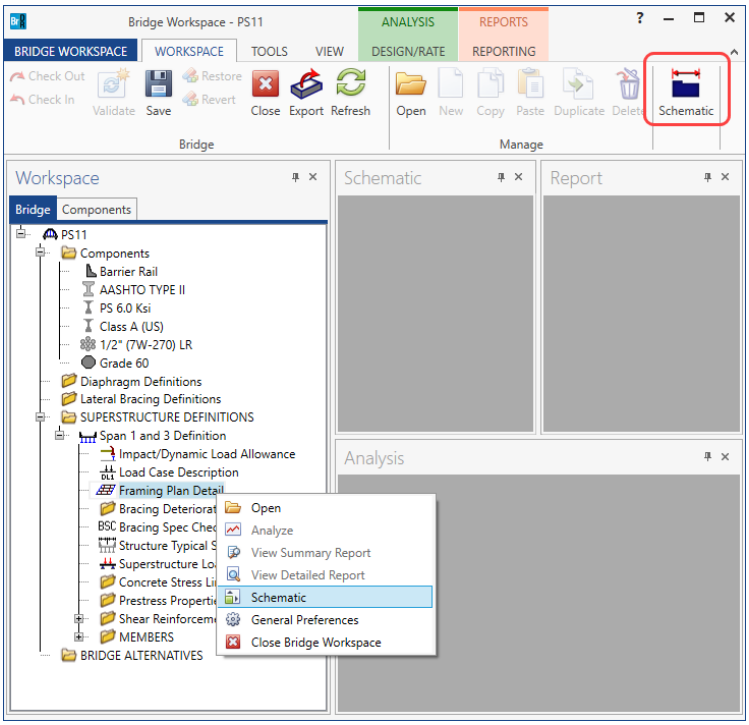
The diaphragms created for **Girder bay 1** are shown below.



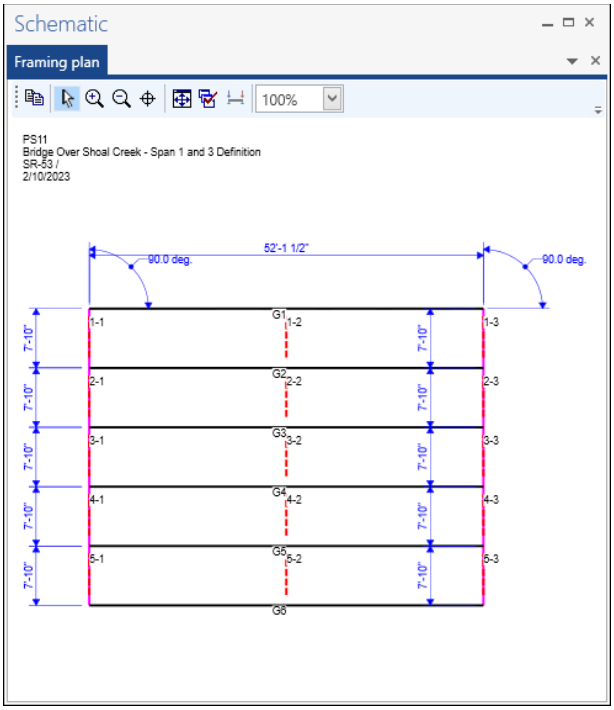
Click **OK** to apply the data and close the window.

Schematic - Framing Plan Detail

While **Framing Plan Detail** is selected in the **Bridge Workspace** tree, open the schematic for the framing plan by selecting the **Schematic** button on the **WORKSPACE** ribbon (or right click on **Framing Plan Detail** in the Bridge Workspace and select **Schematic** from the menu).

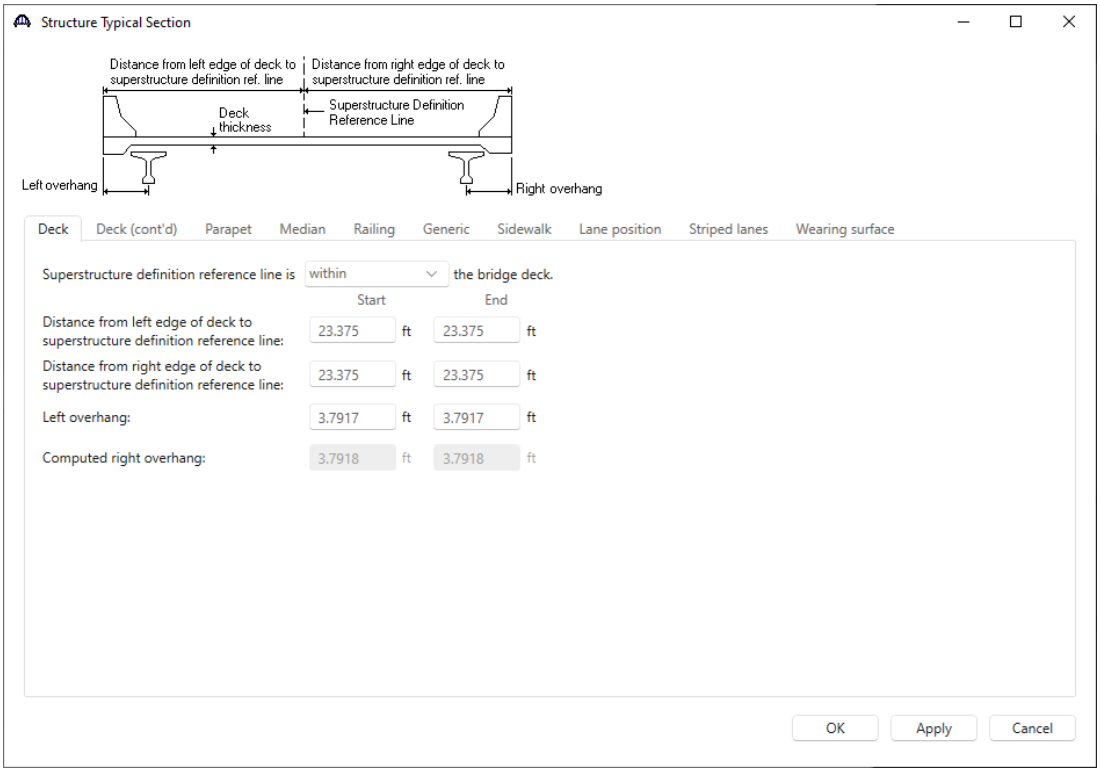


The following schematic will be displayed.



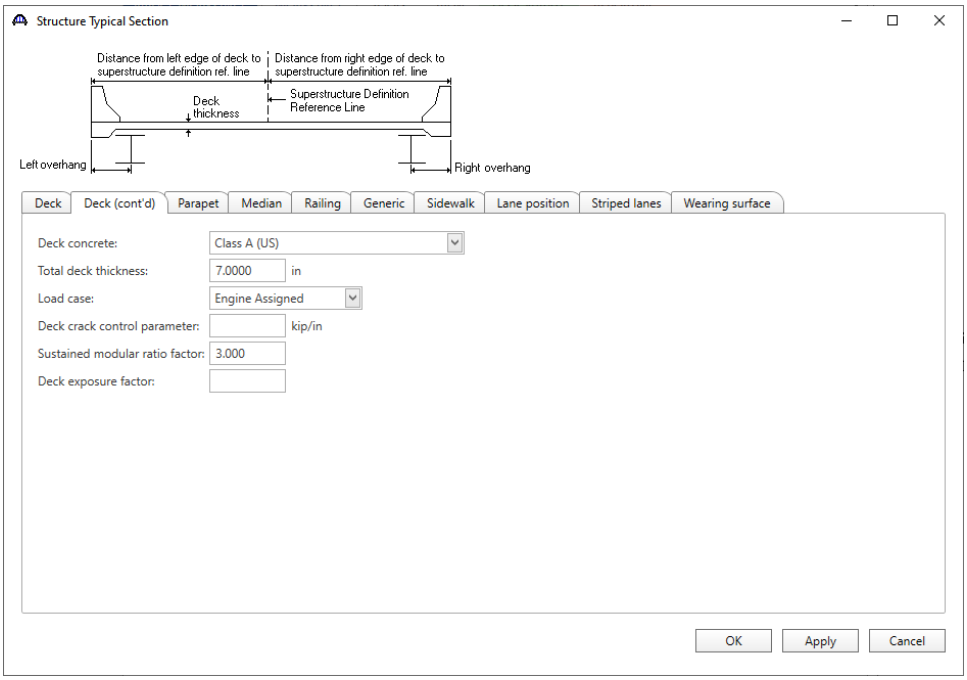
Structure Typical Section - Deck

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.



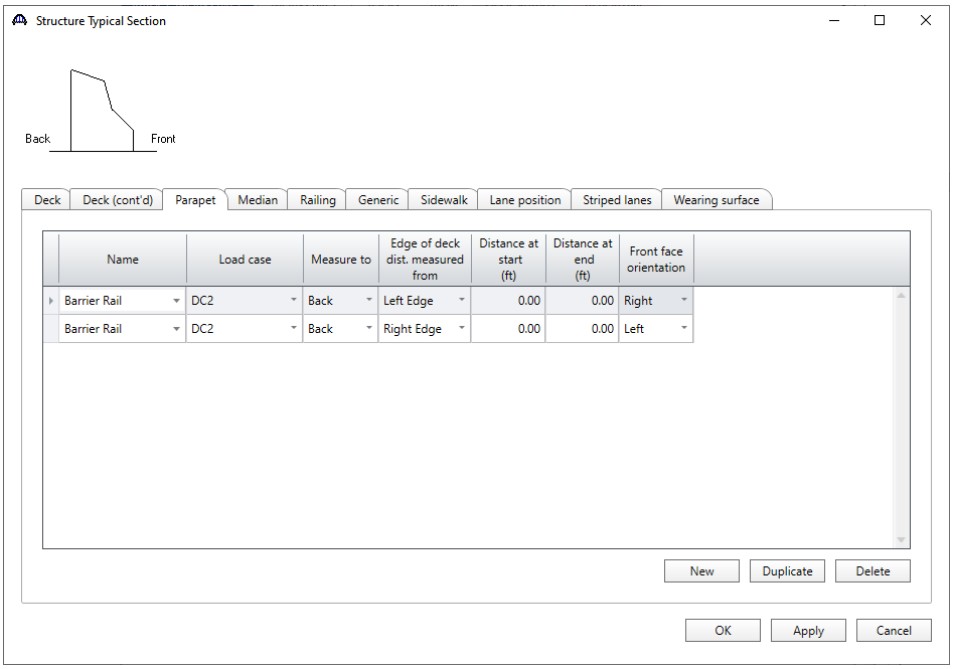
Structure Typical Section – Deck (cont'd)

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



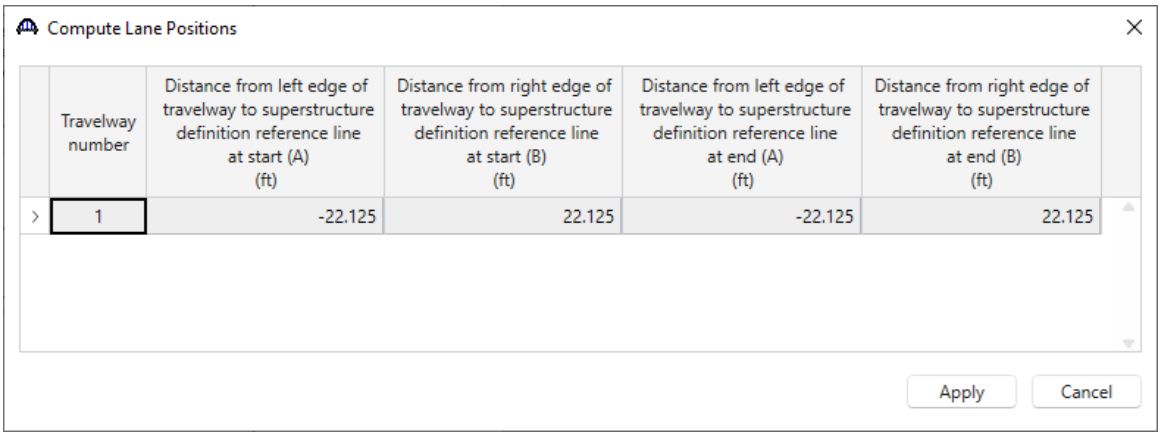
Structure Typical Section – Parapets

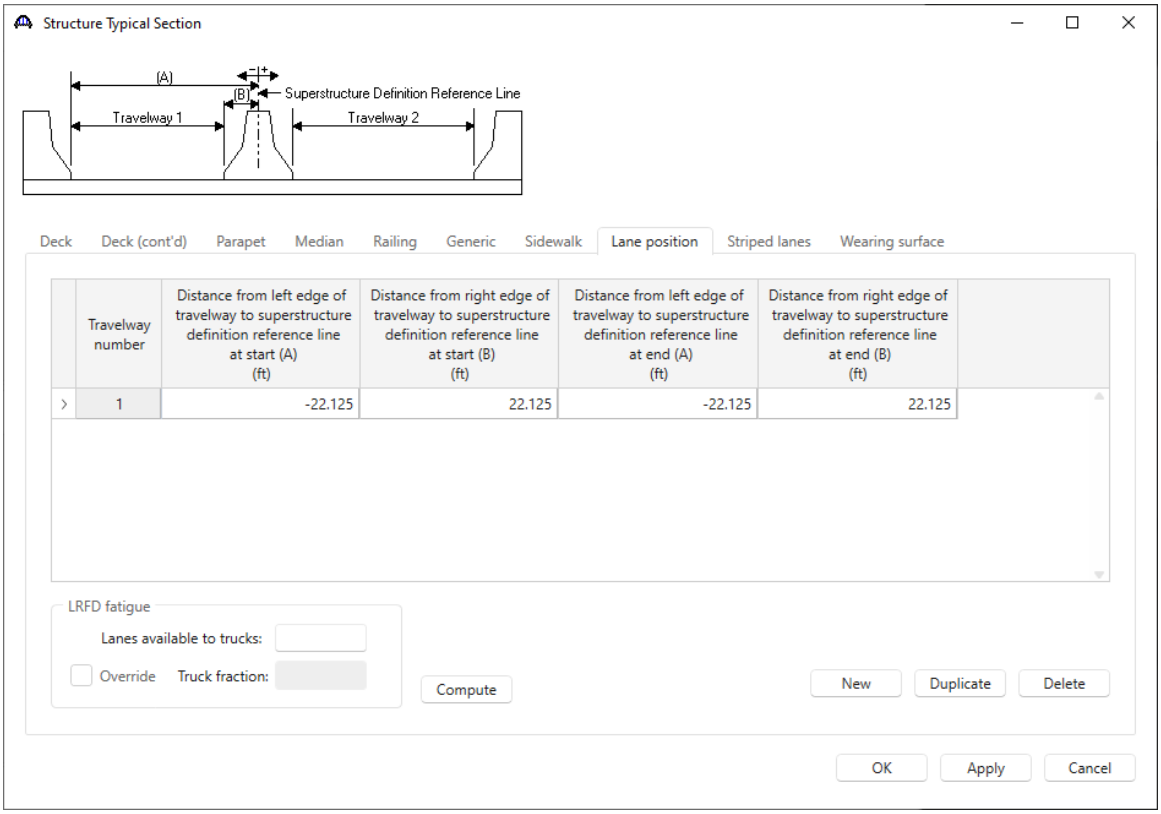
Add two parapets as shown below.



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.

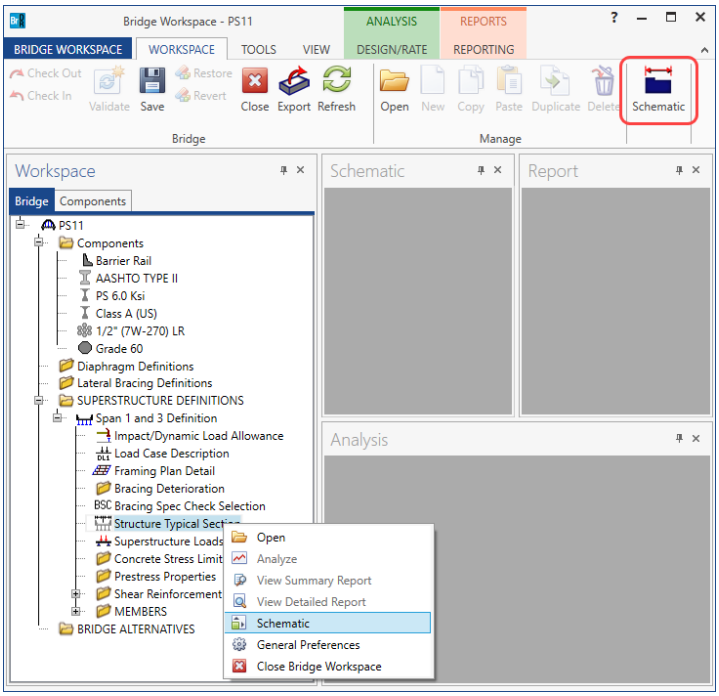




Click **OK** to apply the data and close the window.

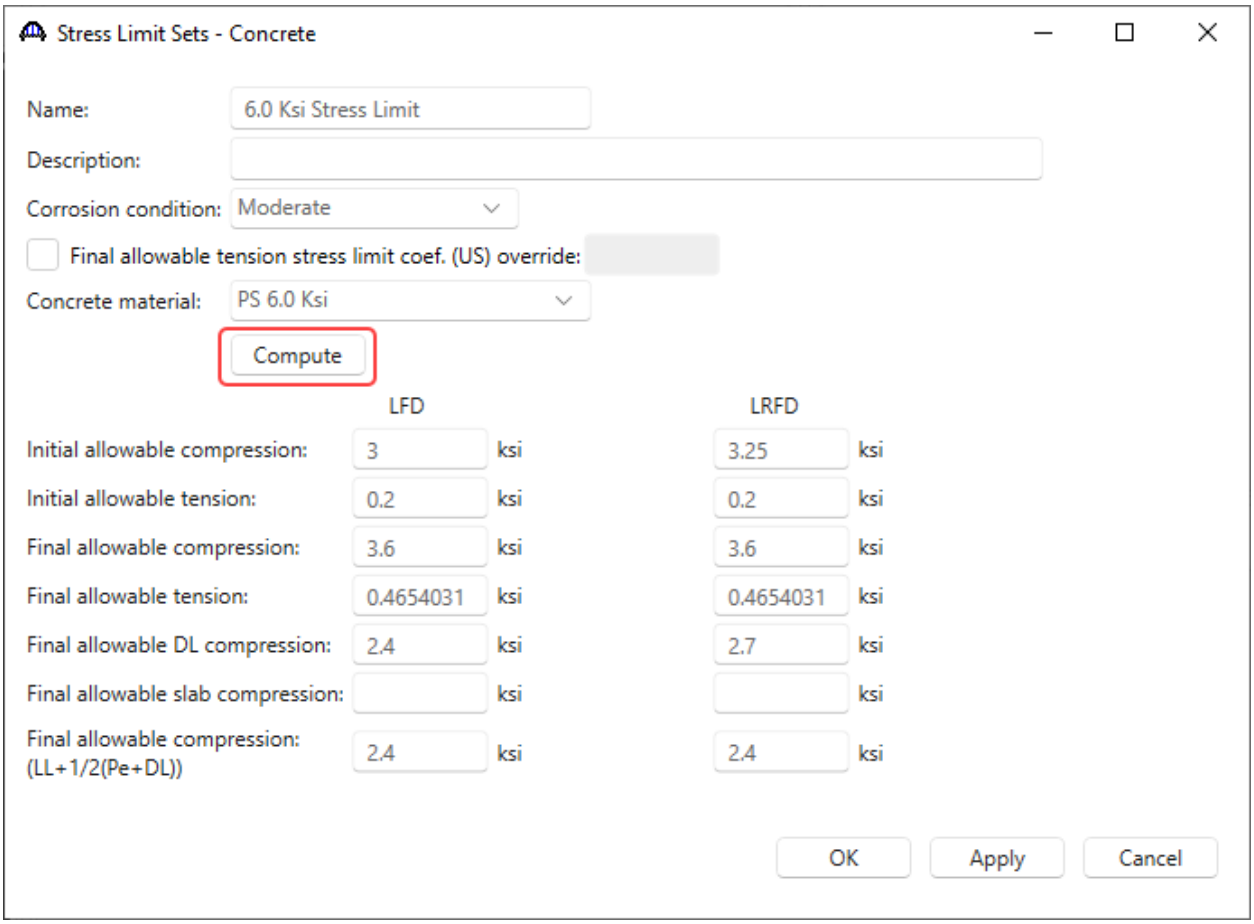
Schematic – Structure Typical Section

While **Structure Typical Section** is selected in the **Bridge Workspace** tree, open the schematic for the structure typical section by selecting the **Schematic** button on the **WORKSPACE** ribbon (or right click on **Structure Typical Section** in the **Bridge Workspace** and select **Schematic** from the menu).



Concrete Stress Limits

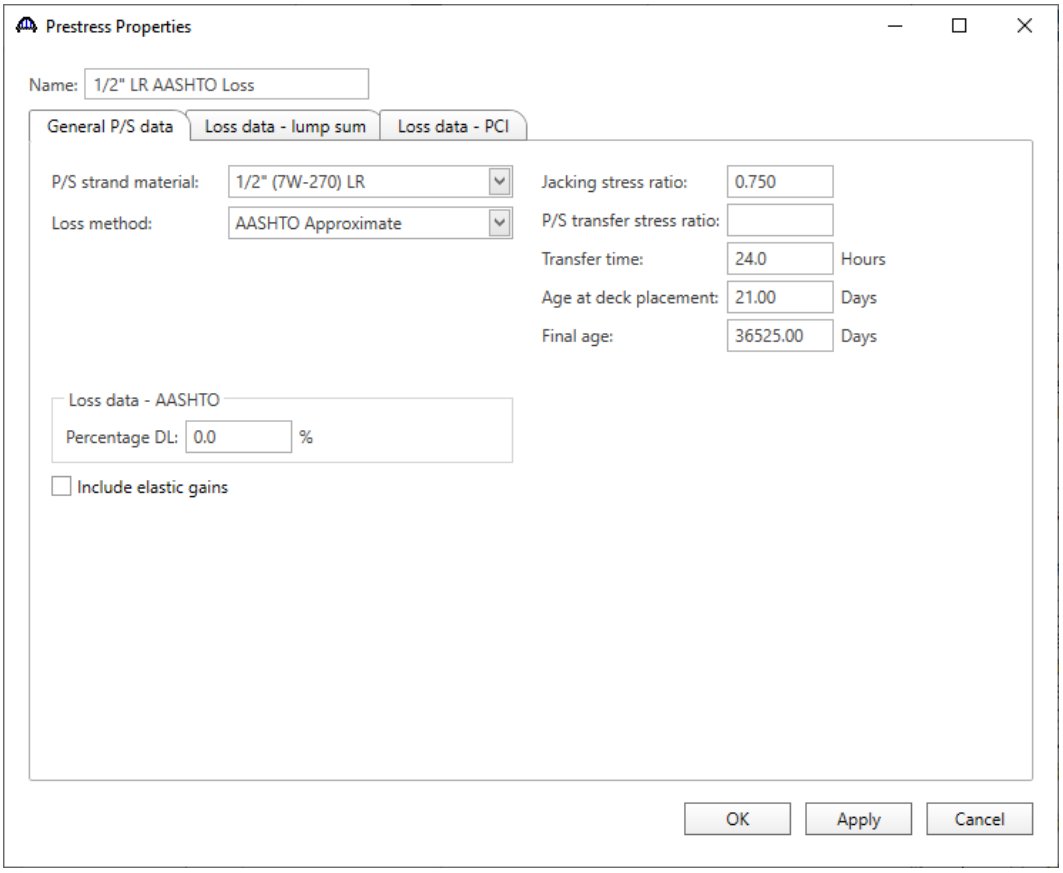
A Stress Limit defines the allowable concrete stresses for a given concrete material. Double click on the **Concrete Stress Limits** node in the **Bridge Workspace** tree to open the **Stress Limit Sets – Concrete** window. Enter the data shown above the **Compute** button and select the **PS 6.0 ksi** material from the drop-down menu of the **Concrete material**. Click the **Compute** button. Default values for the allowable stresses will be computed based on the **Concrete material** selected and the AASHTO Specifications. A default value for the **Final allowable slab compression** is not computed since the deck concrete is typically different from the concrete used in the beam.



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

Prestress Properties

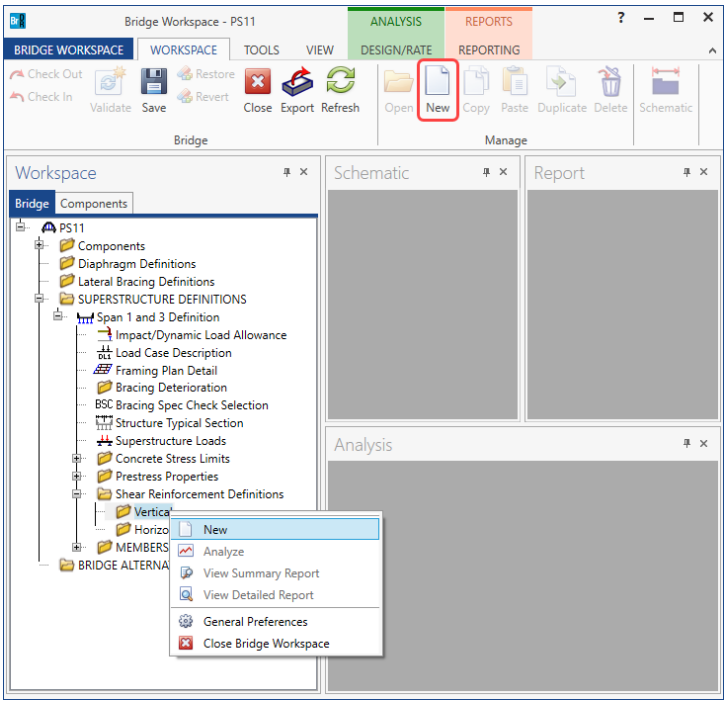
Double click on the **Prestress Properties** node in the **Bridge Workspace** tree to open the **Prestress Properties** window. Define the prestress properties as shown below. Since the **AASHTO Approximate** method is used to compute the losses, only the information on the **General P/S data** tab is required.

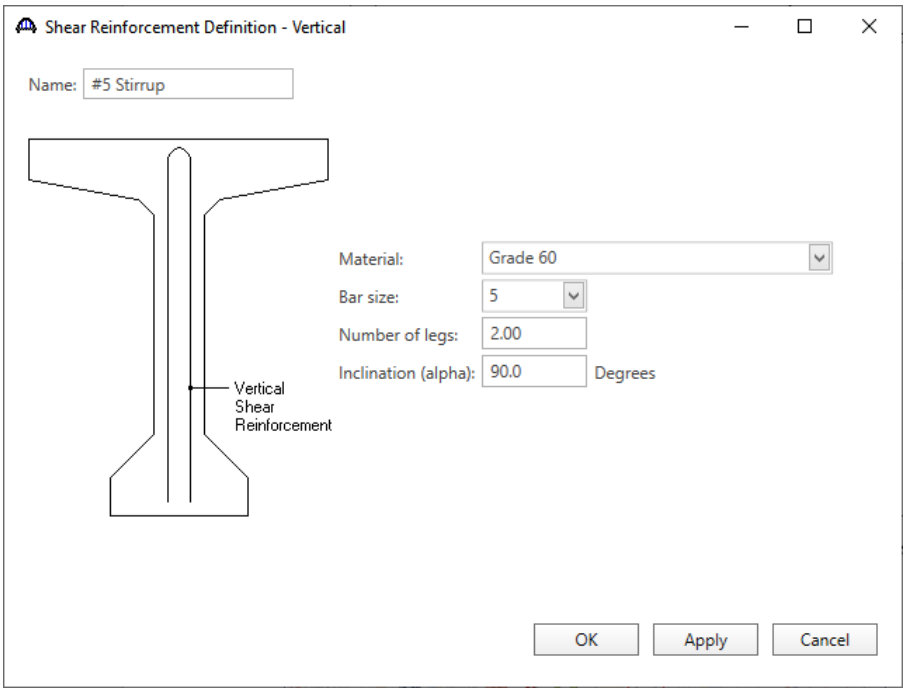


Click **OK** to apply the data and close the window.

Shear Reinforcement

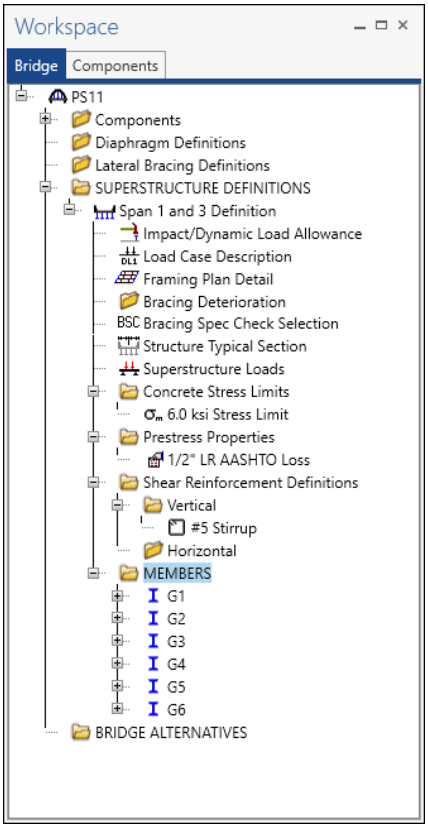
Define shear reinforcement to be used by the girders. Expand the **Shear Reinforcement Definitions** on the **Bridge Workspace** tree, select the **Vertical** node and click on **New** from the **Manage** group of the **WORKSPACE** ribbon (or double click on **Vertical)**.





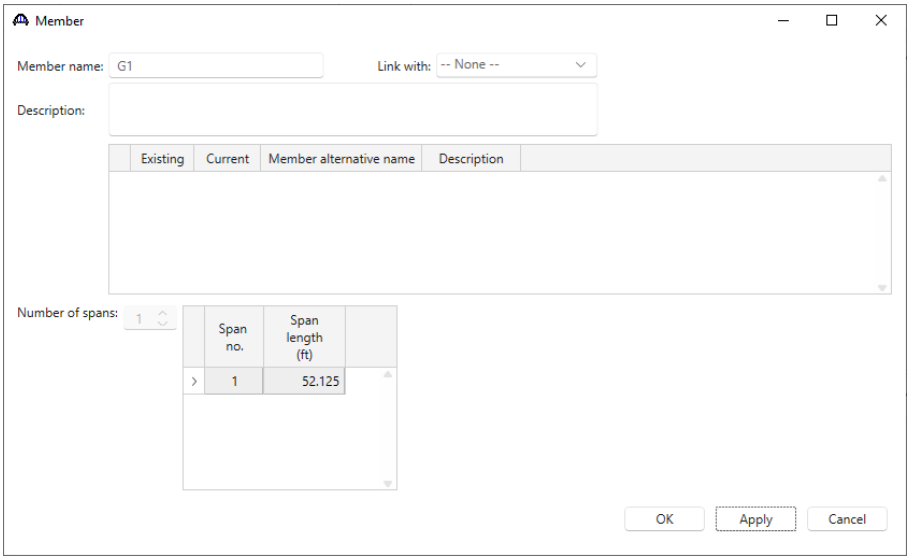
Click **OK** to apply the data and close the window.

A partially expanded **Bridge Workspace** is shown below.



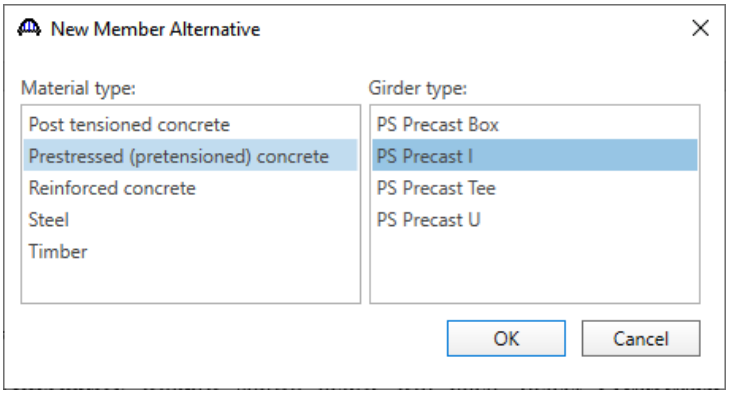
Describing a member

Double-click on the member **G1** in the **Bridge Workspace** tree to open the **Member** window. 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.



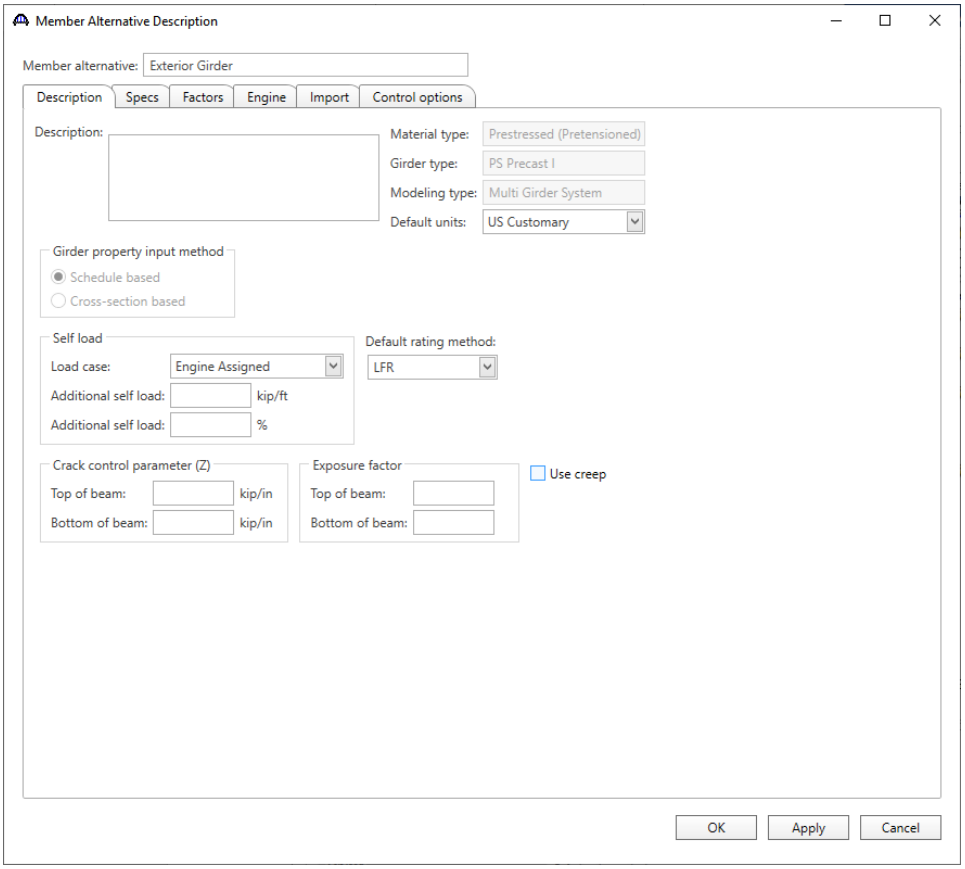
Defining a Member Alternative

Double-click on **MEMBER ALTERNATIVES** in the **Bridge Workspace** tree for member **G1** to create a new member alternative. The **New Member Alternative** window shown below will open. Select **Prestressed (pretensioned) concrete** for the **Material type** and **PS Precast I** for the **Girder Type**.



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

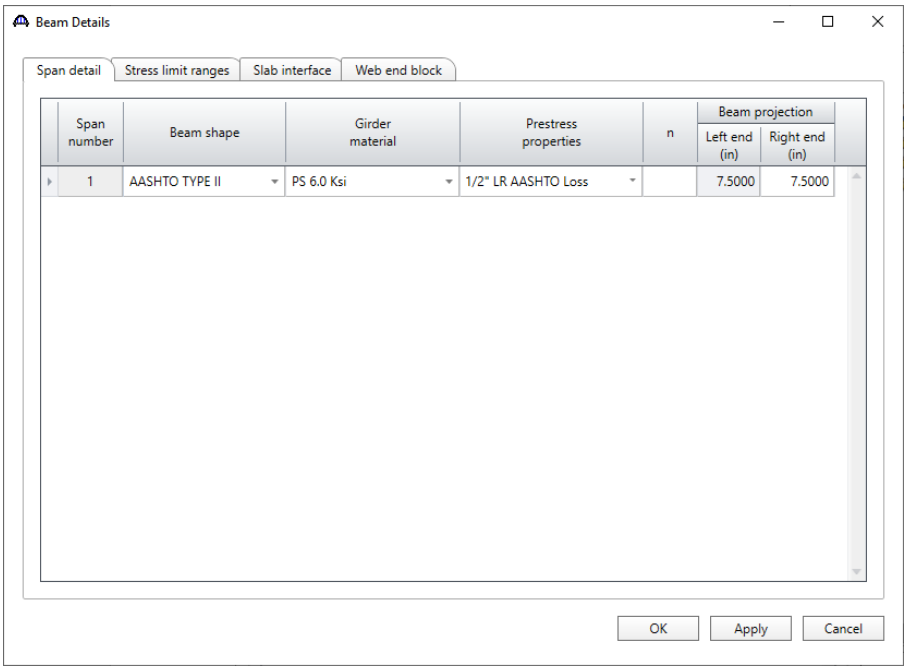
The Member Alternative Description window will open. Enter the data as shown below. The **Schedule based Girder property input method** is the only input method available for a prestressed concrete girder.



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

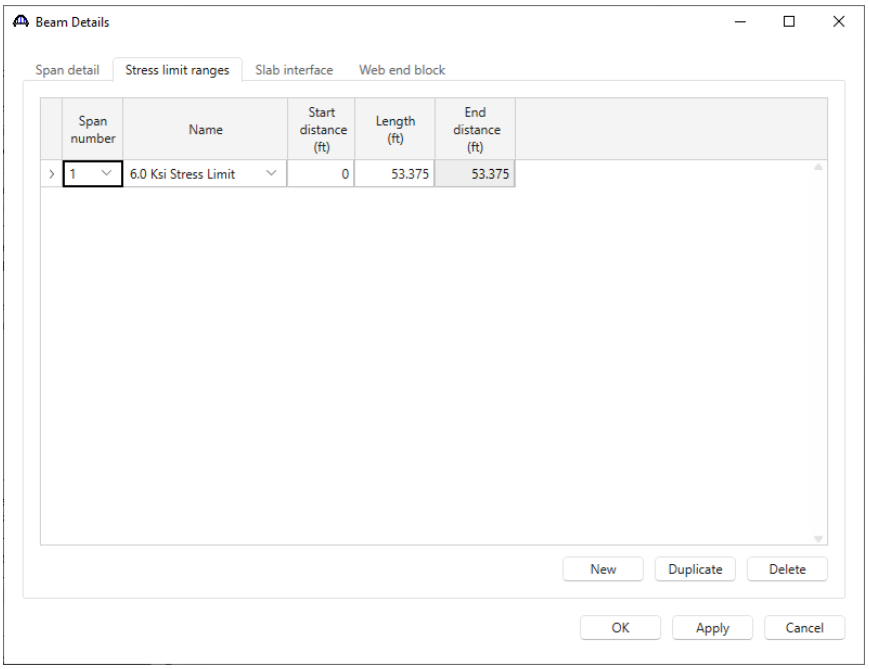
Beam Details – Span Detail

Next describe the beam by double clicking on the **Beam Details** node in the **Bridge Workspace** tree. Enter the data as shown below.



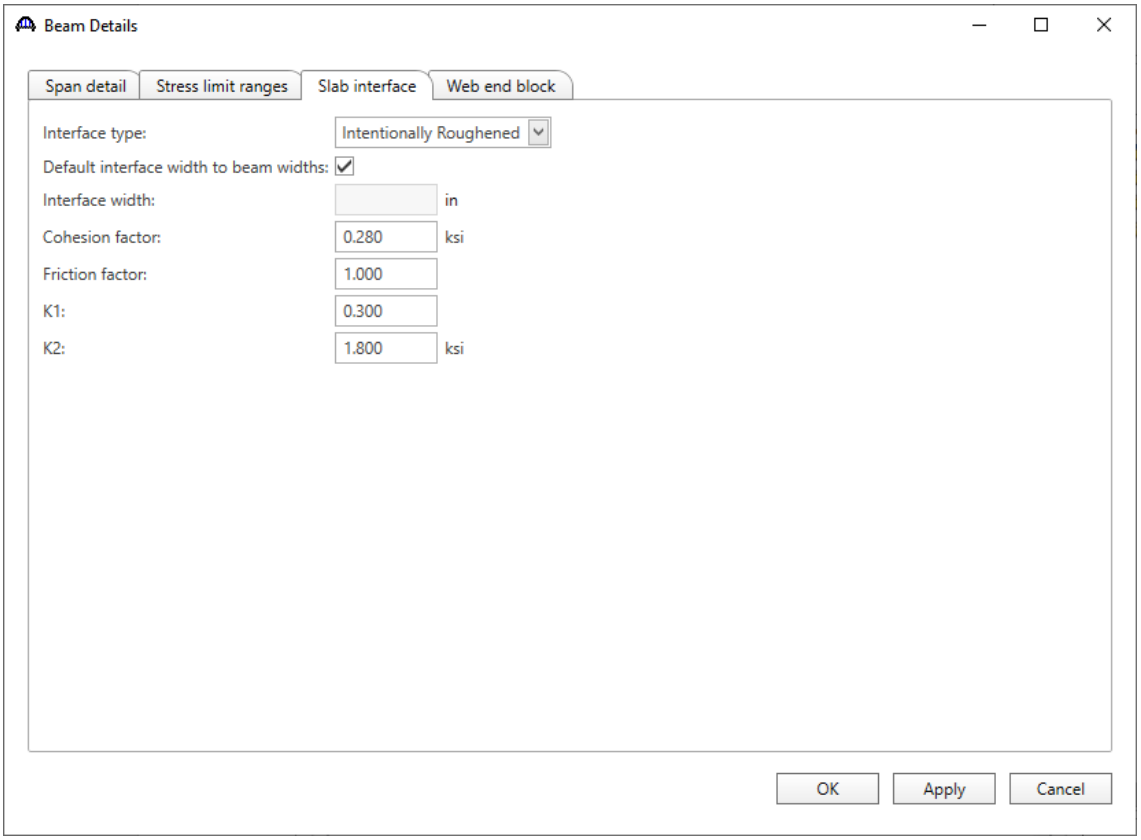
Beam Details – Stress limit ranges

Select the **Stress limit ranges** tab and enter the data as shown below. Note that stress limit ranges are defined over the entire length of the precast girder, including the projections of the girder past the centerline of bearing which were entered on the **Span detail** tab.



Beam Details – Slab interface

Select the **Slab interface** tab and select **Intentionally Roughened** as the **Interface type**.

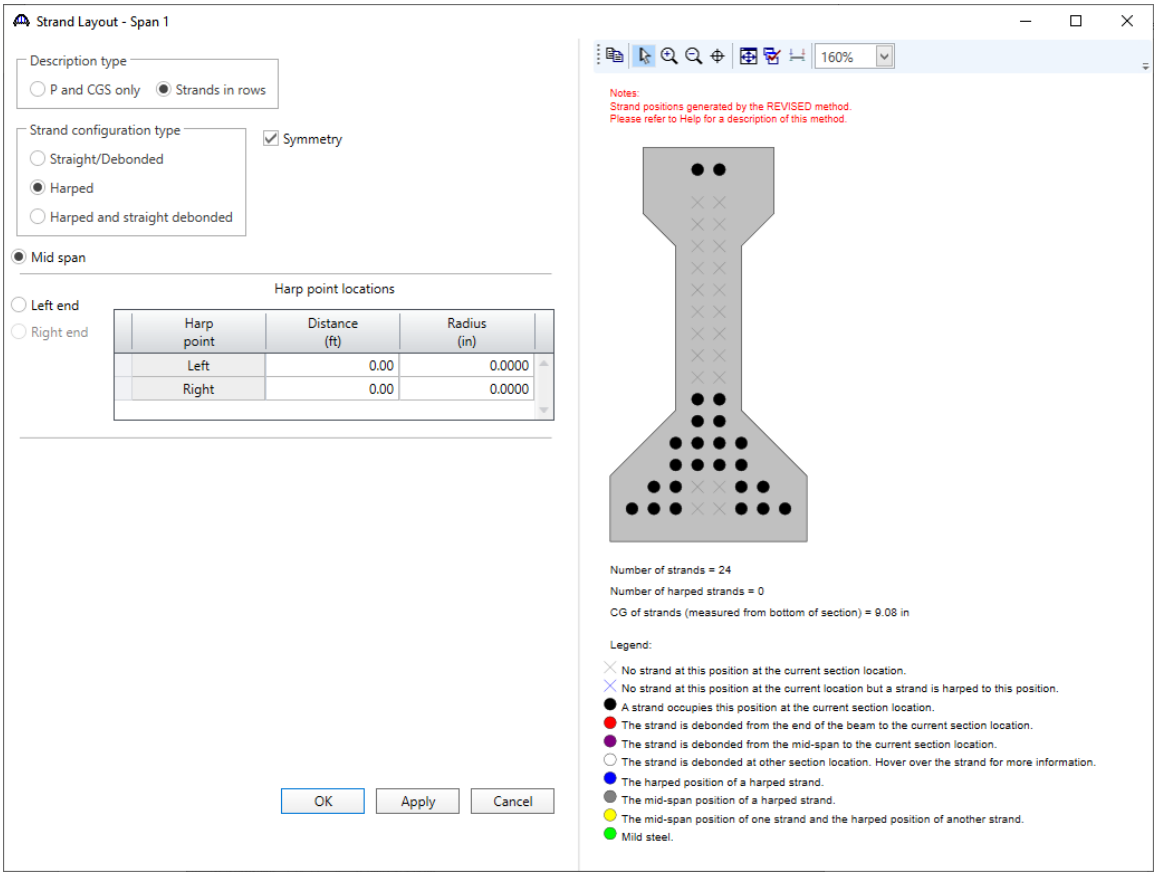


Click **OK** to apply the data and close the window.

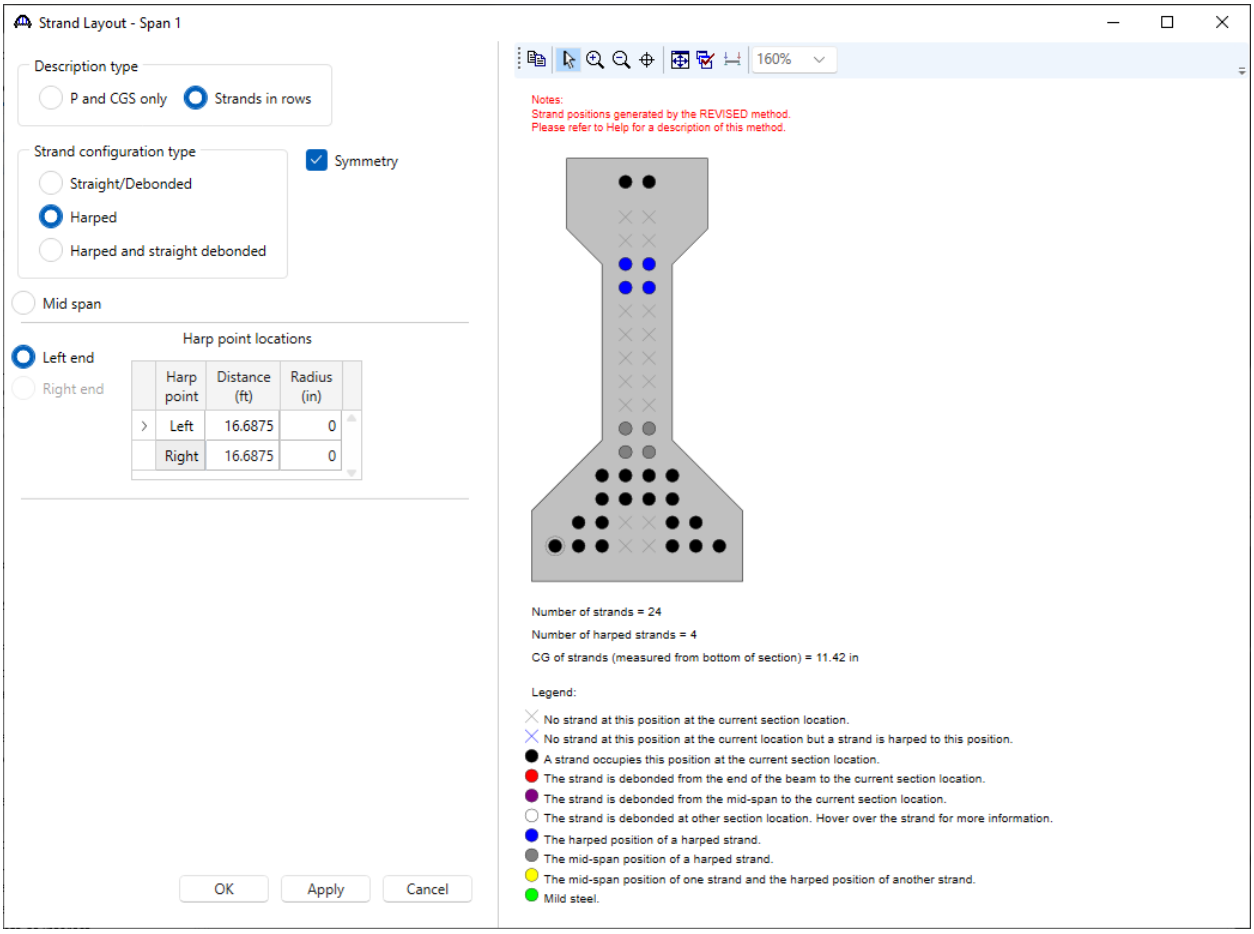
Strand Layout

Expand the **Strand Layout** node in the **Bridge Workspace** tree and open the **Span 1** window. Use the **Zoom** buttons on the right side of this window to shrink/expand the schematic of the beam shape so that the entire beam is visible.

Select the **Description type** as **Strands in rows** and the **Strand configuration type** as **Harped**. Define the following strand layout at midspan by selecting the strand positions in the right hand schematic.



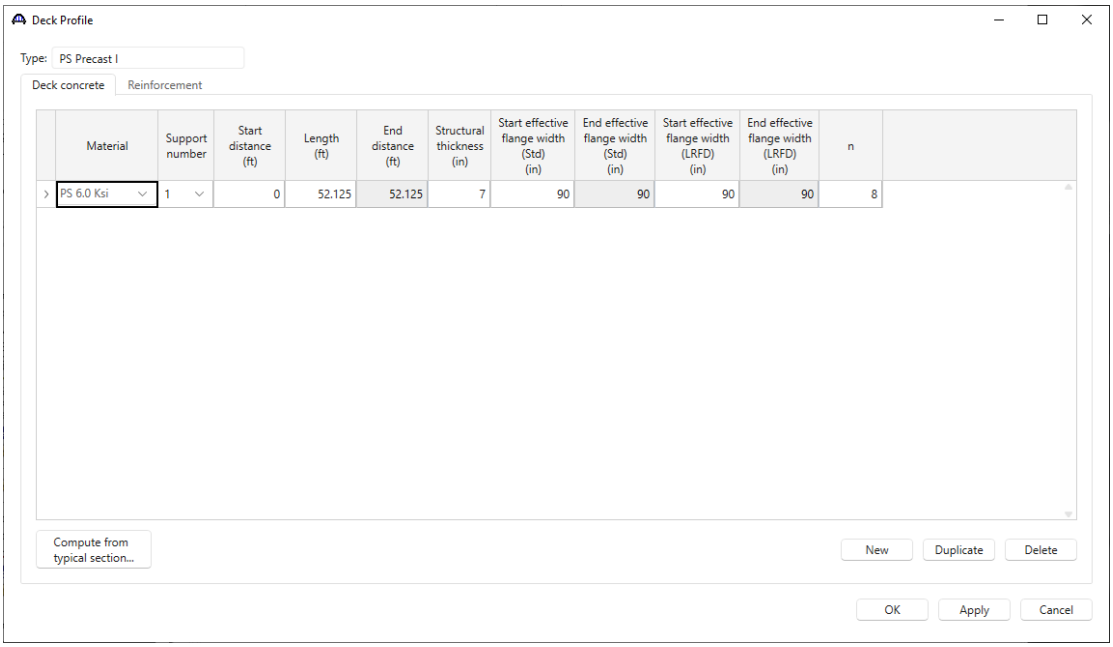
Now select the **Left end** radio button and enter the following harped point locations at the left end of the precast girder. The harped strands can be defined at the left end of the span by selecting harped strand locations in the right hand schematic. Define the following harped strands in the position as shown below.



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

Deck Profile

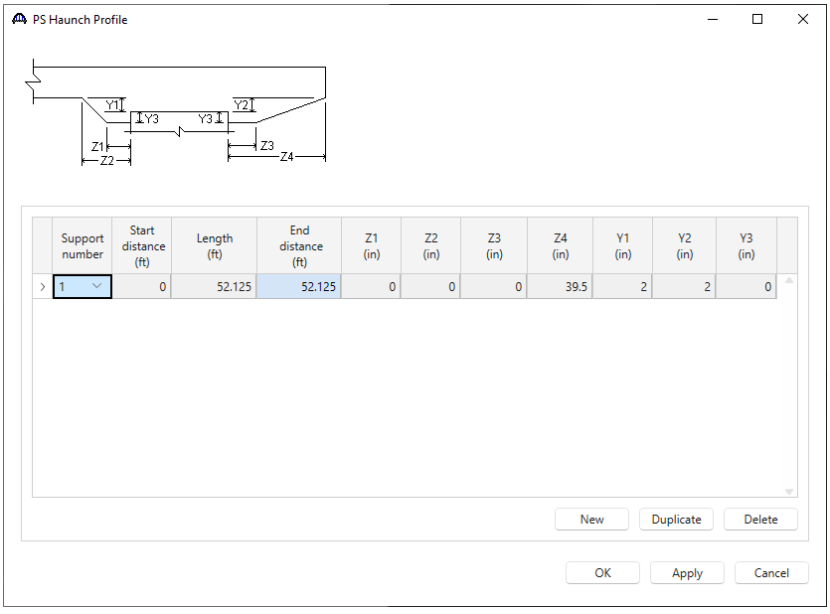
Next open the **Deck Profile** window by double-clicking the **Deck Profile** node in the **Bridge Workspace** tree and enter the data describing the structural properties of the deck. The window is shown below.



No deck reinforcement is described. Close the window by clicking **OK**.

Haunch Profile

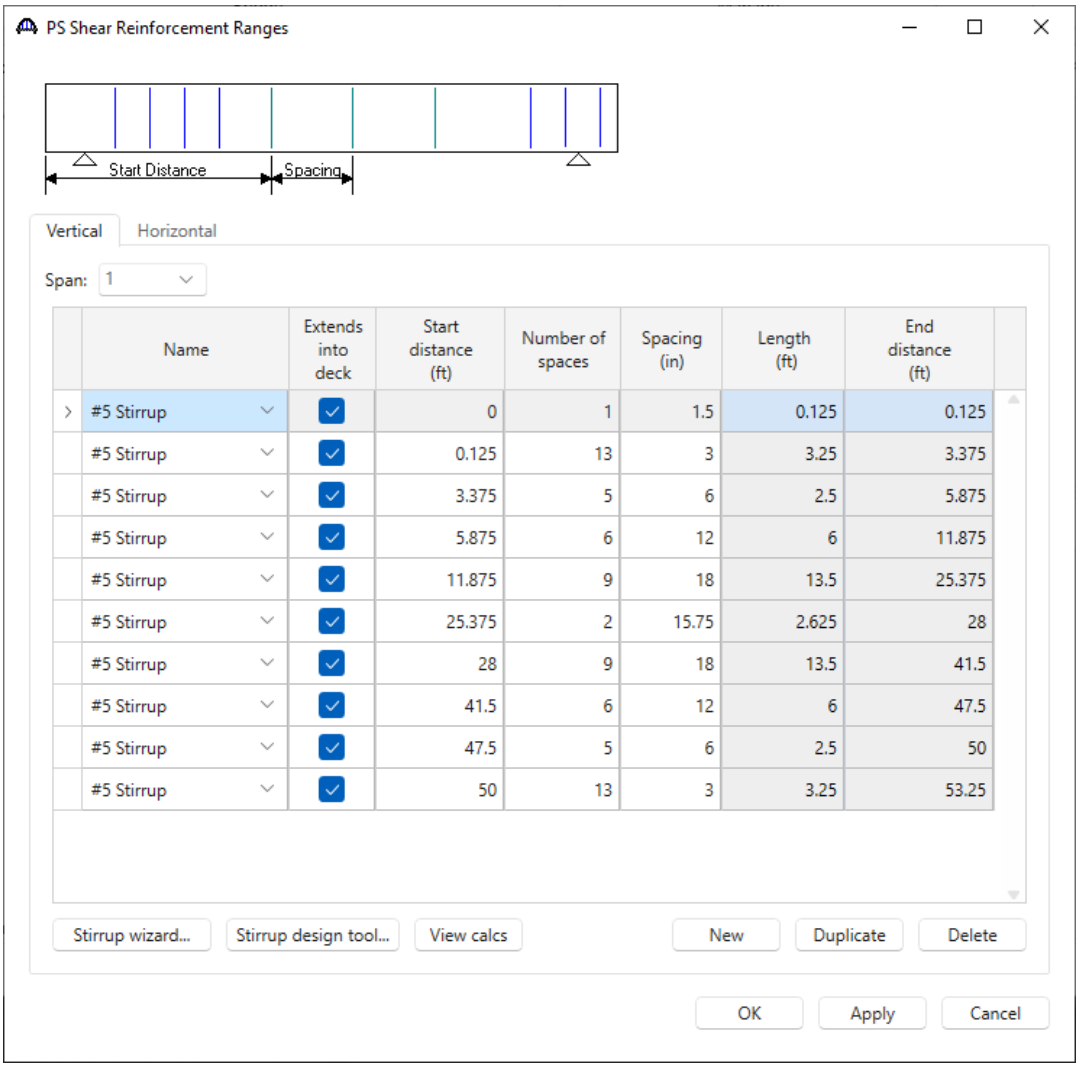
The haunch profile is defined by double-clicking on the **Haunch Profile** node in the **Bridge Workspace** tree. Enter data as shown below.



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

Shear Reinforcement Ranges

Double-click on the **Shear Reinforcement Ranges** node in the **Bridge Workspace** tree to open the **PS Shear Reinforcement Ranges** window. The PS shear reinforcement ranges are entered as described below. The vertical shear reinforcement is defined as extending into the deck on the **Vertical** tab of this window. This indicates composite action between the beam and the deck. Data does not have to be entered on the **Horizontal** tab to indicate composite action since that has been defined by extending the vertical bars into the deck. Create a new row after completing the current row. The **Start distance** of the new row will be populated with the **End distance** of the current row.

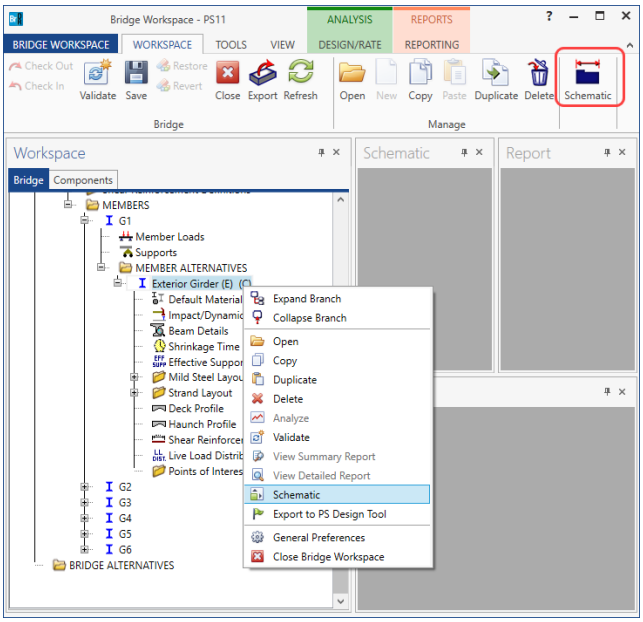


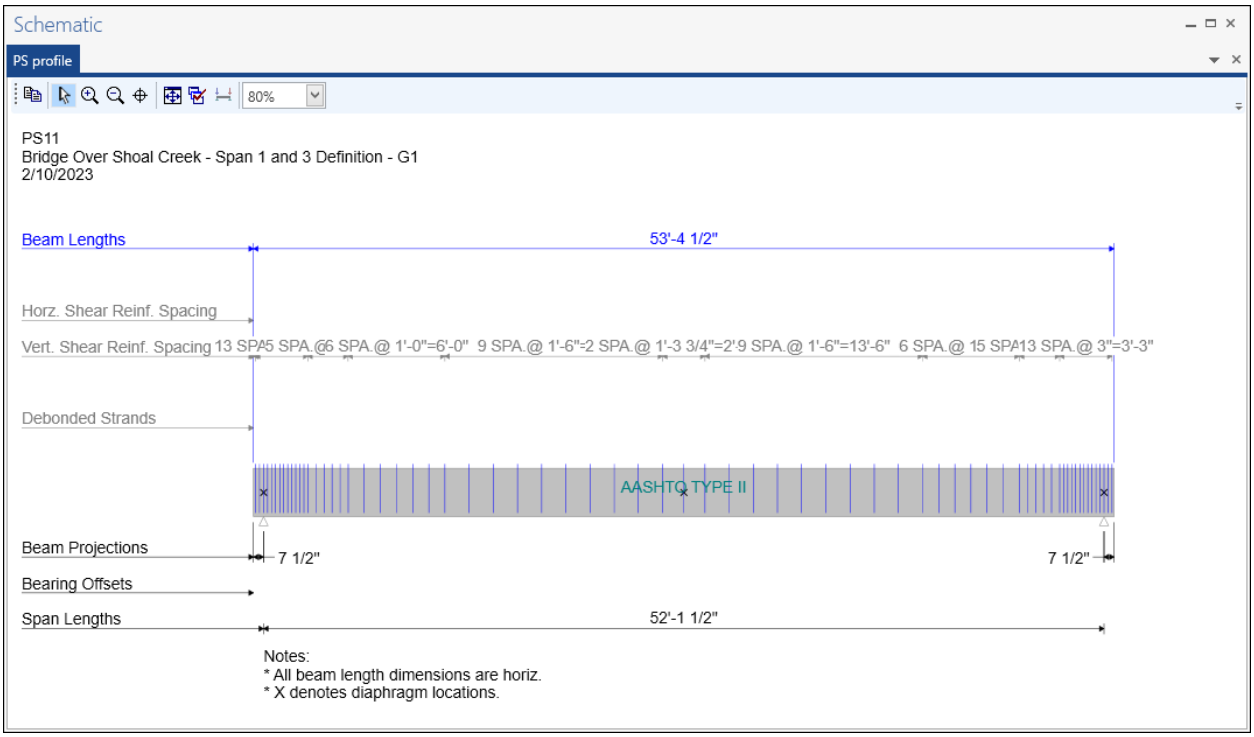
Click **OK** to apply the data and close the window.

The description of the exterior girder for this superstructure definition is completed.

Schematic – Exterior Girder (E) (C) (member alternative)

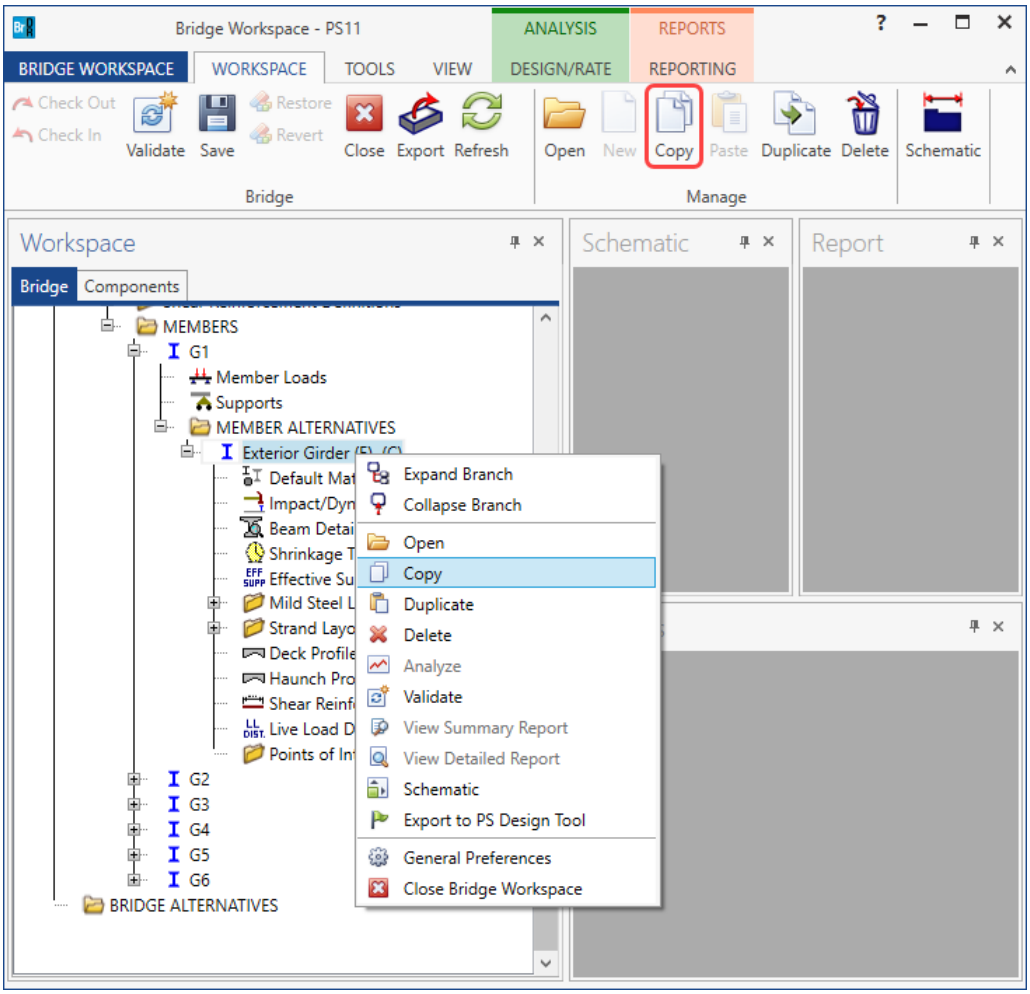
While **Exterior Girder (E) (C)** member alternative is selected in the **Bridge Workspace** tree, open the schematic for the member alternative by selecting the **Schematic** button on the **WORKSPACE** ribbon (or right click on **Exterior Girder (E) (C)** in the **Bridge Workspace** and select **Schematic** from the menu).



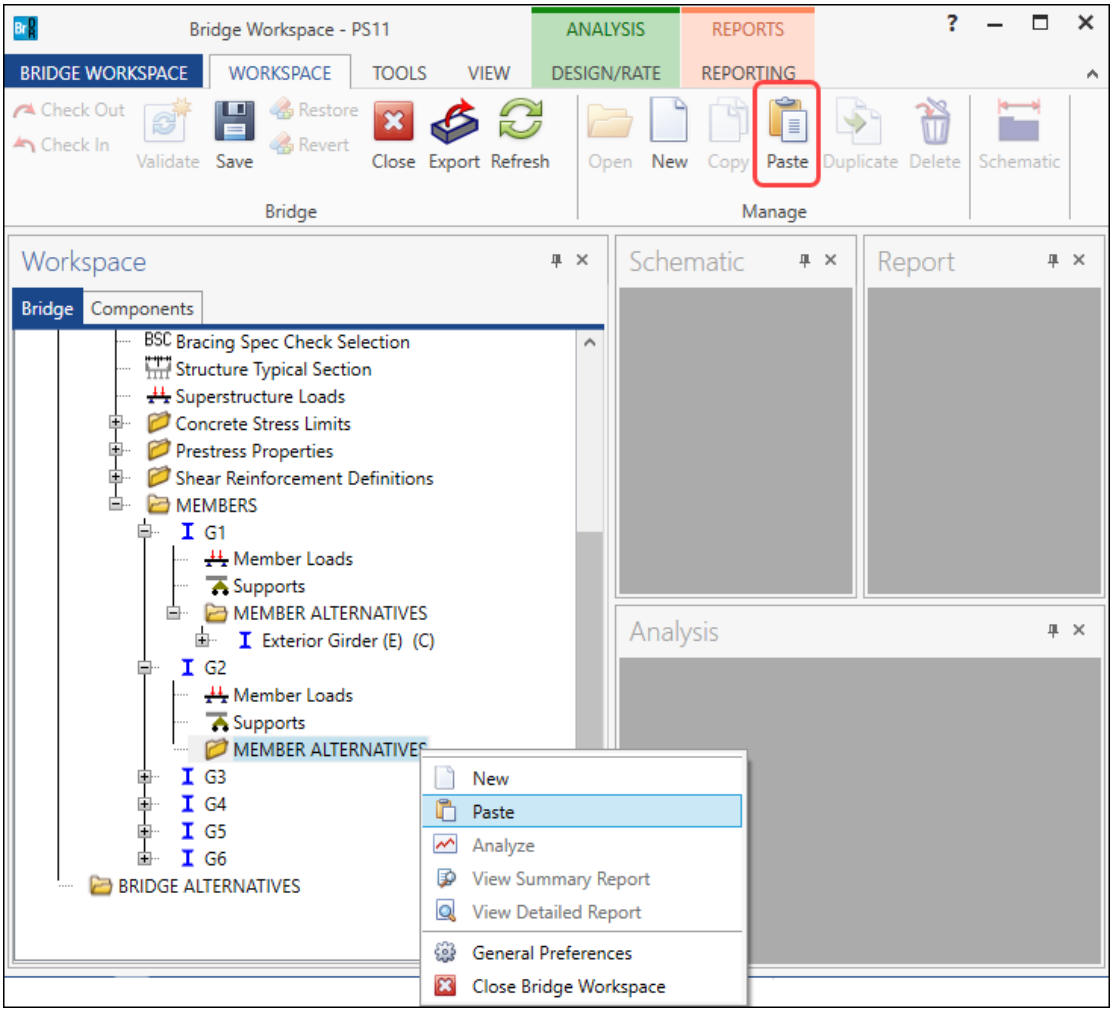


Copy of exterior girder to an interior girder (G2) and check the Deck Profile and Haunch Profile

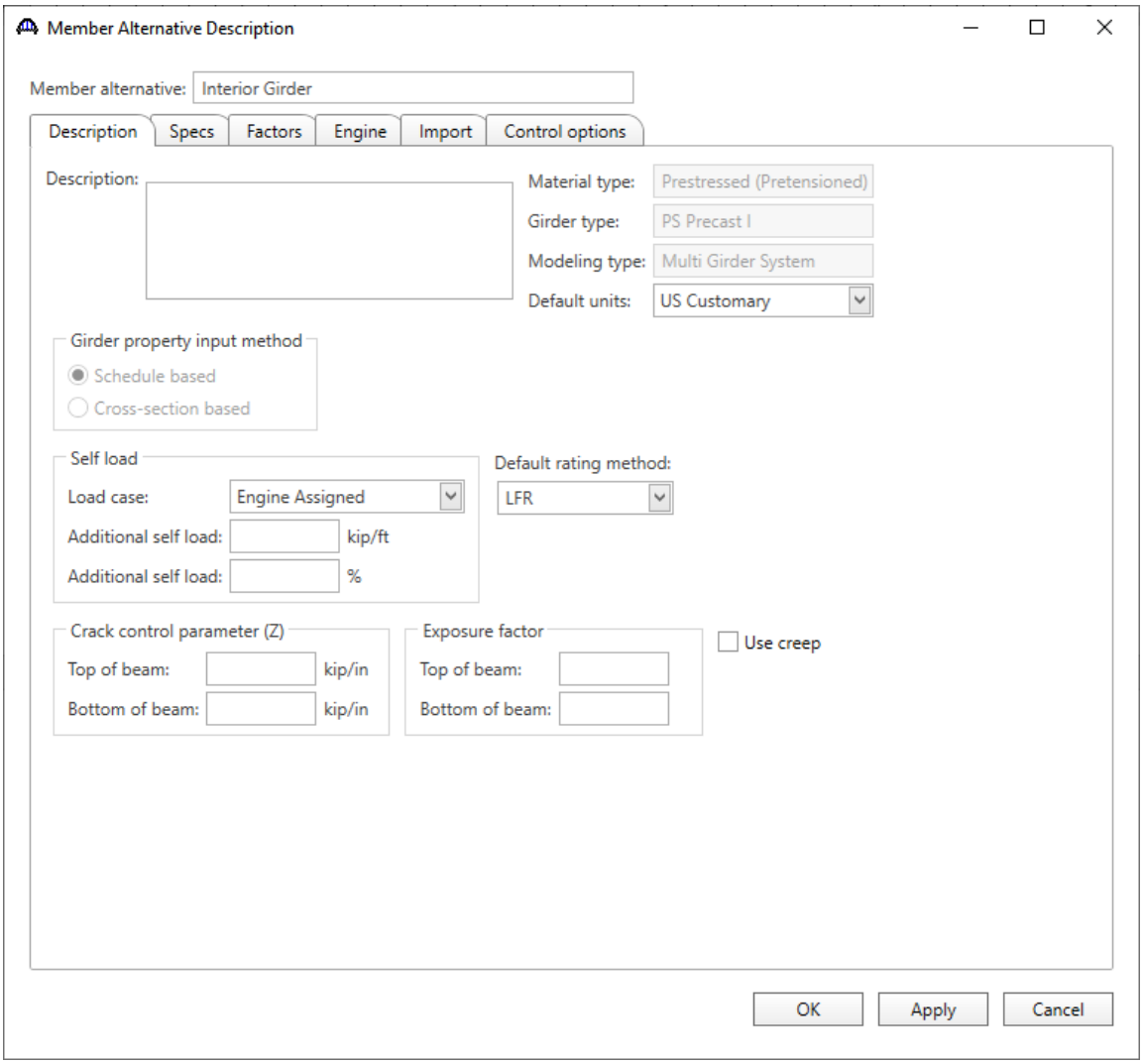
Create a copy of the **Exterior Girder** member alternative. To make a copy, click on the **Exterior Girder (E) (C)** member alternative in the **Bridge Workspace** tree and click the **Copy** button from the **Manage** group of the **WORKSPACE** ribbon (or right-click on **Exterior Girder** and select **Copy** from the menu).



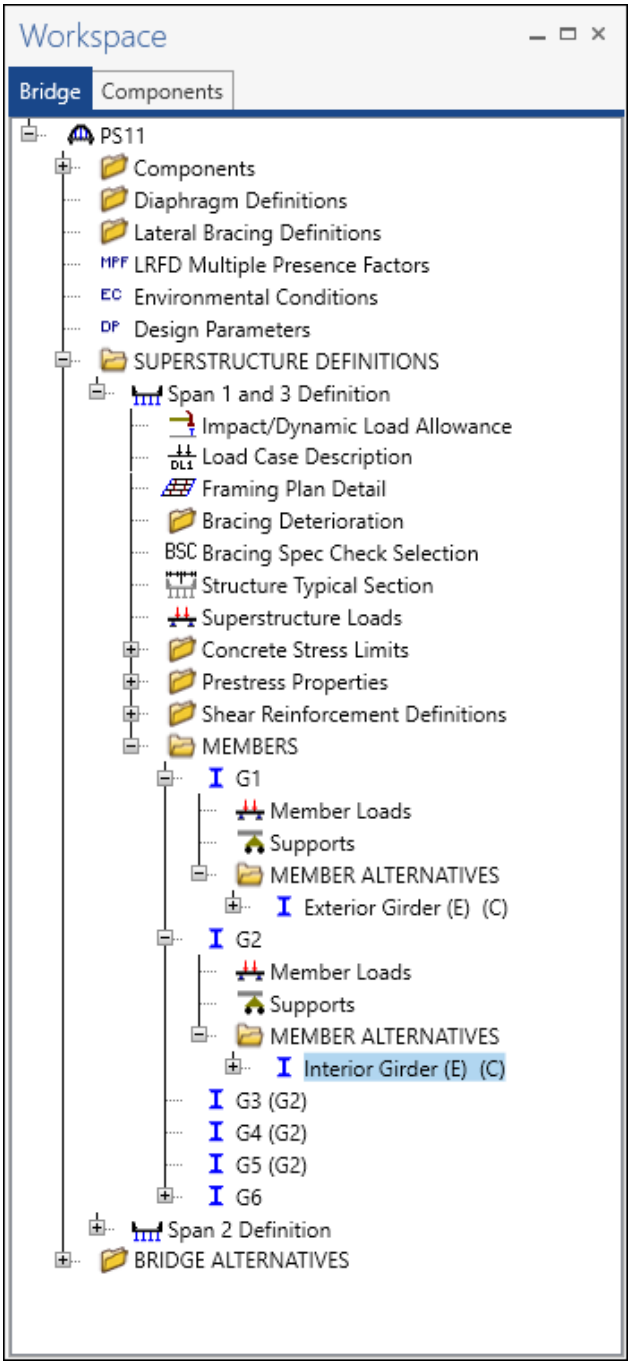
Now click on the **MEMBER ALTERNATIVES** node under the member **G2** in the **Bridge Workspace** tree and click the **Paste** button from the **Manage** group of the **WORKSPACE** ribbon (or right-click on **MEMBER ALTERNATIVES** and select **Paste** from the drop-down menu).



Double click on the copied member alternative and rename it as shown below.

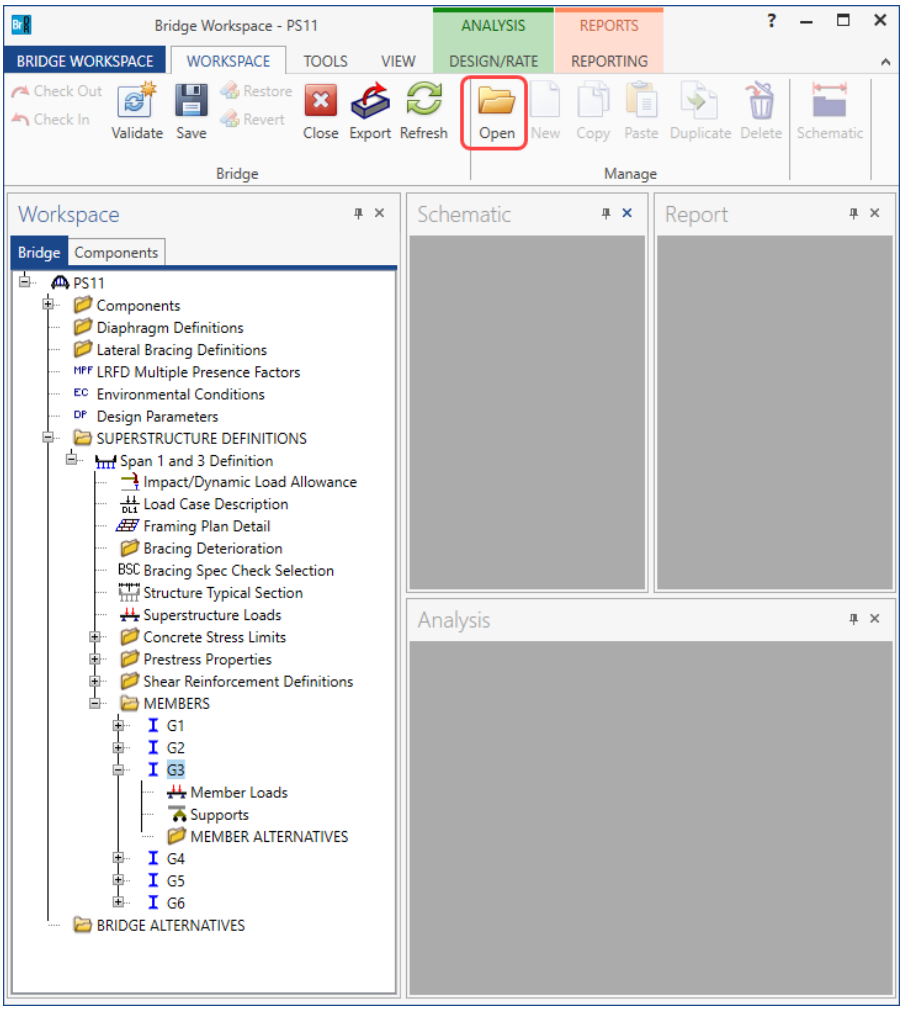


The **Bridge Workspace** tree will be updated with the new copy as shown below.

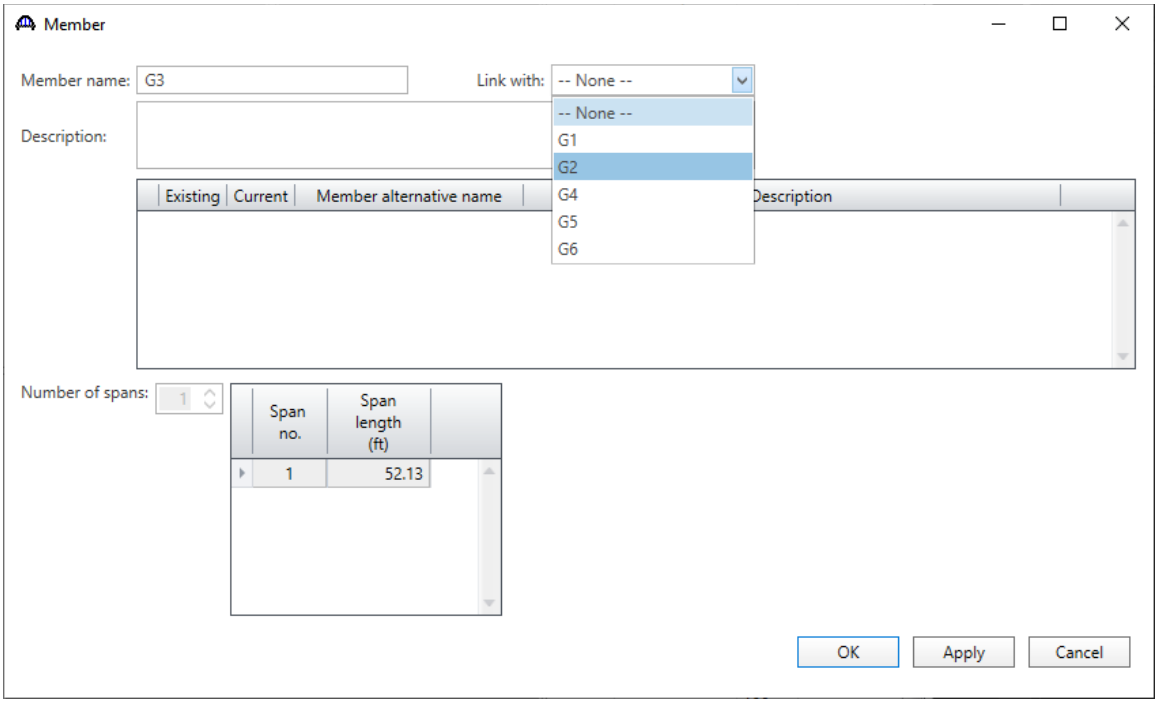


Link all other interior girders (G3, G4 and G5) to G2

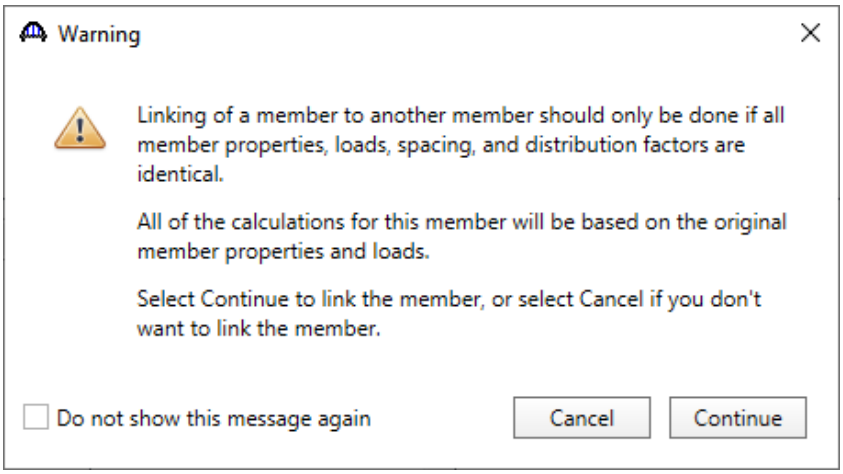
To link the interior girder **G3** to **G2**, double click on the **G3** node in the **Bridge Workspace** tree (or select **G3** and click the **Open** button from the **Manage** group of the **WORKSPACE** ribbon). This opens the **Member** window for this girder as shown below.



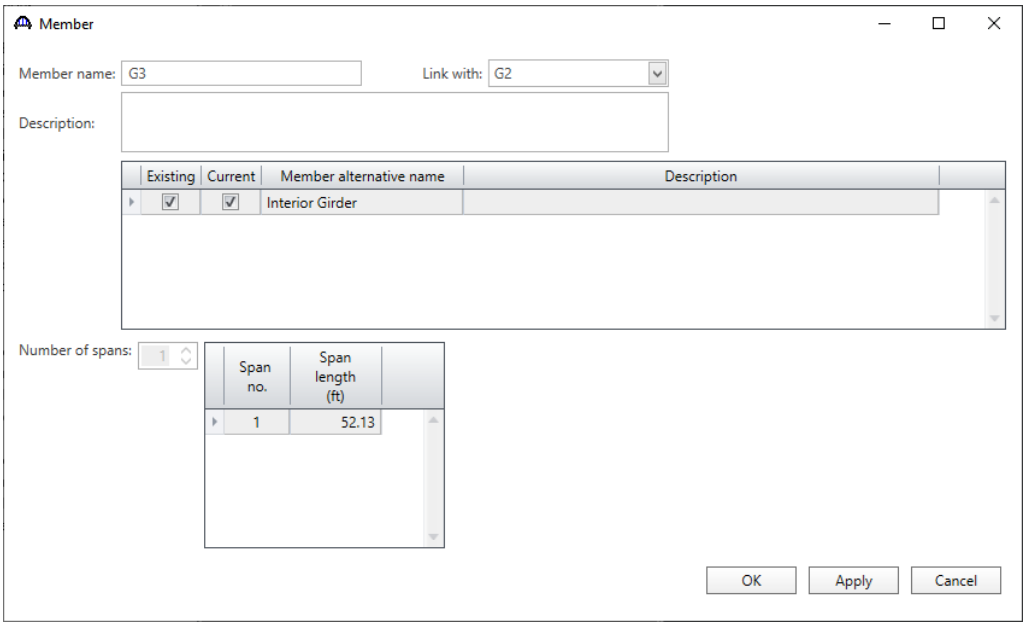
From the menu options under **Link with**, select **G2** as shown below.



The following warning message shows up. Review the message and click **Continue** to link the member.



The **Member** window for **G3** will now be updated with the details from girder member **G2** indicating that the member has been linked. (See below)

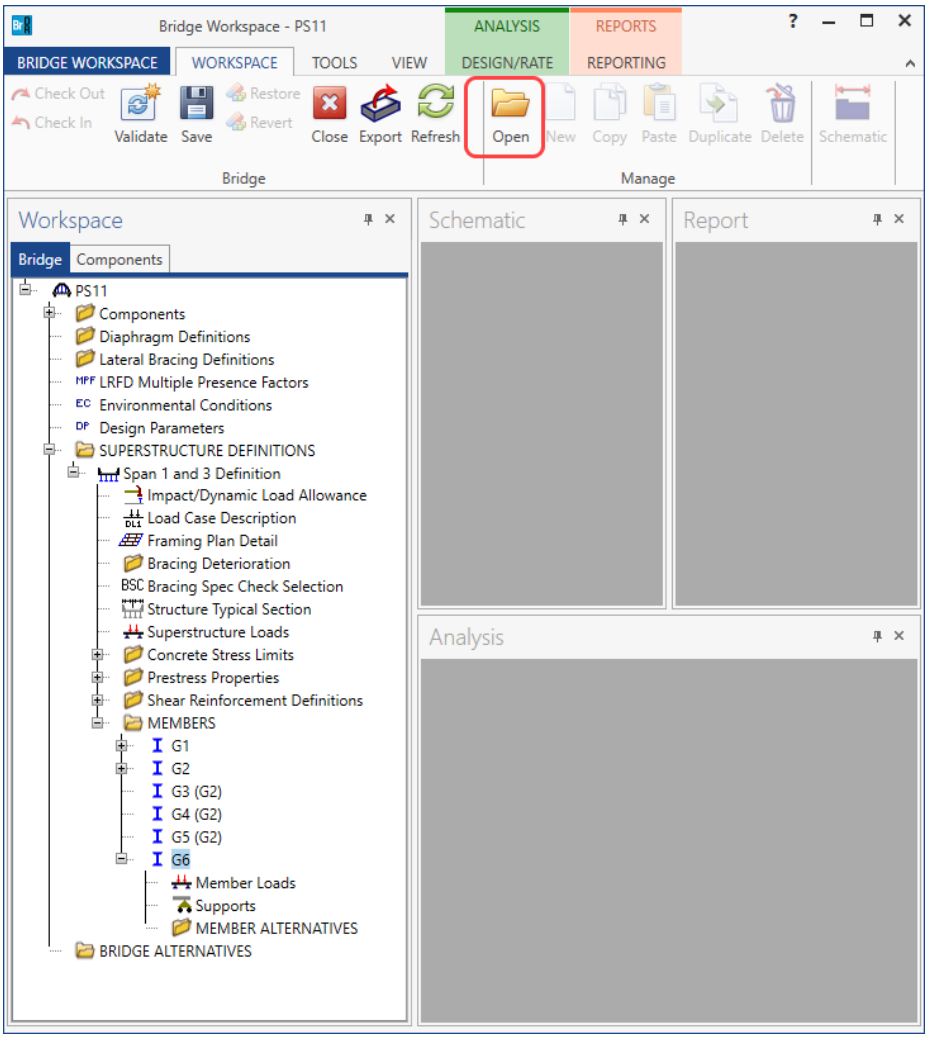


Click **OK** to apply the data and close the window.

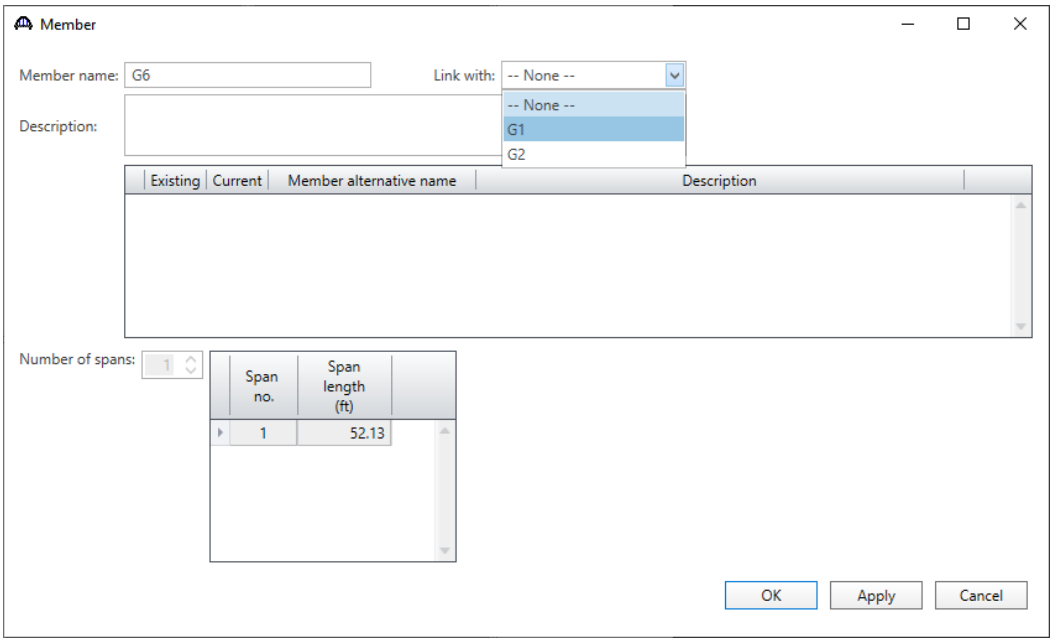
Repeat this process for the remaining interior girders (**G4** and **G5**)

Link other exterior girders (G6) to G1

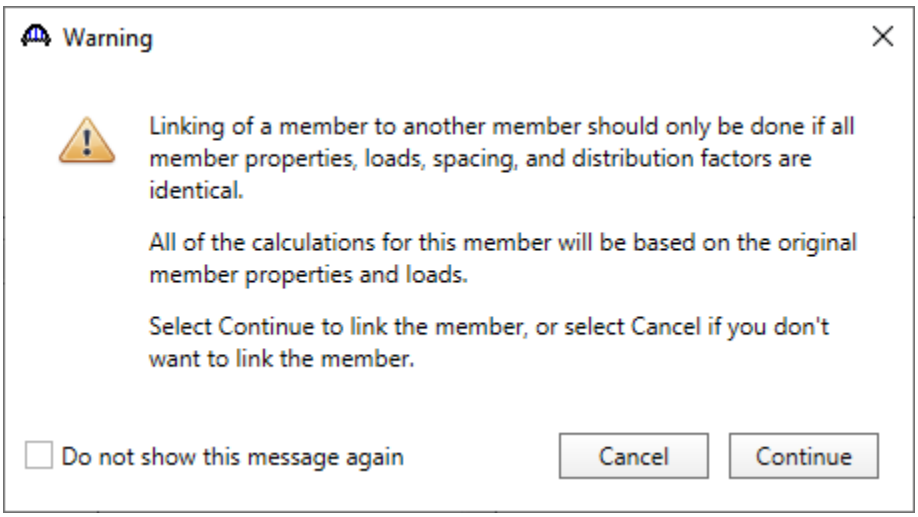
Linking exterior girder follows the same procedure as shown previously to link the interior girder. Open the **Member** window for girder **G6** by double clicking on the **G6** node in the **Bridge Workspace** tree (or select **G6** and click the **Open** button from the **Manage** group of the **WORKSPACE** ribbon).



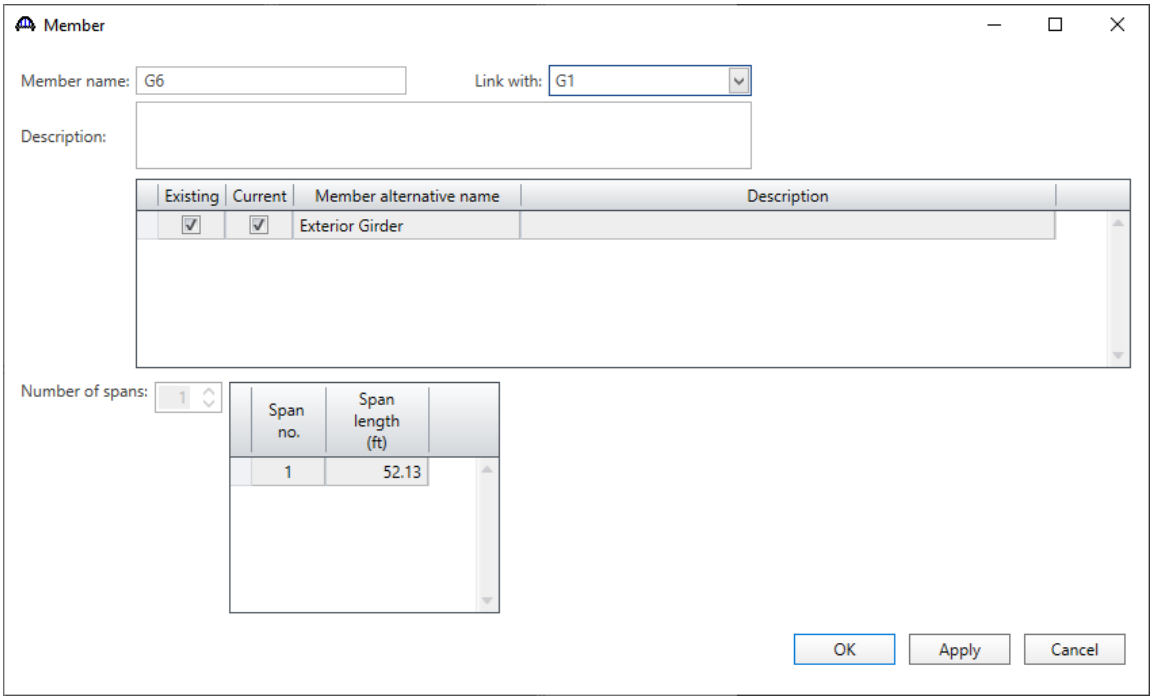
In the Member window, under Link with, select **G1.** The options will not include the other interior girder (**G3, G4** and **G5**) since they are already linked with girder **G2**.



The following warning message shows up. Review the message and click **Continue** to link the member.



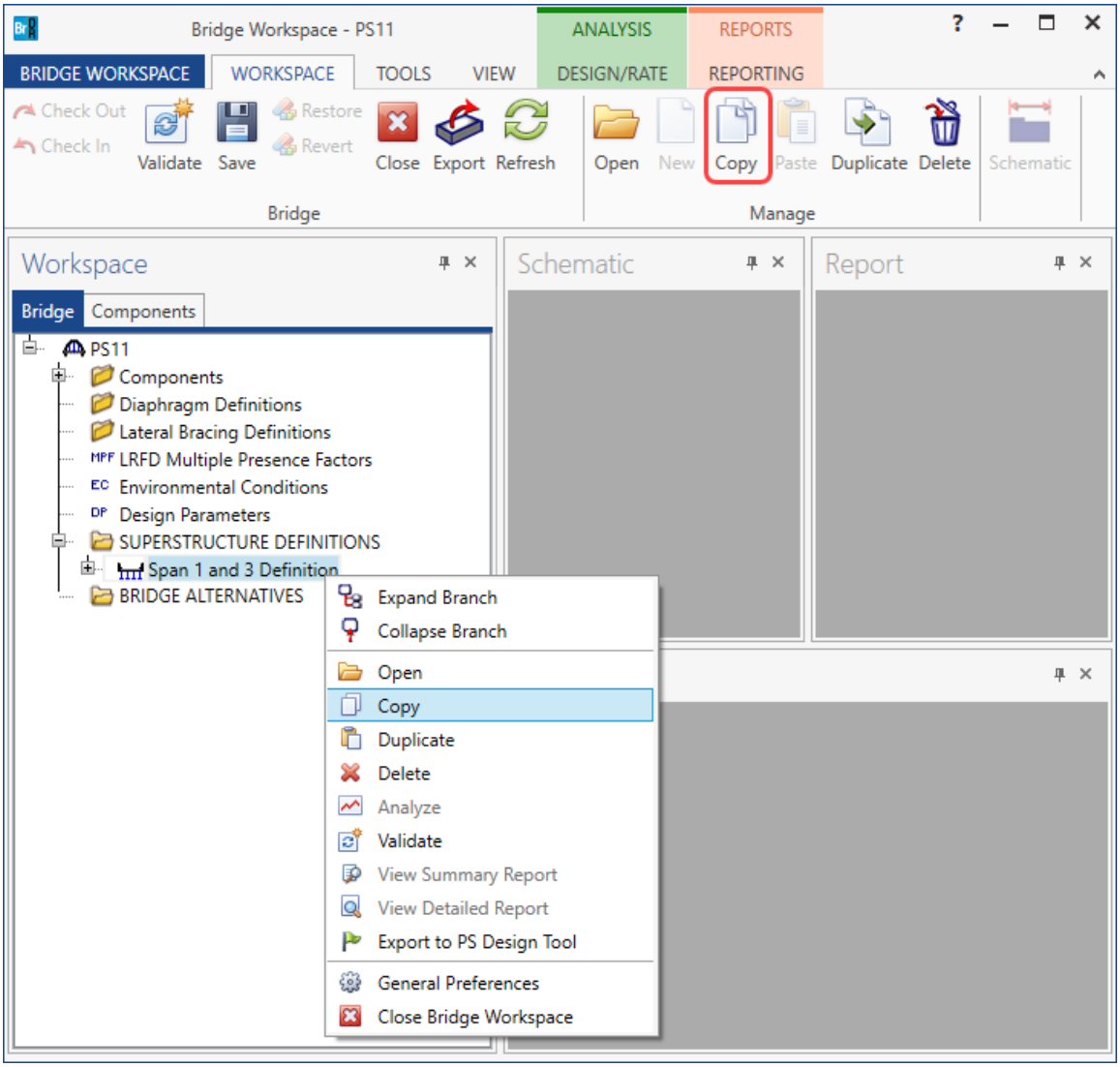
The **Member** window for **G6** will now be updated with the details from girder member **G1** indicating that the member has been linked. (See below)



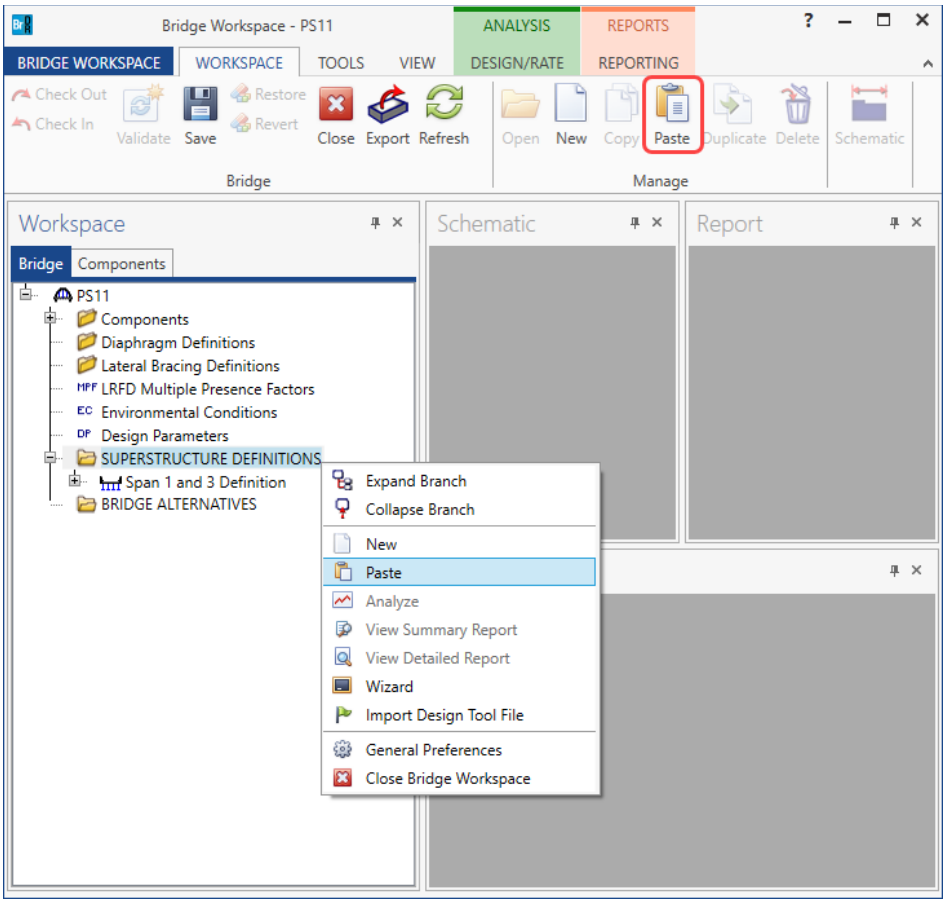
Click **OK** to apply the data and close the window.

Create another BrDR Superstructure Definition (Span 2 Definition) for Span No. 2 by copying Span 1 and 3 Definition

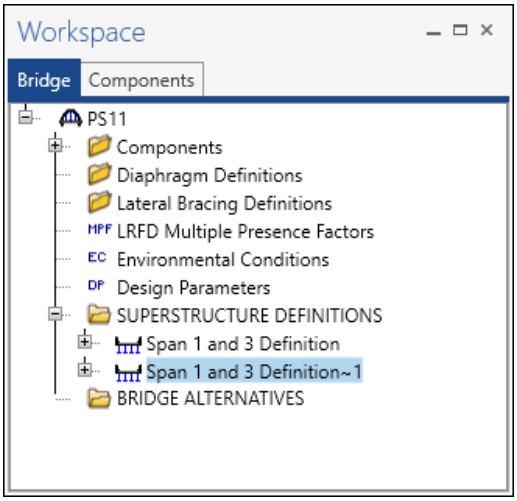
To copy a superstructure definition, select the **Span 1 and 3 Definition** node in the **Bridge Workspace** tree and click the **Copy** button from the **Manage** group of the **WORKSPACE** ribbon (or right-click on **Span 1 and 3 Definition** and select **Copy** from the menu) as shown below.



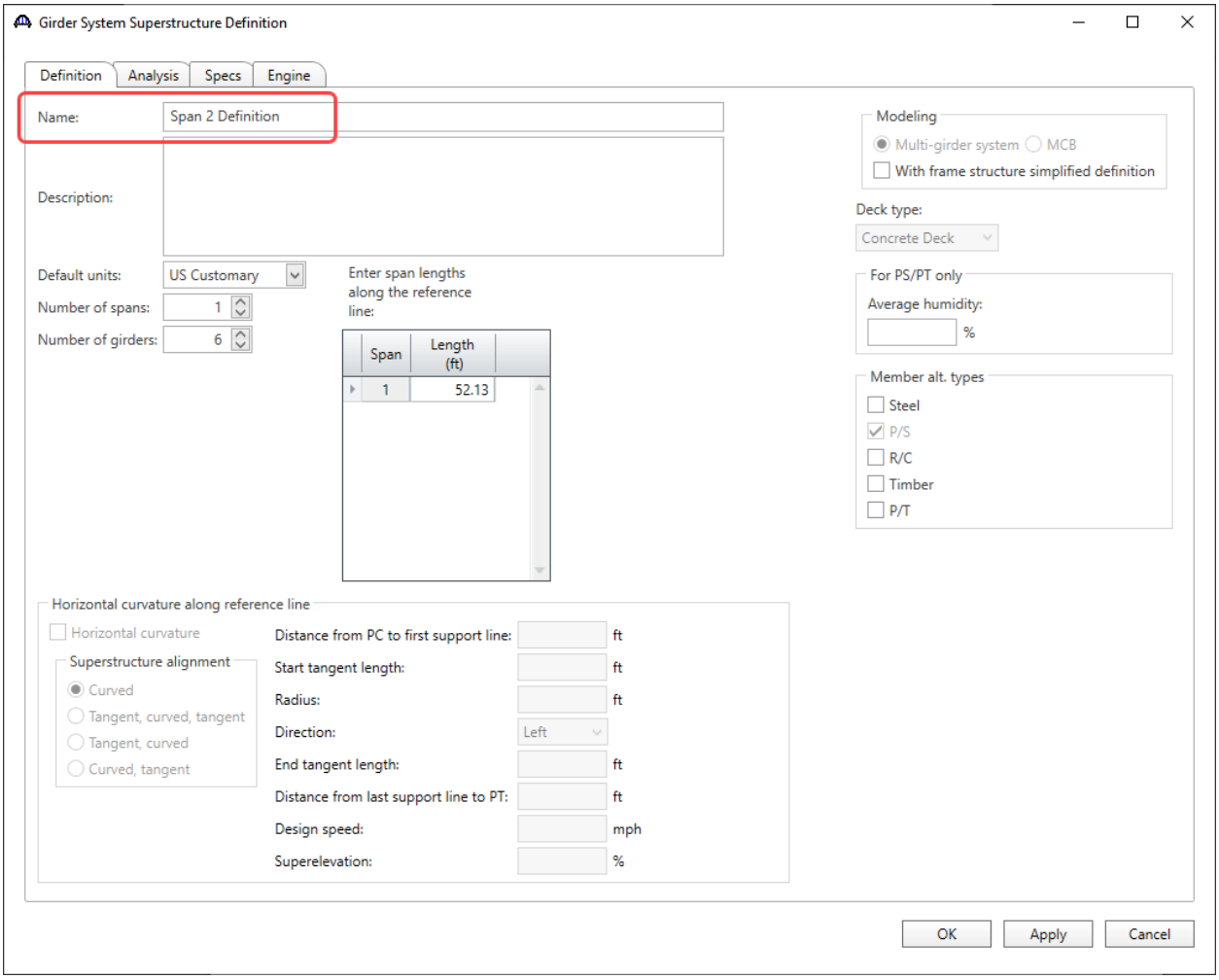
Now click on the **SUPERSTRUCTURE DEFINITIONS** node in the **Bridge Workspace** tree and click the **Paste** button from the **Manage** group of the **WORKSPACE** ribbon (or right-click on **SUPERSTRUCTURE DEFINITIONS** and select **Paste** from the menu) as shown below.



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



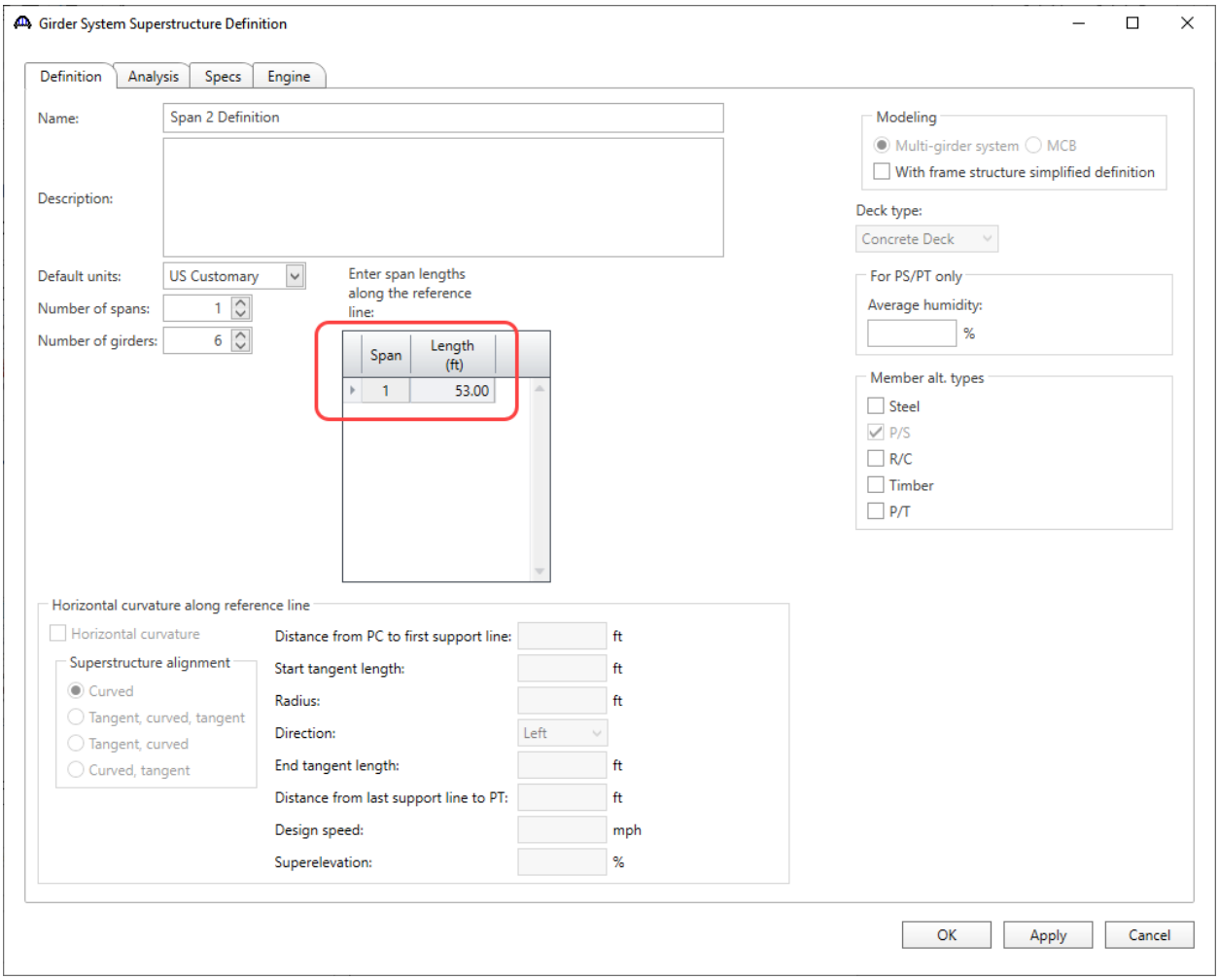
Double click on the newly created **Span 1 and 3 Definition ~ 1** superstructure definition to open the **Girder System Superstructure Definition** window. Rename this superstructure definition to **Span 2 Definition** as shown below.



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

Modify the span length in Superstructure Definition

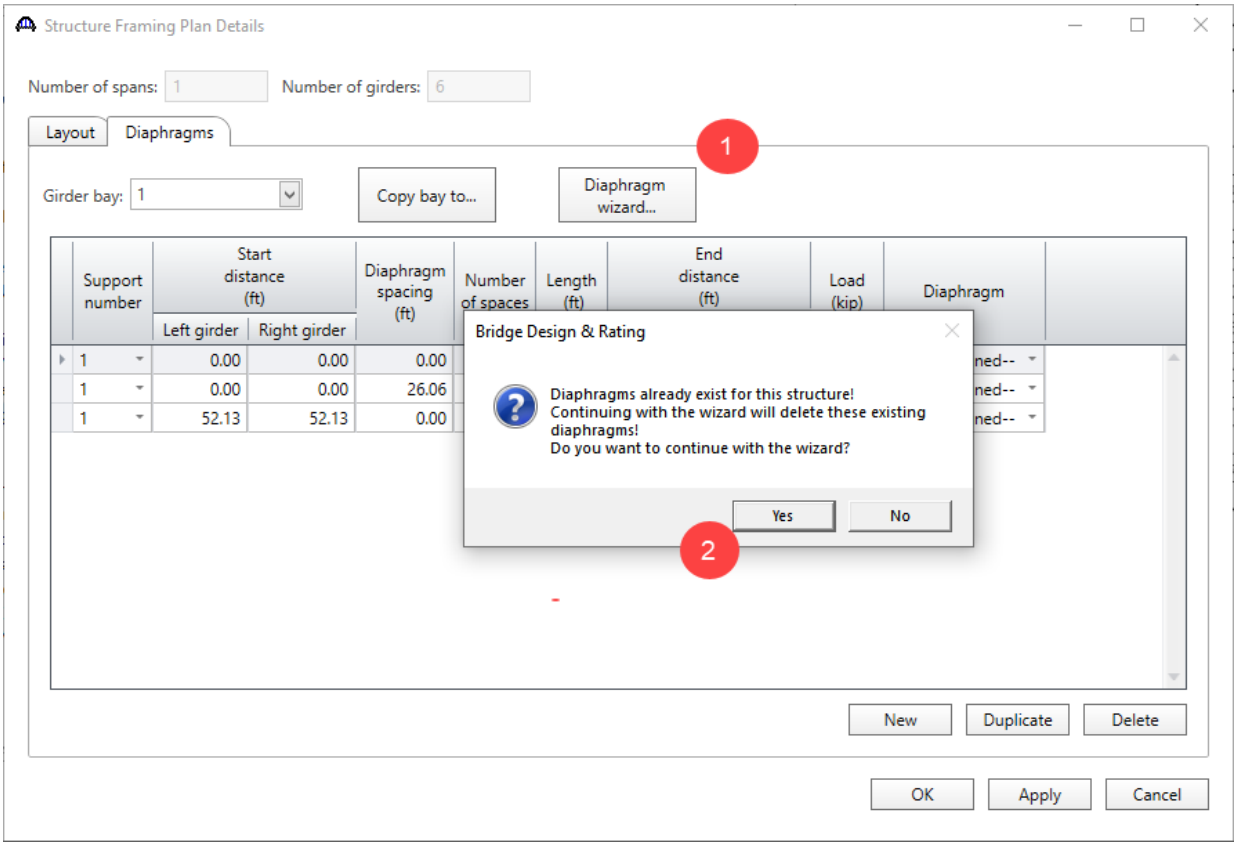
Double click on the **Span 2 Definition** node in the **Bridge Workspace** tree to open the **Girder System Superstructure Definition** window. Change the span length of this superstructure as shown below.



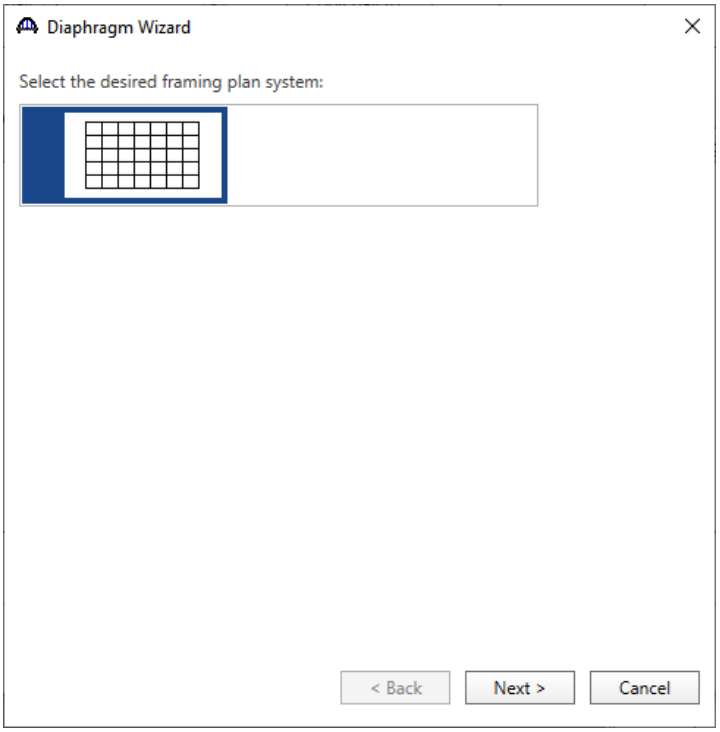
Click **OK** to apply the data and close the window.

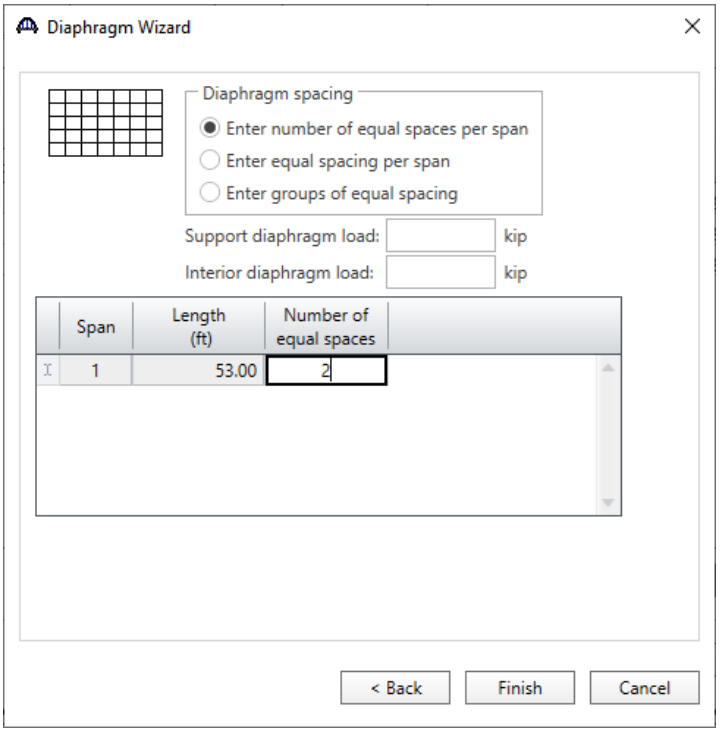
Repopulate the diaphragm spacing using the Diaphragm Wizard

Double-click on **Framing Plan Detail** in the **Bridge Workspace** tree to describe the framing plan in the **Structure Framing Plan Details** window. Switch to the **Diaphragms** tab to enter diaphragm spacing. Click the **Diaphragm wizard…** button to add diaphragms for the entire structure. A window appears warning the user that continuing with the wizard will delete the existing diaphragms. Click **Yes** to continue as shown below.



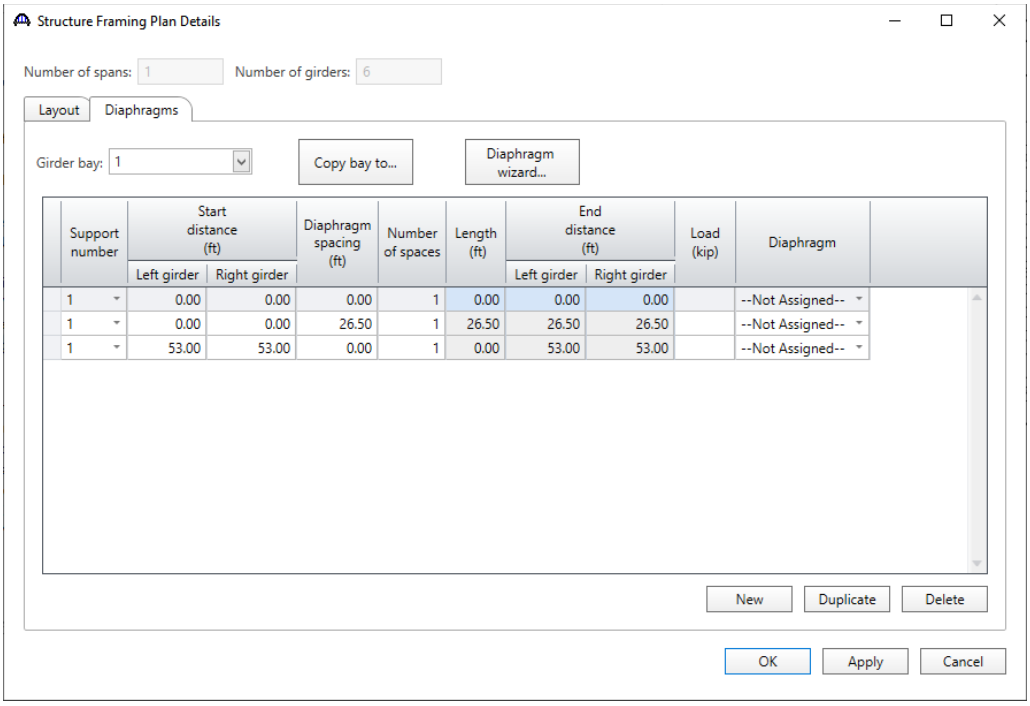
Select the desired framing plan system and click the **Next** button. Enter the following data on the window shown below.





Click the **Finish** button to add the diaphragms. The **Diaphragm Wizard** will create diaphragms for all the girder bays in the structure.

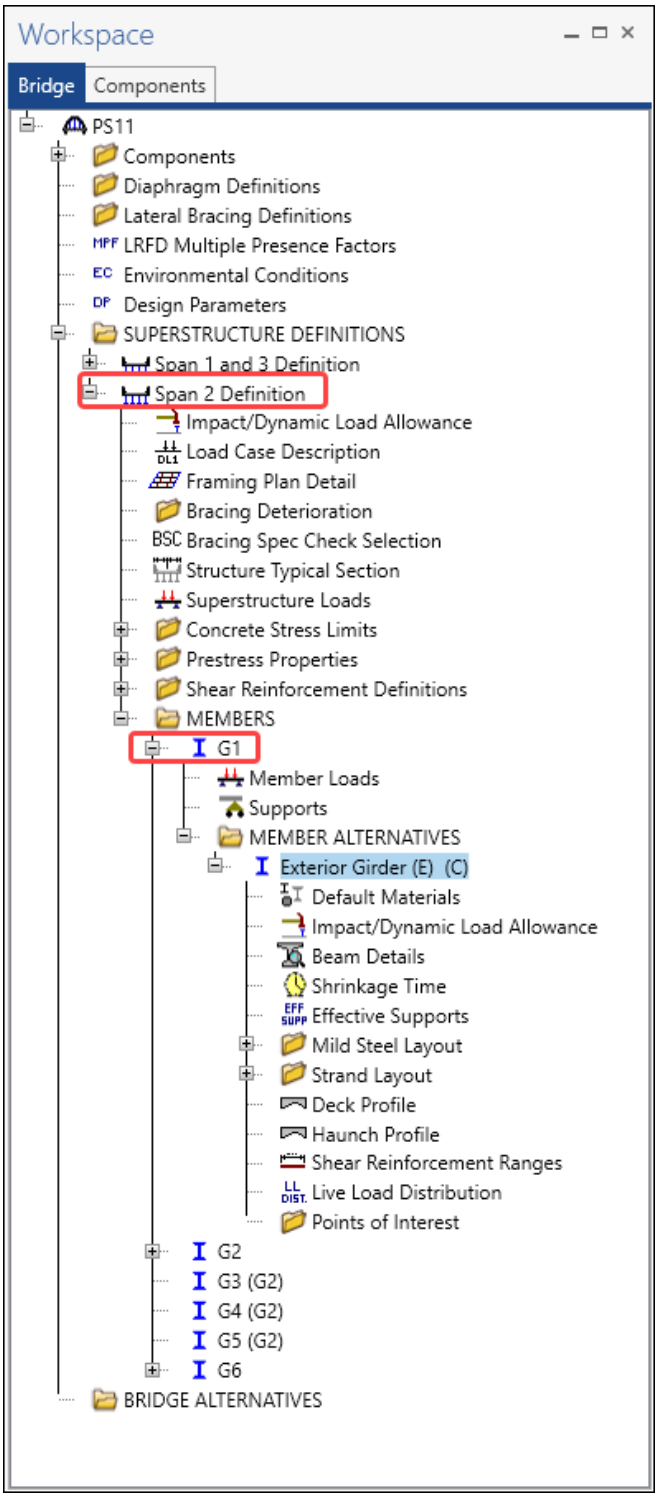
The diaphragms created for **Girder bay 1** are shown below.



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

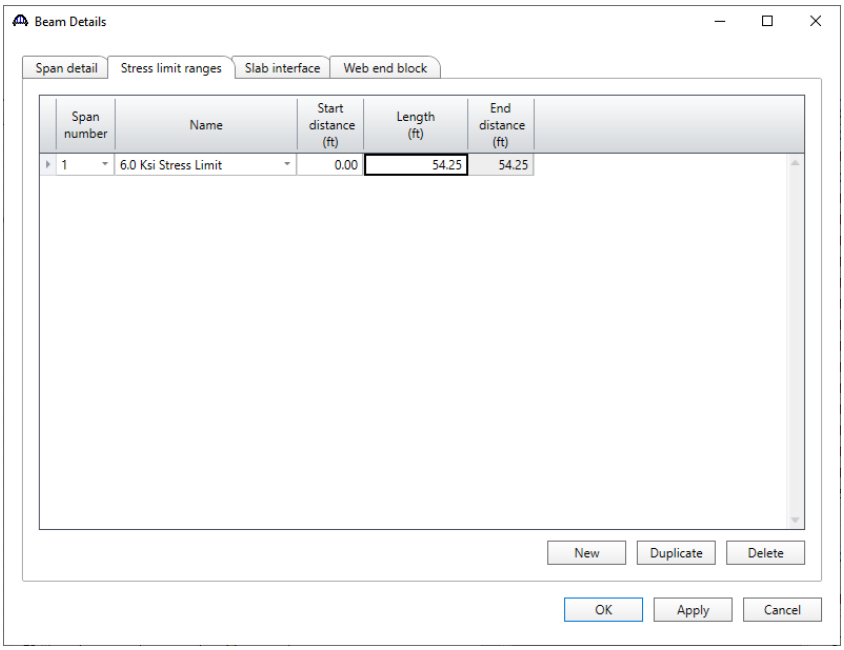
Modify the length of the range in Beam Details, Deck Profile and Haunch Profile.

Expand **MEMBERS**, **G1**, **Exterior Girder (E)(C)** nodes in the **Bridge Workspace** tree to modify data of the exterior girder of the **Span 2 Definition** superstructure as shown below.



Beam Details

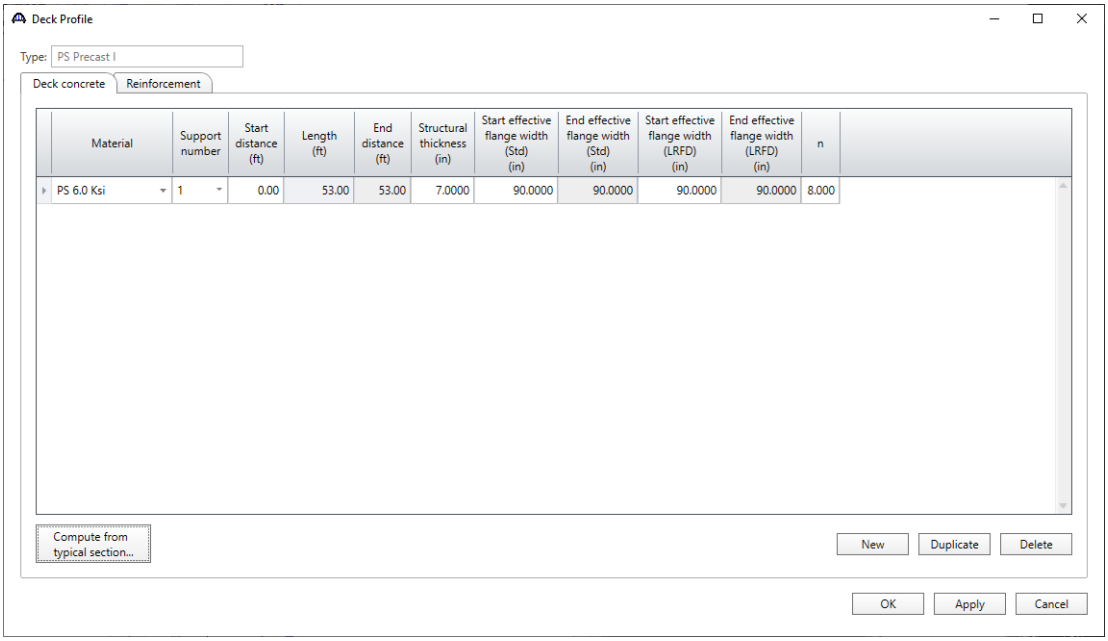
Double click on the **Beam Details** node in the **Bridge Workspace** tree to open the **Beam Details** window. Navigate to the **Stress limit ranges** tab and modify the **Length** as shown below.



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

Deck Profile

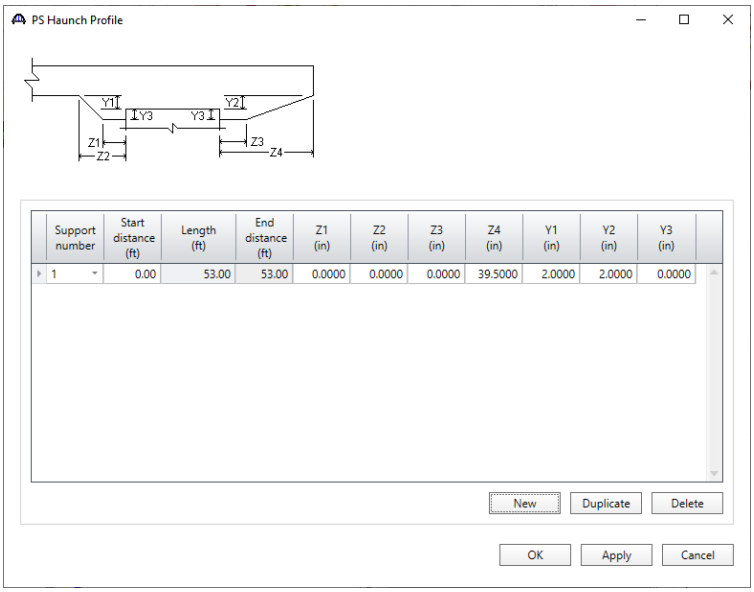
Double click on the **Deck Profile** node in the **Bridge Workspace** tree to open the **Deck Profile** window. Modify the **Length** as shown below.



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

Haunch Profile

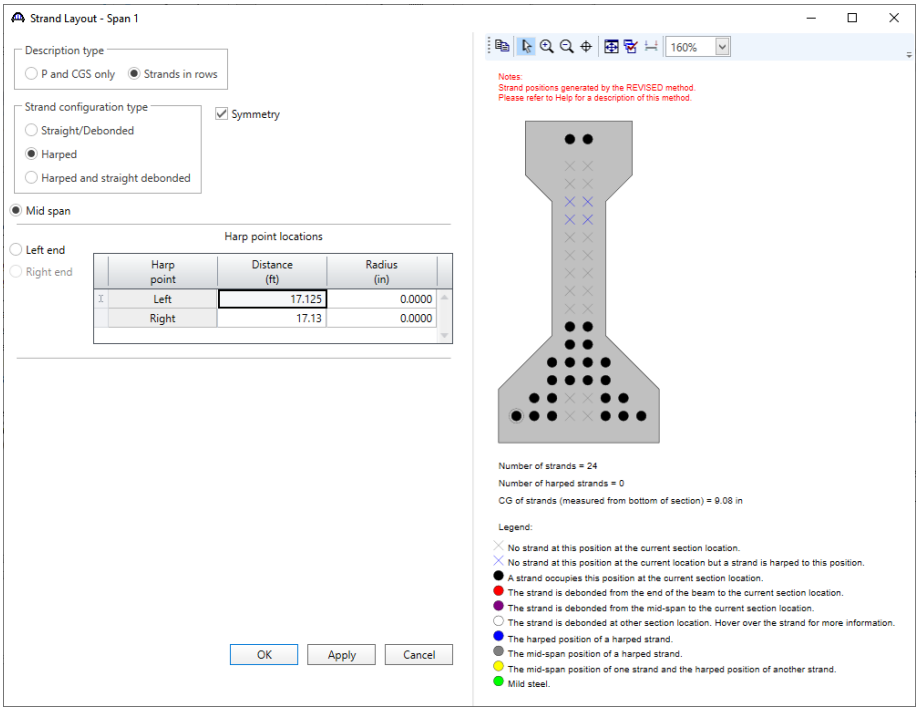
Double click on the **Haunch Profile** node in the **Bridge Workspace** tree to open the **PS Haunch Profile** window. Modify the **Length** as shown below.



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

Modify the harp point distance in Strand Layout

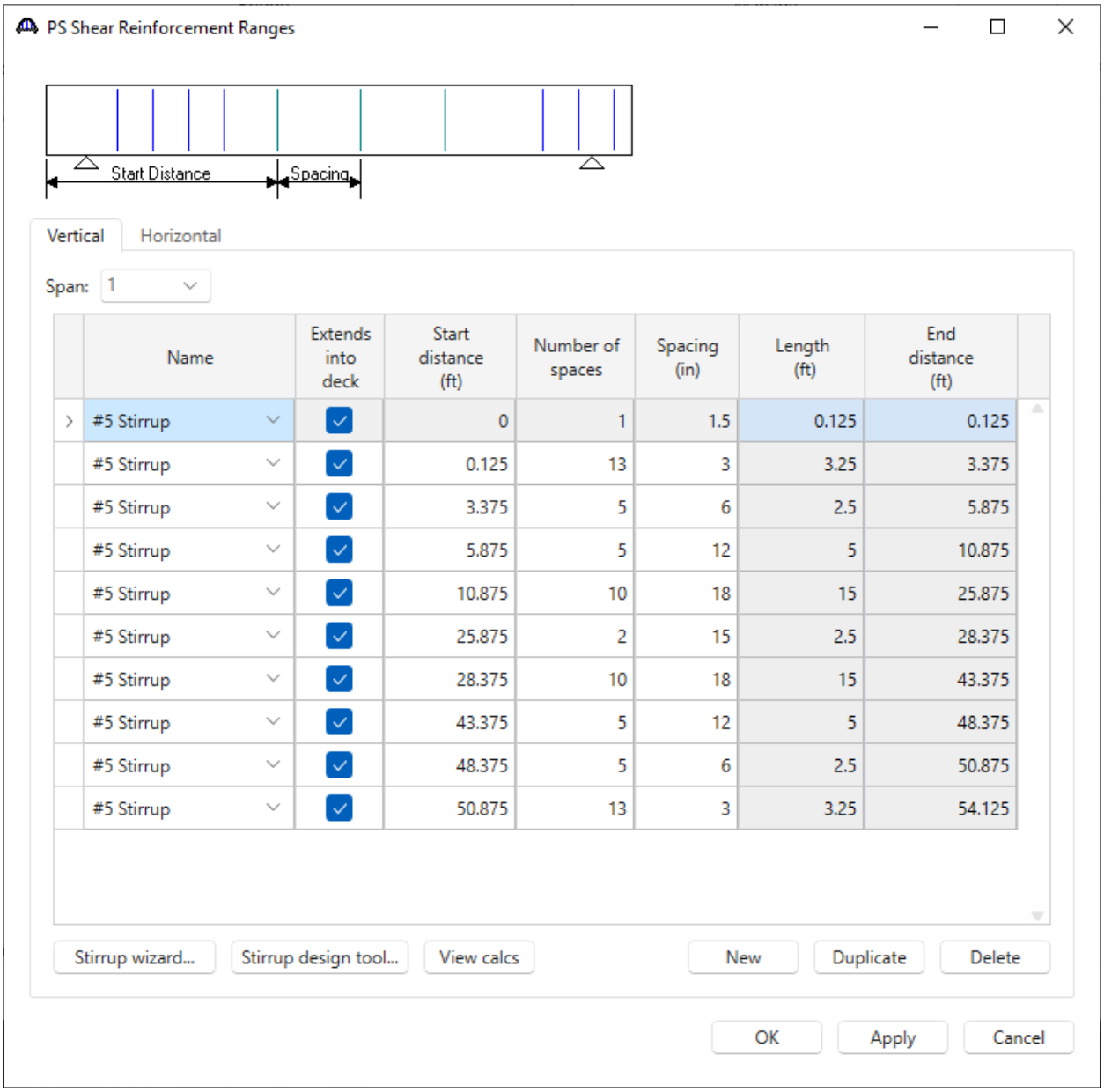
Expand the **Strand Layout** node in the **Bridge Workspace** tree and double click on **Span 1** to open the **Strand Layout – Span 1** window. Modify the **Harp point locations** as shown below.



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

Re-enter the Shear Reinforcement Ranges

Double click on the **Shear Reinforcement Ranges** window in the **Bridge Workspace** tree to open the **PS Shear Reinforcement Ranges** window. Re-enter the shear reinforcement ranges as shown below.



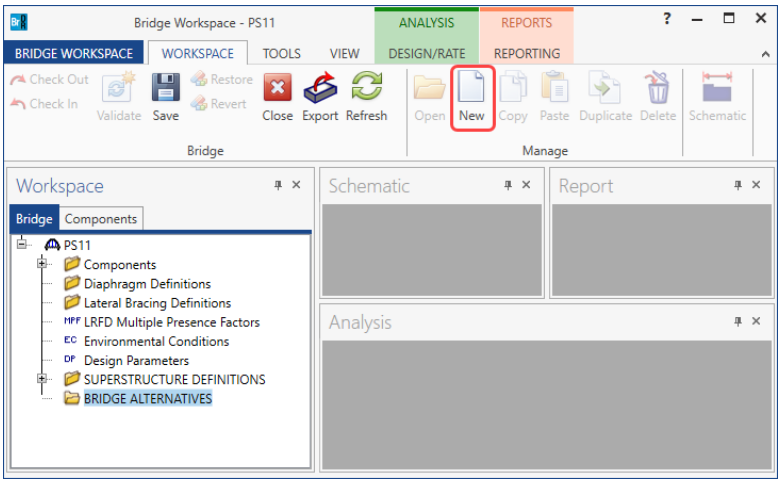
Click **OK** to apply the data and close the window.

Make sure to modify these for the interior girder (**G2**) of the **Span 2 Definition** superstructure.

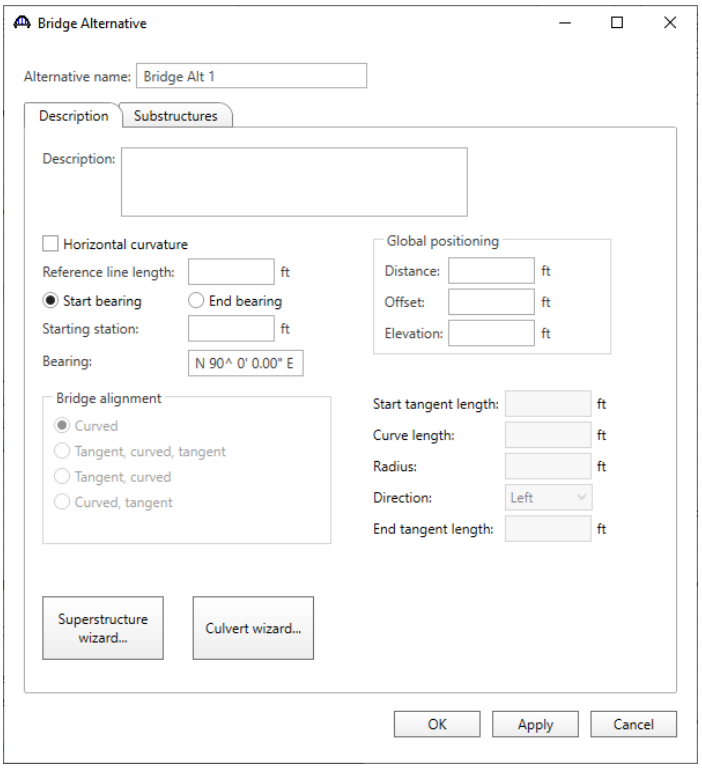
Create one Bridge Alternative and three superstructures.

The first superstructure is for Span No. 1, the second superstructure is for Span No. 2 and the third superstructure is for Span No. 3

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).

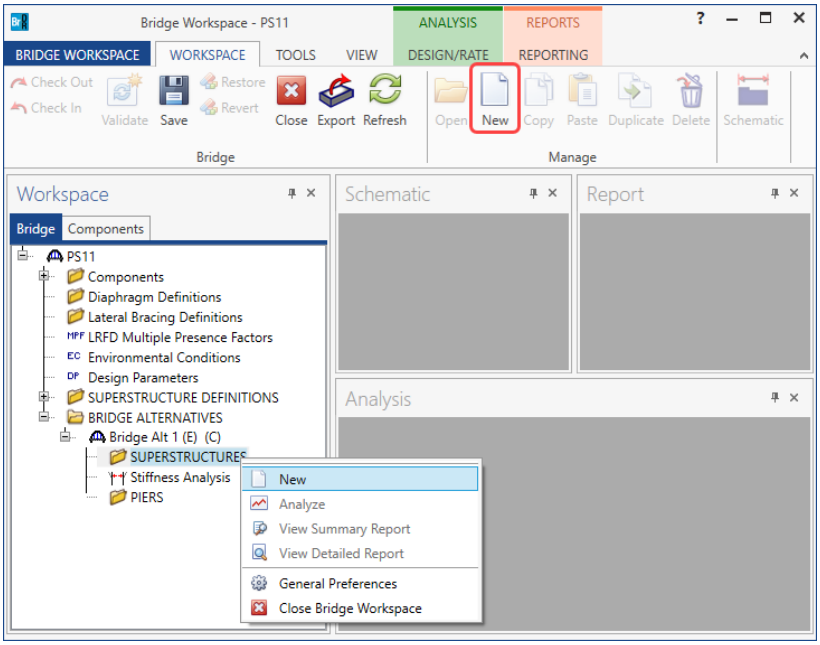


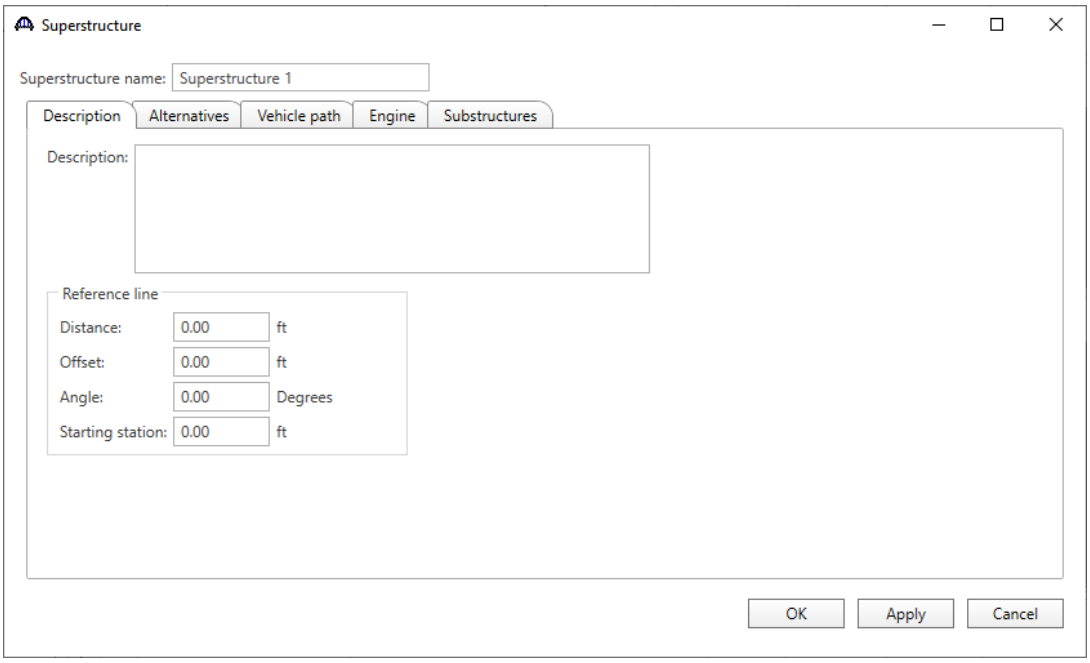
Enter the following data.



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

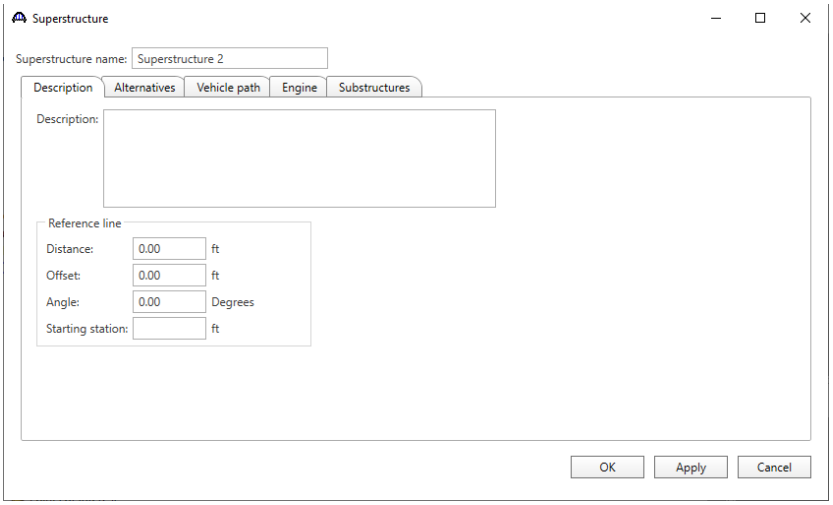
Expand the **Bridge Alt 1** node in the **Bridge Workspace** tree by clicking the ⊞ button. Double-click on the **SUPERSTRUCTURES** node (or select **SUPERSTRUCTURES** and click **New** from the **Manage** group of the **WORKSPACE** ribbon) and enter the following new superstructure.

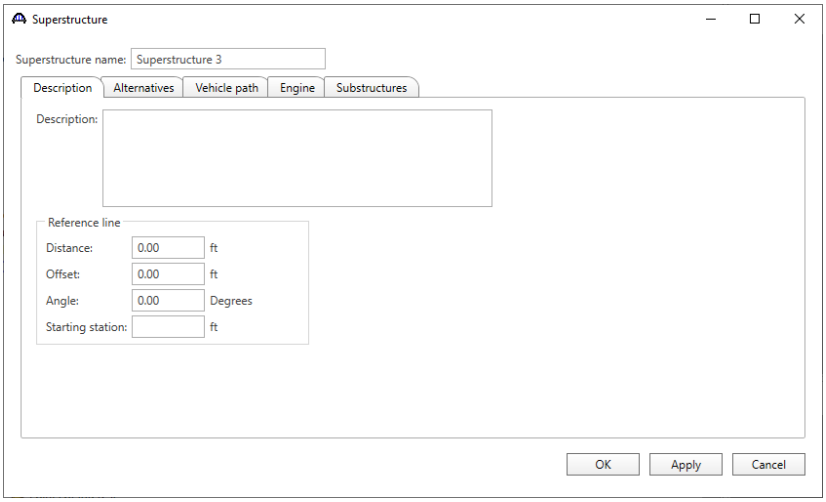




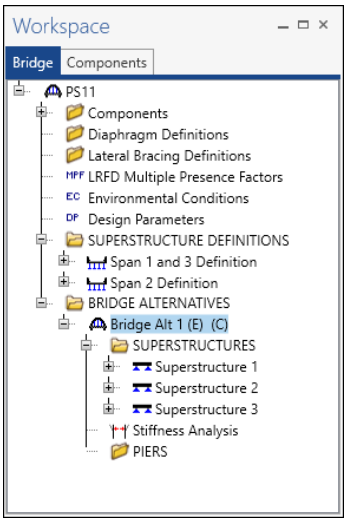
Click **OK** to apply the data and close the window.

Similarly create two other superstructures for Span No. 2 and Span No. 3 as shown below.



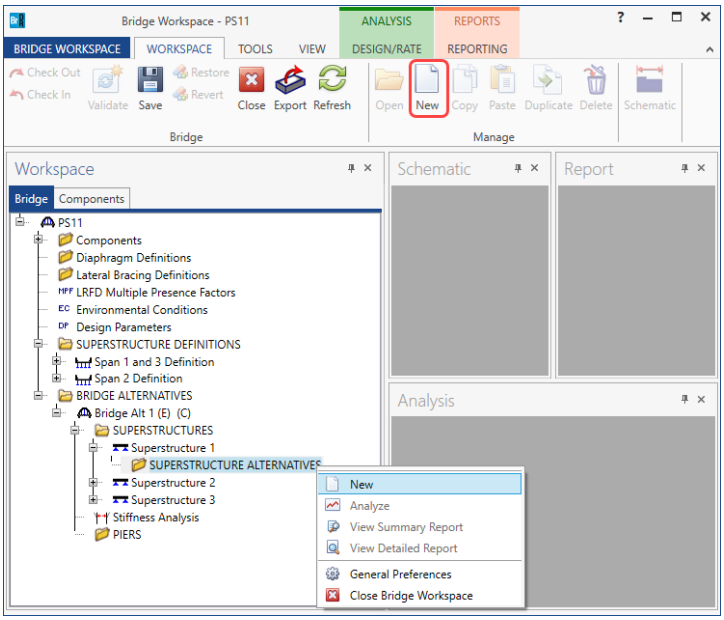


The partially expanded Bridge Workspace tree is shown below.

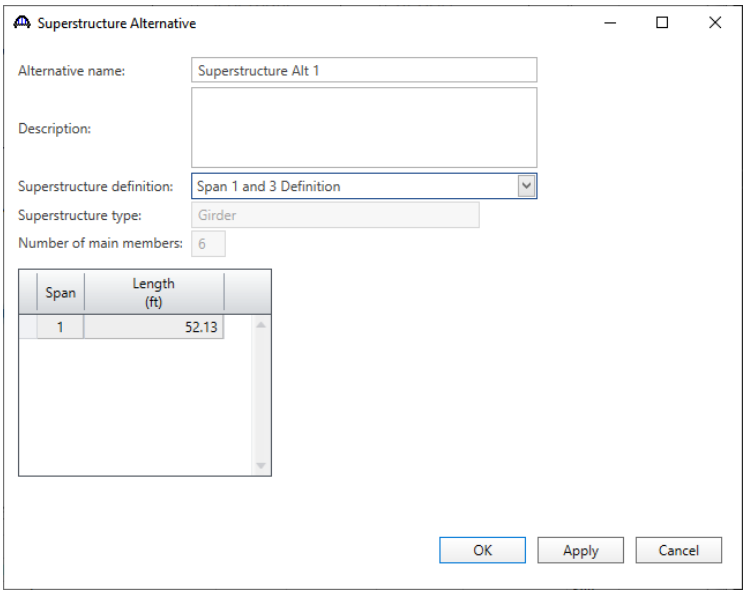


Assign Span 1 and 3 Definition to the first and third Superstructures and assign Span 2 Definition to the second superstructure

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

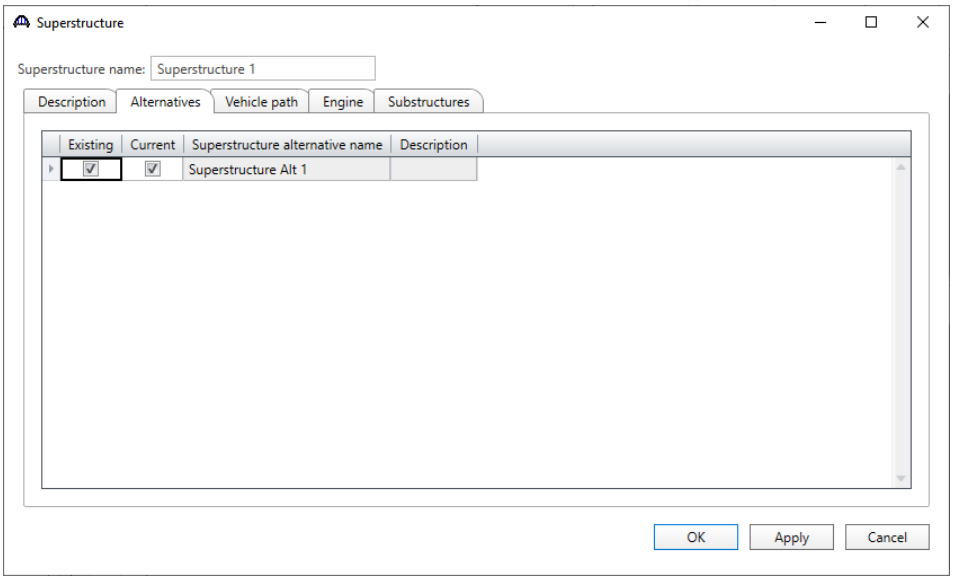


Select the **Superstructure definition Span 1 and 3 Definition** as the current superstructure definition for this Superstructure Alternative.



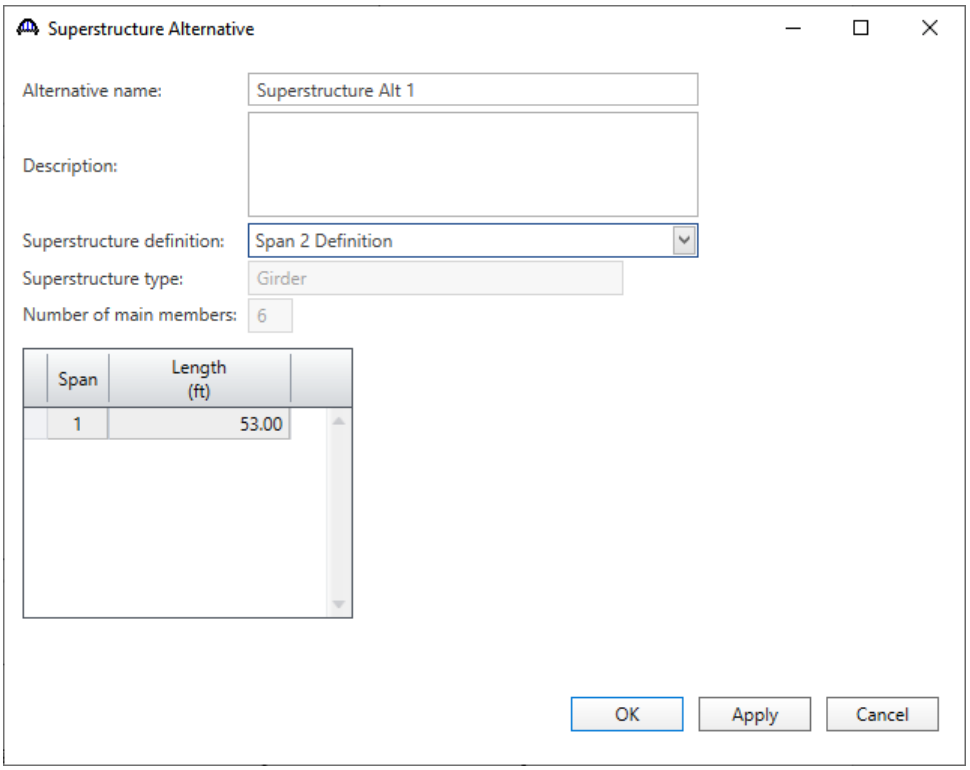
Click **OK** to apply the data and close the window.

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

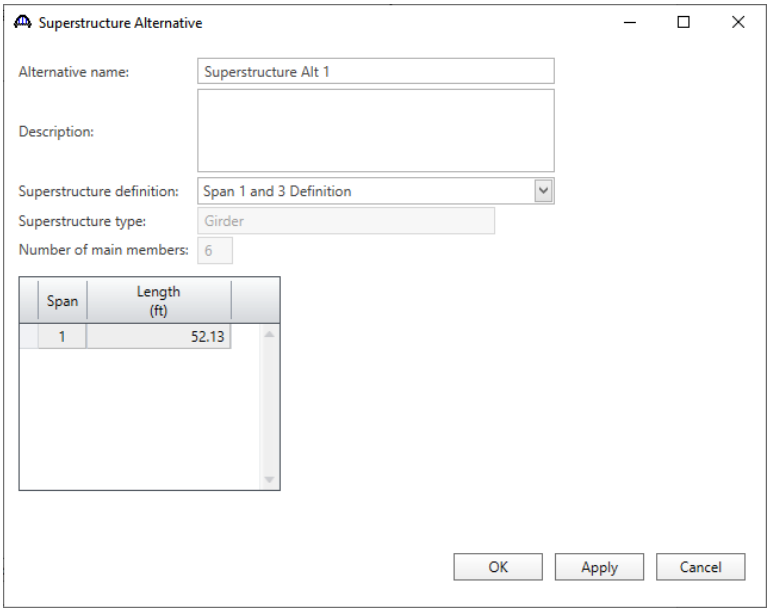


Similarly add two other **SUPERSTRUCTURES** and assign **Span 2 Definition** to **Superstructure 2** and **Span 1 and 3 Definition** to **Superstructure 3** as shown below.

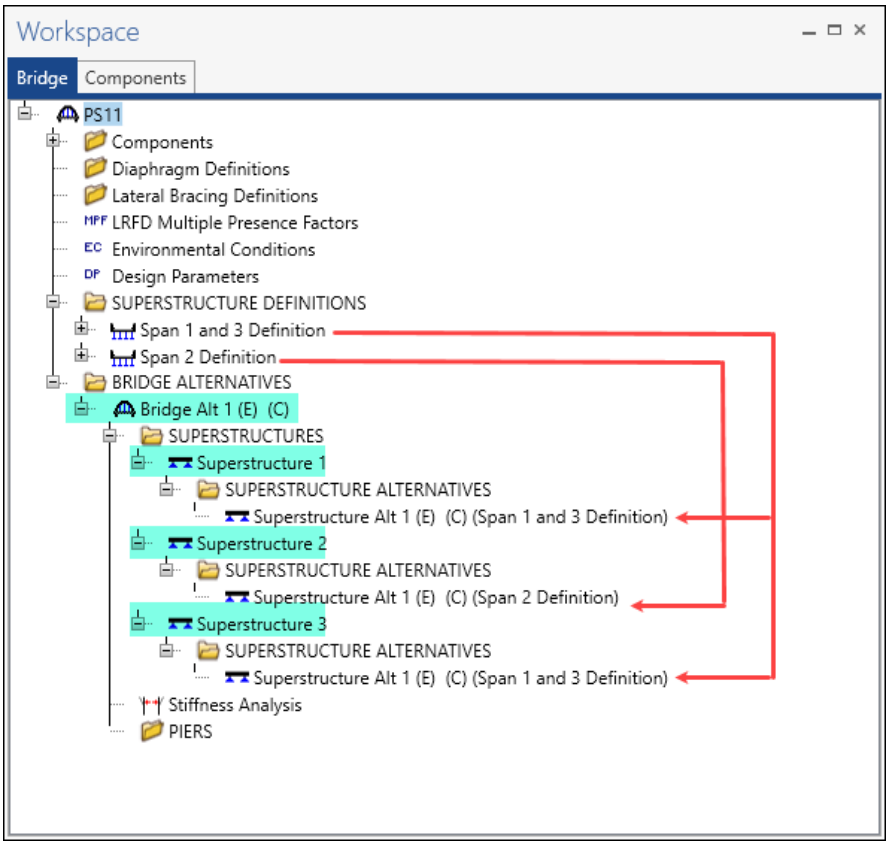
Superstructure 2



Superstructure 3

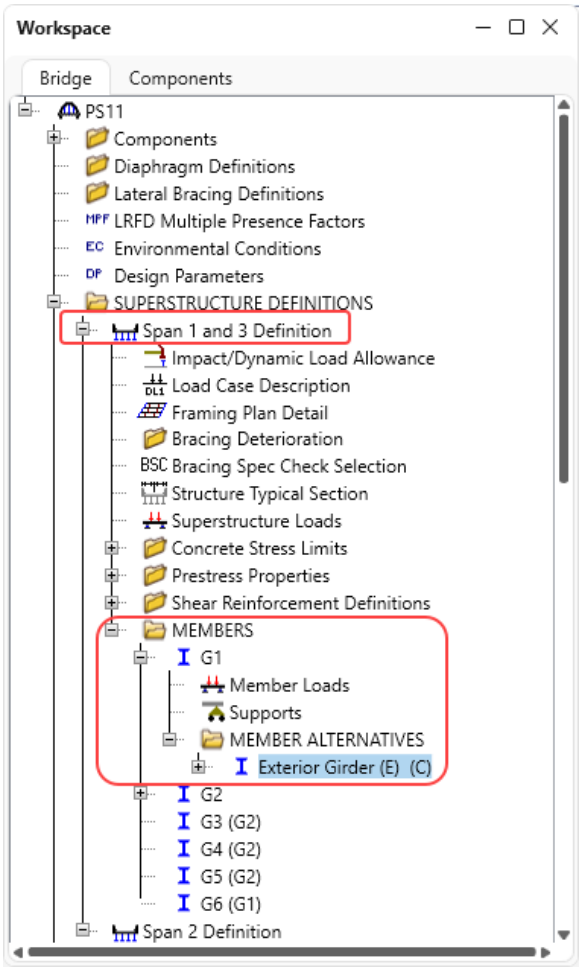


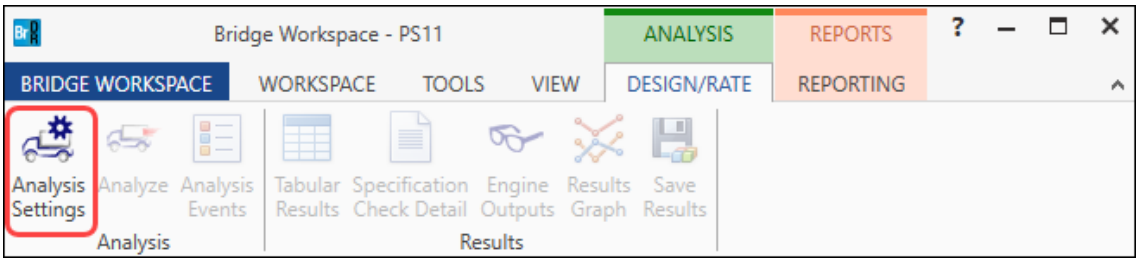
The partially expanded **Bridge Workspace** tree is shown below.



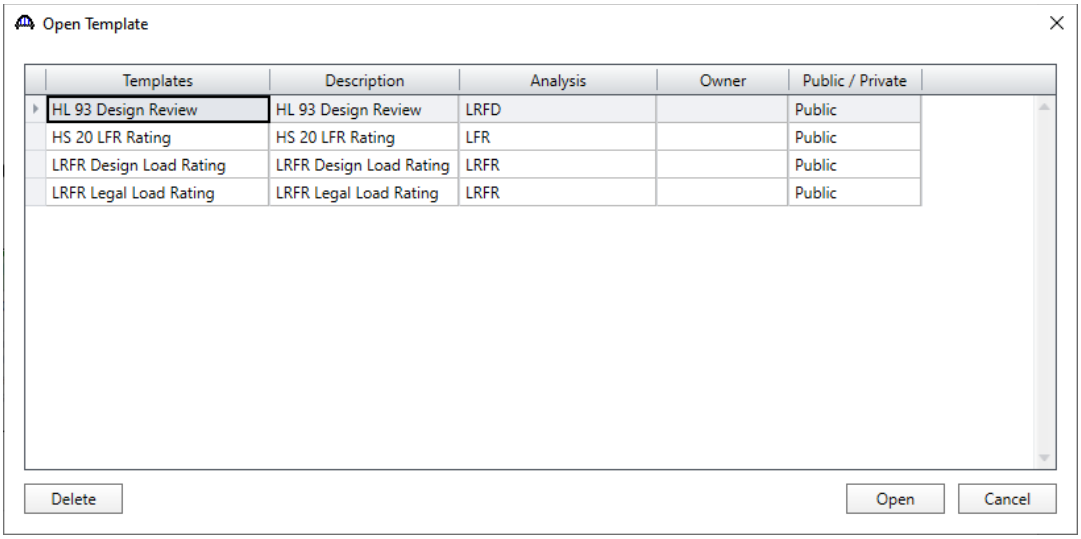
LRFD Design Review

To perform an LRFD design review of this exterior girder, select **Exterior Girder** under member **G1** of the **Span 1 and 3 Definition** superstructure in the **Bridge Workspace tree** and select the **Analysis Settings** button on the **Analysis** group of the **DESIGN/RATE** ribbon. The window shown below opens.

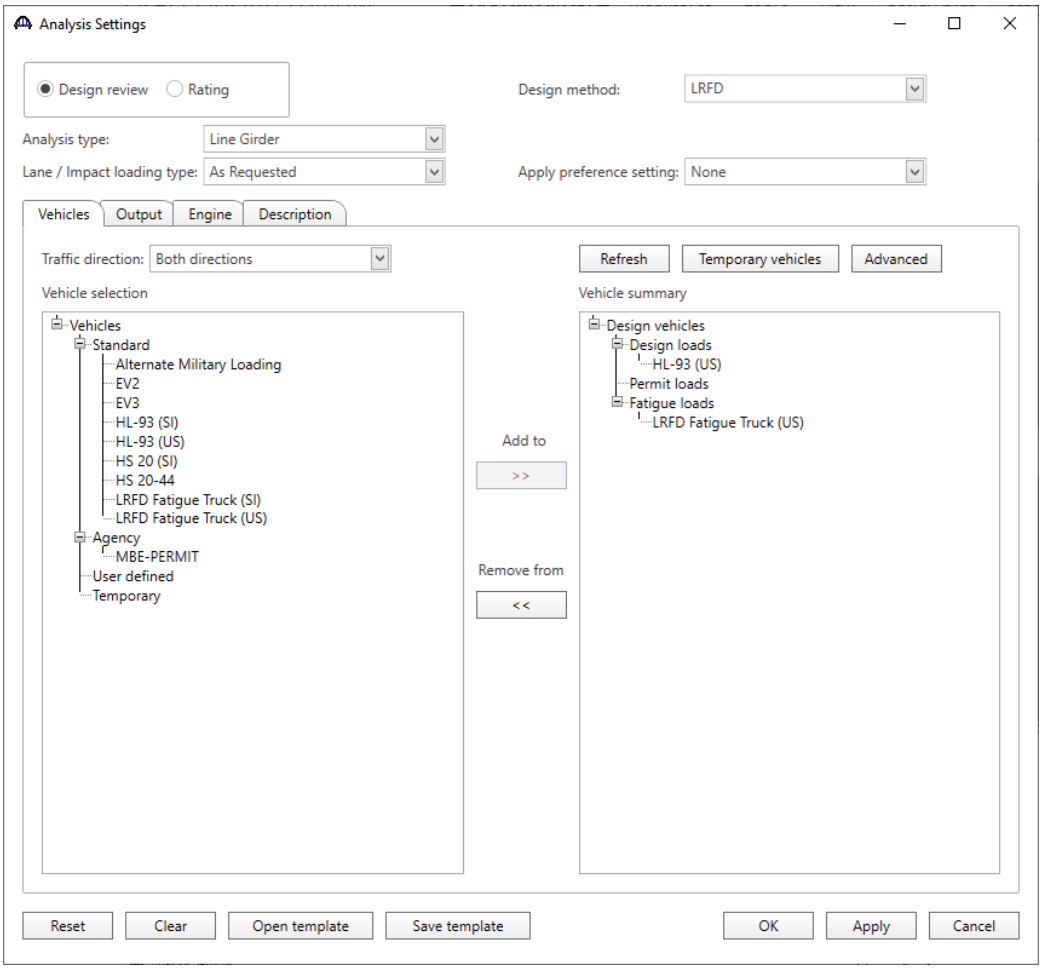




Click the **Open Template** button and select the **HL 93 Design Review** to be used in the rating and click **OK**.



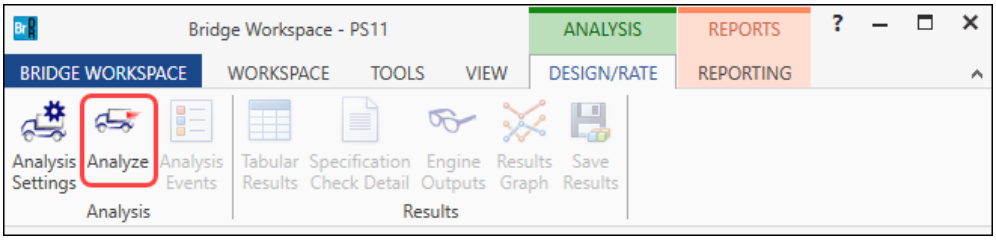
The **Analysis Settings** window will be updated as shown below.



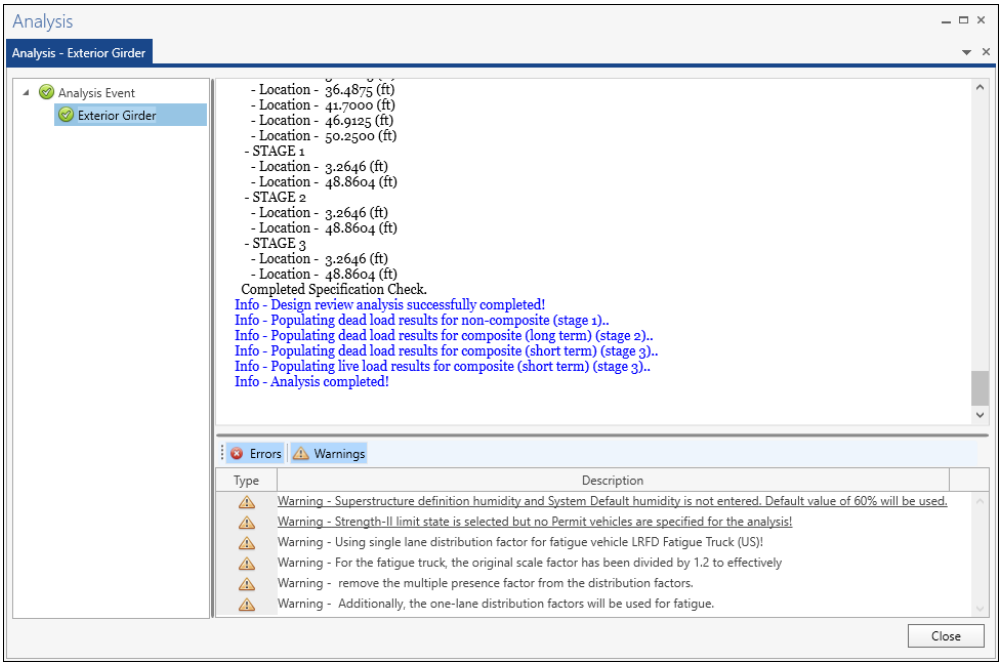
Click **OK** to apply the data and close the window.

Specification Checks

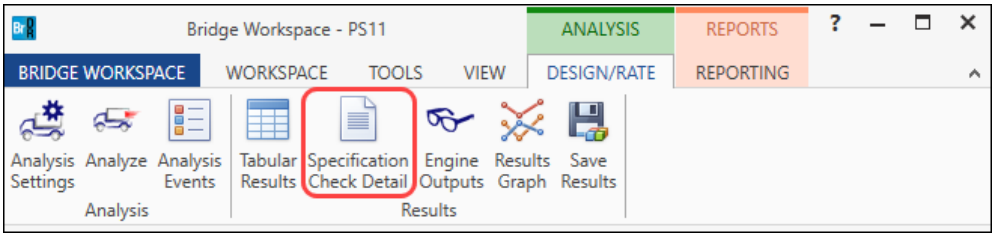
Next click the **Analyze** button on the **Analysis** group of the **DESIGN/RATE** ribbon to perform the design review.



After the analysis is complete, review the information and the warning messages on the **Analysis** window.



Click on the **Specification Check Detail** button from the **Results** group of the **DESIGN/RATE** ribbon to open the **Specification Checks** window.



The details for one of the specification checks is shown below.