

AASHTOWare BrDR 7.5.0

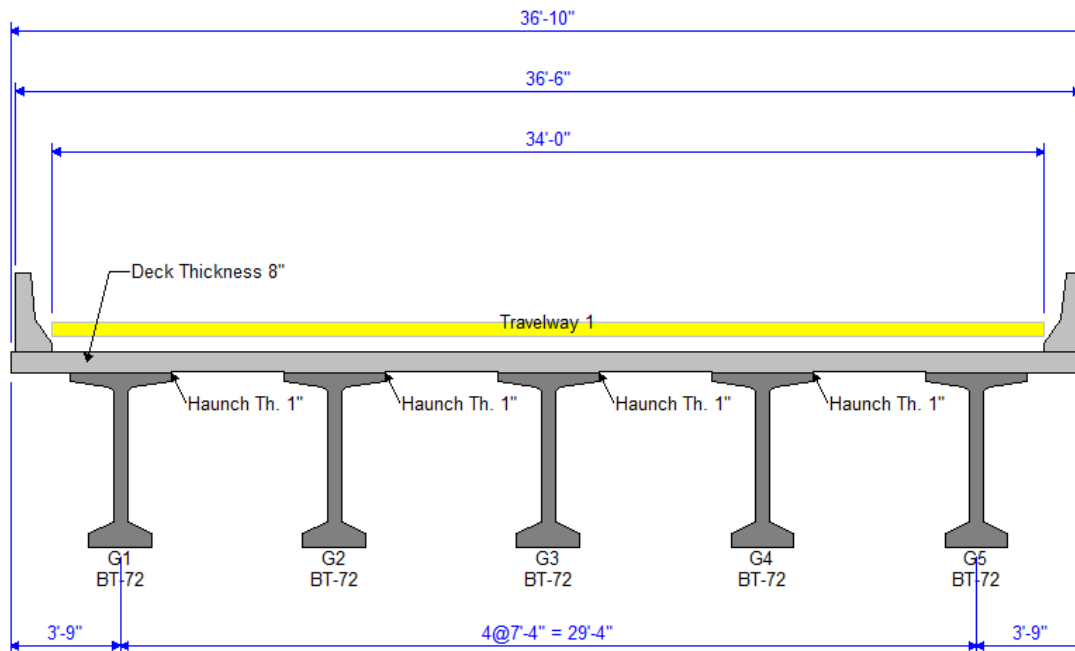
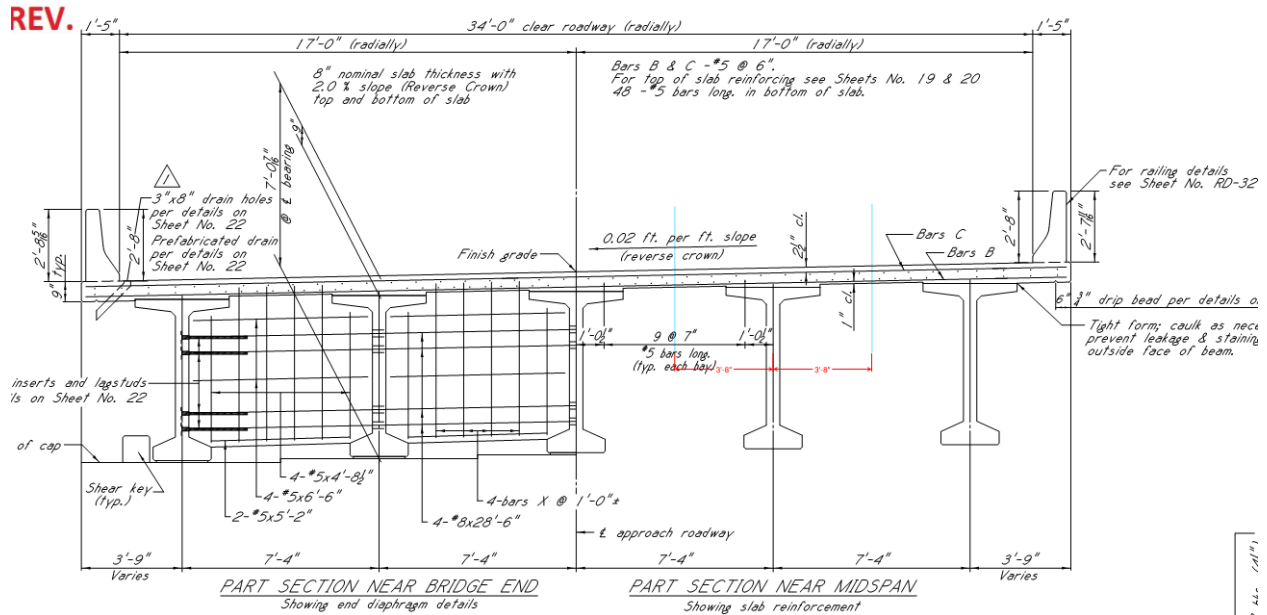
Prestress Tutorial 14

PS14 – Prestressed Concrete I Beam Example

PS14 – Prestressed Concrete I Beam Example

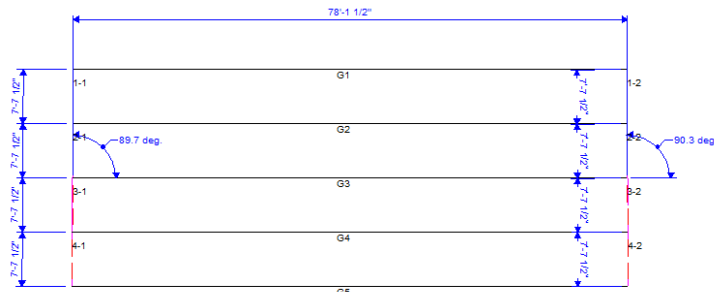
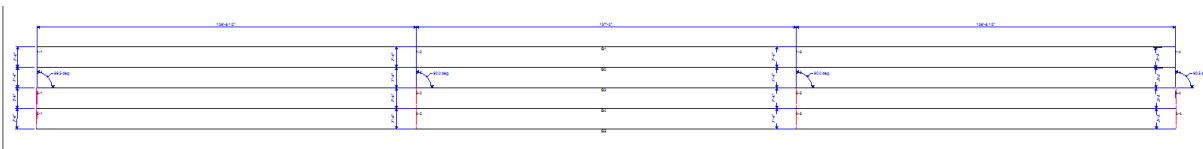
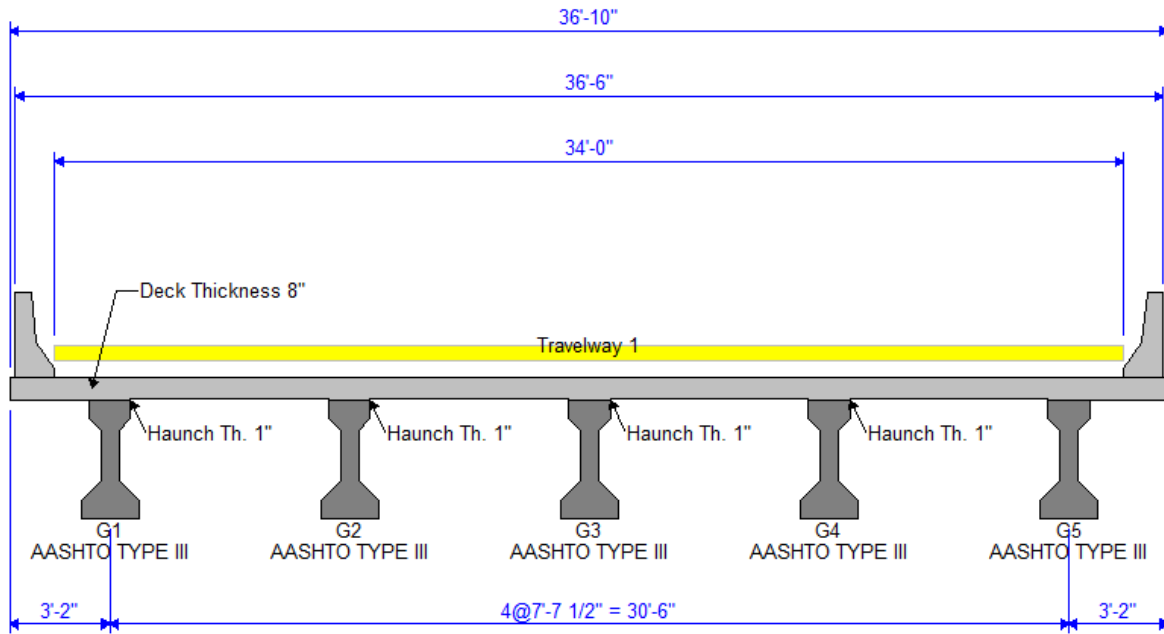
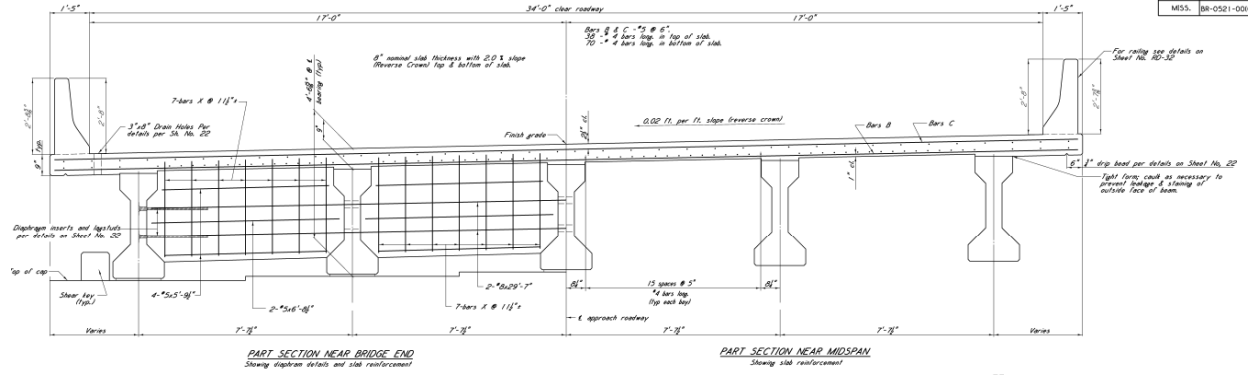
PS14 – Prestressed Concrete I Beam Example

This example details the data input of a prestressed concrete I beam bridge and performing an analysis. This is a bridge from the Mississippi DOT inventory which includes two units of SR 429, a three-span (138 ft each) continuous unit and a single 80 ft span unit.



PS14 – Prestressed Concrete I Beam Example

STATE PROJECT NO.
MSS. BR-0521-00004



PS14 – Prestressed Concrete I Beam Example

Topics Covered

- Comments and Assumptions
- Data Entry of Prestressed concrete I beam with draped strands input as girder system.
- Prestressed multi-span modeling options.
 - Multi-span continuous
 - Multi-span continuous and simple span
- Export of prestressed concrete beams to the BrDR LRFD analysis engine
- Analysis and Results

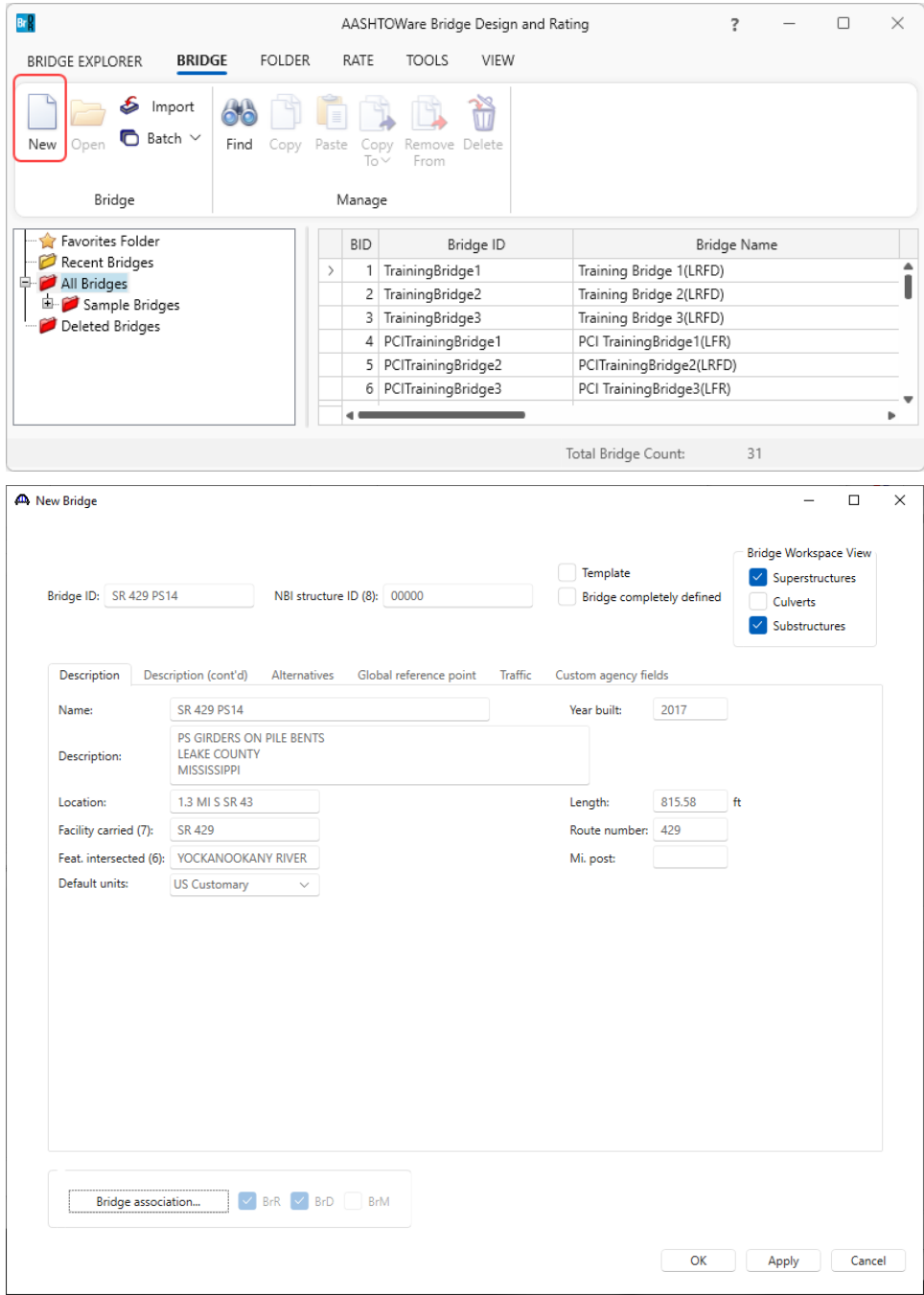
Comments and Assumptions

- Assume 5000 psi for the 28-day compressive concrete strength of the Type III PS Beam for the 80-foot span.
- Due to rounding on the design plans, the BrDR span lengths are slightly off from the design drawings. Lengths are within 1/16”.
- The plans show a discrepancy for strand type for the 138 ft beam details. The notes indicate ½” diameter 270 K-LR strands where the table and section show 0.6” diameter 270 K-LR strands so 0.6” diameter 270 K-LR strands will be used in the model.
- With larger radius, assume the overhangs as equal.
- Due to the limitations in BrDR, the skew angle at Support 2 & 3 of the three-span continuous unit will be 90 degrees.
- Traffic data and design speed for LRFR analysis
 - a. Assumed ADTT = 41 per NBI
- ¼” Integral Wearing Surface
- HL93 will be the vehicle used for ratings.
- District, County and Owner information is not populated.
- For the exterior beams, an LRFD effective width = Overhang + S/2 is used, even though the overhang is greater than S/2 (C4.6.2.6.1).

PS14 – Prestressed Concrete I Beam Example

Data Entry of Prestressed concrete I beam with draped strands input as girder system.


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

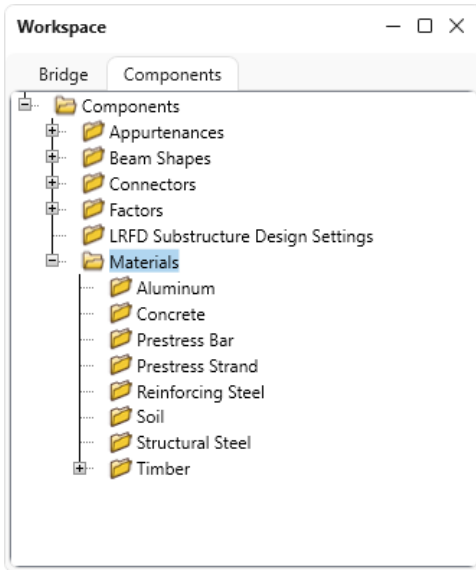


Click **OK** to apply the data and close the window.

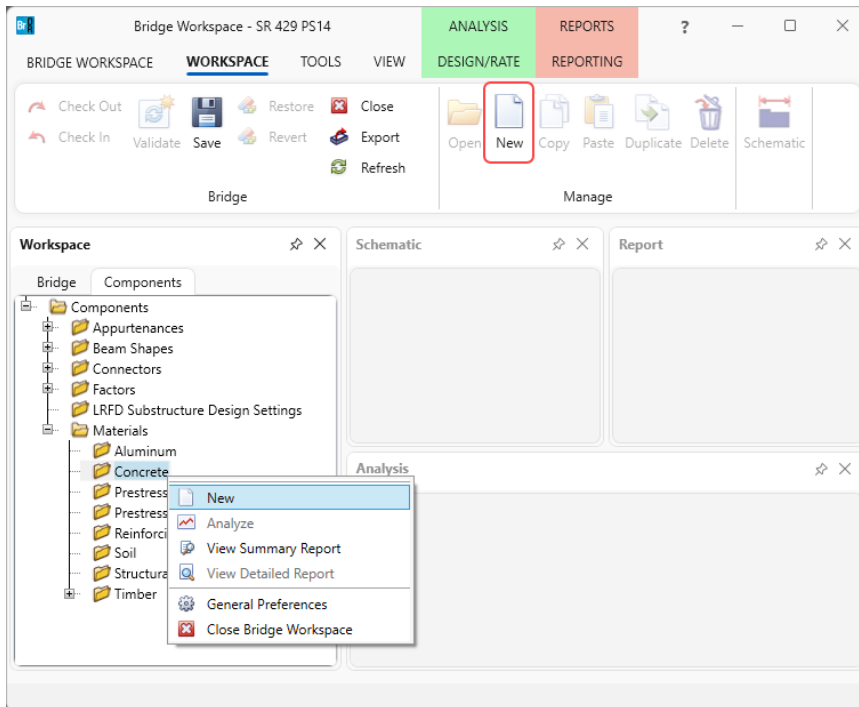
PS14 – Prestressed Concrete I Beam Example

Bridge Materials

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**).



PS14 – Prestressed Concrete I Beam Example

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

The screenshot shows a dialog box titled "Bridge Materials - Concrete". The "Name" field is "Class FX Beam Concrete 138 FT" and the "Description" is "Class FX cement concrete". The input fields for material properties are as follows:

Property	Value	Unit
Compressive strength at 28 days (f'c)	7.5	ksi
Initial compressive strength (f'ci)	6	ksi
Composition of concrete	Normal	
Density (for dead loads)	0.15	kcf
Density (for modulus of elasticity)	0.145	kcf
Poisson's ratio	0.2	
Coefficient of thermal expansion (α)	0.000006	1/F
Splitting tensile strength (fct)		ksi
LRFD Maximum aggregate size		in

The "Compute" button is highlighted. Below it, the calculated values are displayed:

Property	Value	Unit
Std modulus of elasticity (Ec)	4989.954377	ksi
LRFD modulus of elasticity (Ec)	4905.547298	ksi
Std initial modulus of elasticity	4463.150877	ksi
LRFD initial modulus of elasticity	4557.295222	ksi
Std modulus of rupture	0.649519	ksi
LRFD modulus of rupture	0.657267	ksi
Shear factor	1	

Buttons at the bottom include "Copy to library...", "Copy from library...", "OK", "Apply", and "Cancel".

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

Add another concrete material in a similar manner. See image below.

The screenshot shows a dialog box titled "Bridge Materials - Concrete". The "Name" field is "Class FX Beam Concrete 80 FT" and the "Description" is "Class FX cement concrete". The input fields for material properties are as follows:

Property	Value	Unit
Compressive strength at 28 days (f'c)	5	ksi
Initial compressive strength (f'ci)	4.2	ksi
Composition of concrete	Normal	
Density (for dead loads)	0.15	kcf
Density (for modulus of elasticity)	0.145	kcf
Poisson's ratio	0.2	
Coefficient of thermal expansion (α)	0.000006	1/F
Splitting tensile strength (fct)		ksi
LRFD Maximum aggregate size		in

The "Compute" button is highlighted. Below it, the calculated values are displayed:

Property	Value	Unit
Std modulus of elasticity (Ec)	4074.280688	ksi
LRFD modulus of elasticity (Ec)	4291.186125	ksi
Std initial modulus of elasticity	3734.139931	ksi
LRFD initial modulus of elasticity	4051.254406	ksi
Std modulus of rupture	0.53033	ksi
LRFD modulus of rupture	0.536656	ksi
Shear factor	1	

Buttons at the bottom include "Copy to library...", "Copy from library...", "OK", "Apply", and "Cancel".

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

PS14 – Prestressed Concrete I Beam Example

Add concrete material for the deck from the library. Click the **Copy from library...** button and use the **Class A (US)** material. Once the material is copied, change the **Name** to **Class AA** and click on the **Compute** button as shown below.

Library Data: Materials - Concrete

Name	Description	Library	Units	Fc	Fci	alpha	DL density	Modulus density	Std modulus of elasticity	LRFD modulus of elasticity	Poisson's ratio	Std Modulus of rupture	LRFD Modulus of rupture
Class A	Class A cement concrete	Standard	SI / Metric	28	0.0000...	0.15	2400	2320	25426.0823	27730.359798	0.2		3.333
> Class A (US)	Class A cement concrete	Standard	US Customary	4.0000006	0.0000...	0.15	0.145	0.145	3644.149254	3986.548657	0.2		0.479857
Class B	Class B cement concrete	Standard	SI / Metric	17	0.0000...	0.15	2400	2320	19811.8437	23520.226422	0.2		2.5976
Class B (US)	Class B cement concrete	Standard	US Customary	2.4000003	0.0000...	0.15	0.145	0.145	2822.746208	3368.115517	0.2		0.371688
Class C	Class C cement concrete	Standard	SI / Metric	28	0.0000...	0.15	2400	2320	25426.0823	27730.359798	0.2		3.333
Class C (US)	Class C cement concrete	Standard	US Customary	4.0000006	0.0000...	0.15	0.145	0.145	3644.149254	3986.548657	0.2		0.479857

OK Apply Cancel

Bridge Materials - Concrete

Name:

Description:

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

Initial compressive strength (f'ci):

Composition of concrete: ▼

Density (for dead loads): kcf

Density (for modulus of elasticity): kcf

Poisson's ratio:

Coefficient of thermal expansion (α): 1/F

Splitting tensile strength (f'ct):

LRFD Maximum aggregate size: in

Std modulus of elasticity (Ec): ksi

LRFD modulus of elasticity (Ec): ksi

Std initial modulus of elasticity:

LRFD initial modulus of elasticity:

Std modulus of rupture: ksi

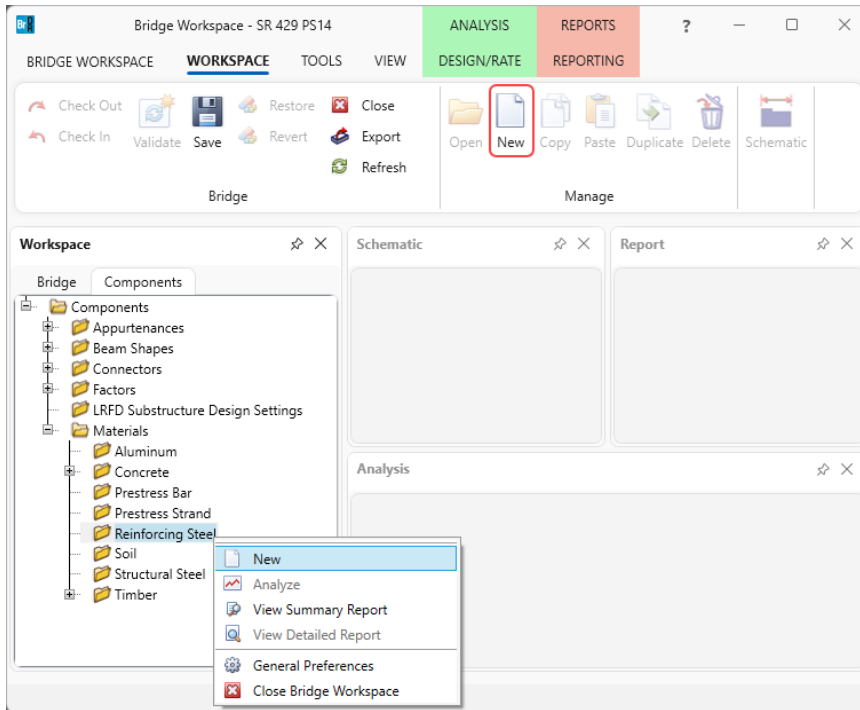
LRFD modulus of rupture: ksi

Shear factor:

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

PS14 – Prestressed Concrete I Beam Example

To add a reinforcement material, select **Reinforcing Steel** in the **Components** tree and select **New** from the **Manage** group of the **WORKSPACE** ribbon (or right mouse click on **Reinforcing Steel** and select **New**)



Click on the **Copy from library...** button in this window and select **Grade 60** from the library and click **OK**.

Library Data: Materials - Reinforcing Steel

Name	Description	Library	Units	Fy	Fu	Es
Grade 300	300 MPa reinforcing steel	Standard	SI / Metric	300	500	199948
Grade 350	350 MPa reinforcing steel (rail-steel)	Standard	SI / Metric	350	550	199948
Grade 40	40 ksi reinforcing steel	Standard	US Customary	40.0000058	70.0000102	29000.004206
Grade 400	400 MPa reinforcing steel	Standard	SI / Metric	400	600	199948
Grade 50	50 ksi reinforcing steel (rail-steel)	Standard	US Customary	50.0000073	80.0000116	29000.004206
Grade 500	500 MPa reinforcing steel	Standard	SI / Metric	500	700	199948
> Grade 60	60 ksi reinforcing steel	Standard	US Customary	60.0000087	90.0000131	29000.004206
Grade 75	75 ksi reinforcing steel	Standard	US Customary	75.0000109	100.0000145	29000.004206
Structural or unknown grade prior 1954	Structural or unknown grade prior to 1954	Standard	US Customary	33.0000048	60.0000087	29000.004206

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

The selected material properties are copied to the **Bridge Materials – Reinforcing Steel** window as shown below.

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

Add the following prestress strands using the same **Copy from Library** technique. The window will be updated as shown below.

LR indicates low-relaxation strands

PRESTRESS REQUIREMENTS

For deflection diagram, see Misc. Span Details per Sheet No. 22

Strand type	Minimum breaking strength lbs/strand	Initial tension lbs/strand	Required number and location of strands				Centroid for total number of strands (in.)		Distance from E span for half-down point	Camber limits	Deflection diagram			Minimum concrete strength at time of release (psi)	
			Total number strands	Straight strands		Draped strands		At E span			At beam end	A	B		C
				Number strands	Centroid (in.)	Number strands	Centroid (in.)								
0.6" #270 K-LR	45,000	11,43,940	36	26	4.19	10	6.50	65.00	4.83	21.08	14'-0"	0 to 5"	54" 18" 21"	6000	

Name	Description	Library	Units	Fy	Fu	Modulus of elasticity	Load per unit length	Diameter	Area	Transfer length (Std)	Transfer length (LRFD)	Strand type	Epoxy coated
0.6" (7W-250) LR	Low relaxation 0.600"/Seven Wire/fpu = 250	Standard	US Customary	225	250	28500	0.737	0.6	0.216	30	36	Low Relaxation	False
0.6" (7W-250) SR	Stress relieved 0.600"/Seven Wire/fpu = 250	Standard	US Customary	212.5	250	28500	0.737	0.6	0.216	30	36	Stress Relieved	False
> 0.6" (7W-270) LR	Low relaxation 0.600"/Seven Wire/fpu = 270	Standard	US Customary	243	270	28500	0.74	0.6	0.217	30	36	Low Relaxation	False
0.6" (7W-270) SR	Stress relieved 0.600"/Seven Wire/fpu = 270	Standard	US Customary	229.5	270	28500	0.74	0.6	0.217	30	36	Stress Relieved	False
1/2" (7W-250) LR	Low relaxation 1/2"/Seven Wire/fpu = 250	Standard	US Customary	225	250	28500	0.49	0.5	0.144	25	30	Low Relaxation	False
1/2" (7W-250) SR	Stress relieved 1/2"/Seven Wire/fpu = 250	Standard	US Customary	212.5	250	28500	0.49	0.5	0.144	25	30	Stress Relieved	False

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

PS14 – Prestressed Concrete I Beam Example

PRESTRESS REQUIREMENTS

LR indicates low-relaxation strands *For deflection diagram, see Misc. Span Details per Sheet No. 22*

Strand type	Minimum breaking strength lbs./strand	Initial tension lbs./strand	Required number and location of strands				Centroid for total number of strands (in.)		Distance from \bar{x} span to hold-down point	Camber limits	Deflection diagram			Minimum concrete strength at time of release (psi)		
			Total number strands	Straight strands		Draped strands		At \bar{x} span			At beam end	A	B		C	
				Number strands	Centroid (in.)	Number strands	Centroid (in.)									
2" ϕ 270 K-LR	41,300	30,980	26	20	4.10	6	4.50	40.00	4.19	12.38	8'-0"	0 to 24"	16"	18"	8"	4200

Library Data: Materials - Prestress Strand

Name	Description	Library	Units	Fy	Fu	Modulus of elasticity	Load per unit length	Diameter	Area	Transfer length (Std)	Transfer length (LRFD)	Strand type	Epoxy coated
1/2" (7W-250) LR	Low relaxation 1/2" Seven Wire/fpu = 250	Standard	US Customary	225	250	28500	0.49	0.5	0.144	25	30	Low Relaxation	False
1/2" (7W-250) SR	Stress relieved 1/2" Seven Wire/fpu = 250	Standard	US Customary	212.5	250	28500	0.49	0.5	0.144	25	30	Stress Relieved	False
> 1/2" (7W-270) LR	Low relaxation 1/2" Seven Wire/fpu = 270	Standard	US Customary	243	270	28500	0.52	0.5	0.153	25	30	Low Relaxation	False
1/2" (7W-270) SR	Stress relieved 1/2" Seven Wire/fpu = 270	Standard	US Customary	229.5	270	28500	0.52	0.5	0.153	25	30	Stress Relieved	False
1/4" (3W-250) LR	Low relaxation 1/4" Three Wire/fpu = 250	Standard	US Customary	225	250	28500	0.13	0.25	0.036	12.5	15	Low Relaxation	False
1/4" (7W-250) LR	Low relaxation 1/4" Seven Wire/fpu = 250	Standard	US Customary	225	250	28500	0.122	0.25	0.036	12.5	15	Low Relaxation	False

OK Apply Cancel

Bridge Materials - PS Strand

Name:

Description:

Strand diameter: in

Strand area: in²

Strand type:

Ultimate tensile strength (Fu): ksi

Yield strength (fy): ksi

Modulus of elasticity (E): ksi

Transfer length (Std): in

Transfer length (LRFD): in

Unit load per length: lb/ft

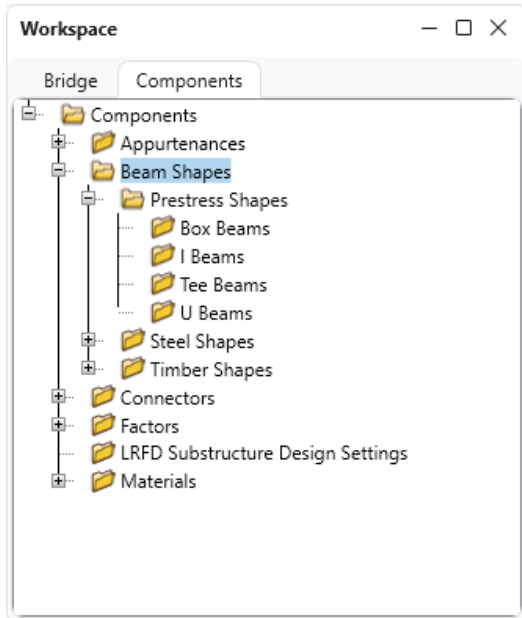
Epoxy coated

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

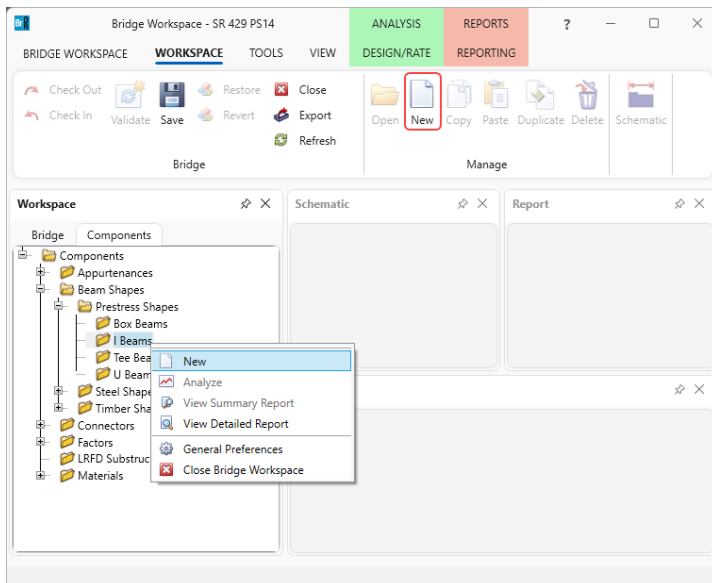
PS14 – Prestressed Concrete I Beam Example

Beam Shapes

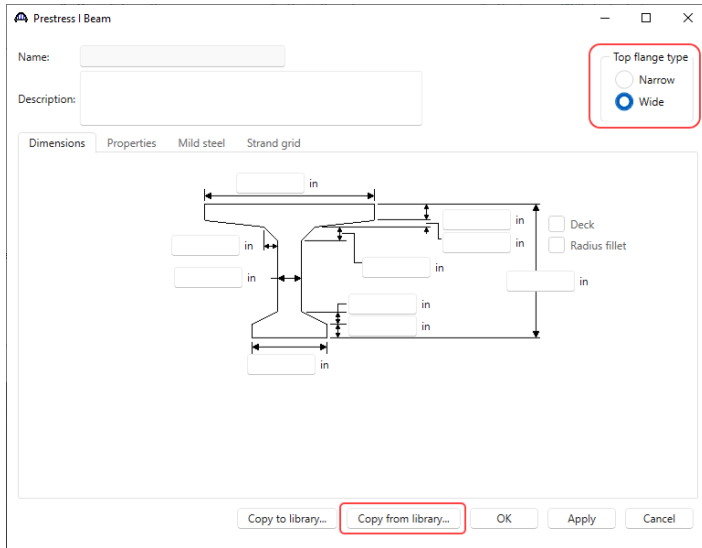
To enter a prestress beam shape to be used in this bridge expand the tree labeled **Beam Shapes** and **Prestress Shapes** as shown below.



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.



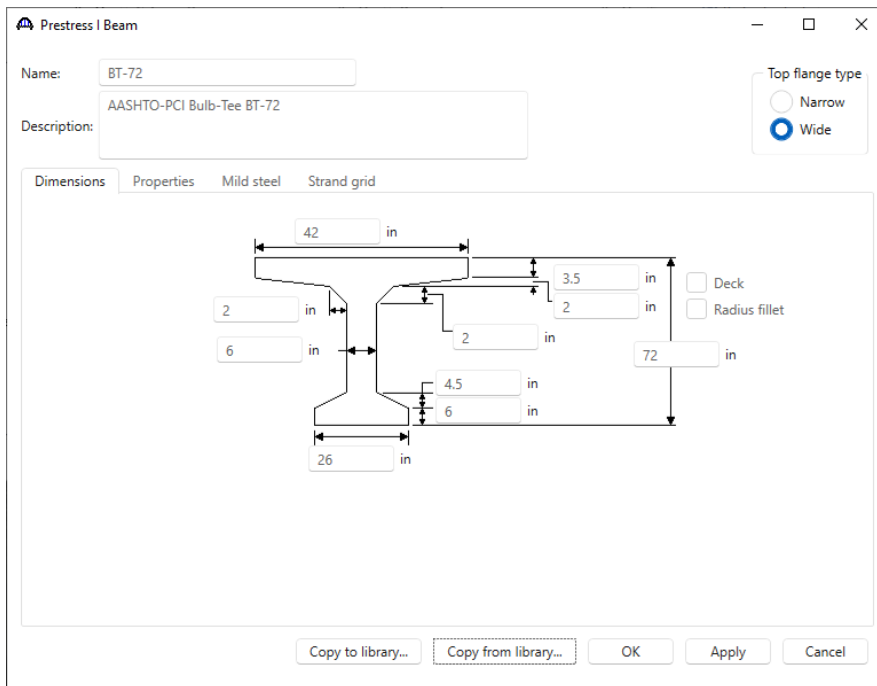
PS14 – Prestressed Concrete I Beam Example



Select the **Top flange type** as **Wide** and click the **Copy from library...** button. Select **BT-72 (AASHTO-PCI Bulb-Tee BT-72)** and click **OK**. The beam properties are copied to the **Prestress I Beam** window as shown below.

The screenshot shows a table titled 'Library Data: Prestress I Beam Shapes'. The table has 20 columns: Name, Description, Library, Units, Depth, Top flange thickness, Top flange width, Bottom flange thickness, Bottom flange width, Top haunch height, Bottom haunch height, Top haunch 2 height, Top haunch 2 width, Deck included, Top flange ext. width, Radius fillet, Top flange radius fillet, Bottom flange radius fillet, Top web radius fillet, and Bottom web radius fillet. The row for 'BT-72' is highlighted in blue. The values for BT-72 are: Name: BT-72, Description: AASHTO-PCI Bulb-Tee BT-72, Library: Standard, Units: US Customary, Depth: 72, Top flange thickness: 3.5, Top flange width: 42, Bottom flange thickness: 6, Bottom flange width: 26, Top haunch height: 2, Bottom haunch height: 4.5, Top haunch 2 height: 2, Top haunch 2 width: 2, Deck included: [checkbox], Top flange ext. width: [checkbox], Radius fillet: [checkbox], Top flange radius fillet: [checkbox], Bottom flange radius fillet: [checkbox], Top web radius fillet: [checkbox], and Bottom web radius fillet: [checkbox].

Name	Description	Library	Units	Depth	Top flange thickness	Top flange width	Bottom flange thickness	Bottom flange width	Top haunch height	Bottom haunch height	Top haunch 2 height	Top haunch 2 width	Deck included	Top flange ext. width	Radius fillet	Top flange radius fillet	Bottom flange radius fillet	Top web radius fillet	Bottom web radius fillet
AASHTO TYPE V	AASHTO TYPE V	Standard	US Customary	63	5	42	8	28	3	10	4	4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AASHTO TYPE VI	AASHTO TYPE VI	Standard	US Customary	72	5	42	8	28	3	10	4	4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BT-54	AASHTO-PCI Bulb-Tee BT-54	Standard	US Customary	54	3.5	42	6	26	2	4.5	2	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BT-63	AASHTO-PCI Bulb-Tee BT-63	Standard	US Customary	63	3.5	42	6	26	2	4.5	2	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BT-72	AASHTO-PCI Bulb-Tee BT-72	Standard	US Customary	72	3.5	42	6	26	2	4.5	2	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I-28x66	I-28x66	Standard	US Customary	66	5	42	8	28	3	10	4	4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I-28x78	I-28x78	Standard	US Customary	78	5	42	8	28	3	10	4	4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I-28x84	I-28x84	Standard	US Customary	84	5	42	8	28	3	10	4	4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



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

PS14 – Prestressed Concrete I Beam Example

Navigate to the **Strand grid** tab. Delete the existing rows and add the following strand layout.

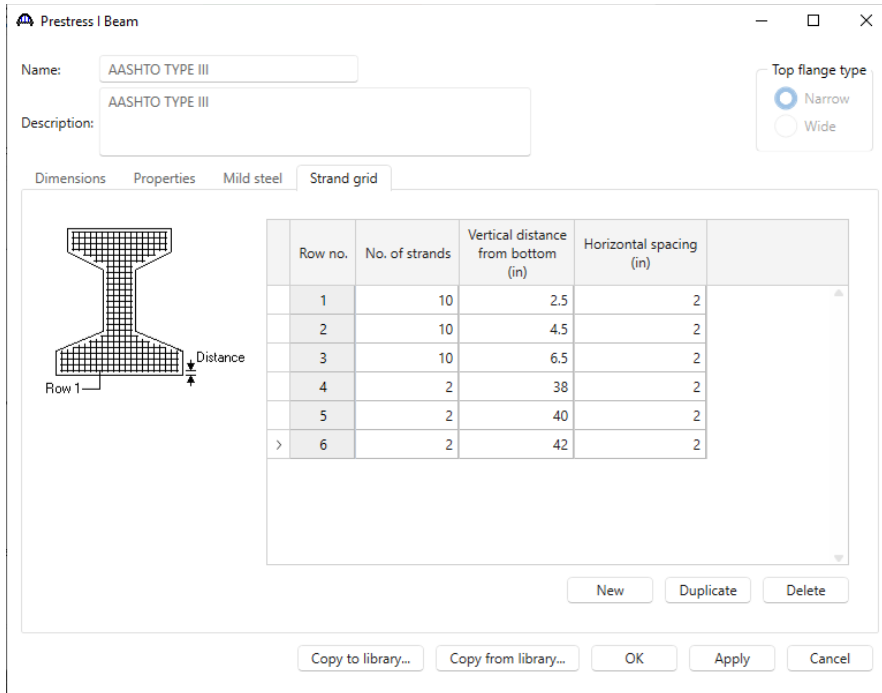
Row no.	No. of strands	Vertical distance from bottom (in)	Horizontal spacing (in)
1	12	2.5	2
2	12	4	2
3	8	6.5	2
4	4	8.5	2
5	2	10.5	2
6	2	61	2
7	2	63	2
8	2	65	2
9	2	67	2
> 10	2	69	2

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

Add another I beam **AASHTO Type III** in a similar way. The window will be updated as shown below.

PS14 – Prestressed Concrete I Beam Example

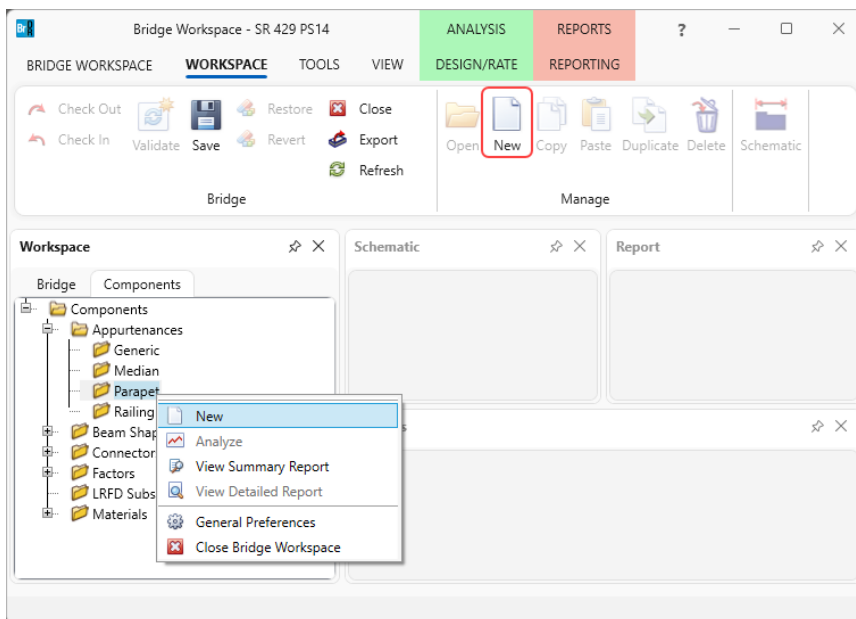
Navigate to the **Strand grid** tab, delete the existing strands, and add the following.



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

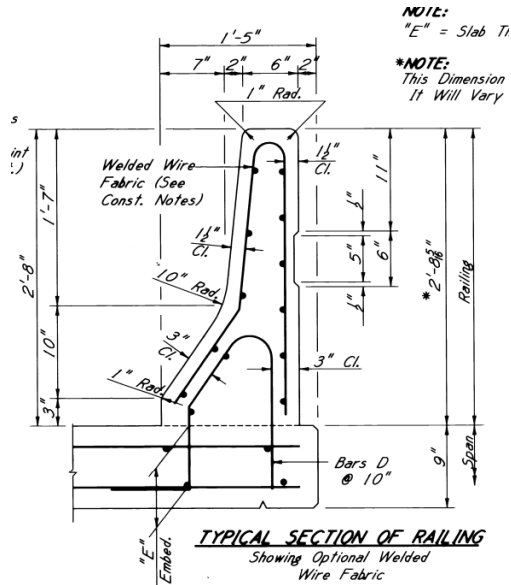
Bridge - Appurtenances

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).



PS14 – Prestressed Concrete I Beam Example

Enter the parapet details as shown below.



Bridge Appurtenances - Parapet

Name:

Description:

All dimensions are in inches

Additional load: kip/ft

Reference Line

Back

Front

Roadway Surface

Parapet unit load: kcf

Calculated properties

Net centroid (from reference line): in

Total load: kip/ft

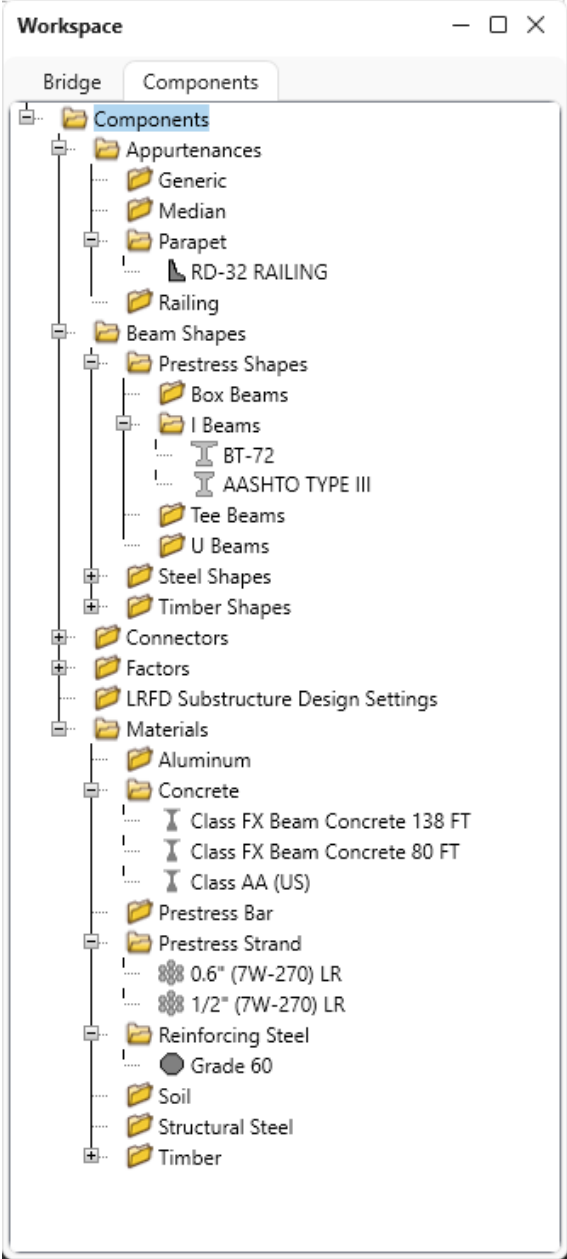
Copy from library... OK Apply Cancel

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

The default impact factors, standard LRFD and LFR factors will be used.

PS14 – Prestressed Concrete I Beam Example

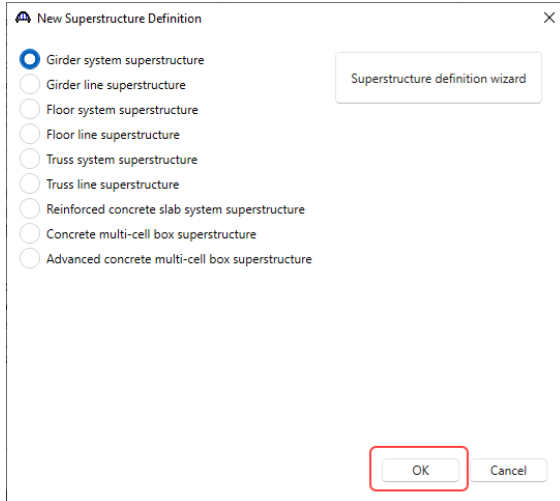
The partially expanded **Bridge Workspace** tree in the **Components** tab is shown below.



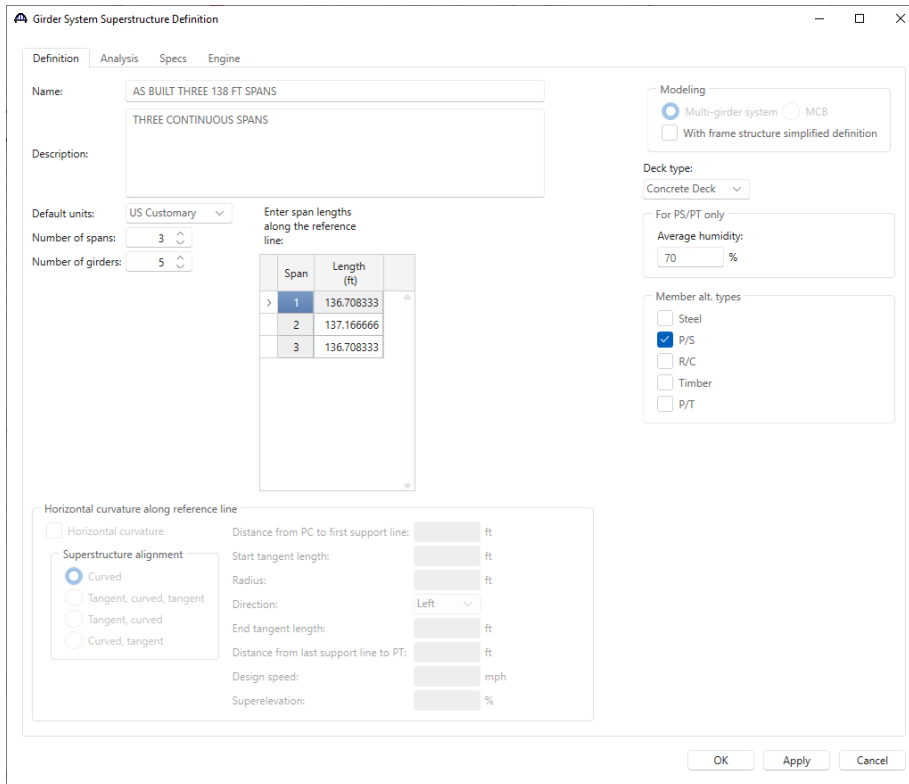
PS14 – Prestressed Concrete I Beam Example

Superstructure definition – AS BUILT THREE 138 FT SPANS

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.

PS14 – Prestressed Concrete I Beam Example

Load Case Description

Expand the **AS BUILT THREE 138 FT SPANS** superstructure definition. Double-click on the **Load Case Description** node in the **Bridge Workspace** tree to open the **Load Case Description** window. Click the **Add default load case descriptions** button to create the following load cases.

The screenshot shows the 'Load Case Description' window with a table of load cases. The 'Add default load case descriptions' button is highlighted with a red box.

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 acting 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

Buttons: 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 Framing Plan Details** window. In this example, all the data will be entered to 4 significant digits, for example enter the 7'-4" spacing as **7.3333**. Click **Apply** after entering the data as shown below.

The screenshot shows the 'Structure Framing Plan Details' window. The 'Layout' tab is selected. The 'Number of spans' is 3 and the 'Number of girders' is 5. The 'Girder spacing orientation' is set to 'Perpendicular to girder'. The 'Support' table shows skew values for supports 1, 2, 3, and 4. The 'Girder spacing' table shows start and end values for girder bays 1, 2, 3, and 4.

Number of spans: 3 Number of girders: 5

Layout Diaphragms

Girder spacing orientation
 Perpendicular to girder
 Along support

Support	Skew (degrees)
> 1	0.5175
2	0
3	0
4	-0.5175

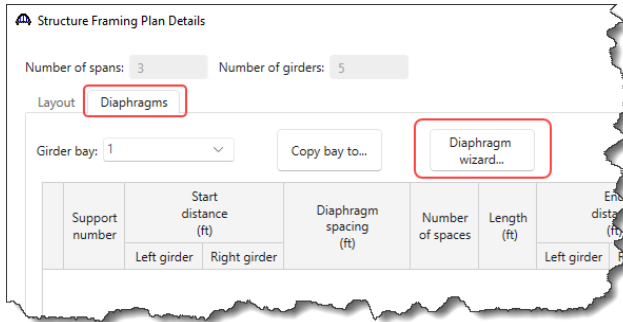
Girder bay	Girder spacing (ft)	
	Start of girder	End of girder
1	7.333333	7.333333
2	7.333333	7.333333
3	7.333333	7.333333
> 4	7.333333	7.333333

Buttons: OK, Apply, Cancel

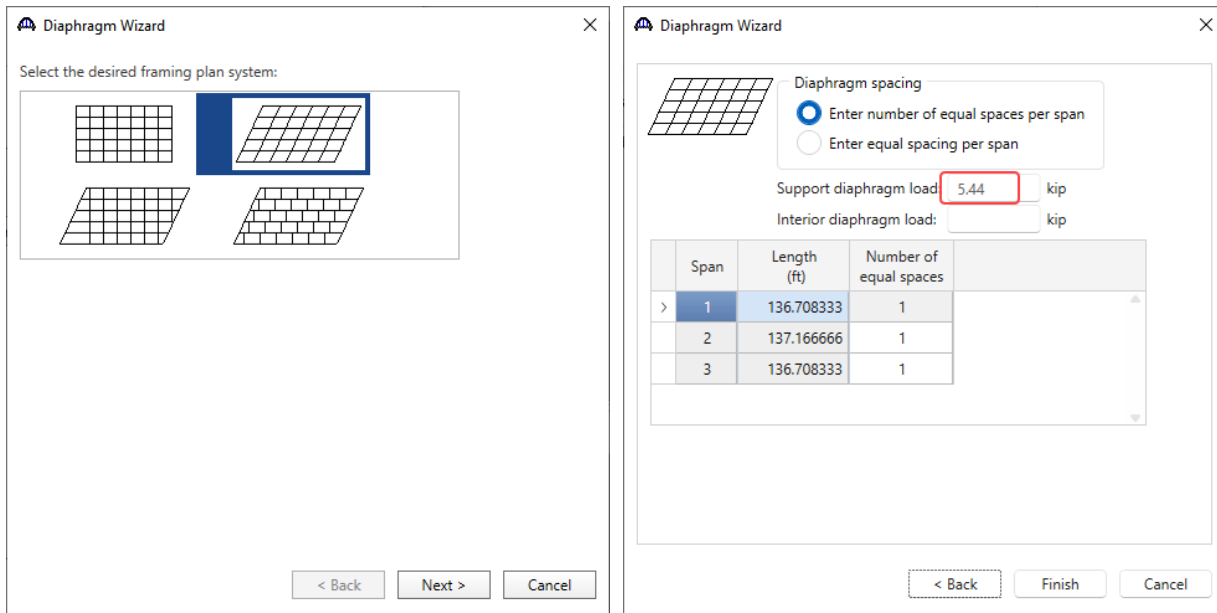
PS14 – Prestressed Concrete I Beam Example

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.

PS14 – Prestressed Concrete I Beam Example

The **Diaphragm Wizard** will create diaphragms for all the girder bays in the structure. The diaphragms created for **each girder bay** is shown below.

Structure Framing Plan Details

Number of spans: 3 Number of girders: 5

Layout Diaphragms

Girder bay: 1 Copy bay to... Diaphragm wizard...

Support number	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)	Diaphragm
	Left girder	Right girder				Left girder	Right girder		
1	0	0	0	1	0	0	0	5.44	--Not Assigned--
2	0	-0.066237	0	1	0	0	-0.066237		--Not Assigned--
2	0	0	0	1	0	0	0	5.44	--Not Assigned--
3	0	-0.066237	0	1	0	0	-0.066237	5.44	--Not Assigned--
3	136.708333	136.642096	0	1	0	136.708333	136.642096		--Not Assigned--
3	136.708333	136.77457	0	1	0	136.708333	136.77457	5.44	--Not Assigned--

New Duplicate Delete

OK Apply Cancel

Structure Framing Plan Details

Number of spans: 3 Number of girders: 5

Layout Diaphragms

Girder bay: 2 Copy bay to... Diaphragm wizard...

Support number	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)	Diaphragm
	Left girder	Right girder				Left girder	Right girder		
1	0	0	0	1	0	0	0	5.44	--Not Assigned--
1	136.708333	136.708333	0	1	0	136.708333	136.708333		--Not Assigned--
2	0	0	0	1	0	0	0	5.44	--Not Assigned--
2	137.100429	137.034192	0	1	0	137.100429	137.034192	5.44	--Not Assigned--
3	136.642096	136.575859	0	1	0	136.642096	136.575859		--Not Assigned--
3	136.77457	136.840807	0	1	0	136.77457	136.840807	5.44	--Not Assigned--

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Structure Framing Plan Details

Number of spans: 3 Number of girders: 5

Layout Diaphragms

Girder bay: 3 Copy bay to... Diaphragm wizard...

Support number	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)	Diaphragm
	Left girder	Right girder				Left girder	Right girder		
1	0	0	0	1	0	0	0	5.44	--Not Assigned--
1	136.708333	136.708333	0	1	0	136.708333	136.708333		--Not Assigned--
2	0	0	0	1	0	0	0	5.44	--Not Assigned--
2	137.034192	136.967955	0	1	0	137.034192	136.967955	5.44	--Not Assigned--
3	136.575859	136.509622	0	1	0	136.575859	136.509622		--Not Assigned--
3	136.840807	136.907044	0	1	0	136.840807	136.907044	5.44	--Not Assigned--

New Duplicate Delete

OK Apply Cancel

Structure Framing Plan Details

Number of spans: 3 Number of girders: 5

Layout Diaphragms

Girder bay: 4 Copy bay to... Diaphragm wizard...

Support number	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)	Diaphragm
	Left girder	Right girder				Left girder	Right girder		
1	0	0	0	1	0	0	0	5.44	--Not Assigned--
1	136.708333	136.708333	0	1	0	136.708333	136.708333		--Not Assigned--
2	0	0	0	1	0	0	0	5.44	--Not Assigned--
2	136.967955	136.901718	0	1	0	136.967955	136.901718	5.44	--Not Assigned--
3	136.509622	136.443385	0	1	0	136.509622	136.443385		--Not Assigned--
3	136.907044	136.973281	0	1	0	136.907044	136.973281	5.44	--Not Assigned--

New Duplicate Delete

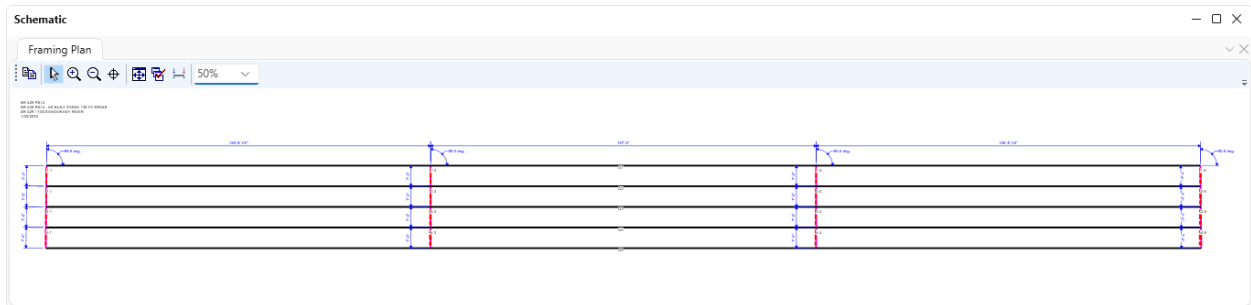
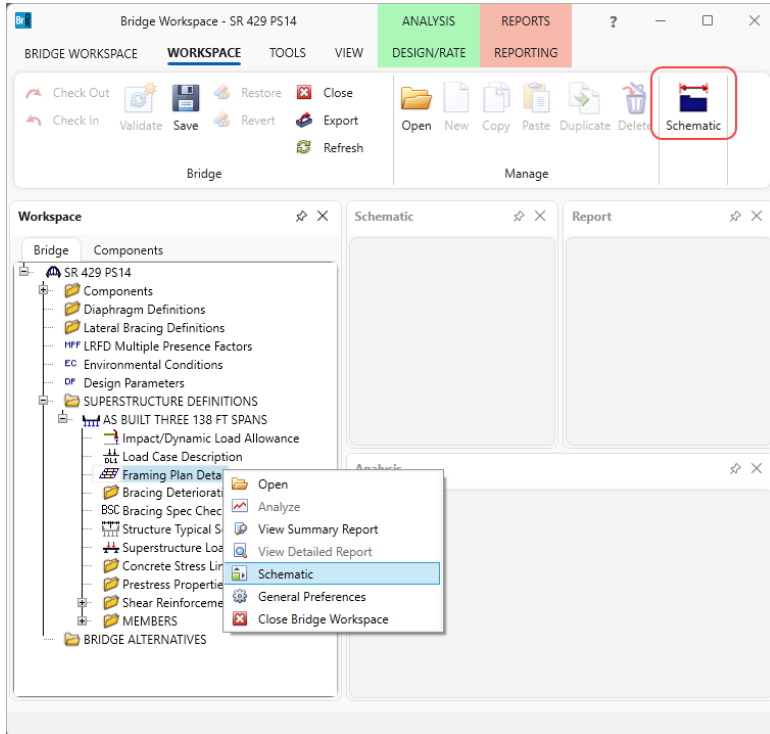
OK Apply Cancel

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

PS14 – Prestressed Concrete I Beam Example

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).



PS14 – Prestressed Concrete I Beam 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 | Distance from right edge of deck to superstructure definition ref. line

Deck thickness

Superstructure Definition Reference Line

Left overhang | Right overhang

Deck | Deck (cont'd) | Parapet | Median | Railing | Generic | Sidewalk | Lane position | Striped lanes | Wearing surface

Superstructure definition reference line is the bridge deck.

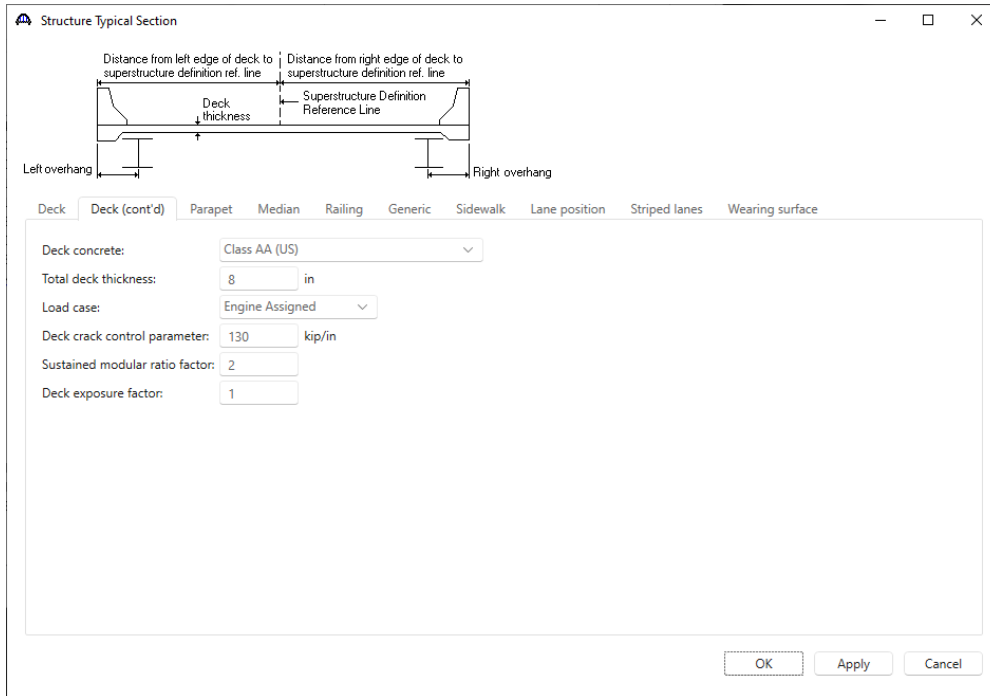
	Start	End
Distance from left edge of deck to superstructure definition reference line:	18.416666 ft	18.416666 ft
Distance from right edge of deck to superstructure definition reference line:	18.416666 ft	18.416666 ft
Left overhang:	3.75 ft	3.75 ft
Computed right overhang:	3.75 ft	3.75 ft

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

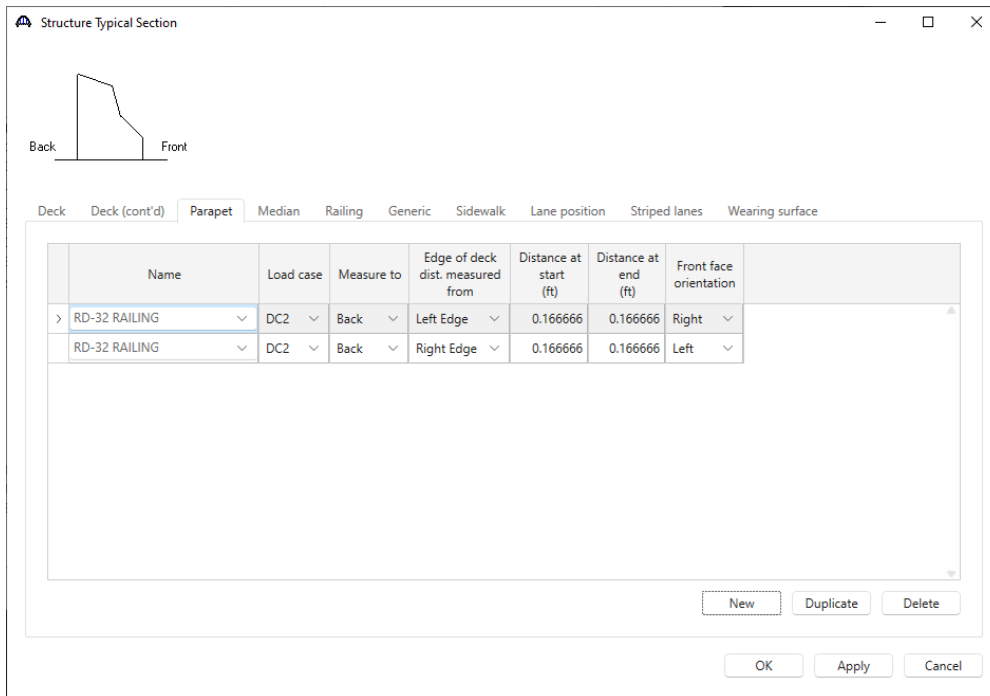
Structure Typical Section – Deck (cont'd)

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 – Parapets

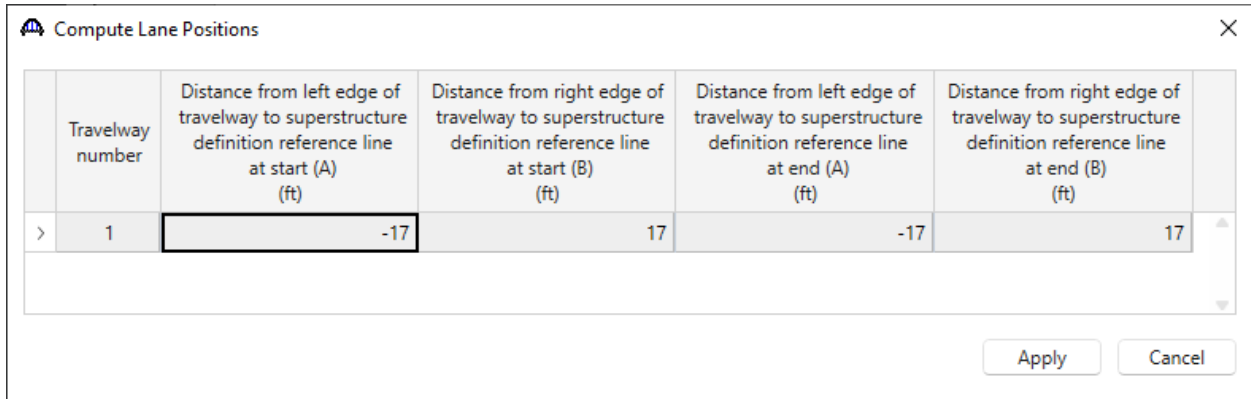
Add two parapets as shown below.



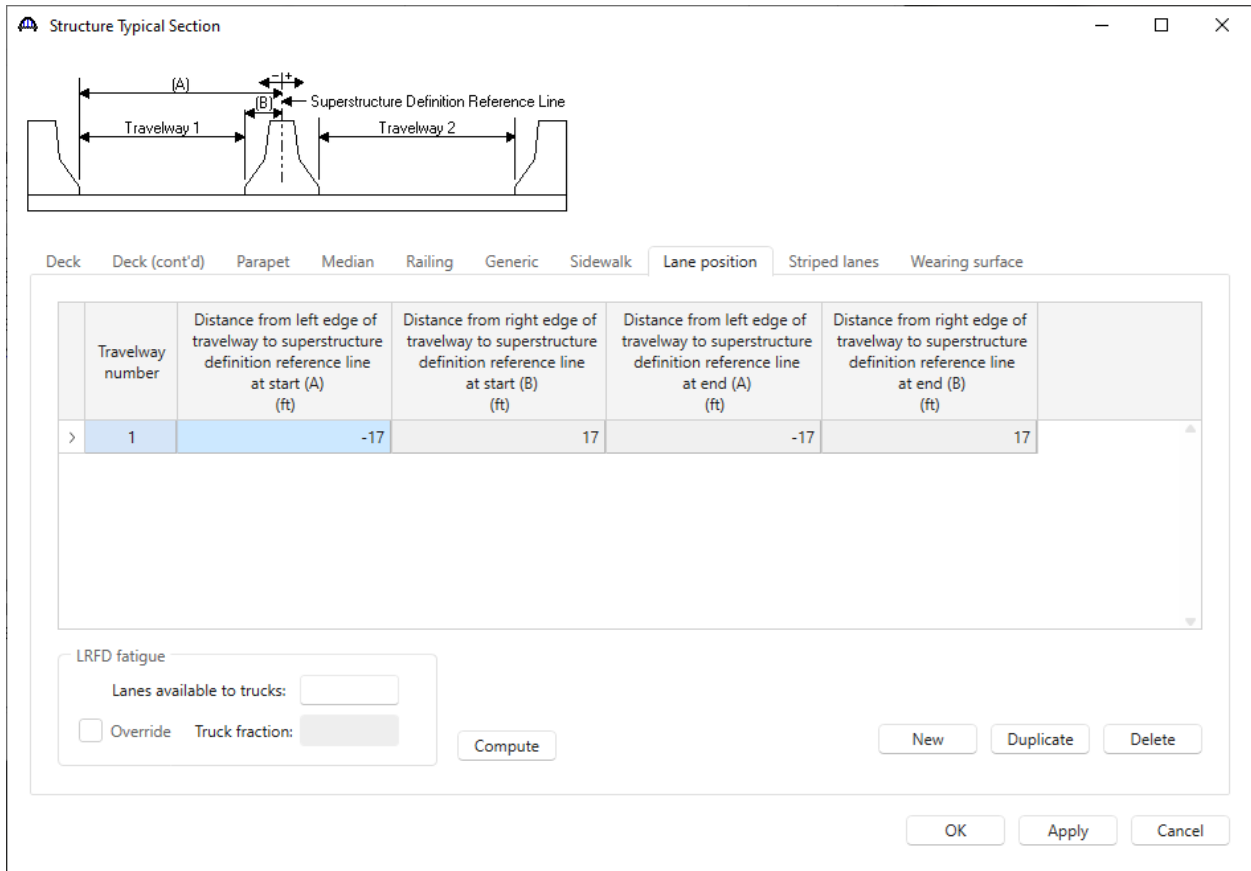
PS14 – Prestressed Concrete I Beam Example

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.



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

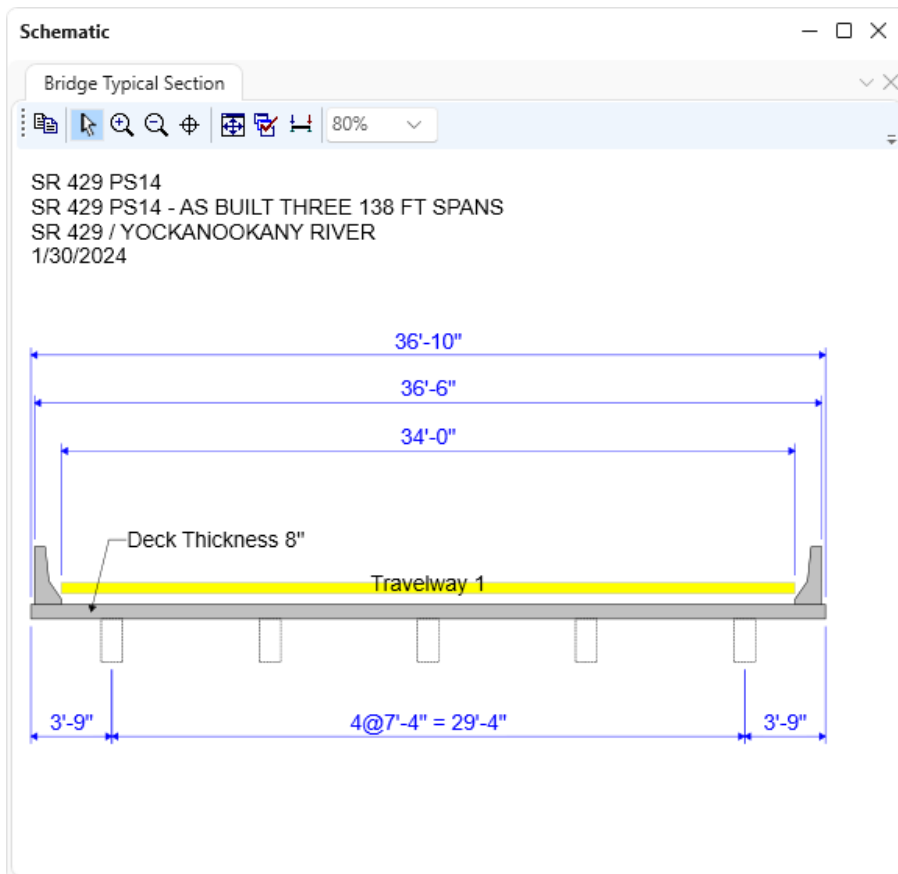
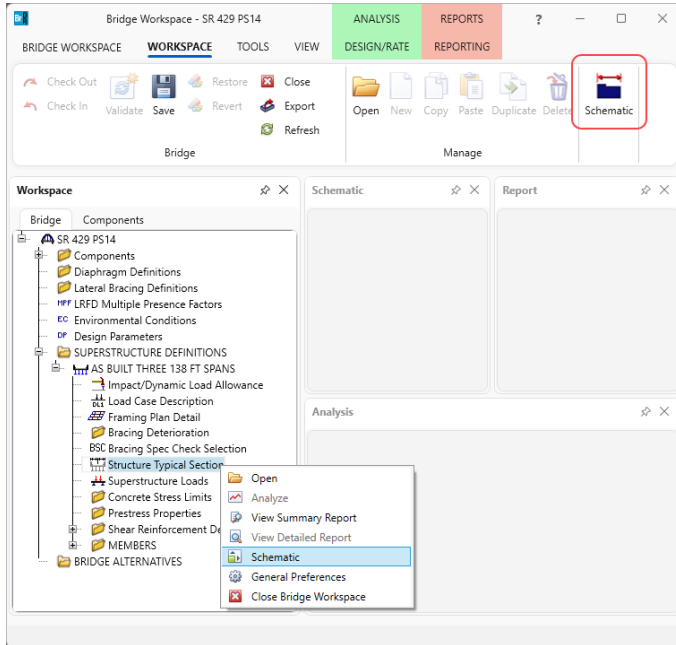


Click **OK** to apply the data and close the window.

PS14 – Prestressed Concrete I Beam Example

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).



PS14 – Prestressed Concrete I Beam Example

Superstructure Loads

Double click on the **Superstructure Loads** node in the **Bridge Workspace** tree to open the **Superstructure Loads** window. Navigate to the **DL distribution** tab in this window. Select options in this window as shown below. The BrDR LRFD engine does not support the transverse continuous beam analysis option.

The screenshot shows the 'Superstructure Loads' dialog box with the 'DL distribution' tab selected. The dialog is divided into two sections: 'Stage 1 dead load distribution' and 'Stage 2 dead load distribution'. Each section has four radio button options and a table for 'User-defined dead load'.

Stage 1 dead load distribution

- By tributary area
- By transverse simple-beam analysis
- By transverse continuous-beam analysis
- By percentage

Girder	Percentage (%)
1	
2	
3	
4	
5	

User-defined dead load

Stage 2 dead load distribution

- Uniformly to all girders
- By tributary area
- By transverse simple-beam analysis
- By transverse continuous-beam analysis
- By percentage

Girder	Percentage (%)
1	
2	
3	
4	
5	

User-defined dead load

Buttons: OK, Apply, Cancel

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

PS14 – Prestressed Concrete I Beam Example

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 data shown above the **Compute** button, select **Moderate** for the **Corrosion condition** and select the **Class FX Beam Concrete 138 FT** concrete 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.

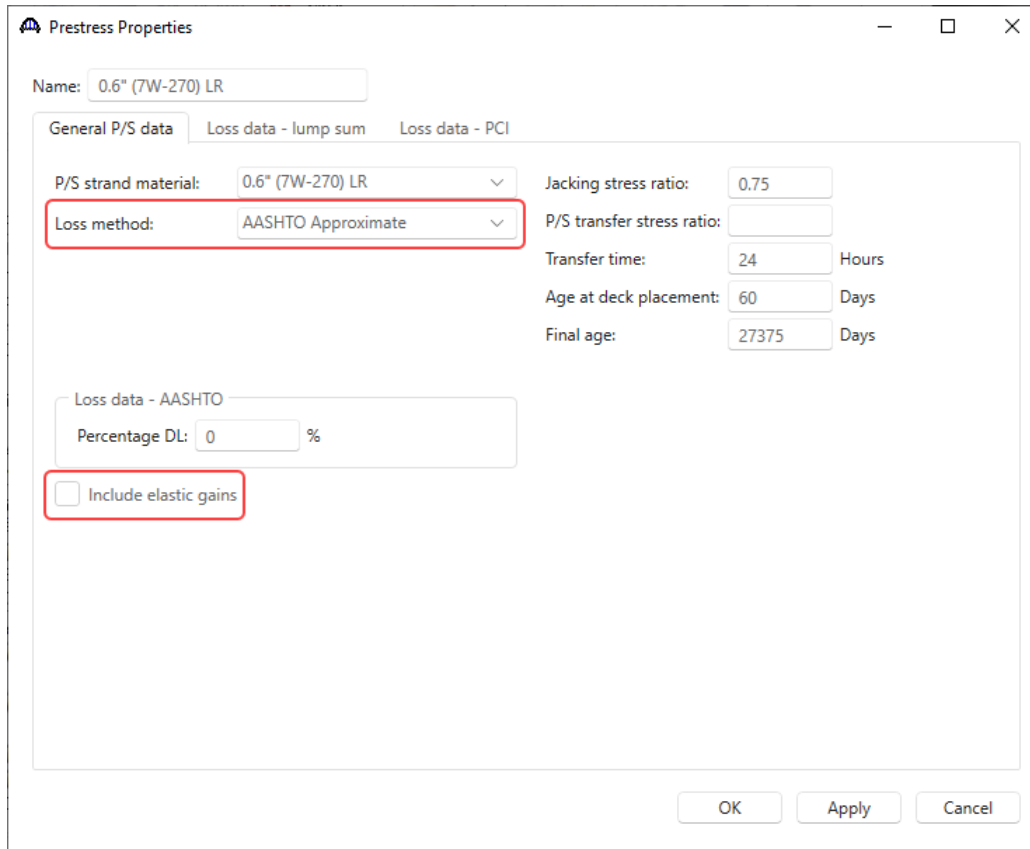
	LFD		LRFD	
Initial allowable compression:	3.6	ksi	3.9	ksi
Initial allowable tension:	0.2	ksi	0.2	ksi
Final allowable compression:	4.5	ksi	4.5	ksi
Final allowable tension:	0.5203364	ksi	0.5203364	ksi
Final allowable DL compression:	3	ksi	3.375	ksi
Final allowable slab compression:		ksi		ksi
Final allowable compression: (LL+1/2(Pe+DL))	3	ksi	3	ksi

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

PS14 – Prestressed Concrete I Beam Example

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.



The screenshot shows the 'Prestress Properties' dialog box with the following settings:

- Name: 0.6" (7W-270) LR
- General P/S data tab selected
- P/S strand material: 0.6" (7W-270) LR
- Loss method: AASHTO Approximate (highlighted with a red box)
- Jacking stress ratio: 0.75
- P/S transfer stress ratio: (empty)
- Transfer time: 24 Hours
- Age at deck placement: 60 Days
- Final age: 27375 Days
- Loss data - AASHTO: Percentage DL: 0 %
- Include elastic gains: (highlighted with a red box)

Buttons at the bottom: OK, Apply, Cancel

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

The following loss methods are available in the BrDR LRFD engine.

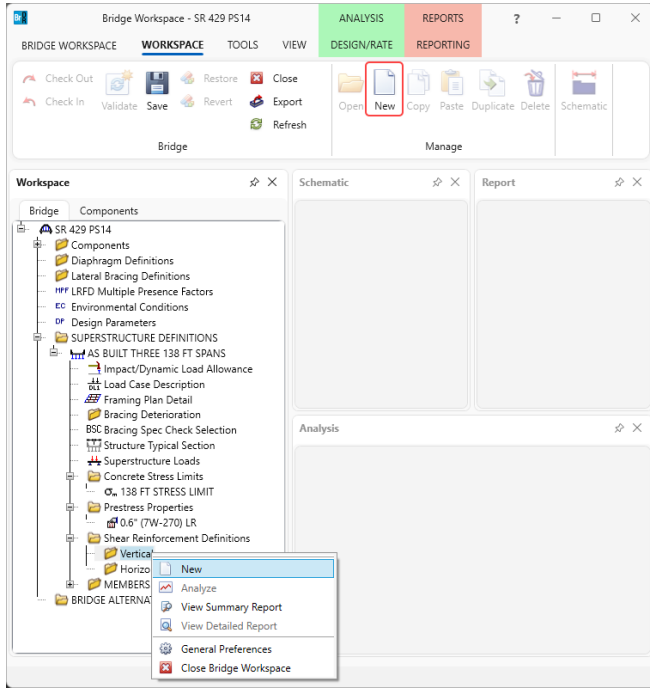
- AASHTO Approximate
- AASHTO Refined
- Lump Sum
- PCI
- Pre-2005 AASHTO Refined (AASHTO Refined, Third edition, 2004 without interims)

Another feature for prestress loss calculations in the BrDR LRFD engine is the ability to include elastic gains and losses due to dead load application.

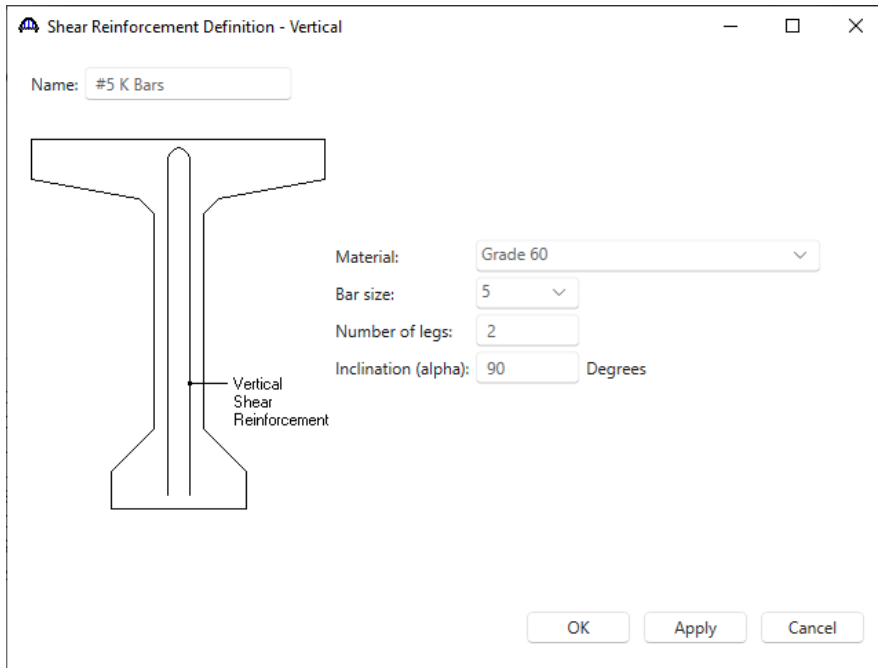
PS14 – Prestressed Concrete I Beam Example

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**).



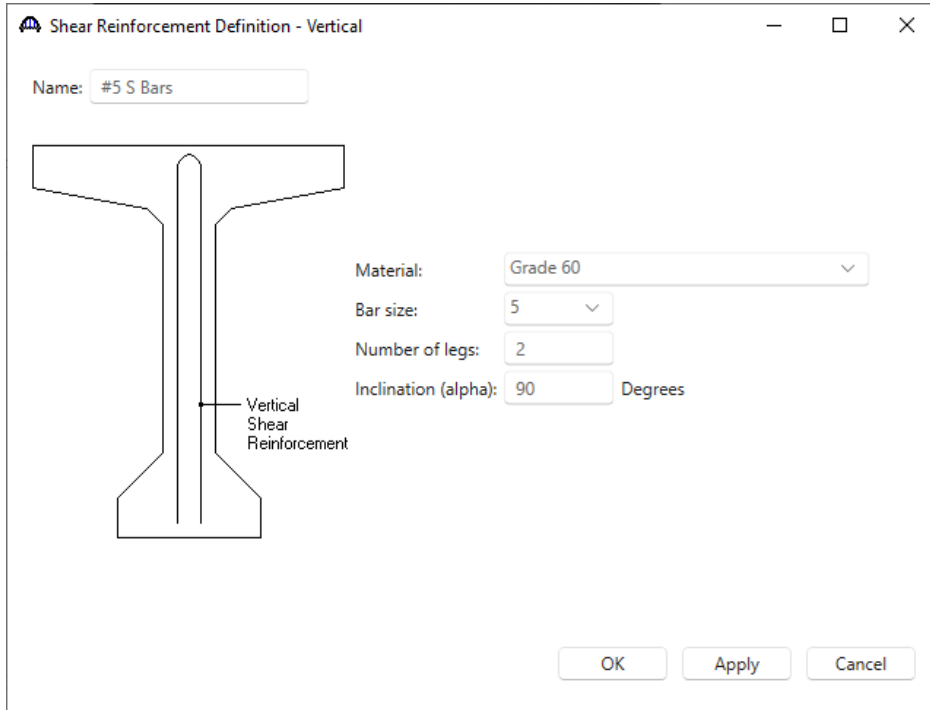
Define the stirrups as shown below.



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

PS14 – Prestressed Concrete I Beam Example

Define the #5 S Bars stirrup definition as shown below. Note that the #5 S Bars are the same definition as the #5 K Bars.



The dialog box titled "Shear Reinforcement Definition - Vertical" contains the following fields and controls:

- Name: #5 S Bars
- Material: Grade 60
- Bar size: 5
- Number of legs: 2
- Inclination (alpha): 90 Degrees

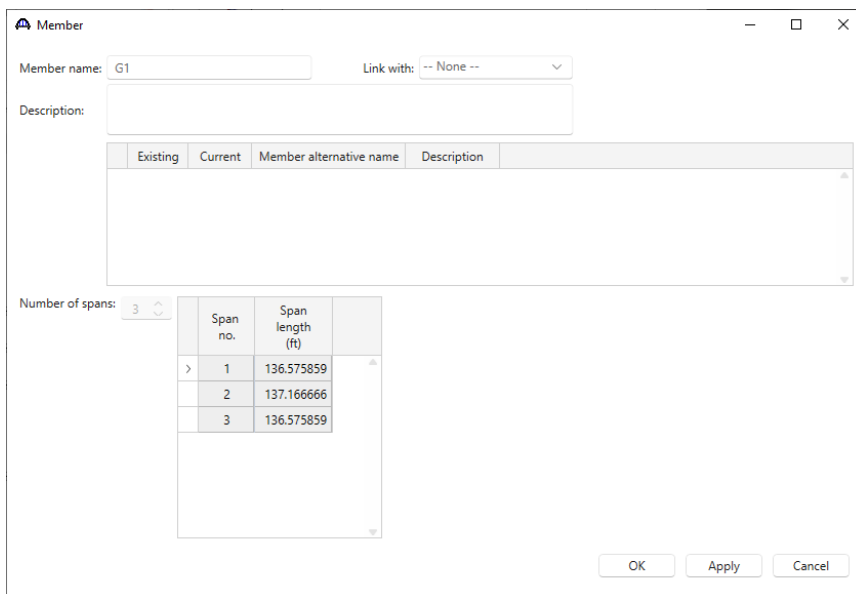
A diagram of an I-beam cross-section is shown on the left, with a vertical line through the web labeled "Vertical Shear Reinforcement".

Buttons: OK, Apply, Cancel

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

Describing a member:

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



The dialog box titled "Member" contains the following fields and controls:

- Member name: G1
- Link with: -- None --
- Description:

Existing	Current	Member alternative name	Description

Number of spans: 3

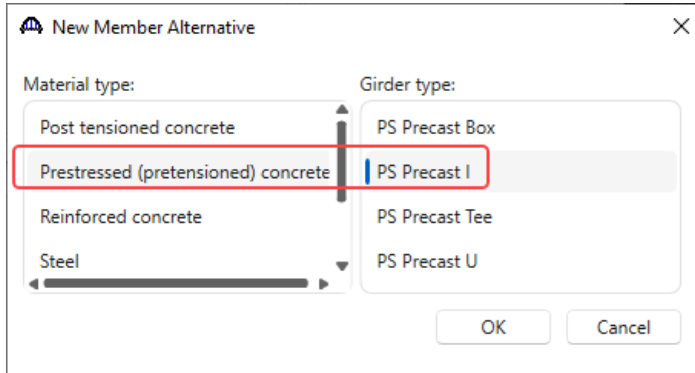
Span no.	Span length (ft)
1	136.575859
2	137.166666
3	136.575859

Buttons: OK, Apply, Cancel

PS14 – Prestressed Concrete I Beam Example

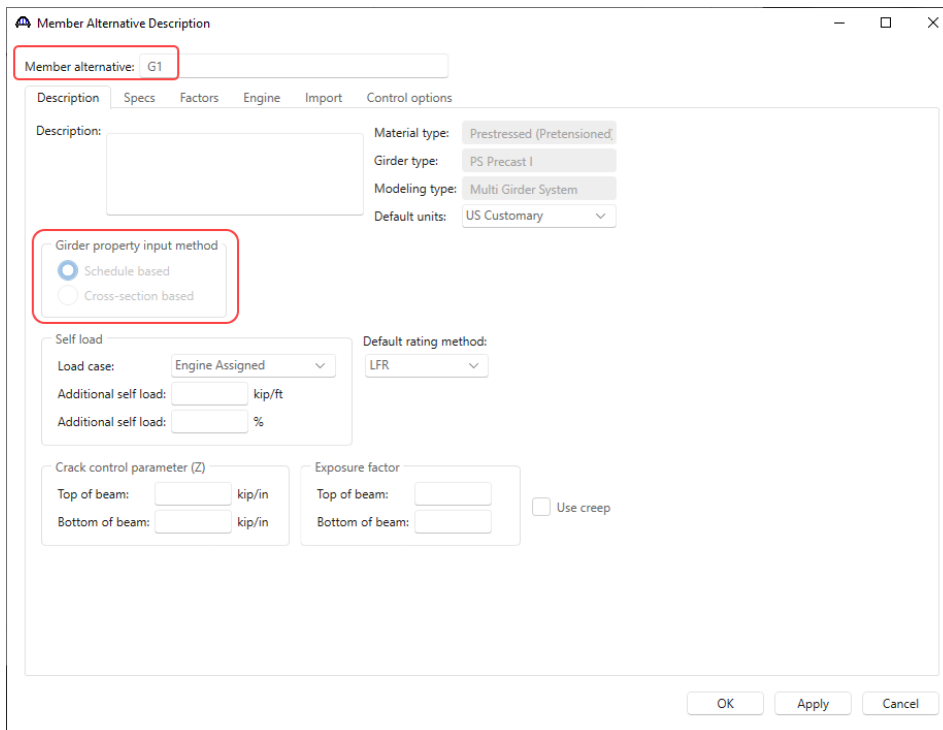
Defining a Member Alternative

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.

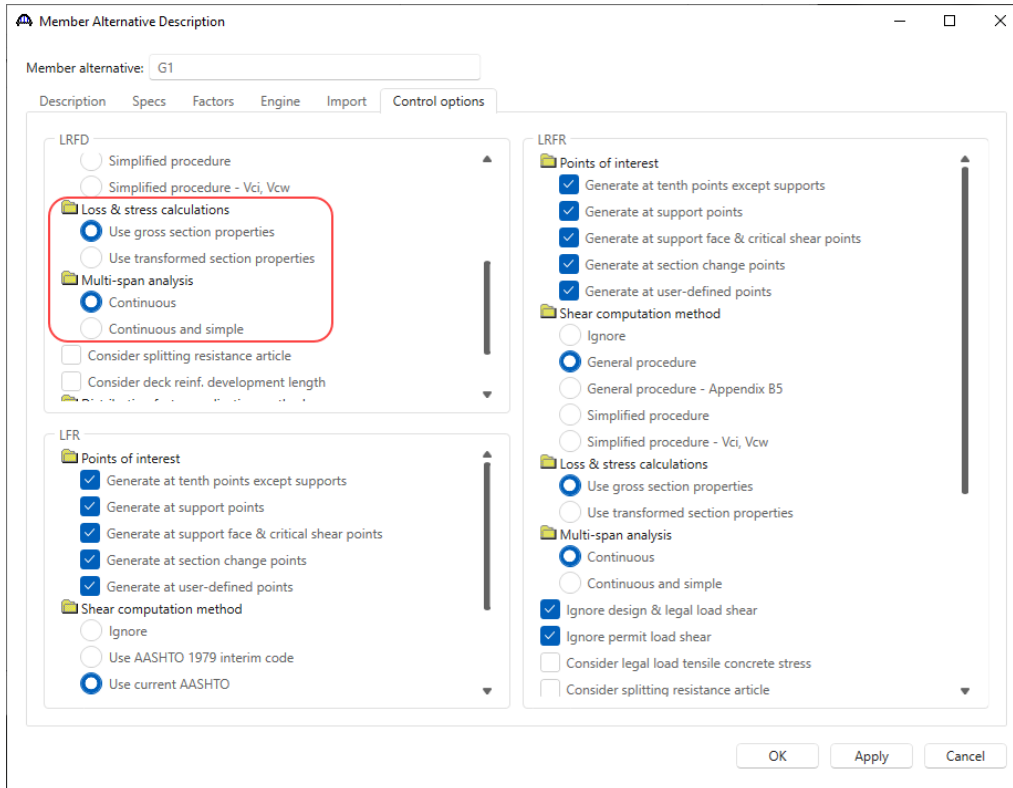
The **Member Alternative Description** window will open as shown below. Enter the name for this member alternative as shown below. The **Schedule based Girder property input method** is the only input method available for a prestressed concrete beam.



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

PS14 – Prestressed Concrete I Beam Example

Navigate to the **Control options** tab and check the **LRFD** options as shown below.



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

The BrDR LRFD engine allows to select either gross or transformed section properties to be used in the loss and stress calculations. Note that the gross section properties are always used in structural analysis.

Prestressed multi-span modeling options

The BrDR LRFD engine also allows to model prestress beams made continuous for live load in two ways.

- Multi-span continuous

The Continuous analysis method considers multi-span structures to be simply supported for beam self-weight and uncured deck and continuously supported for composite dead and live loads. This method takes advantage of the continuity connection to reduce the maximum positive moment at mid-spans.

- Multi-span continuous and simple span

The Continuous and Simple method analyzes the structure as simply supported for beam self-weight and uncured deck and both continuously and simply supported for composite dead and live loads. The maximum effects from the two analyses are then used in the specification checking. This method accounts for the condition where full continuity is not provided at interior supports and does not reduce the maximum positive moment at mid-spans.

PS14 – Prestressed Concrete I Beam Example

Beam Details

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

Span number	Beam shape	Girder material	Prestress properties	n	Beam projection	
					Left end (in)	Right end (in)
1	BT-72	Class FX Beam Concrete 138 FT	0.6* (7W-270) LR		9	6
2	BT-72	Class FX Beam Concrete 138 FT	0.6* (7W-270) LR		6	6
3	BT-72	Class FX Beam Concrete 138 FT	0.6* (7W-270) LR		6	9

Diagram labels: CL of Bearing on Left, SL, SR, CL of Bearing on Right, CL of Pier

Support number	Support distance on left, SL (in)	Support distance on right, SR (in)
2	11	11
3	11	11

PS14 – Prestressed Concrete I Beam Example

Beam Details

Span detail Continuous support detail **Stress limit ranges** Slab interface Continuity diaphragm Web end block

Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)
1	138 FT STRESS LIMIT	0	136.9092	136.9092
2	138 FT STRESS LIMIT	0	136.333333	136.333333
> 3	138 FT STRESS LIMIT	0	136.9092	136.9092

New Duplicate Delete

OK Apply Cancel

Beam Details

Span detail Continuous support detail Stress limit ranges **Slab interface** Continuity diaphragm Web end block

Interface type: Intentionally Roughened

Default interface width to beam widths:

Interface width: in

Cohesion factor: 0.28 ksi

Friction factor: 1

K1: 0.3

K2: 1.8 ksi

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface **Continuity diaphragm** Web end block

Span number	Left support				Right support			
	Material	Distance (in)	Bar count	Bar size	Material	Distance (in)	Bar count	Bar size
1					Grade 60	3.5	2	10
1					Grade 60	7	2	10
1					Grade 60	11	1	10
1					Grade 60	20	1	10
1					Grade 60	29	1	10
1					Grade 60	38	1	10
2	Grade 60	3.5	2	10	Grade 60	3.5	2	10
2	Grade 60	7	2	10	Grade 60	7	2	10
2	Grade 60	11	1	10	Grade 60	11	1	10
2	Grade 60	20	1	10	Grade 60	20	1	10
2	Grade 60	29	1	10	Grade 60	29	1	10
2	Grade 60	38	1	10	Grade 60	38	1	10
3	Grade 60	3.5	2	10	Grade 60			
3	Grade 60	7	2	10	Grade 60			
3	Grade 60	11	1	10	Grade 60			
3	Grade 60	20	1	10	Grade 60			
3	Grade 60	29	1	10	Grade 60			
3	Grade 60	38	1	10	Grade 60			

Ignore positive moment at supports in ratings

New Duplicate Delete

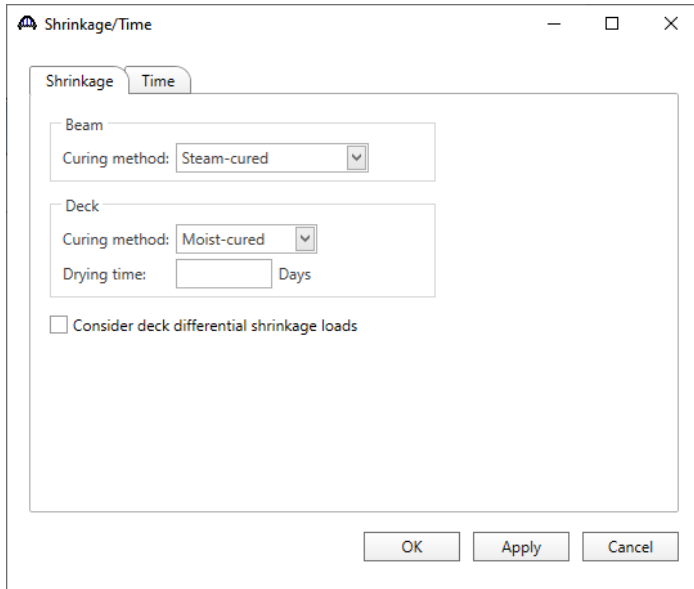
OK Apply Cancel

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

PS14 – Prestressed Concrete I Beam Example

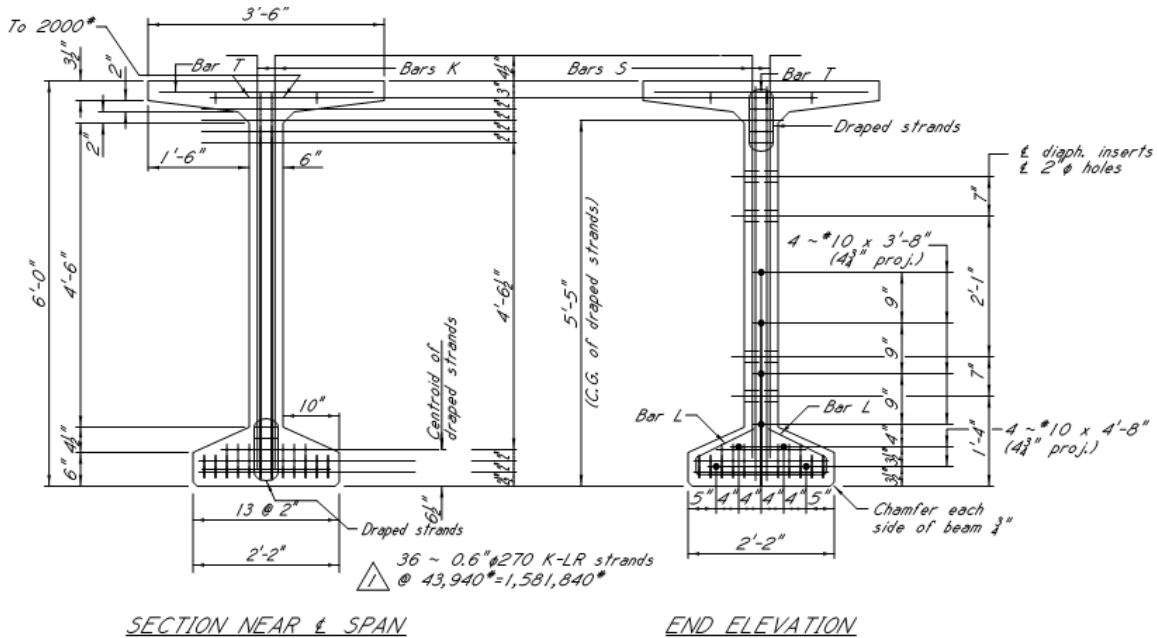
Shrinkage Time

Double-click on the **Shrinkage Time** node in the **Bridge Workspace** tree to open the **Shrinkage/Time** window. Enter the data as shown below.

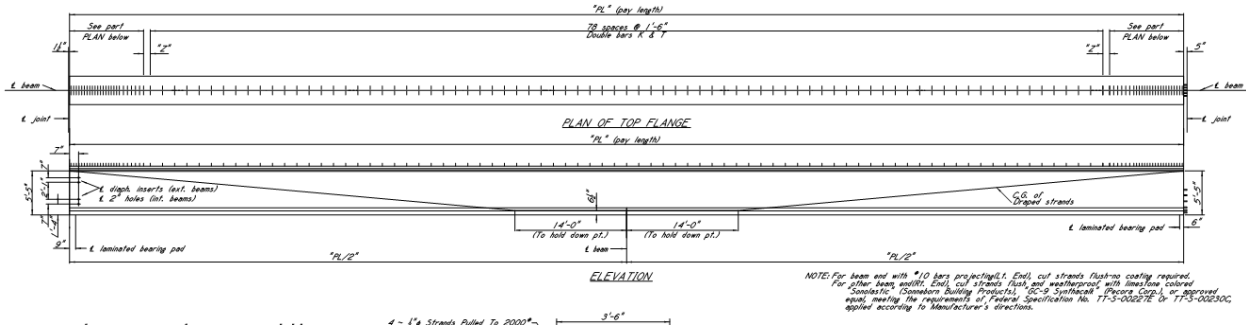


Click **OK** to apply the data and close the window.

Strand Layout



PS14 – Prestressed Concrete I Beam Example



Expand the tree under **Strand Layout** 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**. The **Mid span** radio button will now become active. Enter details as shown below.

Strand Layout - Span 1
125%

Description type

P and CGS only Strands in rows

Strand configuration type

Straight/Debonded Harped Harped and straight debonded

Symmetry

Mid span

Left end Right end

Harp point locations

Harp point	Distance (ft)	Radius (in)
> Left	54.45459	0
Right	54.45459	0

Notes:
Strand positions generated by the REVISED method.
Please refer to Help for a description of this method.

Number of strands = 36
Number of harped strands = 0
CG of strands (measured from bottom of section) = 4.67 in

Legend:

- × No strand at this position at the current section location.
- × No strand at this position at the current location but a strand is harped to this position.
- A strand occupies this position at the current section location.
- The strand is debonded from the end of the beam to the current section location.
- The strand is debonded from the mid-span to the current section location.
- The strand is debonded at other section location. Hover over the strand for more information.
- The harped position of a harped strand.
- The mid-span position of a harped strand.
- The mid-span position of one strand and the harped position of another strand.
- Mild steel.

OK
Apply
Cancel

PS14 – Prestressed Concrete I Beam Example

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

Strand Layout - Span 1
125%

Description type

P and CGS only Strands in rows

Strand configuration type

Straight/Debonded Symmetry

Harped

Harped and straight debonded

Mid span

Left end

Right end

Harp point locations			
Harp point	Distance (ft)	Radius (in)	
Left	54.45459	0	
> Right	54.45459	0	

Notes:
Strand positions generated by the REVISED method.
Please refer to Help for a description of this method.

Number of strands = 36
 Number of harped strands = 10
 CG of strands (measured from bottom of section) = 20.94 in

Legend:

- × No strand at this position at the current section location.
- × No strand at this position at the current location but a strand is harped to this position.
- A strand occupies this position at the current section location.
- The strand is debonded from the end of the beam to the current section location.
- The strand is debonded from the mid-span to the current section location.
- The strand is debonded at other section location. Hover over the strand for more information.
- The harped position of a harped strand.
- The mid-span position of a harped strand.
- The mid-span position of one strand and the harped position of another strand.
- Mild steel.

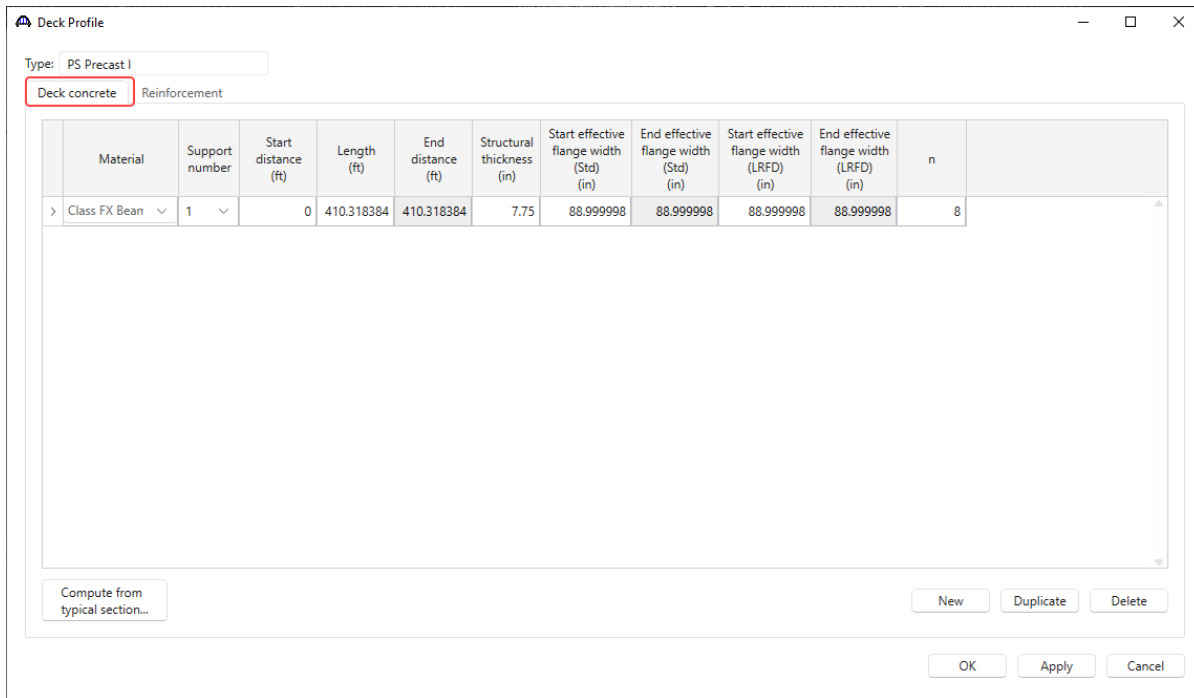
Click **OK** to apply the data and close the window.

Repeat the process to describe the same strand layout for **Span 2** and **Span 3**. Span 2 Harp point is located at **54.16666** ft and Span 3 Harp point is located at **54.45460** ft.

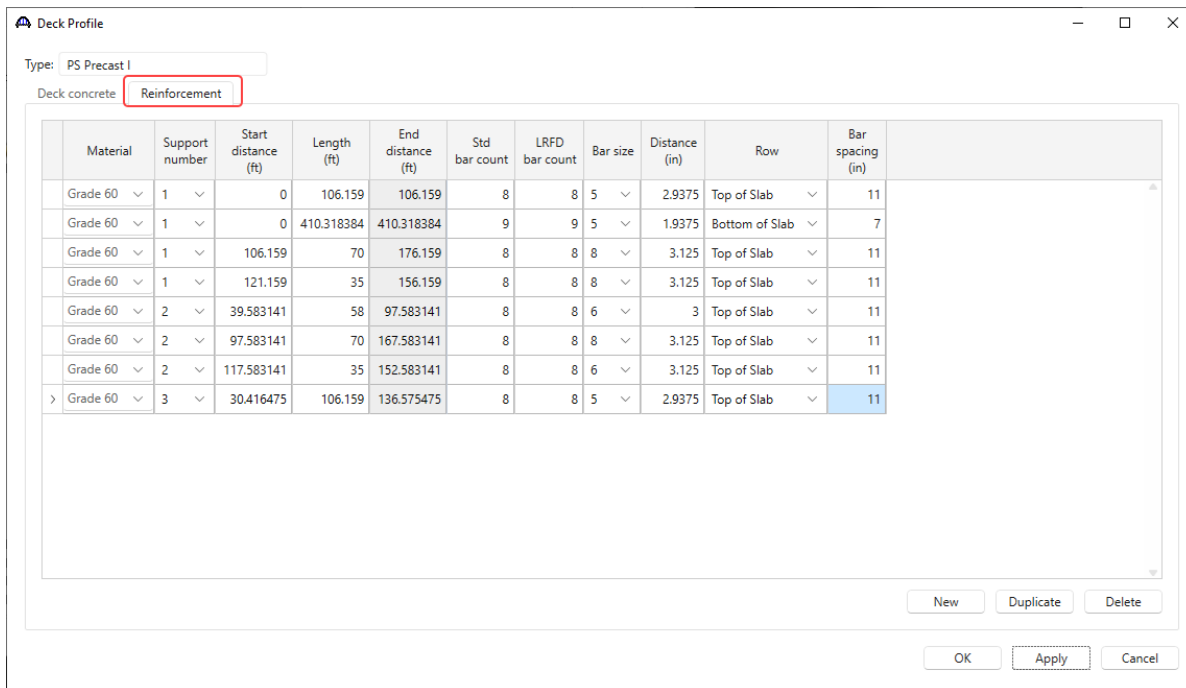
PS14 – Prestressed Concrete I Beam Example

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.



Navigate to the **Reinforcement** tab and describe the deck reinforcement as shown below.

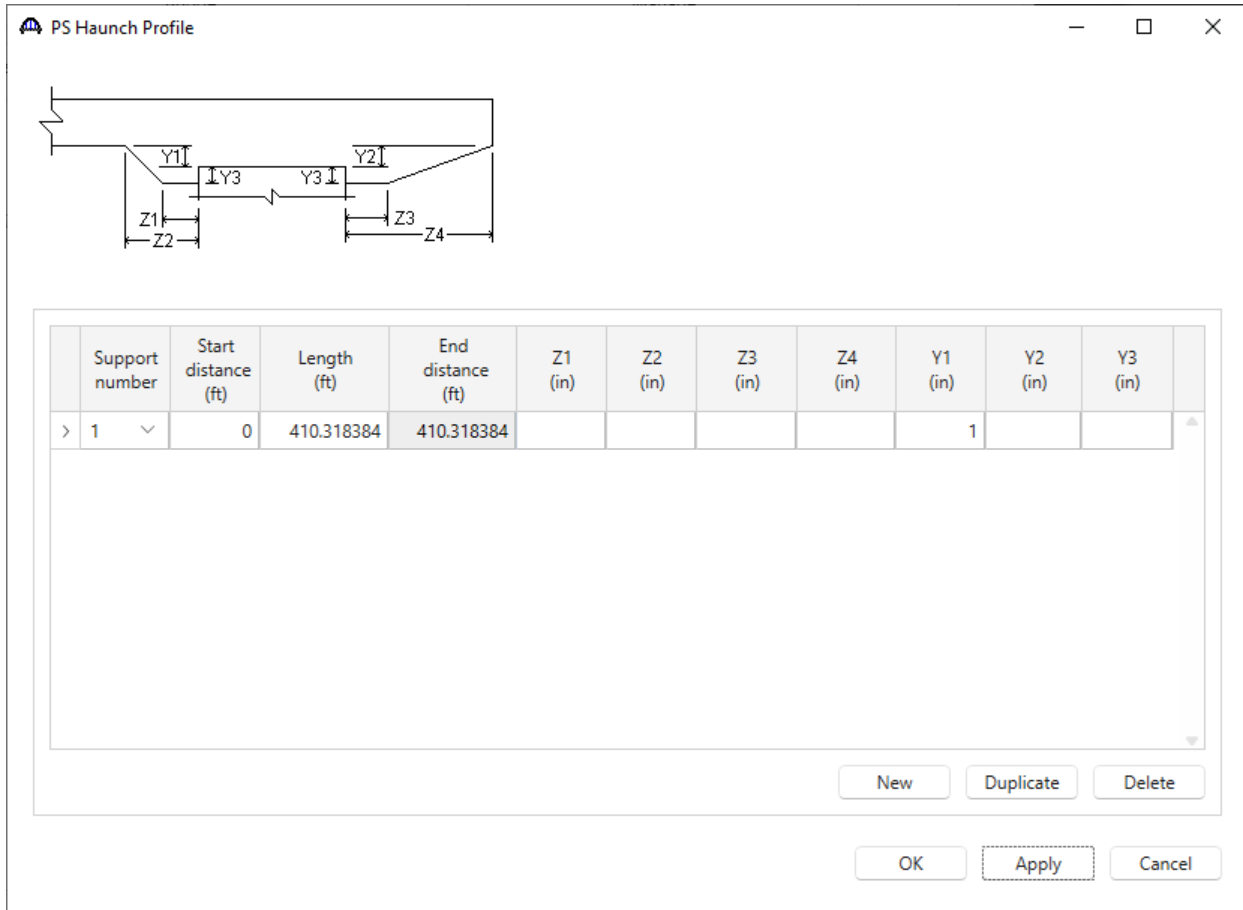


Click **OK** to apply the data and close the window.

PS14 – Prestressed Concrete I Beam Example

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



The dialog box, titled "PS Haunch Profile", contains a schematic diagram of a haunched beam. The diagram shows a beam with a central section of constant depth and haunched ends. Key dimensions are labeled: Z1 and Z2 at the left end, Z3 and Z4 at the right end, and Y1, Y2, and Y3 representing vertical offsets or depths at various points along the beam.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Z3 (in)	Z4 (in)	Y1 (in)	Y2 (in)	Y3 (in)
> 1	0	410.318384	410.318384					1		

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

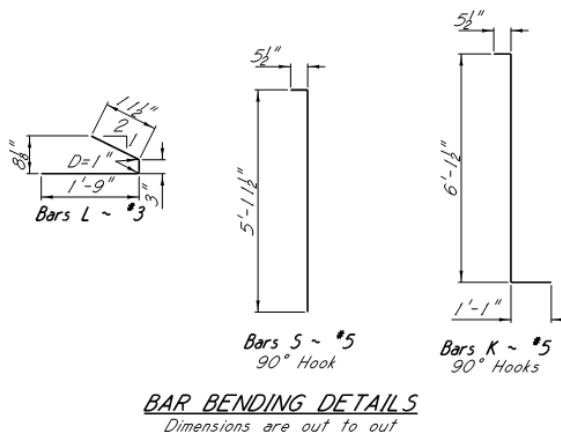
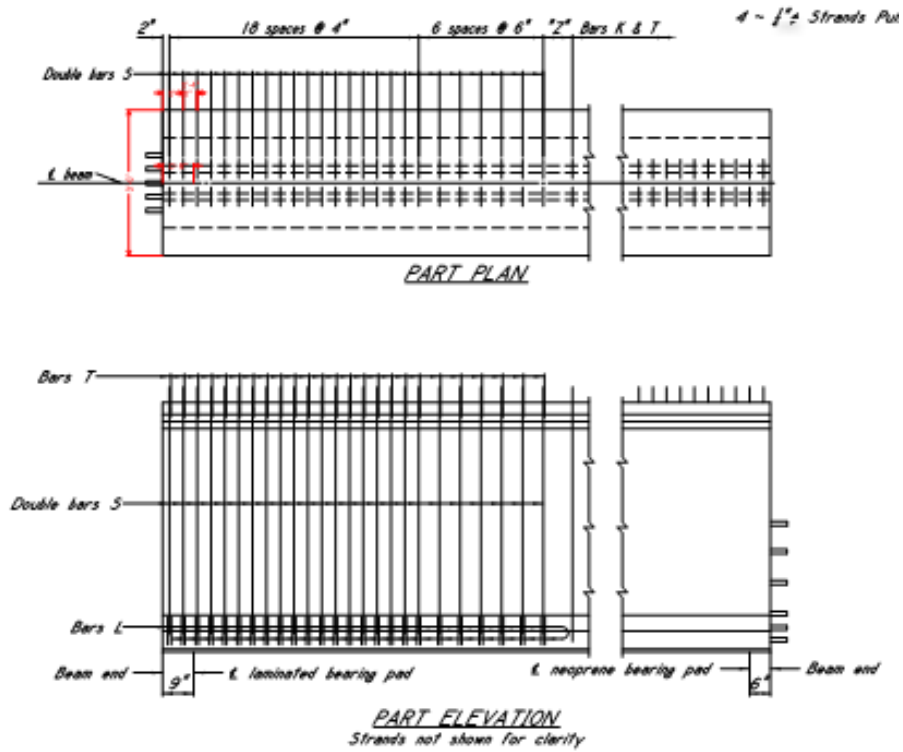
Click **OK** to apply the data and close the window.

PS14 – Prestressed Concrete I Beam Example

Shear Reinforcement Ranges

Use the **Stirrup wizard** from the **Shear Reinforcement Ranges** window to create the following shear stirrups. Double-click on the **Shear Reinforcement Ranges** node in the **Bridge Workspace** tree to open the **PS Shear Reinforcement Ranges** window.

Beam elevation showing stirrups



PS14 – Prestressed Concrete I Beam Example

Click on the **Stirrup Wizard** button and enter the following data for each span as shown below.

Vertical Stirrup Wizard ✕

Span: 1 ▼

0.75 ft 135.659192 ft 0.5 ft

Distance from left end to first stirrup: ft Distance from left end to last stirrup: ft

Distance from right end to last stirrup: ft All extended into deck

	Reinf. name	Number of spaces	Spacing (in)
	#5 S Bars	1	0
	#5 S Bars	16	4
	#5 S Bars	6	6
	#5 K Bars	1	10.4552
	#5 K Bars	78	18
>	#5 S Bars	1	10.4552

Symmetry

Finish by symmetry

Even number spaces

Odd number spaces

	Reinf. name	Number of spaces	Spacing (in)
	#5 S Bars	6	6
	#5 K Bars	1	10.4552
	#5 K Bars	78	18
>	#5 S Bars	1	10.4552
	#5 S Bars	6	6
	#5 S Bars	18	4

Symmetry

Finish by symmetry

Even number spaces

Odd number spaces

 Apply span

PS14 – Prestressed Concrete I Beam Example

Vertical Stirrup Wizard

Span: 2

0.5 ft 135.333332 ft 0.5 ft

Distance from left end to first stirrup: 0.166666 ft Distance from left end to last stirrup: 136.333332 ft

Distance from right end to last stirrup: 0 ft All extended into deck

Reinf. name	Number of spaces	Spacing (in)
#5 S Bars	1	0
#5 S Bars	18	4
#5 S Bars	6	6
#5 K Bars	1	7
#5 K Bars	78	18
> #5 S Bars	1	7

New Duplicate Delete

name	spaces	spacing
#5 S Bars	6	6
#5 K Bars	1	7
#5 K Bars	78	18
> #5 S Bars	1	7
#5 S Bars	6	6
#5 S Bars	18	4

New Duplicate Delete

Symmetry

Finish by symmetry

Even number spaces

Odd number spaces

Apply all **Apply span** Cancel

PS14 – Prestressed Concrete I Beam Example

Vertical Stirrup Wizard

Span: 3

Distance from left end to first stirrup: 0.166666 ft Distance from left end to last stirrup: 136.909199 ft

Distance from right end to last stirrup: -0.00000705 ft All extended into deck

Reinf. name	Number of spaces	Spacing (in)
#5 S Bars	1	0
#5 S Bars	18	4
#5 S Bars	6	6
#5 K Bars	1	10.4552
#5 K Bars	78	18
> #5 S Bars	1	10.4552

New Duplicate Delete

Reinf. name	Number of spaces	Spacing (in)
#5 S Bars	6	6
#5 K Bars	1	10.4552
#5 K Bars	78	18
> #5 S Bars	1	10.4552
#5 S Bars	6	6
#5 S Bars	18	4

New Duplicate Delete

Symmetry

Finish by symmetry

Even number spaces


Odd number spaces

Apply all Apply span Cancel

Click **Apply all** and the wizard closes returning to the **PS Shear Reinforcement Ranges** window populated as shown below.

PS14 – Prestressed Concrete I Beam Example

PS Shear Reinforcement Ranges



Vertical Horizontal

Span: 1 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	10.4552	0.87126667	10.03793267
#5 K Bars	<input checked="" type="checkbox"/>	10.03793267	78	18	117	127.03793267
#5 S Bars	<input checked="" type="checkbox"/>	127.03793267	1	10.4552	0.87126667	127.90919934
#5 S Bars	<input checked="" type="checkbox"/>	127.90919934	6	6	3	130.90919934
#5 S Bars	<input checked="" type="checkbox"/>	130.90919934	18	4	6	136.90919934


Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

PS Shear Reinforcement Ranges



Vertical Horizontal

Span: 2 Copy span to...

	Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
>	#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
	#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
	#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
	#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
	#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	7	0.58333333	9.74999933
	#5 K Bars	<input checked="" type="checkbox"/>	9.74999933	78	18	117	126.74999933
	#5 S Bars	<input checked="" type="checkbox"/>	126.74999933	1	7	0.58333333	127.33333266
	#5 S Bars	<input checked="" type="checkbox"/>	127.33333267	6	6	3	130.33333267
	#5 S Bars	<input checked="" type="checkbox"/>	130.33333267	18	4	6	136.33333267

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 3 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> #5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	10.4552	0.87126667	10.03793267
#5 K Bars	<input checked="" type="checkbox"/>	10.03793267	78	18	117	127.03793267
#5 S Bars	<input checked="" type="checkbox"/>	127.03793267	1	10.4552	0.87126667	127.90919934
#5 S Bars	<input checked="" type="checkbox"/>	127.90919933	6	6	3	130.90919933
#5 S Bars	<input checked="" type="checkbox"/>	130.90919933	18	4	6	136.90919933

Stirrup wizard... Stirrup design tool... View calcs New Duplicate Delete

OK Apply Cancel

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

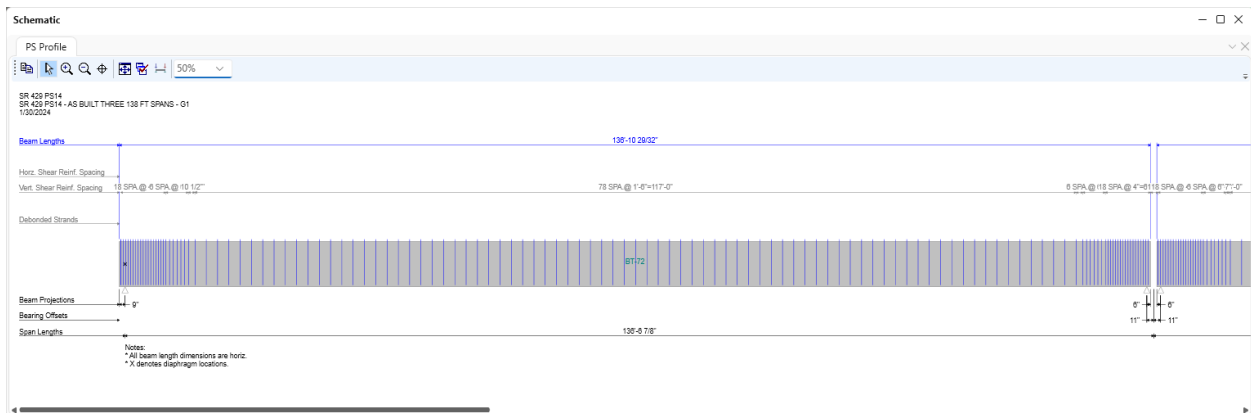
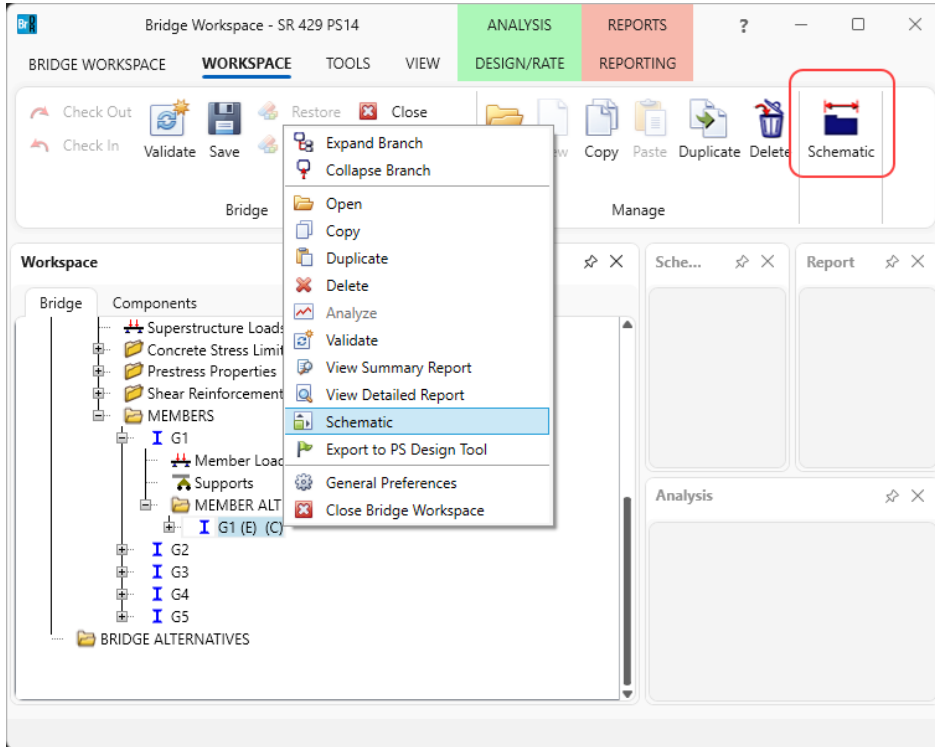
Live Load Distribution

The live load distribution factors will be computed by the BrDR LRFD engine during analysis.

PS14 – Prestressed Concrete I Beam Example

Schematic – G1 Member Alternative

While the member alternative **G1 (E) (C)** 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 **G1 (E) (C)** in the **Bridge Workspace** and select **Schematic** from the menu).



PS14 – Prestressed Concrete I Beam Example

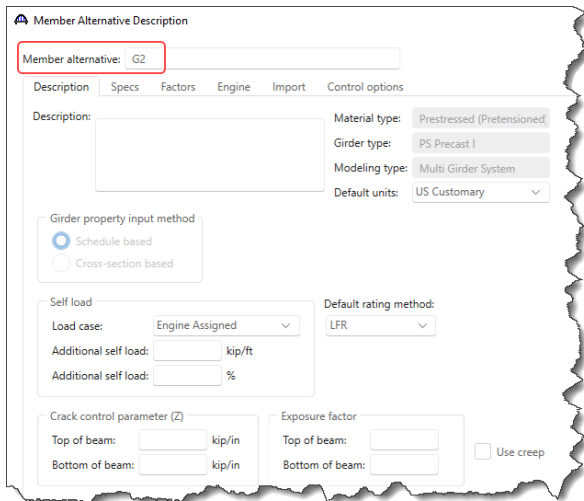
Girder 1 is complete. Girders G2-G5 are similar but the lengths are different.

Harp Locations			
Girder	Span 1	Span 2	Span 3
1	54.45460	54.16667	54.45460
2	54.48771	54.16667	54.48771
3	54.52083	54.16667	54.52083
4	54.55395	54.16667	54.55395
5	54.58707	54.16667	54.58707

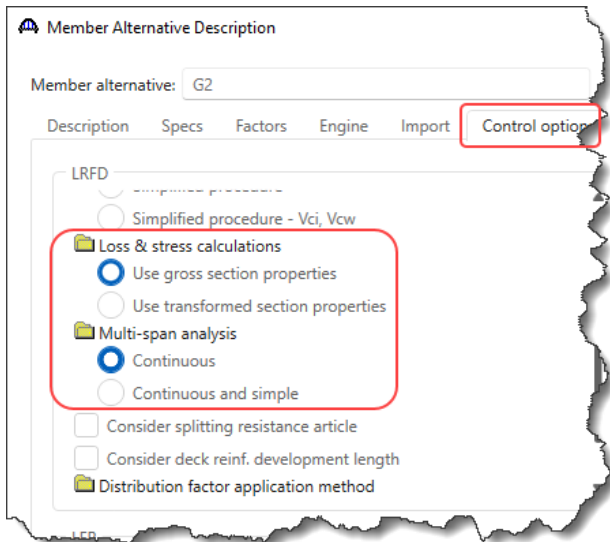
Enter the girder G2-G5 and see images to update the differences in windows shown below.

Girder G2

Member Alternative Description



Member Alternative Description – Control Options



PS14 – Prestressed Concrete I Beam Example

Beam Details – Span detail

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Span number	Beam shape	Girder material	Prestress properties	n	Beam projection	
					Left end (in)	Right end (in)
1	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		9	6
2	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		6	6
3	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		6	9

Beam Details – Continuous support detail

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Support number	Support distance on left, SL (in)	Support distance on right, SR (in)
2	11	11
3	11	11

Beam Details – Stress limit ranges

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)
1	138 FT STRESS LIMIT	0	136.9754	136.9754
2	138 FT STRESS LIMIT	0	136.333333	136.333333
3	138 FT STRESS LIMIT	0	136.9754	136.9754

PS14 – Prestressed Concrete I Beam Example

Beam Details – Slab interface

Beam Details

Span detail Continuous support detail Stress limit ranges **Slab interface** Continuity diaphragm Web end block

Interface type: Intentionally Roughened

Default interface width to beam width:

Interface width: in

Cohesion factor: ksi

Friction factor:

K1:

K2: ksi

Beam Details – Continuity diaphragm

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface **Continuity diaphragm** Web end block

Span number	Left support				Right support			
	Material	Distance (in)	Bar count	Bar size	Material	Distance (in)	Bar count	Bar size
1					Grade 60	3.5	2	10
1					Grade 60	7	2	10
1					Grade 60	11	1	10
1					Grade 60	20	1	10
1					Grade 60	29	1	10
> 1					Grade 60	38	1	10
2	Grade 60	3.5	2	10	Grade 60	3.5	2	10
2	Grade 60	7	2	10	Grade 60	7	2	10
2	Grade 60	11	1	10	Grade 60	11	1	10
2	Grade 60	20	1	10	Grade 60	20	1	10
2	Grade 60	29	1	10	Grade 60	29	1	10
2	Grade 60	38	1	10	Grade 60	38	1	10
3	Grade 60	3.5	2	10	Grade 60			
3	Grade 60	7	2	10	Grade 60			
3	Grade 60	11	1	10	Grade 60			
3	Grade 60	20	1	10	Grade 60			
3	Grade 60	29	1	10	Grade 60			
3	Grade 60	38	1	10	Grade 60			

Ignore positive moment at supports in ratings

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Strand Layout

Strand layout is similar to **G1**, but the length is different. See below for **G2** harp locations and enter them in the window by following the steps used for **G1**.

Harp Locations			
Girder	Span 1	Span 2	Span 3
2	54.48771	54.16667	54.48771

Deck Profile – Deck concrete

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

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
> Class AA (US) v	1 v	0	410.450858	410.450858	7.75	87.999996	87.999996	87.999996	87.999996	8

Deck Profile – Reinforcement

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

Material	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Std bar count	LRFD bar count	Bar size	Distance (in)	Row	Bar spacing (in)
Grade 60 v	1 v	0	410.450858	410.450858	10	10	5 v	1.9375	Bottom of Slab v	7
Grade 60 v	1 v	0	106.225429	106.225429	8	8	5 v	2.9375	Top of Slab v	11
Grade 60 v	1 v	106.225429	70	176.225429	8	8	8 v	3.125	Top of Slab v	11
Grade 60 v	1 v	121.225429	35	156.225429	8	8	8 v	3.125	Top of Slab v	11
Grade 60 v	2 v	39.583333	58	97.583333	8	8	6 v	3	Top of Slab v	11
Grade 60 v	2 v	97.583333	70	167.583333	8	8	8 v	3.125	Top of Slab v	11
Grade 60 v	3 v	15.416667	35	50.416667	8	8	8 v	3.125	Top of Slab v	11
> Grade 60 v	3 v	30.416667	106.225429	136.642096	8	8	5 v	2.9375	Top of Slab v	11

PS14 – Prestressed Concrete I Beam Example

PS Haunch Profile

PS Haunch Profile

The diagram shows a cross-section of a haunched beam. The top flange has a width Z1 on each side of the central web. The bottom flange has a width Z2 on each side. The height of the top flange is Y1, and the height of the bottom flange is Y3. The web has a thickness Y3.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)	Y3 (in)
> 1	0	410.450858	410.450858			1	

PS Shear Reinforcement Ranges

PS Shear Reinforcement Ranges

The diagram shows a beam with vertical and horizontal shear reinforcement ranges. The vertical ranges are indicated by blue vertical lines, and the horizontal ranges are indicated by green vertical lines. The start distance and spacing are labeled.

Vertical Horizontal

Span: 1 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	10.852	0.904333	10.070999
#5 K Bars	<input checked="" type="checkbox"/>	10.070999	78	18	117	127.070999
#5 S Bars	<input checked="" type="checkbox"/>	127.070999	1	10.852	0.904333	127.975332
#5 S Bars	<input checked="" type="checkbox"/>	127.975332	6	6	3	130.975332
> #5 S Bars	<input checked="" type="checkbox"/>	130.975332	18	4	6	136.975332

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 2 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	7	0.583333	9.749999
#5 K Bars	<input checked="" type="checkbox"/>	9.749999	78	18	117	126.749999
#5 S Bars	<input checked="" type="checkbox"/>	126.749999	1	7	0.583333	127.333332
#5 S Bars	<input checked="" type="checkbox"/>	127.333332	6	6	3	130.333332
#5 S Bars	<input checked="" type="checkbox"/>	130.333332	18	4	6	136.333332

Stirrup wizard... Stirrup design tool... View calcs New Duplicate Delete

OK Apply Cancel

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 3 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	10.852	0.904333	10.070999
#5 K Bars	<input checked="" type="checkbox"/>	10.070999	78	18	117	127.070999
#5 S Bars	<input checked="" type="checkbox"/>	127.070999	1	10.852	0.904333	127.975332
#5 S Bars	<input checked="" type="checkbox"/>	127.975332	6	6	3	130.975332
#5 S Bars	<input checked="" type="checkbox"/>	130.975332	18	4	6	136.975332

Stirrup wizard... Stirrup design tool... View calcs New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Girder G3

Member Alternative Description

Member Alternative Description

Member alternative: G3

Description | Specs | Factors | Engine | Import | Control options

Description:

Material type: Prestressed (Pretensioned)
Girder type: PS Precast I
Modeling type: Multi Girder System
Default units: US Customary

Girder property input method
 Schedule based
 Cross-section based

Self load
Load case: Engine Assigned
Additional self load: _____ kip/ft
Additional self load: _____ %

Default rating method: LFR

Crack control parameter (Z)
Top of beam: _____ kip/in
Bottom of beam: _____ kip/in

Exposure factor
Top of beam: _____
Bottom of beam: _____

Use creep

Member Alternative Description – Control Options

Member Alternative Description

Member alternative: G3

Description | Specs | Factors | Engine | Import | Control options

LRFD

Simplified procedure - V_c , V_w

Loss & stress calculations
 Use gross section properties
 Use transformed section properties

Multi-span analysis
 Continuous
 Continuous and simple

Consider splitting resistance article
 Consider deck reinf. development length

Distribution factor application method

PS14 – Prestressed Concrete I Beam Example

Beam Details – Span detail

Beam Details

Span detail | Continuous support detail | Stress limit ranges | Slab interface | Continuity diaphragm | Web end block

Span number	Beam shape	Girder material	Prestress properties	n	Beam projection	
					Left end (in)	Right end (in)
1	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		9	6
2	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		6	6
3	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		6	9

Beam Details – Continuous support detail

Beam Details

Span detail | Continuous support detail | Stress limit ranges | Slab interface | Continuity diaphragm | Web end block

Support number	Support distance on left, SL (in)	Support distance on right, SR (in)
2	11	11
3	11	11

Beam Details – Stress limit ranges

Beam Details

Span detail | Continuous support detail | Stress limit ranges | Slab interface | Continuity diaphragm | Web end block

Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)
1	138 FT STRESS LIMIT	0	137.0417	137.0417
2	138 FT STRESS LIMIT	0	136.333333	136.333333
3	138 FT STRESS LIMIT	0	137.0417	137.0417

PS14 – Prestressed Concrete I Beam Example

Beam Details – Slab interface

Beam Details

Span detail Continuous support detail Stress limit ranges **Slab interface** Continuity diaphragm Web end block

Interface type: Intentionally Roughened ▾

Default interface width to beam widths:

Interface width: in

Cohesion factor: ksi

Friction factor:

K1:

K2: ksi

Beam Details – Continuity diaphragm

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface **Continuity diaphragm** Web end block

Span number	Left support				Right support			
	Material	Distance (in)	Bar count	Bar size	Material	Distance (in)	Bar count	Bar size
> 1 ▾	▾			▾	Grade 60 ▾	3.5	2	10 ▾
1 ▾	▾			▾	Grade 60 ▾	7	2	10 ▾
1 ▾	▾			▾	Grade 60 ▾	11	1	10 ▾
1 ▾	▾			▾	Grade 60 ▾	20	1	10 ▾
1 ▾	▾			▾	Grade 60 ▾	29	1	10 ▾
1 ▾	▾			▾	Grade 60 ▾	38	1	10 ▾
2 ▾	Grade 60 ▾	3.5	2	10 ▾	Grade 60 ▾	3.5	2	10 ▾
2 ▾	Grade 60 ▾	7	2	10 ▾	Grade 60 ▾	7	2	10 ▾
2 ▾	Grade 60 ▾	11	1	10 ▾	Grade 60 ▾	11	1	10 ▾
2 ▾	Grade 60 ▾	20	1	10 ▾	Grade 60 ▾	20	1	10 ▾
2 ▾	Grade 60 ▾	29	1	10 ▾	Grade 60 ▾	29	1	10 ▾
2 ▾	Grade 60 ▾	38	1	10 ▾	Grade 60 ▾	38	1	10 ▾
3 ▾	Grade 60 ▾	3.5	2	10 ▾	Grade 60 ▾			▾
3 ▾	Grade 60 ▾	7	2	10 ▾	▾			▾
3 ▾	Grade 60 ▾	11	1	10 ▾	▾			▾
3 ▾	Grade 60 ▾	20	1	10 ▾	▾			▾
3 ▾	Grade 60 ▾	29	1	10 ▾	▾			▾
3 ▾	Grade 60 ▾	38	1	10 ▾	▾			▾

Ignore positive moment at supports in ratings

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Strand Layout

Strand layout is similar to **G1**, but the length is different. See below for **G3** harp locations and enter them in the window by following the steps used for **G1**.

Harp Locations			
Girder	Span 1	Span 2	Span 3
3	54.52083	54.16667	54.52083

Deck Profile – Deck concrete

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

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
> Class AA (US) v	1 v	0	410.583332	410.583332	7.75	87.999996	87.999996	87.999996	87.999996	8

Deck Profile – Reinforcement

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

Material	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Std bar count	LRFD bar count	Bar size	Distance (in)	Row	Bar spacing (in)
> Grade 60 v	1 v	0	410.583332	410.583332	10	10	5 v	1.9375	Bottom of Slab v	7
Grade 60 v	1 v	0	106.291666	106.291666	8	8	5 v	2.9375	Top of Slab v	11
Grade 60 v	1 v	106.291666	70	176.291666	8	8	8 v	3.125	Top of Slab v	11
Grade 60 v	1 v	121.291666	35	156.291666	8	8	8 v	3.125	Top of Slab v	11
Grade 60 v	2 v	39.583333	58	97.583333	8	8	6 v	3	Top of Slab v	11
Grade 60 v	2 v	97.583333	70	167.583333	8	8	8 v	3.125	Top of Slab v	11
Grade 60 v	3 v	15.416667	35	50.416667	8	8	8 v	3.125	Top of Slab v	11
Grade 60 v	3 v	30.416667	106.291666	136.708333	8	8	5 v	2.9375	Top of Slab v	11

PS14 – Prestressed Concrete I Beam Example

PS Haunch Profile

PS Haunch Profile

The diagram shows a cross-section of a haunched I-beam. The top flange is wider than the bottom flange. Dimensions are labeled as follows: Z1 is the distance from the centerline to the start of the haunch on both sides; Z2 is the total width of the haunch; Y1 is the depth of the top flange; and Y3 is the depth of the web.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)	Y3 (in)
> 1	0	410.583332	410.583332			1	

PS Shear Reinforcement Ranges

PS Shear Reinforcement Ranges

The diagram shows a horizontal beam with several vertical lines representing shear reinforcement bars. A 'Start Distance' is indicated from the left support to the first bar, and 'Spacing' is indicated between subsequent bars.

Vertical Horizontal

Span: 1 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> #5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	11.25	0.9375	10.104166
#5 K Bars	<input checked="" type="checkbox"/>	10.104166	78	18	117	127.104166
#5 S Bars	<input checked="" type="checkbox"/>	127.104166	1	11.25	0.9375	128.041666
#5 S Bars	<input checked="" type="checkbox"/>	128.041666	6	6	3	131.041666
#5 S Bars	<input checked="" type="checkbox"/>	131.041666	18	4	6	137.041666

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 2 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> #5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	7	0.583333	9.749999
#5 K Bars	<input checked="" type="checkbox"/>	9.749999	78	18	117	126.749999
#5 S Bars	<input checked="" type="checkbox"/>	126.749999	1	7	0.583333	127.333332
#5 S Bars	<input checked="" type="checkbox"/>	127.333332	6	6	3	130.333332
#5 S Bars	<input checked="" type="checkbox"/>	130.333332	18	4	6	136.333332

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 3 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> #5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	11.25	0.9375	10.104166
#5 K Bars	<input checked="" type="checkbox"/>	10.104166	78	18	117	127.104166
#5 S Bars	<input checked="" type="checkbox"/>	127.104166	1	11.25	0.9375	128.041666
#5 S Bars	<input checked="" type="checkbox"/>	128.041666	6	6	3	131.041666
#5 S Bars	<input checked="" type="checkbox"/>	131.041666	18	4	6	137.041666

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Girder G4

Member Alternative Description

Member Alternative Description

Member alternative: G4

Description | Specs | Factors | Engine | Import | Control options

Description:

Material type: Prestressed (Pretensioned)
Girder type: PS Precast I
Modeling type: Multi Girder System
Default units: US Customary

Girder property input method
 Schedule based
 Cross-section based

Self load
Load case: Engine Assigned
Additional self load: kip/ft
Additional self load: %

Default rating method: LFR

Crack control parameter (Z)
Top of beam: kip/in
Bottom of beam: kip/in

Exposure factor
Top of beam:
Bottom of beam:
 Use creep

Member Alternative Description – Control Options

Member Alternative Description

Member alternative: G4

Description | Specs | Factors | Engine | Import | Control options

LRFD

Simplified procedure - V_{ci} , V_{cw}

Loss & stress calculations
 Use gross section properties
 Use transformed section properties

Multi-span analysis
 Continuous
 Continuous and simple

Consider splitting resistance article
 Consider deck reinf. development length

Distribution factor application method

LFR

PS14 – Prestressed Concrete I Beam Example

Beam Details – Span detail

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Span number	Beam shape	Girder material	Prestress properties	n	Beam projection	
					Left end (in)	Right end (in)
1	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		9	6
2	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		6	6
3	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		6	9

Beam Details – Continuous support detail

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Support number	Support distance on left, SL (in)	Support distance on right, SR (in)
2	11	11
3	11	11

Beam Details – Stress limit ranges

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)
1	138 FT STRESS LIMIT	0	137.1079	137.1079
2	138 FT STRESS LIMIT	0	136.333333	136.333333
3	138 FT STRESS LIMIT	0	137.1079	137.1079

PS14 – Prestressed Concrete I Beam Example

Beam Details – Slab interface

Beam Details

Span detail Continuous support detail Stress limit ranges **Slab interface** Continuity diaphragm Web end block

Interface type: Intentionally Roughened ▾

Default interface width to beam widths:

Interface width: in

Cohesion factor: ksi

Friction factor:

K1:

K2: ksi

Beam Details – Continuity diaphragm

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface **Continuity diaphragm** Web end block

Span number	Left support				Right support			
	Material	Distance (in)	Bar count	Bar size	Material	Distance (in)	Bar count	Bar size
1 ▾	▾			▾	Grade 60 ▾	3.5	2	10 ▾
1 ▾	▾			▾	Grade 60 ▾	7	2	10 ▾
1 ▾	▾			▾	Grade 60 ▾	11	1	10 ▾
1 ▾	▾			▾	Grade 60 ▾	20	1	10 ▾
1 ▾	▾			▾	Grade 60 ▾	29	1	10 ▾
1 ▾	▾			▾	Grade 60 ▾	38	1	10 ▾
2 ▾	Grade 60 ▾	3.5	2	10 ▾	Grade 60 ▾	3.5	2	10 ▾
2 ▾	Grade 60 ▾	7	2	10 ▾	Grade 60 ▾	7	2	10 ▾
2 ▾	Grade 60 ▾	11	1	10 ▾	Grade 60 ▾	11	1	10 ▾
2 ▾	Grade 60 ▾	20	1	10 ▾	Grade 60 ▾	20	1	10 ▾
2 ▾	Grade 60 ▾	29	1	10 ▾	Grade 60 ▾	29	1	10 ▾
> 2 ▾	Grade 60 ▾	38	1	10 ▾	Grade 60 ▾	38	1	10 ▾
3 ▾	Grade 60 ▾	3.5	2	10 ▾	▾			▾
3 ▾	Grade 60 ▾	7	2	10 ▾	▾			▾
3 ▾	Grade 60 ▾	11	1	10 ▾	▾			▾
3 ▾	Grade 60 ▾	20	1	10 ▾	▾			▾
3 ▾	Grade 60 ▾	29	1	10 ▾	▾			▾
3 ▾	Grade 60 ▾	38	1	10 ▾	▾			▾

Ignore positive moment at supports in ratings

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Strand Layout

Strand layout is similar to **G1**, but the length is different. See below for **G3** harp locations and enter them in the window by following the steps used for **G1**.

Harp Locations			
Girder	Span 1	Span 2	Span 3
4	54.55395	54.16667	54.55395

Deck Profile – Deck concrete

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

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
> Class AA (US)	1	0	410.715806	410.715806	7.75	87.999996	87.999996	87.999996	87.999996	8

Deck Profile – Reinforcement

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

Material	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Std bar count	LRFD bar count	Bar size	Distance (in)	Row	Bar spacing (in)
> Grade 60	1	0	410.715806	410.715806	10	10	5	1.9375	Bottom of Slab	7
Grade 60	1	0	106.357904	106.357904	8	8	5	2.9375	Top of Slab	11
Grade 60	1	106.357904	70	176.357904	8	8	8	3.125	Top of Slab	11
Grade 60	1	121.357904	35	156.357904	8	8	8	3.125	Top of Slab	11
Grade 60	2	39.583334	58	97.583334	8	8	6	3	Top of Slab	11
Grade 60	2	97.583334	70	167.583334	8	8	8	3.125	Top of Slab	11
Grade 60	3	15.416666	35	50.416666	8	8	8	3.125	Top of Slab	11
Grade 60	3	30.416668	106.357904	136.774572	8	8	5	2.9375	Top of Slab	11

PS14 – Prestressed Concrete I Beam Example

PS Haunch Profile

PS Haunch Profile

The diagram shows a cross-section of a haunched I-beam. The top flange is wider than the bottom flange. Dimensions are labeled as follows: Z1 is the distance from the centerline to the edge of the top flange; Z2 is the distance from the centerline to the edge of the bottom flange; Y1 is the height of the top flange; and Y3 is the height of the web.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)	Y3 (in)
> 1	0	410.715806	410.715806			1	

PS Shear Reinforcement Ranges

PS Shear Reinforcement Ranges

The diagram shows a beam with vertical and horizontal shear reinforcement ranges. The vertical ranges are indicated by blue vertical lines, and the horizontal ranges are indicated by green horizontal lines. The diagram also shows the start distance and spacing for the reinforcement.

Vertical Horizontal

Span: 1 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> #5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	11.647	0.970583	10.137249
#5 K Bars	<input checked="" type="checkbox"/>	10.137249	78	18	117	127.137249
#5 S Bars	<input checked="" type="checkbox"/>	127.137249	1	11.647	0.970583	128.107832
#5 S Bars	<input checked="" type="checkbox"/>	128.107833	6	6	3	131.107833
#5 S Bars	<input checked="" type="checkbox"/>	131.107833	18	4	6	137.107833

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 2 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	7	0.583333	9.749999
#5 K Bars	<input checked="" type="checkbox"/>	9.749999	78	18	117	126.749999
#5 K Bars	<input checked="" type="checkbox"/>	126.749999	1	7	0.583333	127.333332
#5 S Bars	<input checked="" type="checkbox"/>	127.333332	6	6	3	130.333332
#5 S Bars	<input checked="" type="checkbox"/>	130.333332	18	4	6	136.333332

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 3 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	11.647	0.970583	10.137249
#5 K Bars	<input checked="" type="checkbox"/>	10.137249	78	18	117	127.137249
#5 S Bars	<input checked="" type="checkbox"/>	127.137249	1	11.647	0.970583	128.107832
#5 S Bars	<input checked="" type="checkbox"/>	128.107832	6	6	3	131.107832
#5 S Bars	<input checked="" type="checkbox"/>	131.107832	18	4	6	137.107832

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Girder G5

Member Alternative Description

Member Alternative Description

Member alternative: G5

Description | Specs | Factors | Engine | Import | Control options

Description:

Material type: Prestressed (Pretensioned)
Girder type: PS Precast I
Modeling type: Multi Girder System
Default units: US Customary

Girder property input method
 Schedule based
 Cross-section based

Self load
Load case: Engine Assigned
Additional self load: kip/ft
Additional self load: %

Default rating method: LFR

Crack control parameter (Z)
Top of beam: kip/in
Bottom of beam: kip/in

Exposure factor
Top of beam:
Bottom of beam:

Use creep

Member Alternative Description – Control Options

Member Alternative Description

Member alternative: G5

Description | Specs | Factors | Engine | Import | Control options

LRFD

Simplified procedure - V_{ci} , V_{cw}

Loss & stress calculations
 Use gross section properties
 Use transformed section properties

Multi-span analysis
 Continuous
 Continuous and simple

Consider splitting resistance article
 Consider deck reinf. development length
 Distribution factor application method

PS14 – Prestressed Concrete I Beam Example

Beam Details – Span detail

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Span number	Beam shape	Girder material	Prestress properties	n	Beam projection	
					Left end (in)	Right end (in)
1	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		9	6
2	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		6	6
> 3	BT-72	Class FX Beam Concrete 138 FT	0.6" (7W-270) LR		6	9

Beam Details – Continuous support detail

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Support number	Support distance on left, SL (in)	Support distance on right, SR (in)
> 2	11	11
3	11	11

Beam Details – Stress limit ranges

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface Continuity diaphragm Web end block

Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)
> 1	138 FT STRESS LIMIT	0	137.1741	137.1741
2	138 FT STRESS LIMIT	0	136.333333	136.333333
3	138 FT STRESS LIMIT	0	137.1741	137.1741

PS14 – Prestressed Concrete I Beam Example

Beam Details – Slab interface

Beam Details

Span detail Continuous support detail Stress limit ranges **Slab interface** Continuity diaphragm Web end block

Interface type: Intentionally Roughened

Default interface width to beam widths:

Interface width: in

Cohesion factor: 0.28 ksi

Friction factor: 1

K1: 0.3

K2: 1.8 ksi

Beam Details – Continuity diaphragm

Beam Details

Span detail Continuous support detail Stress limit ranges Slab interface **Continuity diaphragm** Web end block

Span number	Left support				Right support			
	Material	Distance (in)	Bar count	Bar size	Material	Distance (in)	Bar count	Bar size
1					Grade 60	3.5	2	10
1					Grade 60	7	2	10
1					Grade 60	11	1	10
1					Grade 60	20	1	10
1					Grade 60	29	1	10
1					Grade 60	38	1	10
2	Grade 60	3.5	2	10	Grade 60	3.5	2	10
2	Grade 60	7	2	10	Grade 60	7	2	10
2	Grade 60	11	1	10	Grade 60	11	1	10
2	Grade 60	20	1	10	Grade 60	20	1	10
2	Grade 60	29	1	10	Grade 60	29	1	10
2	Grade 60	38	1	10	Grade 60	38	1	10
> 3	Grade 60	3.5	2	10	Grade 60			
3	Grade 60	7	2	10				
3	Grade 60	11	1	10				
3	Grade 60	20	1	10				
3	Grade 60	29	1	10				
3	Grade 60	38	1	10				

Ignore positive moment at supports in ratings

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Strand Layout

Strand layout is similar to **G1**, but the length is different. See below for **G5** harp locations and enter them in the window by following the steps used for **G1**.

Harp Locations			
Girder	Span 1	Span 2	Span 3
5	54.58707	54.16667	54.58707

Deck Profile – Deck concrete

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

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
> Class AA (US)	1	0	410.84828	410.84828	7.75	88.999998	88.999998	88.999998	88.999998	8

Deck Profile – Reinforcement

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

Material	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Std bar count	LRFD bar count	Bar size	Distance (in)	Row	Bar spacing (in)
> Grade 60	1	0	410.848281	410.848281	9	9	5	1.9375	Bottom of Slab	7
Grade 60	1	0	106.424141	106.424141	8	8	5	2.9375	Top of Slab	11
Grade 60	1	106.424141	70	176.424141	8	8	8	3.125	Top of Slab	11
Grade 60	1	121.424141	35	156.424141	8	8	8	3.125	Top of Slab	11
Grade 60	2	39.583334	58	97.583334	8	8	6	3	Top of Slab	11
Grade 60	2	97.583334	70	167.583334	8	8	8	3.125	Top of Slab	11
Grade 60	3	15.416666	35	50.416666	8	8	8	3.125	Top of Slab	11
Grade 60	3	30.416668	106.424141	136.840809	8	8	5	2.9375	Top of Slab	11

PS14 – Prestressed Concrete I Beam Example

PS Haunch Profile

The diagram shows a haunched beam profile with dimensions Z1, Z2, Z3, Z4 for the bottom flange and Y1, Y2, Y3 for the depth. The table below provides the numerical values for these dimensions.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Z3 (in)	Z4 (in)	Y1 (in)	Y2 (in)	Y3 (in)
> 1	0	410.84828	410.84828					1		

PS Shear Reinforcement Ranges

The diagram shows a beam with vertical reinforcement bars. The 'Start Distance' and 'Spacing' are indicated. The table below details the reinforcement ranges.

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> #5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	12.045	1.00375	10.170416
#5 K Bars	<input checked="" type="checkbox"/>	10.170416	78	18	117	127.170416
#5 S Bars	<input checked="" type="checkbox"/>	127.170416	1	12.045	1.00375	128.174166
#5 S Bars	<input checked="" type="checkbox"/>	128.174166	6	6	3	131.174166
#5 S Bars	<input checked="" type="checkbox"/>	131.174166	18	4	6	137.174166

PS14 – Prestressed Concrete I Beam Example

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 2 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	7	0.583333	9.749999
#5 K Bars	<input checked="" type="checkbox"/>	9.749999	78	18	117	126.749999
#5 K Bars	<input checked="" type="checkbox"/>	126.749999	1	7	0.583333	127.333332
#5 S Bars	<input checked="" type="checkbox"/>	127.333332	6	6	3	130.333332
#5 S Bars	<input checked="" type="checkbox"/>	130.333332	18	4	6	136.333332

Stirrup wizard... Stirrup design tool... View calcs New Duplicate Delete

OK Apply Cancel

PS Shear Reinforcement Ranges

Vertical Horizontal

Span: 3 Copy span to...

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	18	4	6	6.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	6.166666	6	6	3	9.166666
#5 K Bars	<input checked="" type="checkbox"/>	9.166666	1	12.045	1.00375	10.170416
#5 K Bars	<input checked="" type="checkbox"/>	10.170416	78	18	117	127.170416
#5 S Bars	<input checked="" type="checkbox"/>	127.170416	1	12.045	1.00375	128.174166
#5 S Bars	<input checked="" type="checkbox"/>	128.174166	6	6	3	131.174166
#5 S Bars	<input checked="" type="checkbox"/>	131.174166	18	4	6	137.174166

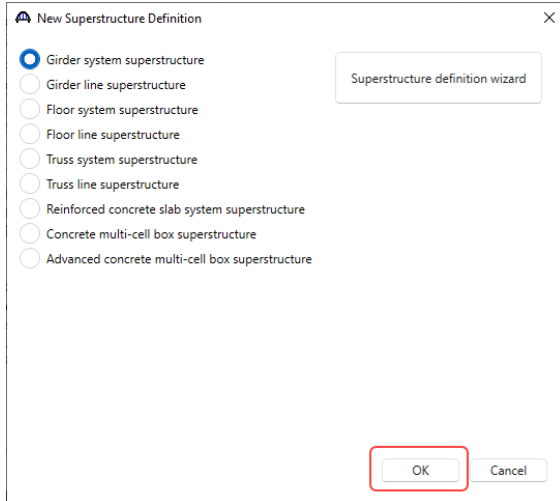
Stirrup wizard... Stirrup design tool... View calcs New Duplicate Delete

OK Apply Cancel

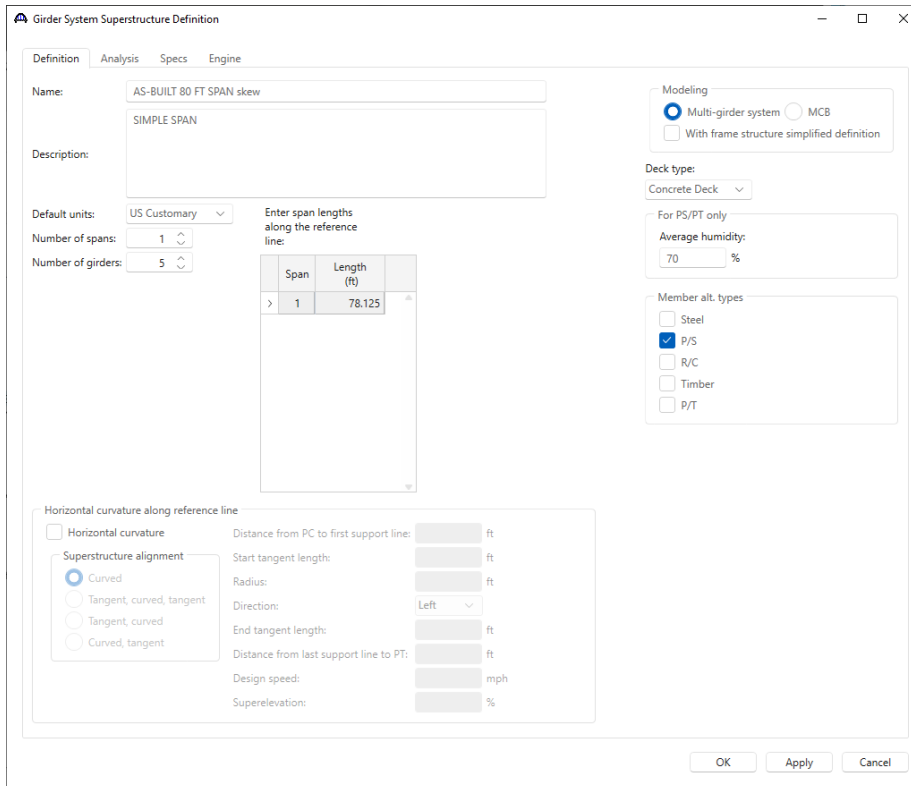
PS14 – Prestressed Concrete I Beam Example

Superstructure definition – AS BUILT 80 FT SPAN skew

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 for the 80 ft span. 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.

PS14 – Prestressed Concrete I Beam Example

Load Case Description

Expand the **AS-BUILT 80 FT SPAN skew** superstructure definition. Double-click on the **Load Case Description** node in the **Bridge Workspace** tree to open the **Load Case Description window**. Click the **Add default load case descriptions** button to create the following load cases.

The screenshot shows the 'Load Case Description' window with a table of load cases. The 'Add default load case descriptions' button is highlighted with a red box.

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 acting 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

Buttons: 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 Framing Plan Details** window. Click **Apply** after entering the data as shown below.

The screenshot shows the 'Structure Framing Plan Details' window with the 'Layout' tab selected. The 'Number of spans' is 1 and 'Number of girders' is 5. The 'Girder spacing orientation' is set to 'Perpendicular to girder'. The 'Support' and 'Skew (degrees)' table is as follows:

Support	Skew (degrees)
> 1	0.3
2	-0.3

The 'Girder spacing (ft)' table is as follows:

Girder bay	Girder spacing (ft)	
	Start of girder	End of girder
> 1	7.625	7.625
2	7.625	7.625
3	7.625	7.625
4	7.625	7.625

Buttons: OK, Apply, Cancel

PS14 – Prestressed Concrete I Beam Example

Structure Framing Plan Detail – Diaphragms

Switch to the **Diaphragms** tab to enter diaphragm spacing for each girder bay as shown below.

Structure Framing Plan Details

Number of spans: 1 Number of girders: 5

Layout: **Diaphragms**

Girder bay: 1 Copy bay to... Diaphragm wizard...

Support number	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)	Diaphragm
	Left girder	Right girder				Left girder	Right girder		
> 1	0	0	0	1	0	0	0	3.19	--Not Assigned--
1	77.965301	78.04515	0	1	0	77.965301	78.04515	3.19	--Not Assigned--

New Duplicate Delete

OK Apply Cancel

Structure Framing Plan Details

Number of spans: 1 Number of girders: 5

Layout: **Diaphragms**

Girder bay: 2 Copy bay to... Diaphragm wizard...

Support number	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)	Diaphragm
	Left girder	Right girder				Left girder	Right girder		
> 1	0	0	0	1	0	0	0	3.19	--Not Assigned--
1	78.04515	78.125	0	1	0	78.04515	78.125	3.19	--Not Assigned--

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Structure Framing Plan Details

Number of spans: 1 Number of girders: 5

Layout Diaphragms

Girder bay: 3 Copy bay to... Diaphragm wizard...

Support number	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)	Diaphragm
	Left girder	Right girder				Left girder	Right girder		
> 1	0	0	0	1	0	0	0	3.19	--Not Assigned--
1	78.125	78.20485	0	1	0	78.125	78.20485	3.19	--Not Assigned--

New Duplicate Delete

OK Apply Cancel

Structure Framing Plan Details

Number of spans: 1 Number of girders: 5

Layout Diaphragms

Girder bay: 4 Copy bay to... Diaphragm wizard...

Support number	Start distance (ft)		Diaphragm spacing (ft)	Number of spaces	Length (ft)	End distance (ft)		Load (kip)	Diaphragm
	Left girder	Right girder				Left girder	Right girder		
> 1	0	0	0	1	0	0	0	3.19	--Not Assigned--
1	78.20485	78.284699	0	1	0	78.20485	78.284699	3.19	--Not Assigned--

New Duplicate Delete

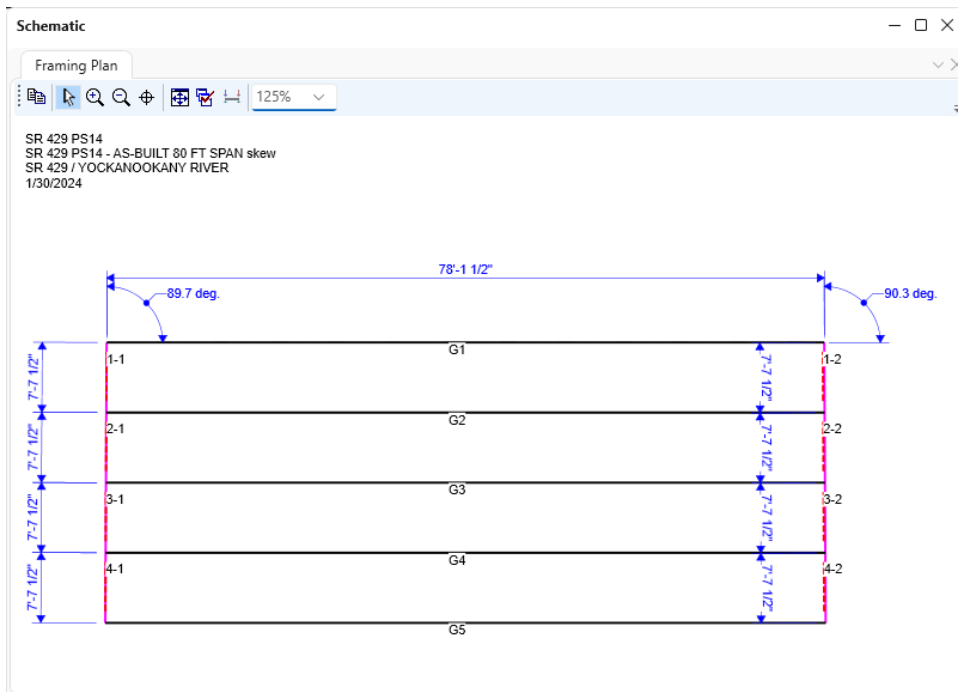
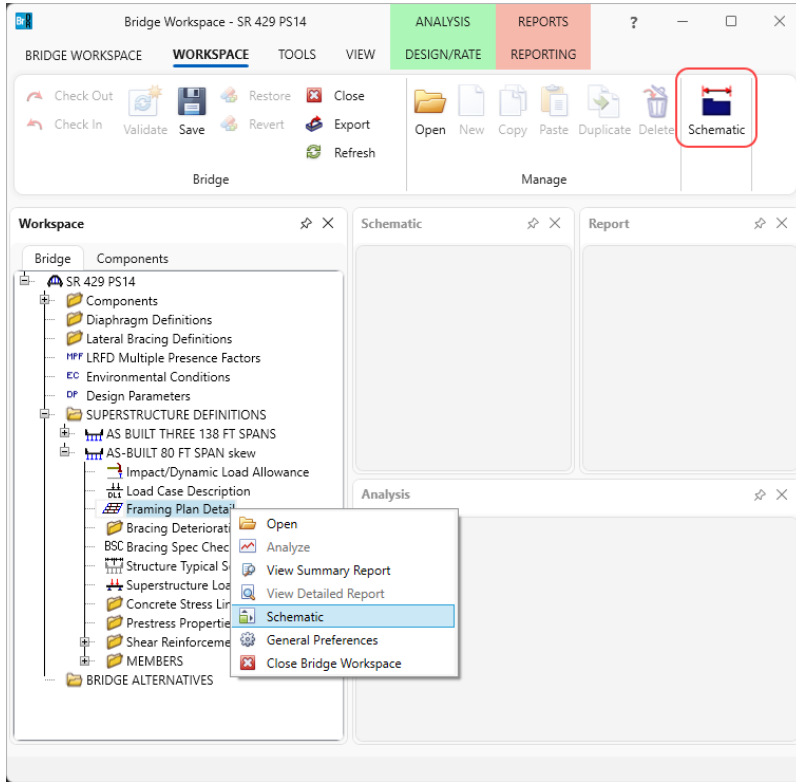
OK Apply Cancel

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

PS14 – Prestressed Concrete I Beam Example

Schematic - Framing Plan Detail

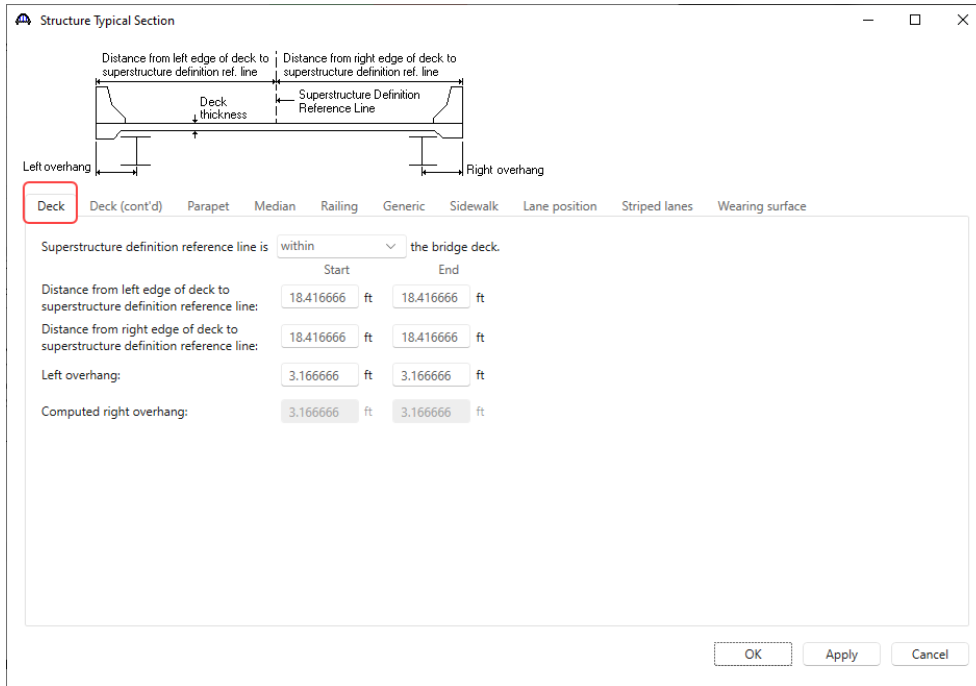
While **Framing Plan Detail** is selected in the **Bridge Workspace** tree, open the schematic for the framing plan by selecting the **Schematic** button on the **WORKSPACE** ribbon (or right click on **Framing Plan Detail** in the Bridge Workspace and select **Schematic** from the menu).



PS14 – Prestressed Concrete I Beam Example

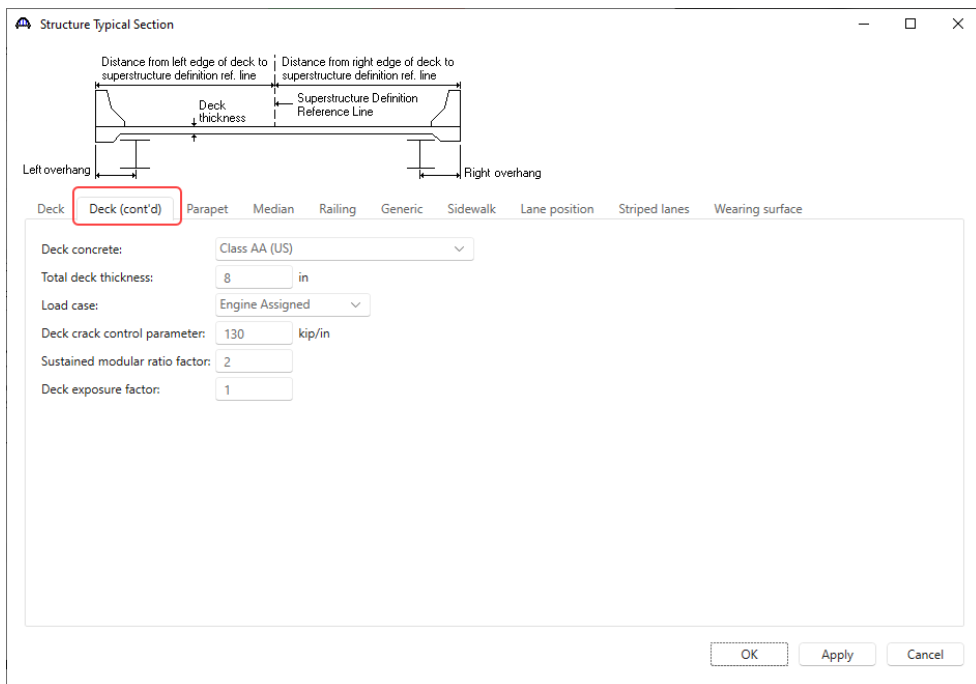
Structure Typical Section - Deck

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 – Deck (cont'd)

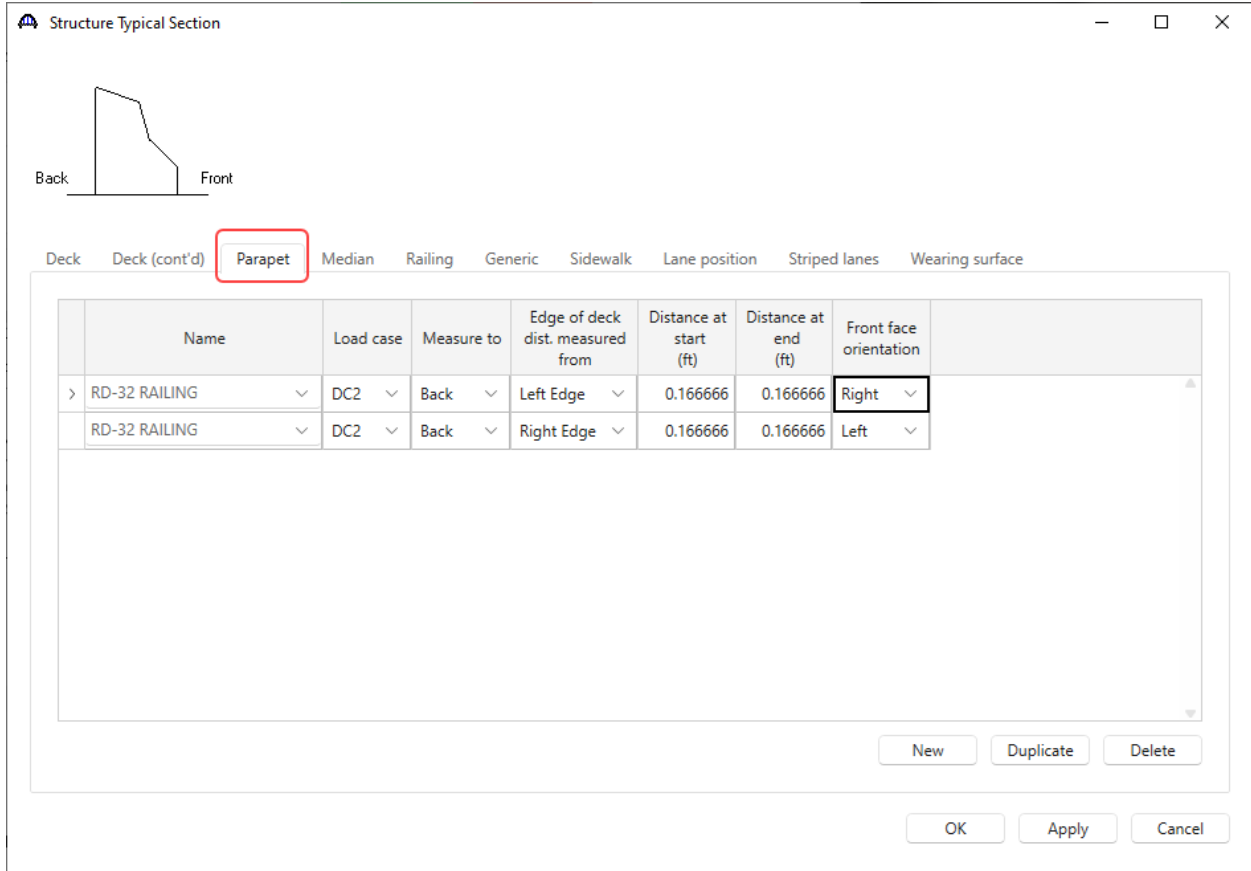
The **Deck (cont'd)** tab is used to enter information about the **Deck concrete** and the **Total deck thickness**. The material to be used for the deck concrete is selected from the list of bridge materials. Enter the data as shown below.



PS14 – Prestressed Concrete I Beam Example

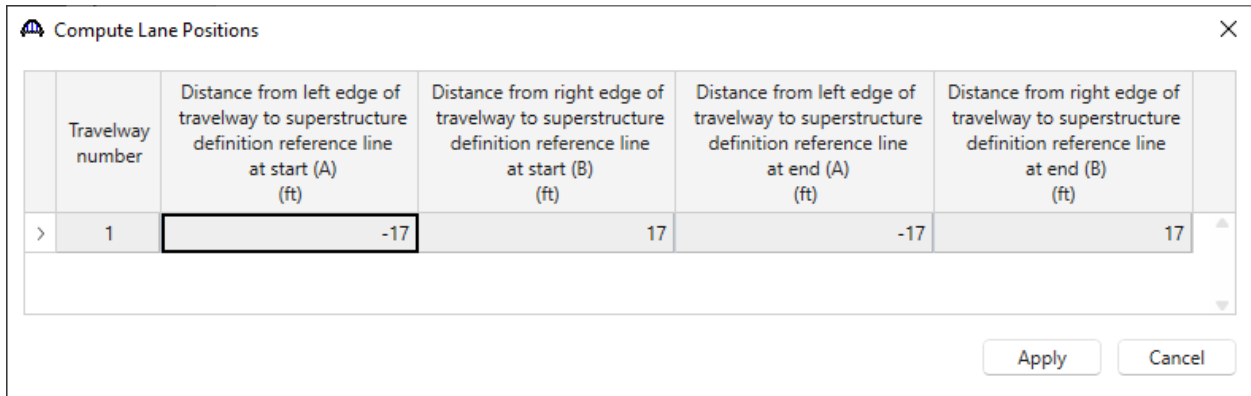
Structure Typical Section – Parapets

Add two parapets as shown below.



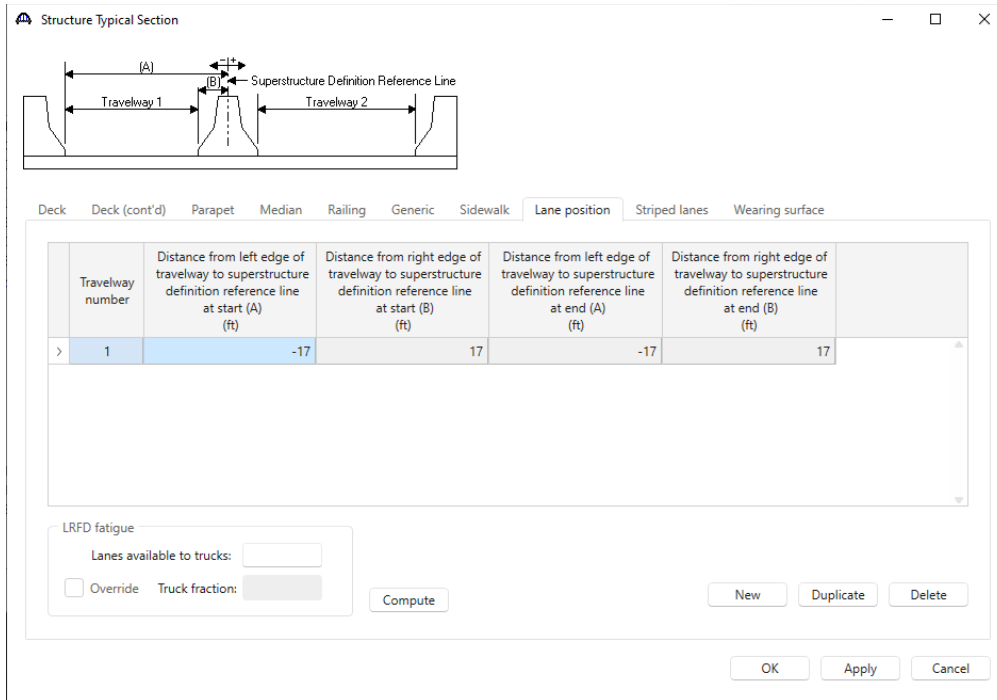
Structure Typical Section – Lane Positions

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.



PS14 – Prestressed Concrete I Beam Example

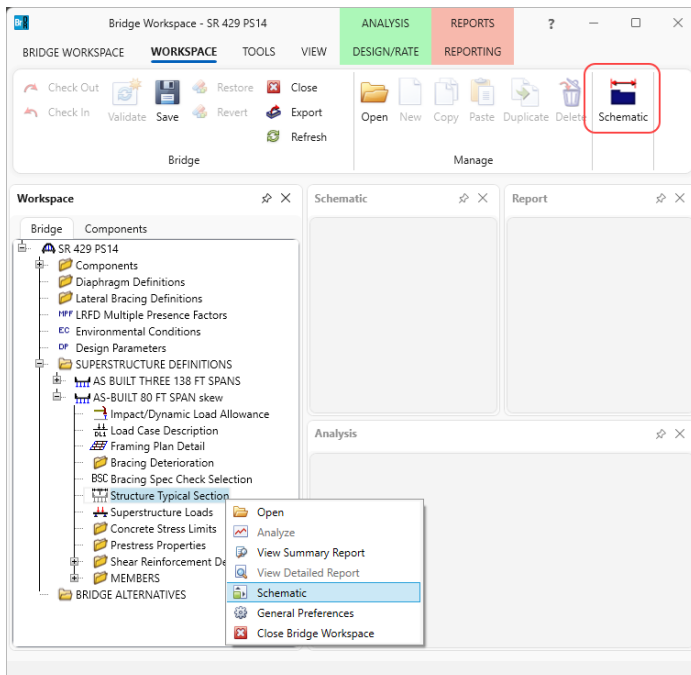
The **Lane Position** tab is populated as shown below.



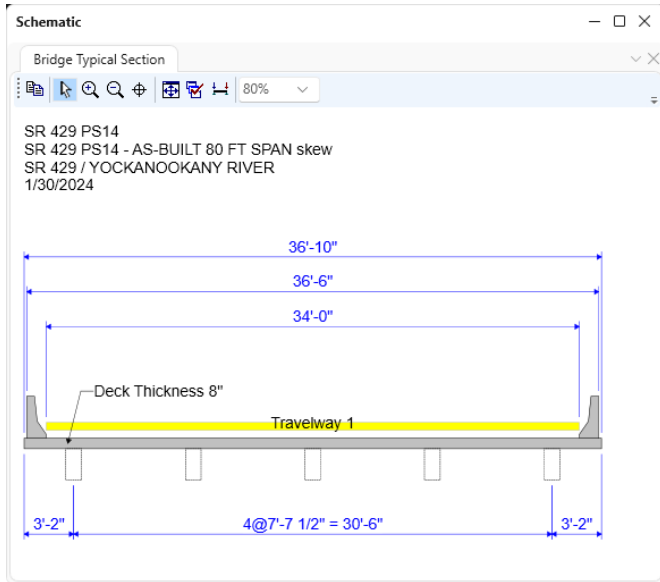
Click **OK** to apply the data and close the window.

Schematic – Structure Typical Section

While the **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).

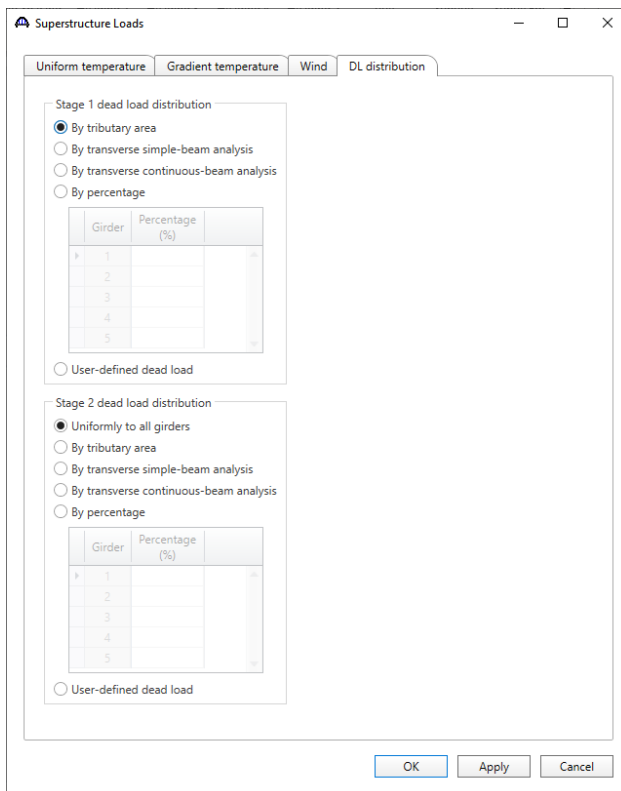


PS14 – Prestressed Concrete I Beam Example



Superstructure Loads

Double click on the **Superstructure Loads** node in the **Bridge Workspace** tree to open the **Superstructure Loads** window. Navigate to the **DL distribution** tab in this window. Select options in this window as shown below. The BrDR LRFD engine does not support the transverse continuous beam analysis option.



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

PS14 – Prestressed Concrete I Beam Example

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 data shown above the **Compute** button, select **Moderate** for the **Corrosion condition** and select the **Class FX Beam Concrete 138 FT** concrete 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.

Stress Limit Sets - Concrete

Name: 80 FT STRESS LIMIT

Description:

Corrosion condition: Moderate

Final allowable tension stress limit coef. (US) override:

Concrete material: Class FX Beam Concrete 80 FT

Compute

	LFD		LRFD	
Initial allowable compression:	2.52	ksi	2.73	ksi
Initial allowable tension:	0.1944222	ksi	0.1942822	ksi
Final allowable compression:	3	ksi	3	ksi
Final allowable tension:	0.4248529	ksi	0.4248529	ksi
Final allowable DL compression:	2	ksi	2.25	ksi
Final allowable slab compression:		ksi		ksi
Final allowable compression: (LL+1/2(Pe+DL))	2	ksi	2	ksi

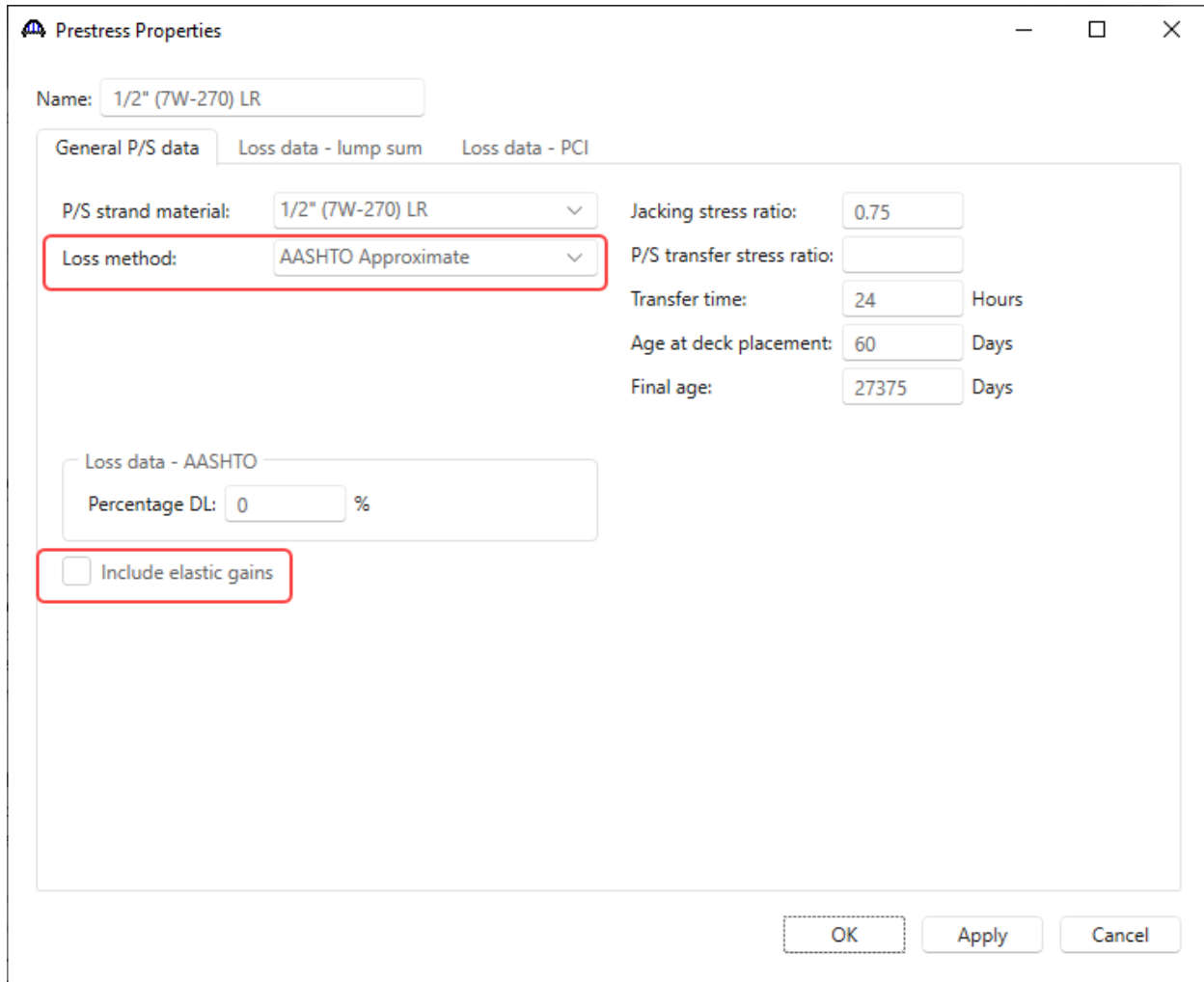
OK Apply Cancel

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

PS14 – Prestressed Concrete I Beam Example

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.



The screenshot shows the 'Prestress Properties' dialog box with the following settings:

- Name: 1/2" (7W-270) LR
- General P/S data tab selected.
- P/S strand material: 1/2" (7W-270) LR
- Loss method: AASHTO Approximate (highlighted with a red box)
- Jacking stress ratio: 0.75
- P/S transfer stress ratio: (empty)
- Transfer time: 24 Hours
- Age at deck placement: 60 Days
- Final age: 27375 Days
- Loss data - AASHTO: Percentage DL: 0 %
- Include elastic gains: (highlighted with a red box)

Buttons at the bottom: OK, Apply, Cancel.

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

The following loss methods are available in the BrDR LRFD engine.

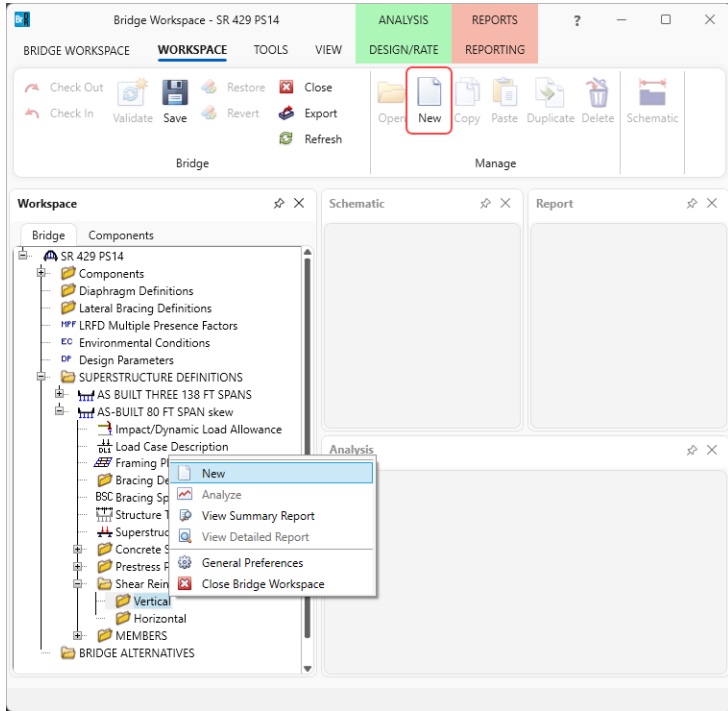
- AASHTO Approximate
- AASHTO Refined
- Lump Sum
- PCI
- Pre-2005 AASHTO Refined (AASHTO Refined, Third edition, 2004 without interims)

Another feature for prestress loss calculations in the BrDR LRFD engine is the ability to include elastic gains and losses due to dead load application.

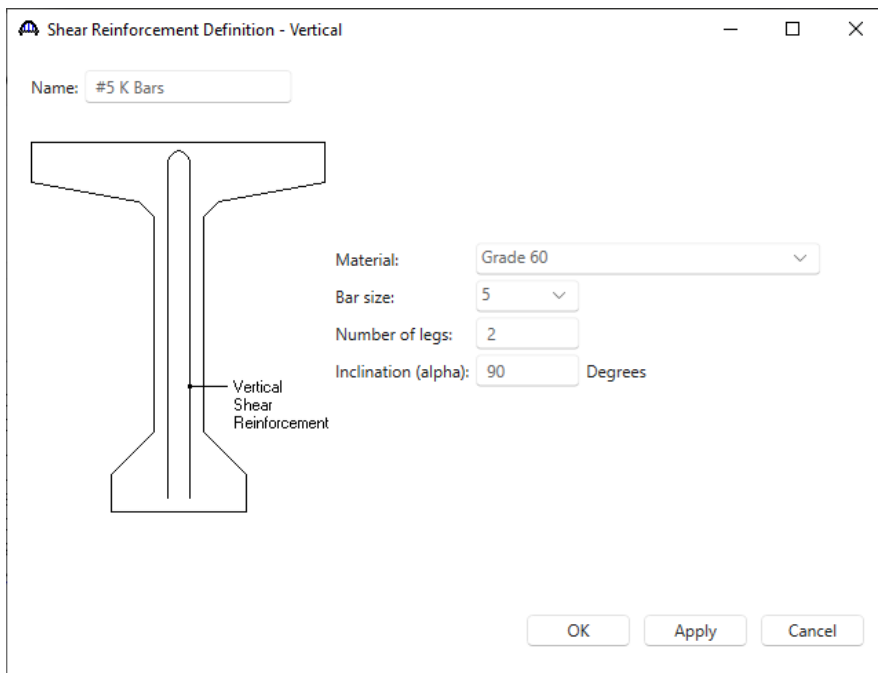
PS14 – Prestressed Concrete I Beam Example

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**).



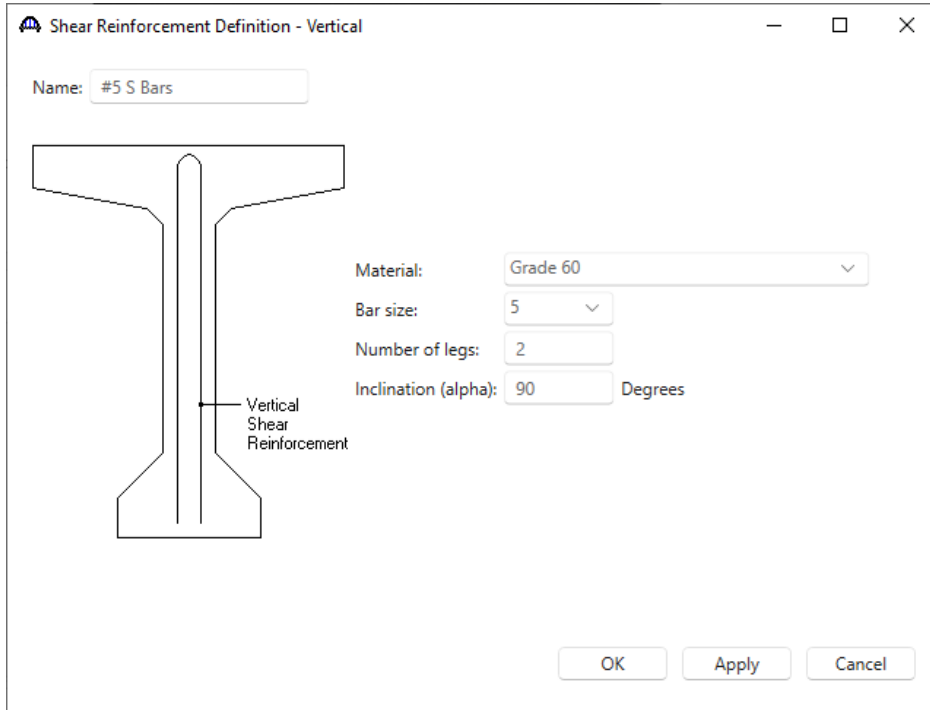
Define the stirrups as shown below.



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

PS14 – Prestressed Concrete I Beam Example

Define the #5 S Bars stirrup definition as shown below. Note that the #5 S Bars are the same definition as the #5 K Bars.



The dialog box titled "Shear Reinforcement Definition - Vertical" contains the following fields and controls:

- Name: #5 S Bars
- Material: Grade 60
- Bar size: 5
- Number of legs: 2
- Inclination (alpha): 90 Degrees

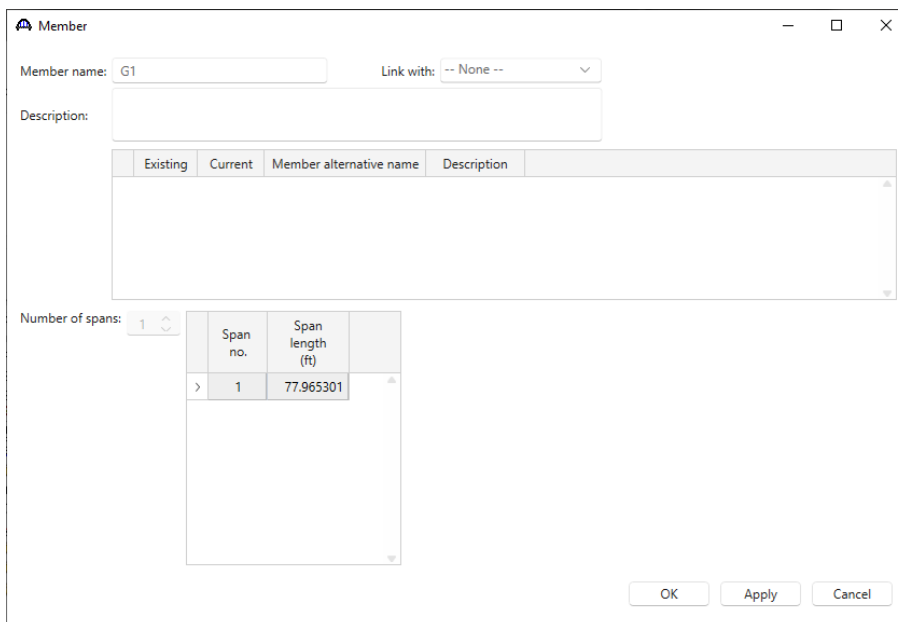
A diagram of an I-beam cross-section is shown on the left, with a vertical line through the web labeled "Vertical Shear Reinforcement".

Buttons: OK, Apply, Cancel

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

Describing a member:

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



The dialog box titled "Member" contains the following fields and controls:

- Member name: G1
- Link with: -- None --
- Description: (empty text box)
- Number of spans: 1
- Table with columns: Existing, Current, Member alternative name, Description
- Table with columns: Span no., Span length (ft)

Existing	Current	Member alternative name	Description

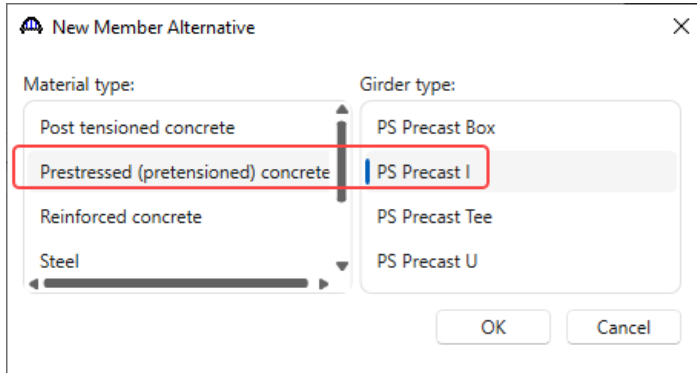
Span no.	Span length (ft)
> 1	77.965301

Buttons: OK, Apply, Cancel

PS14 – Prestressed Concrete I Beam Example

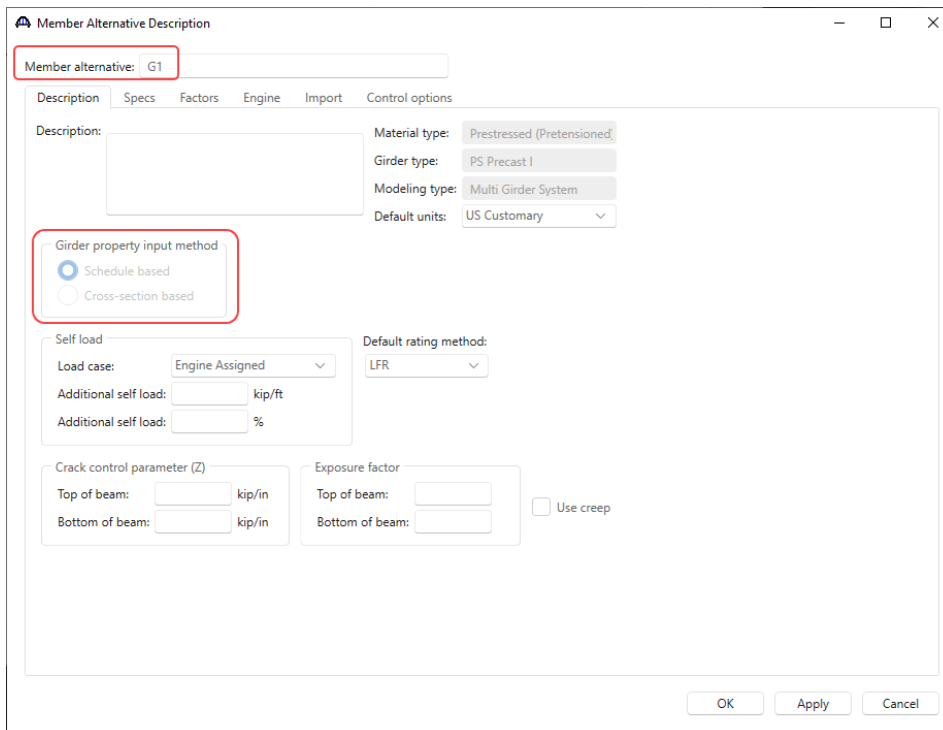
Defining a Member Alternative

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 as shown below. Enter the name for this member alternative as shown below. The **Schedule based Girder property input method** is the only input method available for a prestressed concrete beam.

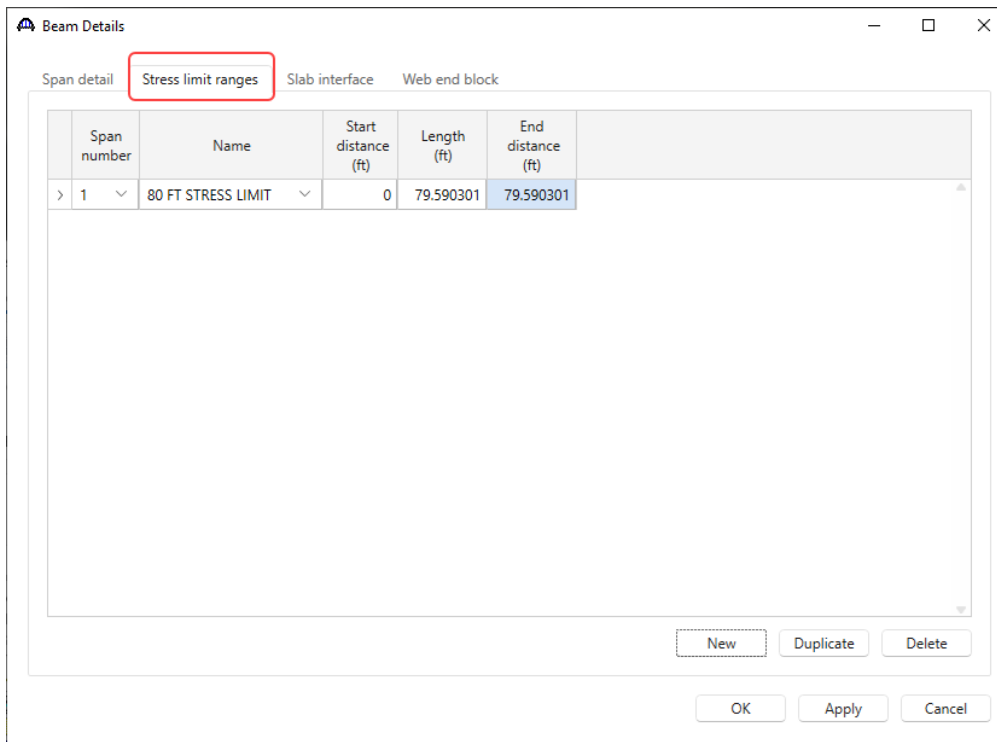
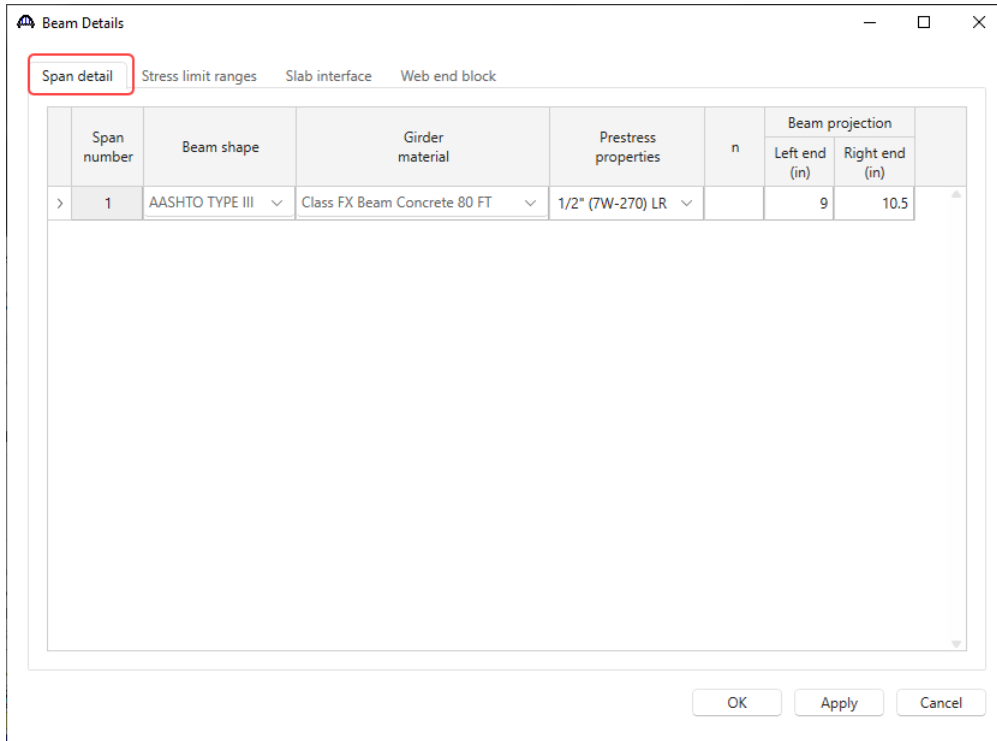


Click **OK** to apply the data and close the window.

PS14 – Prestressed Concrete I Beam Example

Beam Details

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



PS14 – Prestressed Concrete I Beam Example

The screenshot shows the 'Beam Details' dialog box with the 'Slab interface' tab selected. The 'Slab interface' tab is highlighted with a red box. The dialog box contains the following fields and options:

- Interface type: Intentionally Roughened (dropdown menu)
- Default interface width to beam widths:
- Interface width: in
- Cohesion factor: ksi
- Friction factor:
- K1:
- K2: ksi

Buttons: OK, Apply, Cancel

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

Shrinkage Time

Double-click on the **Shrinkage Time** node in the **Bridge Workspace** tree to open the **Shrinkage/Time** window.

Enter the data as shown below.

The screenshot shows the 'Shrinkage/Time' dialog box with the 'Time' tab selected. The dialog box contains the following fields and options:

- Beam:
- Curing method: Steam-cured (dropdown menu)
- Deck:
- Curing method: Moist-cured (dropdown menu)
- Drying time: Days
- Consider deck differential shrinkage loads

Buttons: OK, Apply, Cancel

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

PS14 – Prestressed Concrete I Beam Example

Strand Layout - Span 1
160%

Description type

P and CGS only Strands in rows

Strand configuration type

Straight/Debonded Symmetry

Harped Harped and straight debonded

Mid span

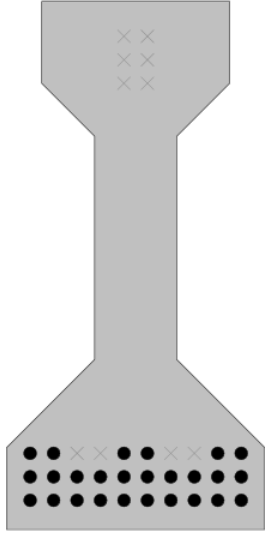
Left end

Right end

Harp point locations

Harp point	Distance (ft)	Radius (in)
> Left	31.79687	0
Right	31.79687	0

Notes:
Strand positions generated by the REVISED method. Please refer to Help for a description of this method.



Number of strands = 20
Number of harped strands = 0
CG of strands (measured from bottom of section) = 4.10 in

Legend:

- x No strand at this position at the current section location.
- x No strand at this position at the current location but a strand is harped to this position.
- A strand occupies this position at the current section location.
- The strand is debonded from the end of the beam to the current section location.
- The strand is debonded from the mid-span to the current section location.
- The strand is debonded at other section location. Hover over the strand for more information.
- The harped position of a harped strand.
- The mid-span position of a harped strand.
- The mid-span position of one strand and the harped position of another strand.
- Mild steel.

OK Apply Cancel

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

PS14 – Prestressed Concrete I Beam Example

Strand Layout - Span 1
160%

Description type

P and CGS only Strands in rows

Strand configuration type

Straight/Debonded Harped Harped and straight debonded

Symmetry

Mid span

Left end Right end

Harp point locations

Harp point	Distance (ft)	Radius (in)
> Left	31.79687	0
Right	31.79687	0

Notes:
Strand positions generated by the REVISED method. Please refer to Help for a description of this method.

Number of strands = 26
Number of harped strands = 6
CG of strands (measured from bottom of section) = 12.38 in

Legend:

- ✕ No strand at this position at the current section location.
- ✕ No strand at this position at the current location but a strand is harped to this position.
- A strand occupies this position at the current section location.
- The strand is debonded from the end of the beam to the current section location.
- The strand is debonded from the mid-span to the current section location.
- The strand is debonded at other section location. Hover over the strand for more information.
- The harped position of a harped strand.
- The mid-span position of a harped strand.
- The mid-span position of one strand and the harped position of another strand.
- Mild steel.

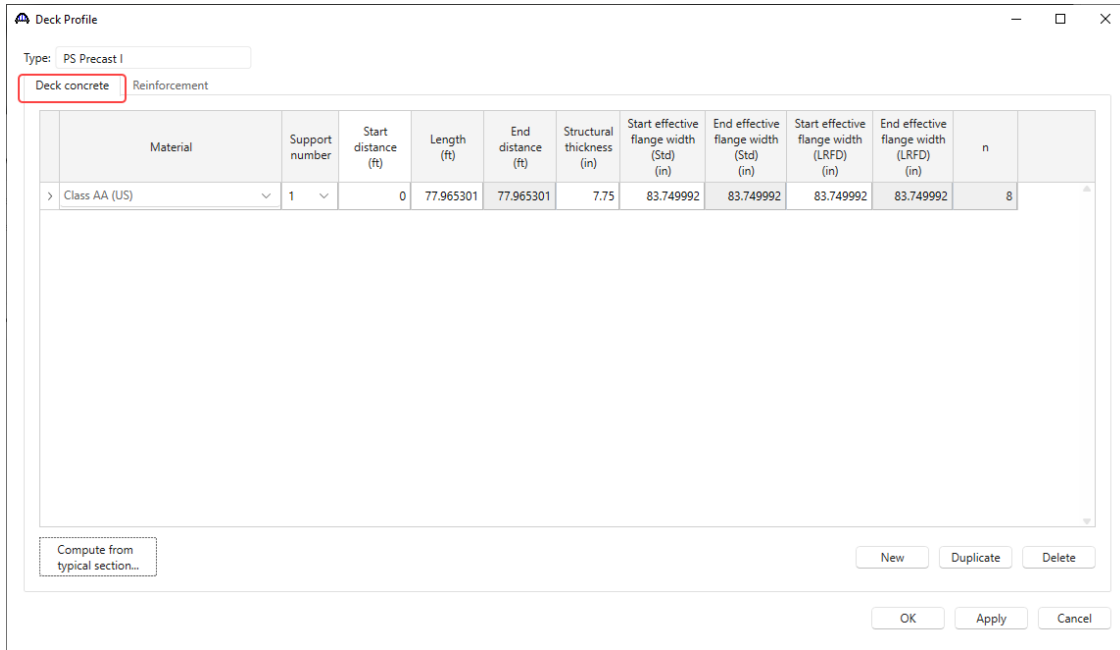
OK Apply Cancel

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

PS14 – Prestressed Concrete I Beam Example

Deck Profile

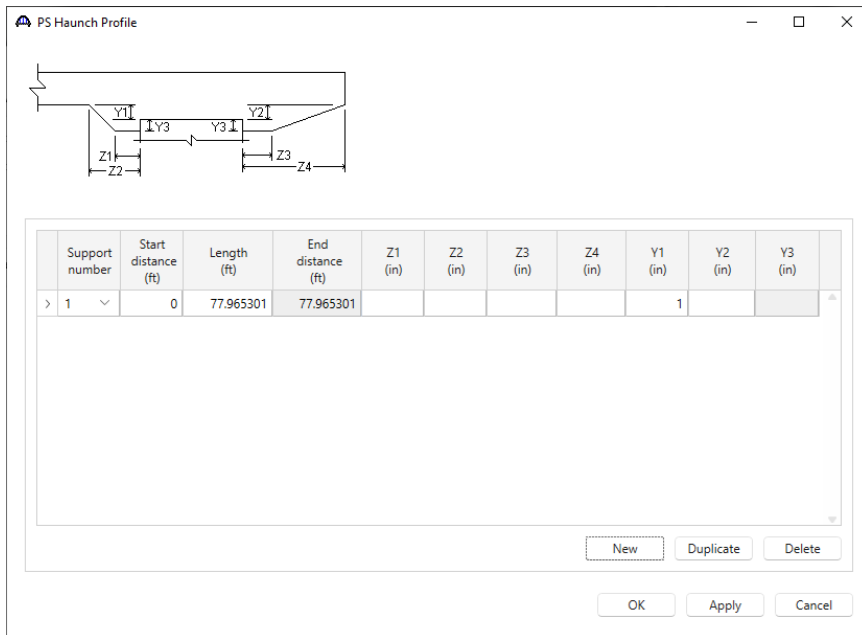
Next open the **Deck Profile** window by double-clicking the **Deck Profile** node in the **Bridge Workspace** tree and enter the data describing the structural properties of the deck. The window is shown below.



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

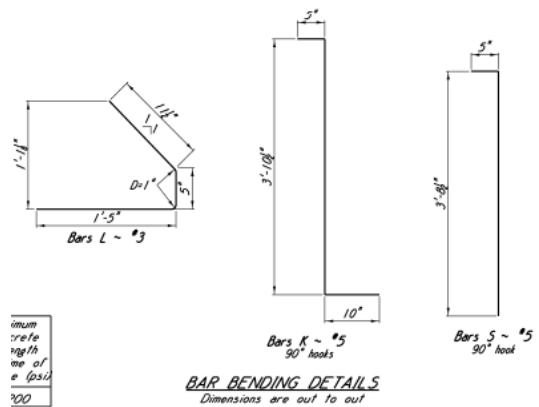
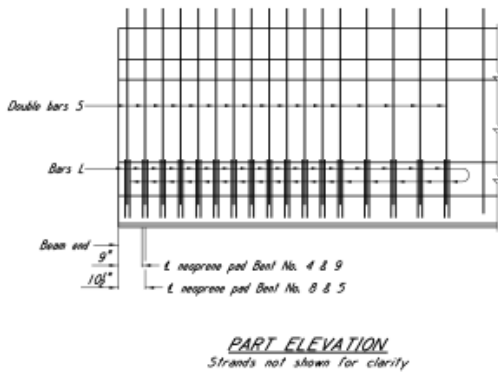
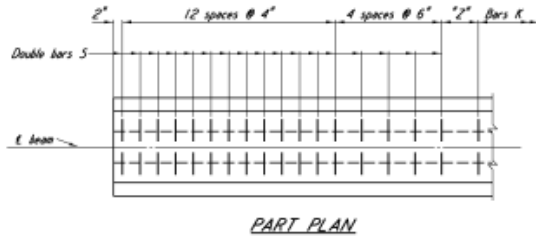


Click **OK** to apply the data and close the window.

PS14 – Prestressed Concrete I Beam Example

Shear Reinforcement Ranges

Use the Stirrup wizard from the **Shear Reinforcement Ranges** window to create the following shear stirrups. Double-click on the **Shear Reinforcement Ranges** node in the **Bridge Workspace** tree to open the **PS Shear Reinforcement Ranges** window.



PS14 – Prestressed Concrete I Beam Example

Enter data as shown below.

PS Shear Reinforcement Ranges
— □ ×

Vertical

Horizontal

Span: 1

	Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
	#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
	#5 S Bars	<input checked="" type="checkbox"/>	0.166666	12	4	4	4.166666
	#5 S Bars	<input checked="" type="checkbox"/>	4.166666	4	6	2	6.166666
	#5 K Bars	<input checked="" type="checkbox"/>	6.166666	1	7.544	0.628667	6.795333
	#5 K Bars	<input checked="" type="checkbox"/>	6.795333	44	18	66	72.795333
	#5 S Bars	<input checked="" type="checkbox"/>	72.795333	1	7.54	0.628333	73.423666
	#5 S Bars	<input checked="" type="checkbox"/>	73.423666	4	6	2	75.423666
>	#5 S Bars	<input checked="" type="checkbox"/>	75.423666	12	4	4	79.423666

Stirrup wizard...
Stirrup design tool...
View calcs

New
Duplicate
Delete

OK
Apply
Cancel

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

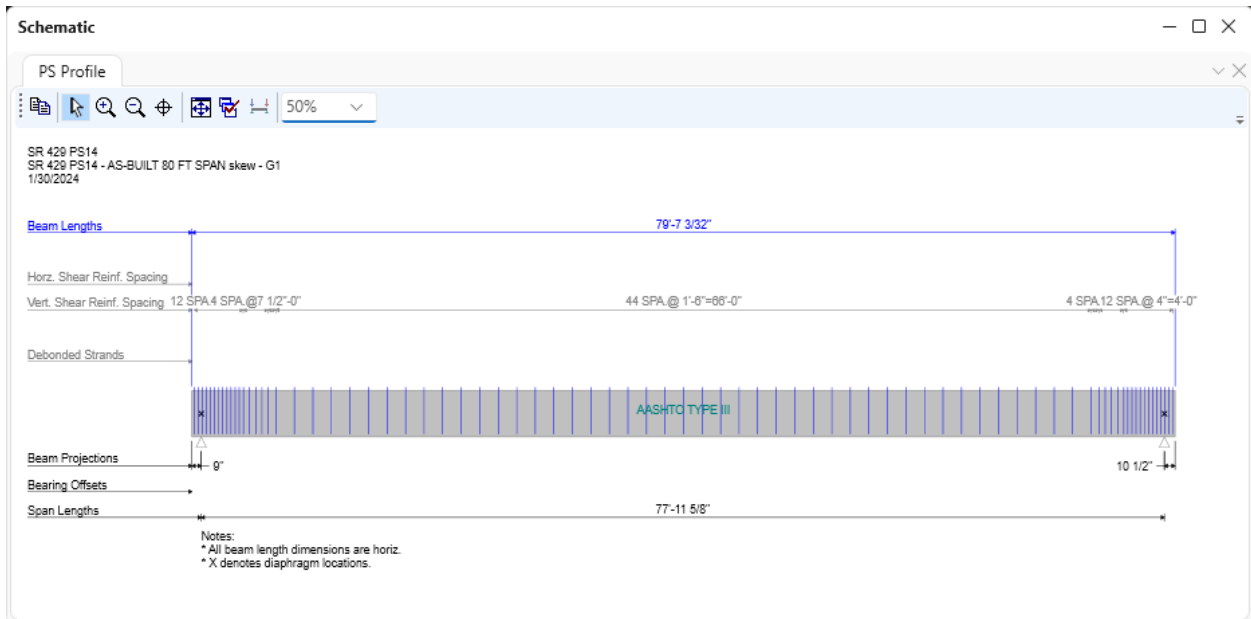
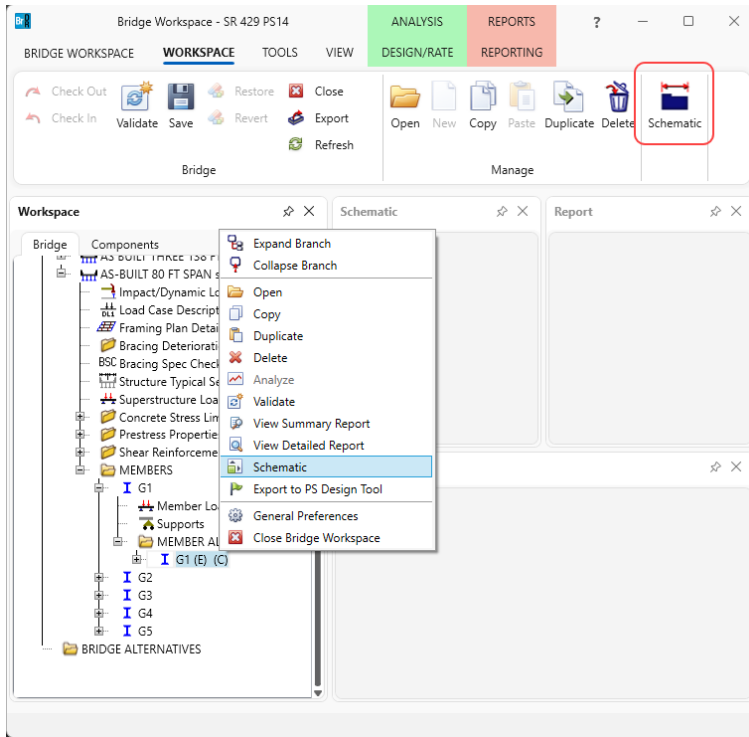
PS14 – Prestressed Concrete I Beam Example

Live Load Distribution

The live load distribution factors will be computed by the BrDR LRFD engine during analysis.

Schematic – G1 Member Alternative

While the member alternative **G1 (E) (C)** 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 **G1 (E) (C)** in the **Bridge Workspace** and select **Schematic** from the menu).



PS14 – Prestressed Concrete I Beam Example

Girder 1 is complete. Girders G2-G5 are similar but the lengths are different.

Harp Locations	
Girder	DRAPE
1	31.79688
2	31.83333
3	31.875
4	31.91667
5	31.95833

Enter the girder G2-G5 and see images to update the differences in windows shown below.

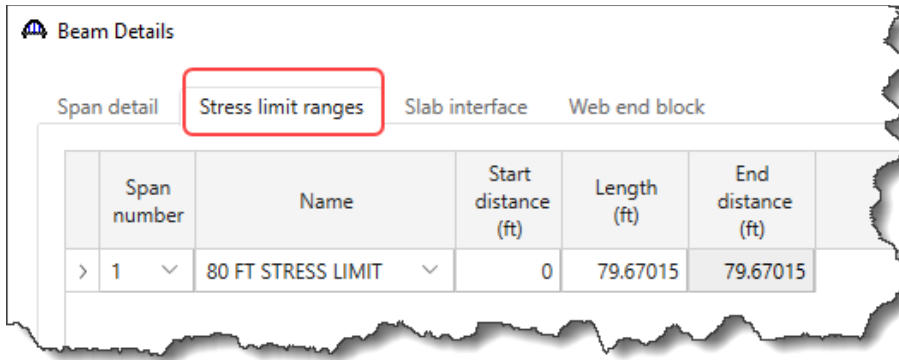
Girder G2

Member Alternative Description

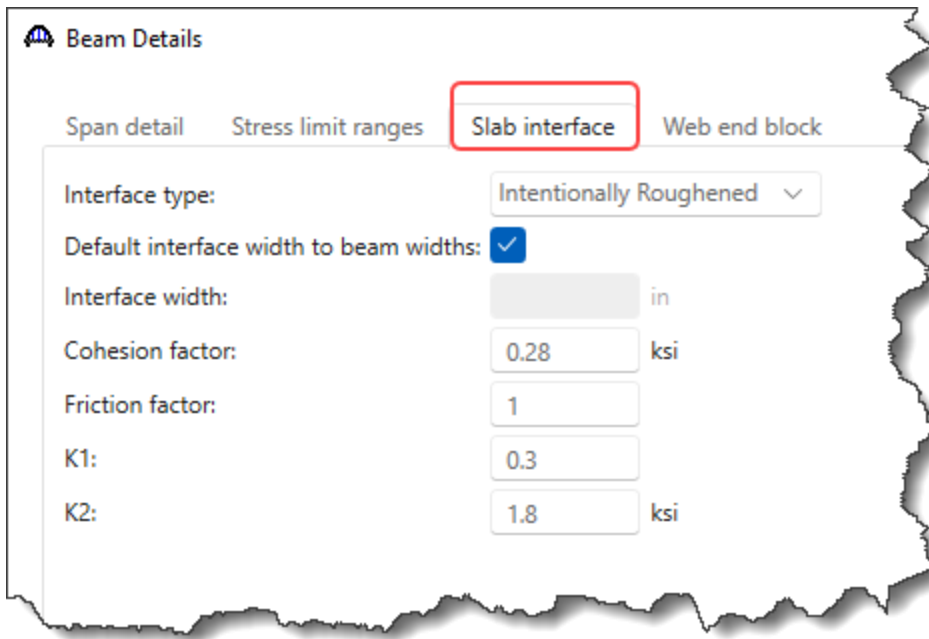
Beam Details – Span detail

Beam Details – Stress limit ranges

PS14 – Prestressed Concrete I Beam Example



Beam Details – Slab interface



Strand Layout

Strand layout is similar to **G1**, but the length is different. See below for **G2** harp locations and enter them in the window by following the steps used for **G1**.

Harp Locations	
Girder	DRAPE
2	31.83333

PS14 – Prestressed Concrete I Beam Example

Deck Profile – Deck concrete

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

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
> Class AA (US) ▾	1 ▾	0	78.04515	78.04515	7.75	91.5	91.5	91.5	91.5	8

PS Haunch Profile

PS Haunch Profile

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)	Y3 (in)
> 1 ▾	0	78.04515	78.04515			1	

PS14 – Prestressed Concrete I Beam Example

PS Shear Reinforcement Ranges

PS Shear Reinforcement Ranges
— □ ×

Vertical Horizontal

Span: 1

	Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
>	#5 S Bars	<input checked="" type="checkbox"/>	0.166666	12	4	4	4.166666
	#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
	#5 S Bars	<input checked="" type="checkbox"/>	4.166666	4	6	2	6.166666
	#5 K Bars	<input checked="" type="checkbox"/>	6.166666	1	8	0.666667	6.833333
	#5 K Bars	<input checked="" type="checkbox"/>	6.833333	44	18	66	72.833333
	#5 S Bars	<input checked="" type="checkbox"/>	72.833333	1	8	0.666667	73.5
	#5 S Bars	<input checked="" type="checkbox"/>	73.499999	4	6	2	75.499999
	#5 S Bars	<input checked="" type="checkbox"/>	75.499999	12	4	4	79.499999

Stirrup wizard...
Stirrup design tool...
View calcs
New
Duplicate
Delete

OK
Apply
Cancel

PS14 – Prestressed Concrete I Beam Example

Girder G3

Member Alternative Description

Member Alternative Description

Member alternative: **G3**

Description | Specs | Factors | Engine | Import | Control options

Description:

Material type: Prestressed (Pretensioned)
 Girder type: PS Precast I
 Modeling type: Multi Girder System
 Default units: US Customary

Girder property input method
 Schedule based
 Cross-section based

Self load
 Load case: Engine Assigned
 Additional self load: kip/ft
 Additional self load: %

Default rating method: LFR

Crack control parameter (Z)
 Top of beam: kip/in
 Bottom of beam: kip/in

Exposure factor
 Top of beam:
 Bottom of beam:

Use creep

Beam Details – Span detail

Beam Details

Span detail | Stress limit ranges | Slab interface | Web end block

Span number	Beam shape	Girder material	Prestress properties	n	Beam projection	
					Left end (in)	Right end (in)
> 1	AASHTO TYPE III	Class FX Beam Concrete 80 FT	1/2" (7W-270) LR		9	10.5

Beam Details – Stress limit ranges

Beam Details

Span detail | **Stress limit ranges** | Slab interface | Web end block

Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)
> 1	80 FT STRESS LIMIT	0	79.75	79.75

PS14 – Prestressed Concrete I Beam Example

Beam Details – Slab interface

Beam Details

Span detail Stress limit ranges **Slab interface** Web end block

Interface type: Intentionally Roughened ▾

Default interface width to beam widths:

Interface width: in

Cohesion factor: ksi

Friction factor:

K1:

K2: ksi

Strand Layout

Strand layout is similar to **G1**, but the length is different. See below for **G2** harp locations and enter them in the window by following the steps used for **G1**.

Harp Locations	
Girder	DRAPE
3	31.875

Deck Profile – Deck concrete

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

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
> Class AA (US) ▾	1 ▾	0	78.125	78.125	7.75	91.5	91.5	91.5	91.5	8

PS14 – Prestressed Concrete I Beam Example

PS Haunch Profile

PS Haunch Profile

The diagram shows a cross-section of a haunched beam. The top flange is horizontal. The web is vertical. The bottom flange is sloped. The dimensions are defined as follows: Z1 is the horizontal distance from the vertical web to the start of the bottom flange slope; Z2 is the horizontal distance from the vertical web to the end of the bottom flange slope; Y1 is the vertical distance from the top flange to the top of the bottom flange; Y3 is the vertical distance from the top of the bottom flange to the bottom of the web.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)	Y3 (in)
> 1	0	78.125	78.125			1	

PS Shear Reinforcement Ranges

PS Shear Reinforcement Ranges

The diagram shows a beam with vertical shear reinforcement ranges. The ranges are defined by start and end distances and spacing. The diagram labels 'Start Distance' and 'Spacing'.

Vertical Horizontal

Span: 1

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> #5 S Bars	<input checked="" type="checkbox"/>	0.166666	12	4	4	4.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	4.166666	4	6	2	6.166666
#5 K Bars	<input checked="" type="checkbox"/>	6.166666	1	8.5	0.708333	6.874999
#5 K Bars	<input checked="" type="checkbox"/>	6.874999	44	18	66	72.874999
#5 S Bars	<input checked="" type="checkbox"/>	72.874999	1	8.5	0.708333	73.583332
#5 S Bars	<input checked="" type="checkbox"/>	73.583333	4	6	2	75.583333
#5 S Bars	<input checked="" type="checkbox"/>	75.583333	12	4	4	79.583333

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Girder G4

Member Alternative Description

Member Alternative Description

Member alternative: **G4**

Description | Specs | Factors | Engine | Import | Control options

Description:

Material type: Prestressed (Pretensioned)
 Girder type: PS Precast I
 Modeling type: Multi Girder System
 Default units: US Customary

Girder property input method
 Schedule based
 Cross-section based

Self load
 Load case: Engine Assigned
 Additional self load: kip/ft
 Additional self load: %

Default rating method: LFR

Crack control parameter (Z)
 Top of beam: kip/in
 Bottom of beam: kip/in

Exposure factor
 Top of beam:
 Bottom of beam: Use creep

Beam Details – Span detail

Beam Details

Span detail | Stress limit ranges | Slab interface | Web end block

Span number	Beam shape	Girder material	Prestress properties	n	Beam projection	
					Left end (in)	Right end (in)
> 1	AASHTO TYPE III	Class FX Beam Concrete 80 FT	1/2" (7W-270) LR		9	10.5

Beam Details – Stress limit ranges

Beam Details

Span detail | **Stress limit ranges** | Slab interface | Web end block

Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)
> 1	80 FT STRESS LIMIT	0	79.82985	79.82985

PS14 – Prestressed Concrete I Beam Example

Beam Details – Slab interface

Beam Details

Span detail Stress limit ranges **Slab interface** Web end block

Interface type: Intentionally Roughened ▾

Default interface width to beam widths:

Interface width: in

Cohesion factor: ksi

Friction factor:

K1:

K2: ksi

Strand Layout

Strand layout is similar to **G1**, but the length is different. See below for **G2** harp locations and enter them in the window by following the steps used for **G1**.

Harp Locations	
Girder	DRAPE
4	31.91667

Deck Profile – Deck concrete

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

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
> Class AA (US)	1	0	78.20485	78.20485	7.75	91.5	91.5	91.5	91.5	8

PS14 – Prestressed Concrete I Beam Example

PS Haunch Profile

PS Haunch Profile

The diagram shows a cross-section of an I-beam with a haunch profile. The haunch is defined by dimensions Z1 (flange width), Z2 (web width), Y1 (top flange thickness), and Y3 (web thickness).

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)	Y3 (in)
> 1	0	78.20485	78.20485			1	

PS Shear Reinforcement Ranges

PS Shear Reinforcement Ranges

The diagram shows a beam with vertical lines representing shear reinforcement. The first line is labeled 'Start Distance' and the spacing between lines is labeled 'Spacing'.

Vertical Horizontal

Span: 1

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
> #5 S Bars	<input checked="" type="checkbox"/>	0.166666	12	4	4	4.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	4.166666	4	6	2	6.166666
#5 K Bars	<input checked="" type="checkbox"/>	6.166666	1	9	0.75	6.916666
#5 K Bars	<input checked="" type="checkbox"/>	6.916666	44	18	66	72.916666
#5 S Bars	<input checked="" type="checkbox"/>	72.916666	1	9	0.75	73.666666
#5 S Bars	<input checked="" type="checkbox"/>	73.666666	4	6	2	75.666666
#5 S Bars	<input checked="" type="checkbox"/>	75.666666	12	4	4	79.666666

Stirrup wizard... Stirrup design tool... View calcs

New Duplicate Delete

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

Girder G5

Member Alternative Description

Member Alternative Description

Member alternative: **G5**

Description | Specs | Factors | Engine | Import | Control options

Description:

Material type: Prestressed (Pretensioned)
 Girder type: PS Precast I
 Modeling type: Multi Girder System
 Default units: US Customary

Girder property input method
 Schedule based
 Cross-section based

Self load
 Load case: Engine Assigned
 Additional self load: kip/ft
 Additional self load: %

Default rating method: LFR

Crack control parameter (Z)
 Top of beam: kip/in
 Bottom of beam: kip/in

Exposure factor
 Top of beam:
 Bottom of beam: Use creep

Beam Details – Span detail

Beam Details

Span detail | Stress limit ranges | Slab interface | Web end block

Span number	Beam shape	Girder material	Prestress properties	n	Beam projection	
					Left end (in)	Right end (in)
> 1	AASHTO TYPE III	Class FX Beam Concrete 80 FT	1/2" (7W-270) LR		9	10.5

Beam Details – Stress limit ranges

Beam Details

Span detail | **Stress limit ranges** | Slab interface | Web end block

Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)
> 1	80 FT STRESS LIMIT	0	79.909699	79.909699

PS14 – Prestressed Concrete I Beam Example

Beam Details – Slab interface

Beam Details

Span detail Stress limit ranges **Slab interface** Web end block

Interface type: Intentionally Roughened ▾

Default interface width to beam widths:

Interface width: in

Cohesion factor: ksi

Friction factor:

K1:

K2: ksi

Strand Layout

Strand layout is similar to **G1**, but the length is different. See below for **G2** harp locations and enter them in the window by following the steps used for **G1**.

Harp Locations	
Girder	DRAPE
5	31.95833

Deck Profile – Deck concrete

Deck Profile

Type: PS Precast I

Deck concrete Reinforcement

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
Class AA (US)	1	0	78.284699	78.284699	7.75	83.749992	83.749992	83.749992	83.749992	8

PS14 – Prestressed Concrete I Beam Example

PS Haunch Profile

The diagram shows a haunched beam profile with dimensions Z1, Z2, Z3, Z4, Y1, Y2, and Y3. The table below provides the numerical values for these dimensions for support 1.

Support number	Start distance (ft)	Length (ft)	End distance (ft)	Z1 (in)	Z2 (in)	Z3 (in)	Z4 (in)	Y1 (in)	Y2 (in)	Y3 (in)
1	0	78.284699	78.284699					1		

PS Shear Reinforcement Ranges

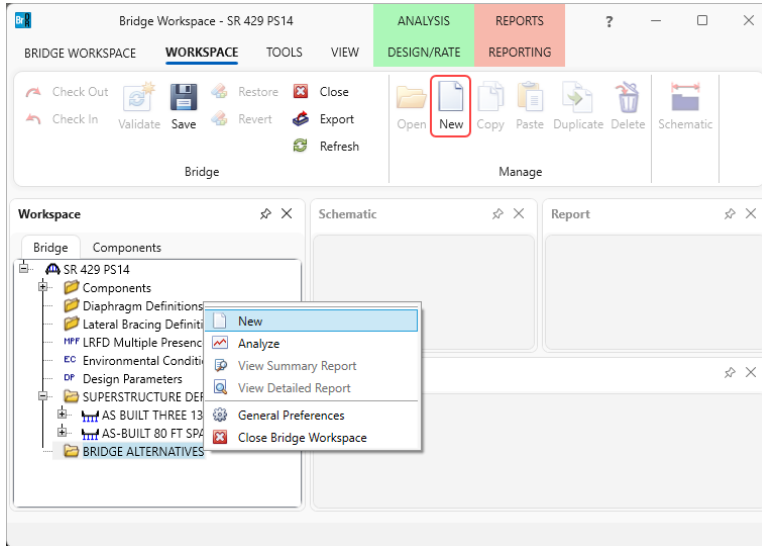
The diagram shows a beam with vertical and horizontal reinforcement ranges. The table below details the configuration for span 1.

Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	12	4	4	4.166666
#5 S Bars	<input checked="" type="checkbox"/>	0.166666	1	0	0	0.166666
#5 S Bars	<input checked="" type="checkbox"/>	4.166666	4	6	2	6.166666
#5 K Bars	<input checked="" type="checkbox"/>	6.166666	1	9.5	0.791667	6.958333
#5 K Bars	<input checked="" type="checkbox"/>	6.958333	44	18	66	72.958333
#5 S Bars	<input checked="" type="checkbox"/>	72.958333	1	9.5	0.791667	73.75
#5 S Bars	<input checked="" type="checkbox"/>	73.749999	4	6	2	75.749999
#5 S Bars	<input checked="" type="checkbox"/>	75.749999	12	4	4	79.749999

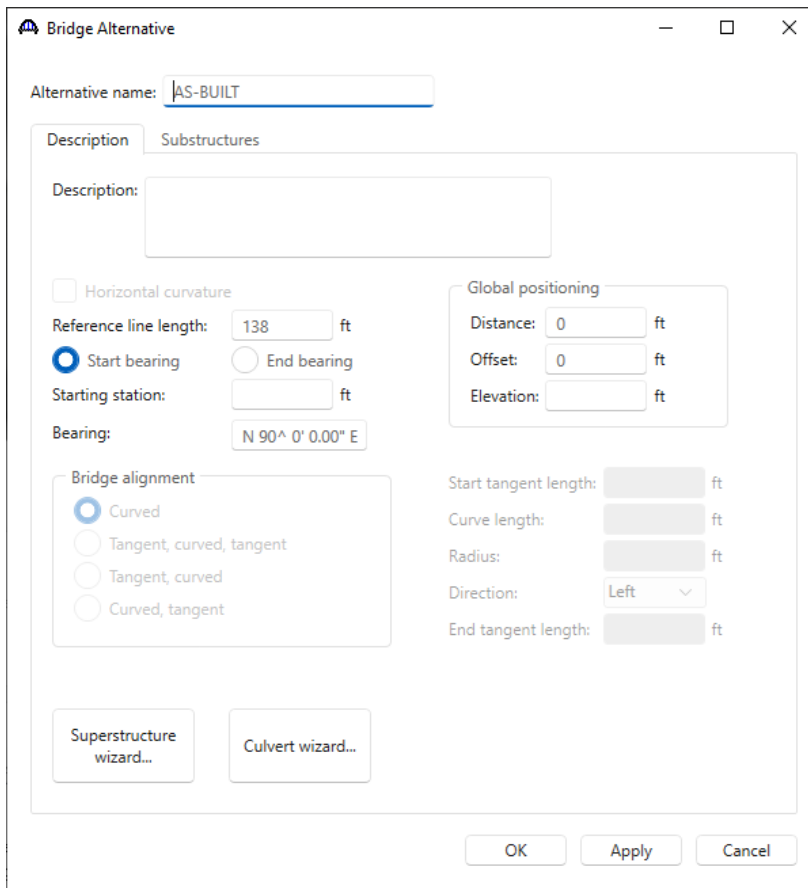
PS14 – Prestressed Concrete I Beam Example

Bridge Alternative

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

A screenshot of the "Bridge Alternative" dialog box. The "Alternative name" field contains "AS-BUILT". The "Description" field contains "Substructures". The "Horizontal curvature" checkbox is unchecked. The "Reference line length" is "138 ft". The "Start bearing" radio button is selected, and the "End bearing" radio button is unselected. The "Starting station" field is empty. The "Bearing" field contains "N 90^0' 0.00" E". The "Global positioning" section has "Distance" set to "0 ft", "Offset" set to "0 ft", and "Elevation" is empty. The "Bridge alignment" section has "Curved" selected, "Tangent, curved, tangent", "Tangent, curved", and "Curved, tangent" are unselected. The "Start tangent length", "Curve length", "Radius", and "End tangent length" fields are empty. The "Direction" dropdown menu is set to "Left". At the bottom, there are "Superstructure wizard..." and "Culvert wizard..." buttons. At the very bottom of the dialog are "OK", "Apply", and "Cancel" buttons.

PS14 – Prestressed Concrete I Beam Example

Expand the **AS-BUILT** node in the **Bridge Workspace** tree. 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 name: AS BUILT THREE 138 FT SPANS

Description

Reference line

Distance: 0 ft

Offset: 0 ft

Angle: 0 Degrees

Starting station: ft

OK Apply Cancel

Expand the **AS BUILT THREE 138 FT SPANS** node in the **Bridge Workspace** tree. 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.

Alternative name: AS BUILT

Description:

Superstructure definition: AS BUILT THREE 138 FT SPANS

Superstructure type: Girder

Number of main members: 5

Span	Length (ft)
1	136.708333
2	137.166666
3	136.708333

OK Apply Cancel

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

PS14 – Prestressed Concrete I Beam Example

Similarly add another **Superstructure** definition and **Superstructure alternative** as shown below.

Superstructure name: AS BUILT 80 FT SPAN

Description Alternatives Vehicle path Engine Substructures

Description:

Reference line

Distance: 0 ft

Offset: 0 ft

Angle: 0 Degrees

Starting station: ft

OK Apply Cancel

Alternative name: AS BUILT 80 FT

Description:

Superstructure definition: AS-BUILT 80 FT SPAN skew

Superstructure type: Girder

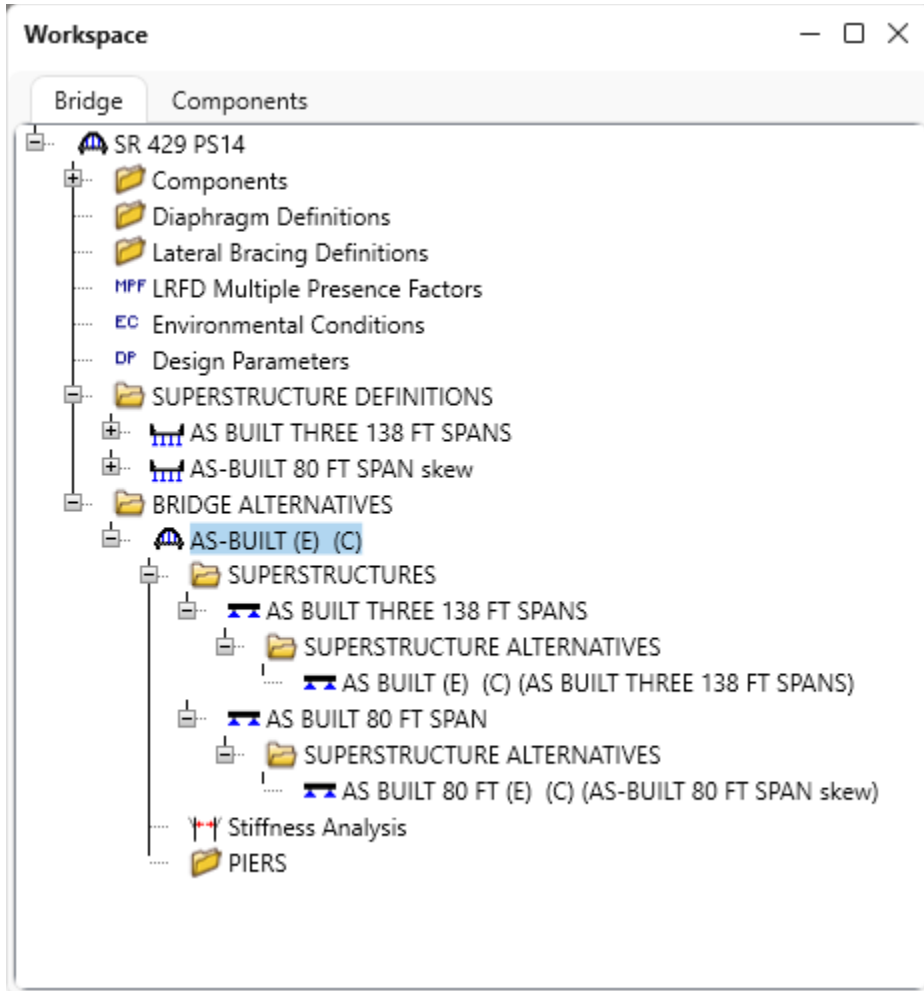
Number of main members: 5

Span	Length (ft)
1	78.125

OK Apply Cancel

PS14 – Prestressed Concrete I Beam Example

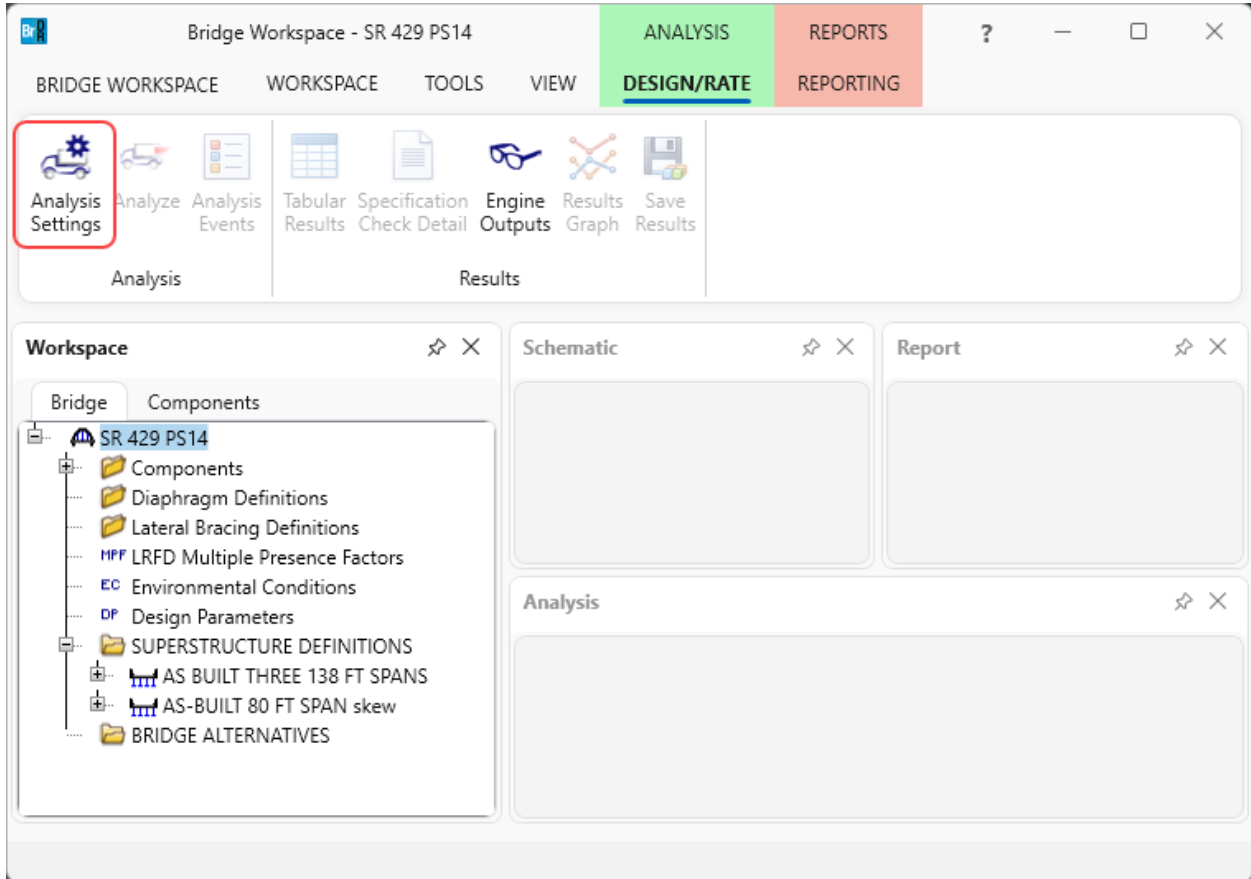
The partially expanded **Bridge Workspace** tree is shown below.



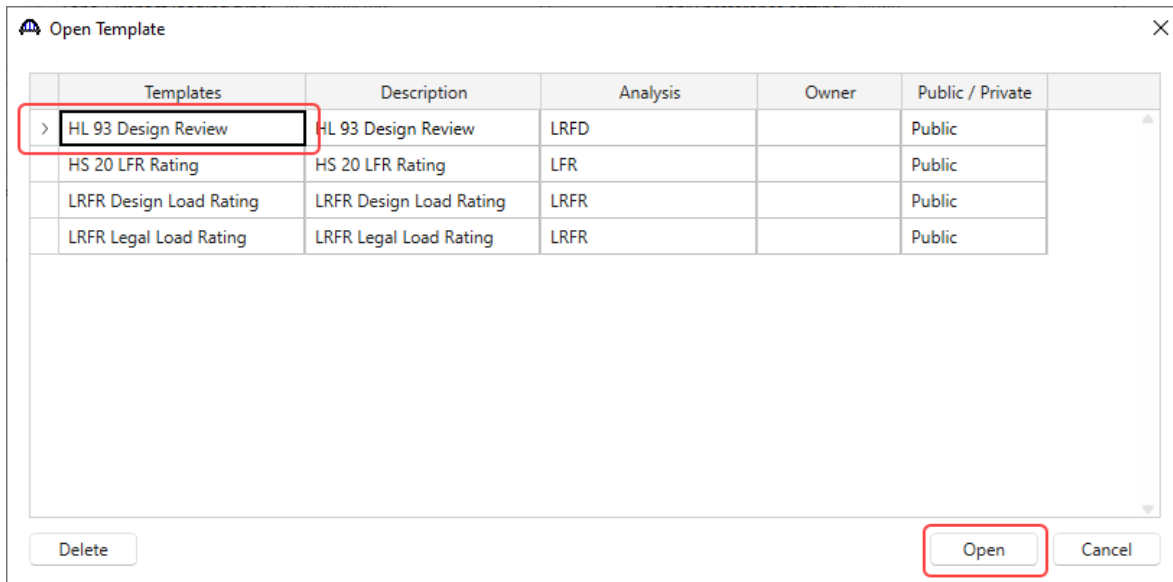
PS14 – Prestressed Concrete I Beam Example

Analysis and Results

To perform an LRFD design review of the entire bridge, select the bridge **SR 429 PS14** in the **Bridge Workspace** tree and select the **Analysis Settings** button on the **Analysis** group of the **DESIGN/RATE** ribbon as shown below:

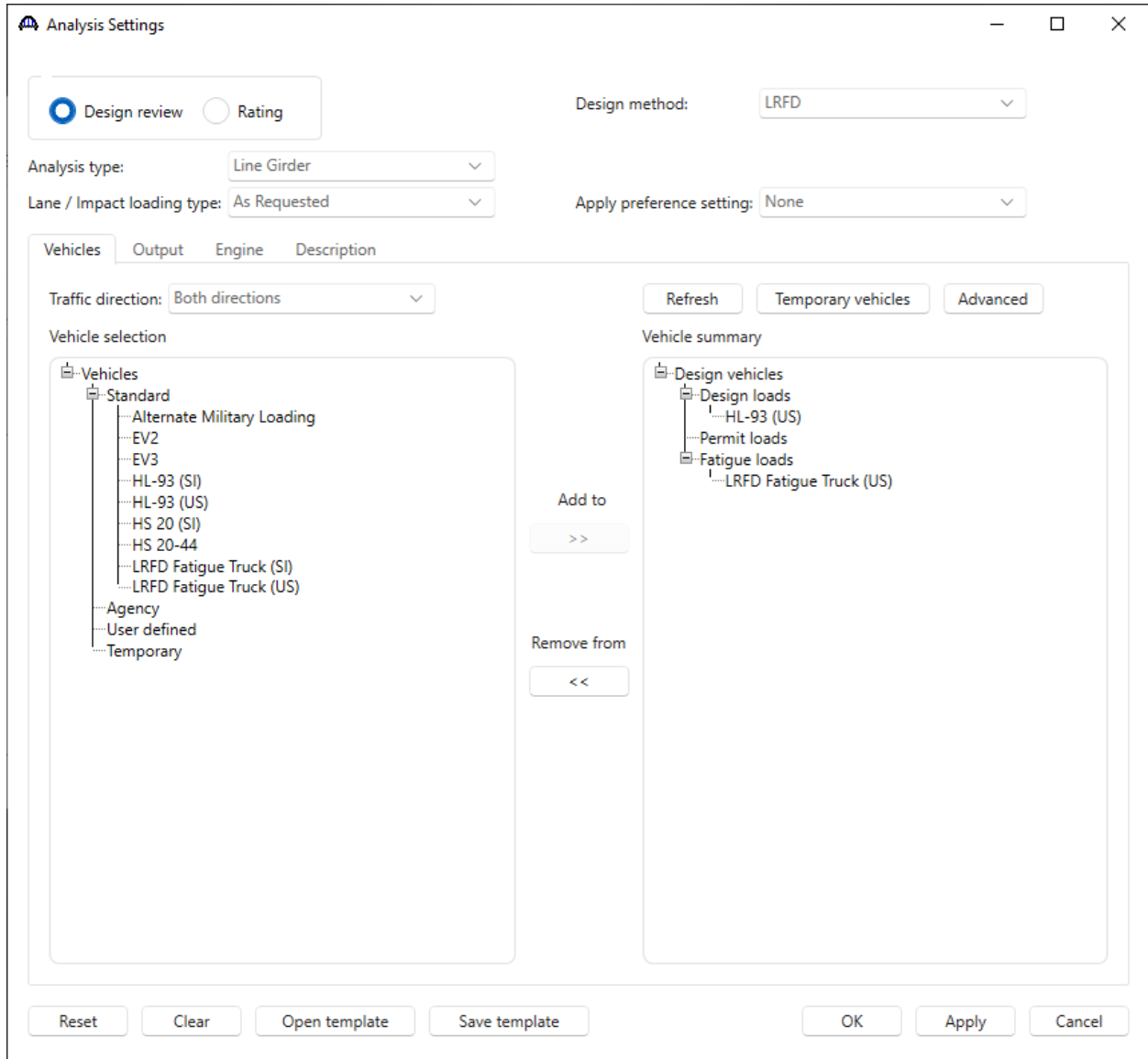


Click the **Open Template** button and select the **HL93 Design Review** to be used in the rating and click **Open**.



PS14 – Prestressed Concrete I Beam Example

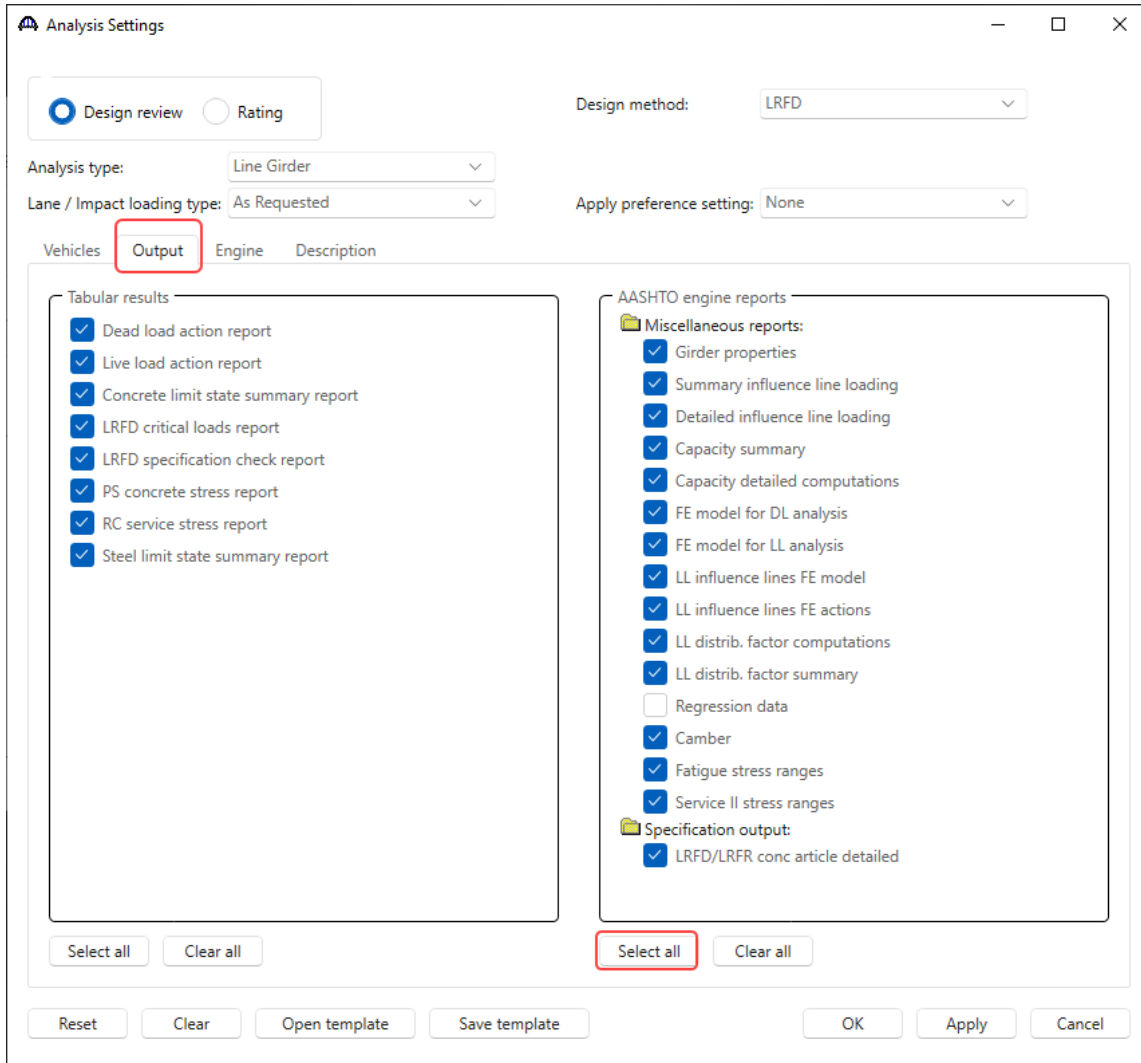
The **Analysis Settings** window will be populated as shown below.



PS14 – Prestressed Concrete I Beam Example

Analysis Settings - Output

Navigate to the Output tab and enter the **Analysis Settings** as shown below.

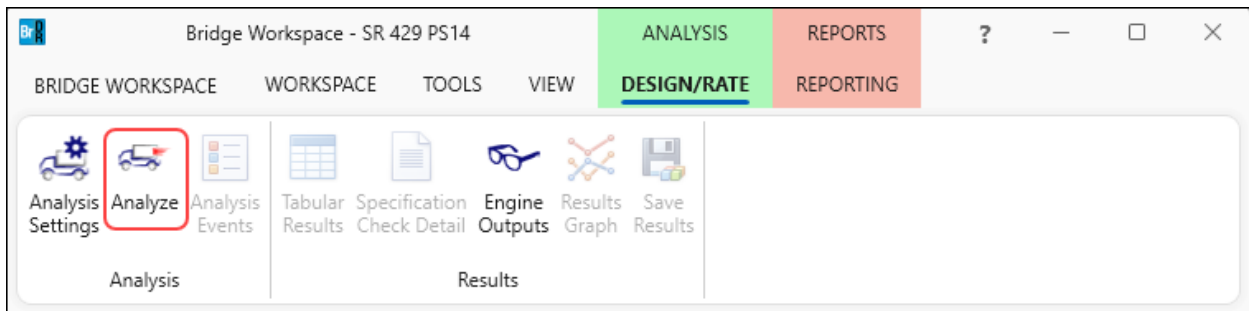


Click **OK** to apply the data and close the window.

Engine Outputs

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

The **Analysis** window should be reviewed for any warning messages.



PS14 – Prestressed Concrete I Beam Example

[Export of prestressed concrete beams to the BrDR LRFD analysis engine.](#)

The following steps are performed when performing a design review of a multi-span prestressed beam using the BrDR LRFD analysis engine:

1. Finite element models are generated for the dead load and live load analyses. A Stage 1 FE model is generated for the dead loads on the non-composite simple span prestressed concrete beam.

For Continuous method of analysis:

A Stage 2 FE model is generated for the continuous final span condition for composite dead load analysis.

A Stage 3 FE model is generated for the continuous final span condition for the live load analysis.

For Continuous and Simple method of analysis:

Two Stage 2 FE models are generated:

Continuous final span condition

Simple span condition

Two Stage3 FE models are generated:

Continuous final span condition

Simple span condition

Stage 2 models contain section properties corresponding to the sustained modular ratio factor entered in BrDR (e.g., $2n$). Stage 3 models contain section properties corresponding to the modular ratio (n).

The model generated by the export to the BrDR LRFD analysis engine will always contain node points at the middle of each simple span, at simple support locations, at harp points, at debond locations and at prestress strand transfer length locations so that the prestress force distribution can be computed.

2. The Stage 1 and 2 FE models are analyzed for the dead load. The prestress loss calculations are then performed along with determining the prestress forces at transfer and the restraint effects for the creep and shrinkage analysis for multi-span structures.
3. The final analysis then takes place. The prestress forces at transfer are applied to the Stage 1 FE model solely to determine the prestress camber in the beam. They are not included in the load combination generation. Creep and shrinkage forces are applied to the Stage 2 FE model.

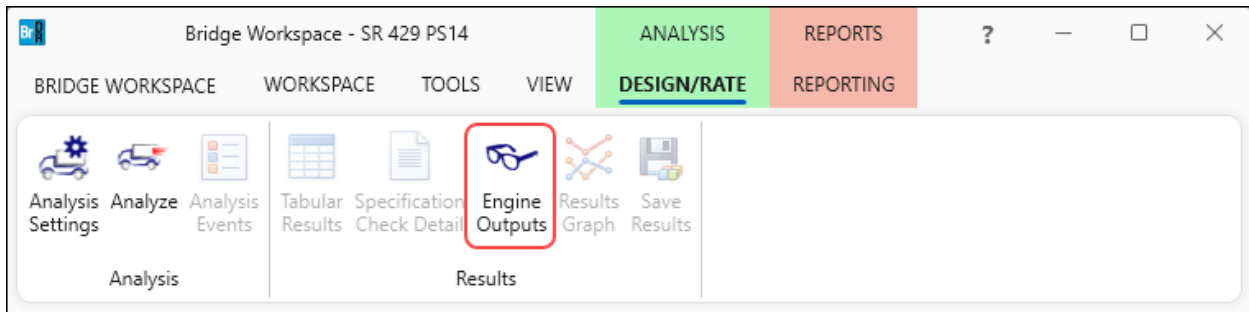
The Stage 1 and 2 FE models are analyzed for the dead load. The Stage 3 FE model is loaded with unit loads at each node to generate influence lines for the beam. The influence loads are then loaded with the selected vehicles to find the maximum live load effects.

PS14 – Prestressed Concrete I Beam Example

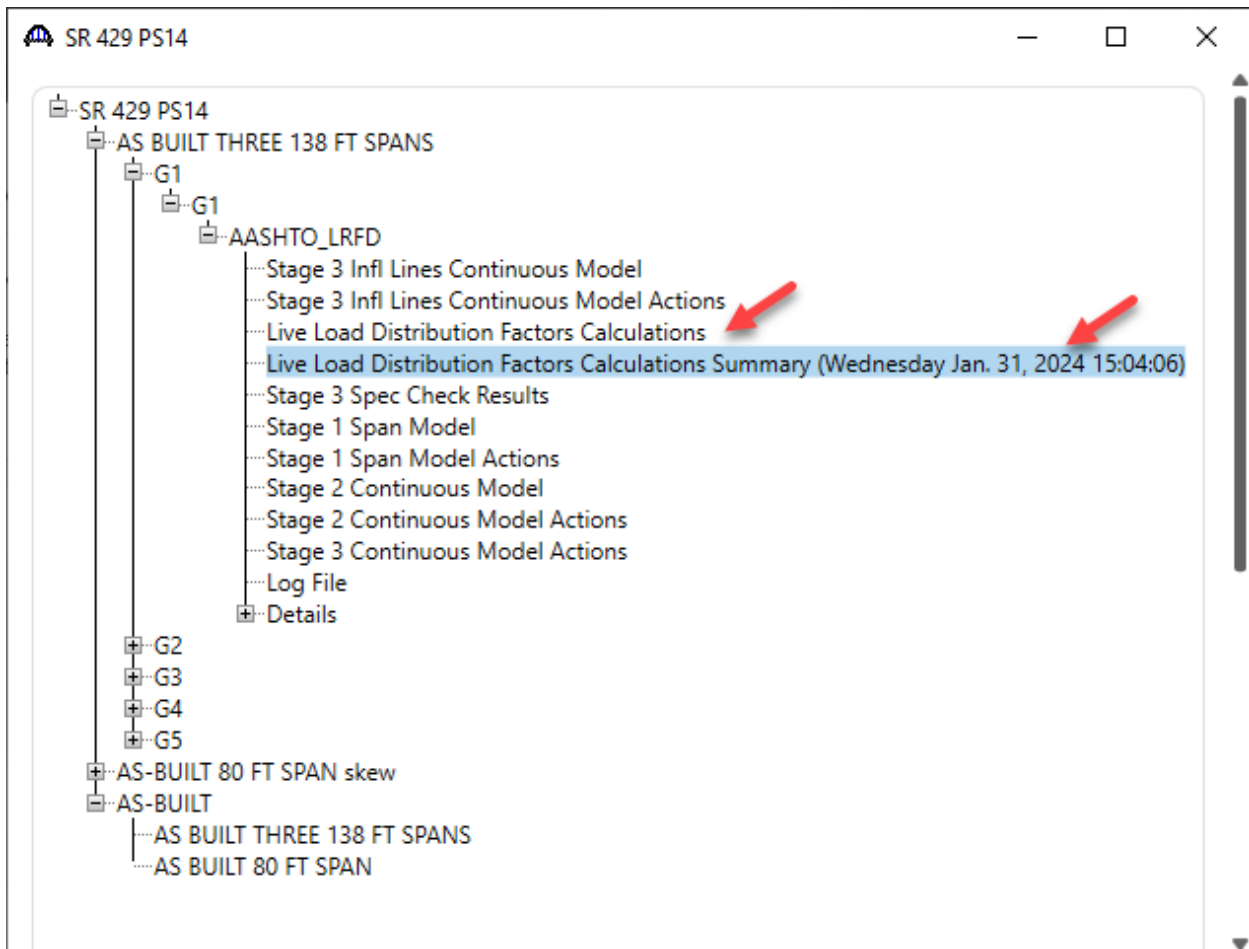
4. Load combinations are generated for the loadings and specification checks are performed at each of the nodes in the finite element model. For the Continuous and Simple method of analysis the maximum force effects between the 2 sets of models are used to generate the load combinations.

Engine Outputs

Click the **Engine Outputs** button from the **Results** group of the **DESIGN/RATE** ribbon to open the following window.



A summary and a detailed report of the computed live load distribution factors are available.



PS14 – Prestressed Concrete I Beam Example

```

LRFD Dist Factor Summary - Notepad
File Edit Format View Help
*****
** Note that this file contains the distribution factors      **
** computed by the BrD wizard based on the bridge description **
** in BrD on the date and time below.  These computed values **
** may not match those shown in BrD if the user has changed  **
** the BrD bridge description after these distribution        **
** factors were computed.                                    **
*****

Bridge: SR 429 PS14
Bridge ID: SR 429 PS14          NBI Structure ID: 00000
BID: 0

Superstructure Def: AS BUILT THREE 138 FT SPANS|
Member: G1
Member Alternative: G1

Date: 1/31/2024          Time: 3:04:05 PM

AASHTO LRFD Bridge Design Specifications, Edition 9, Interim 0

          Moment Distribution Factor Schedule

Start      End      Single Lane      Multi Lane
Distance   Distance   DF               DF
(ft)       (ft)       (Lanes)         (Lanes)
-----
  0.00     109.14     0.764(L)        0.621(A)
 109.14    174.72     0.764(L)        0.621(A)
 174.72    235.59     0.764(L)        0.621(A)
 235.59    301.18     0.764(L)        0.621(A)
 301.18    410.32     0.764(L)        0.621(A)

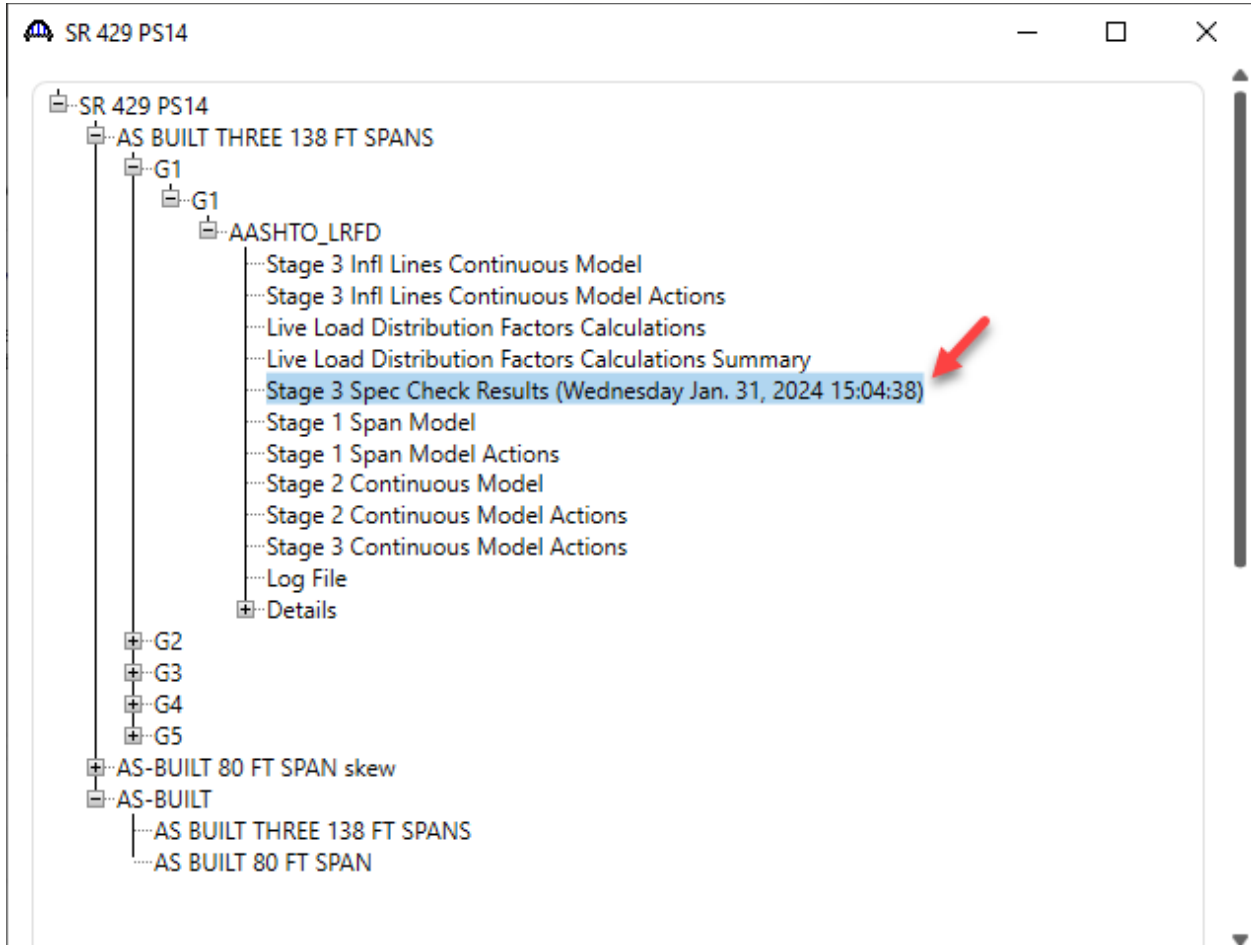
          Shear Distribution Factor Schedule

Start      End      Single Lane      Multi Lane
Distance   Distance   DF               DF
(ft)       (ft)       (Lanes)         (Lanes)
-----
  0.00      6.83      0.765(L)        0.640(A)
  6.83     20.49     0.764(L)        0.640(A)
 20.49     34.14     0.764(L)        0.640(A)
 34.14     47.80     0.764(L)        0.640(A)
 47.80     61.46     0.764(L)        0.640(A)
 61.46     68.29     0.764(L)        0.639(A)
 68.29    136.58     0.764(L)        0.639(A)
136.58    273.74     0.764(L)        0.639(A)
273.74    342.03     0.764(L)        0.639(A)
342.03    348.86     0.764(L)        0.639(A)
348.86    362.52     0.764(L)        0.640(A)
362.52    376.17     0.764(L)        0.640(A)
376.17    389.83     0.764(L)        0.640(A)
389.83    403.49     0.764(L)        0.640(A)
403.49    410.32     0.765(L)        0.640(A)

Ln 14, Col 48      80%      Windows (CRLF)      UTF-8
    
```


PS14 – Prestressed Concrete I Beam Example

A summary report of the specification check results is also available. This summary report lists the design ratios for each spec article at each spec check location point. The design ratio is the ratio of capacity to demand. A design ratio less than one indicates the demand is greater than the capacity and the spec article fails. A design ratio equal to 99.0 indicates the section is subject to zero demand. 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.



PS14 – Prestressed Concrete I Beam Example

The following file opens.

Stage 3 Spec Check Results

Bridge ID : SR 429 PS14
 Bridge : SR 429 PS14
 Superstructure Def : AS BUILT THREE 138 FT SPANS
 Member : G1
 Analysis Preference Setting :

AASHTO LRFD Specification, Edition 9, Interim 0

NBI Structure ID : 00000
 Bridge Alt : AS-BUILT
 Member Alt : G1

Specification Check Summary

Article	Status
Initial Stress at Transfer (5.9.2.3.1a, 5.9.2.3.1b)	Pass
Splitting Resistance in Anchorage Zones (5.9.4.4.1)	Pass
Final Stress due to Permanent and Transient Loads (5.9.2.3.2a, 5.9.2.3.2b)	Pass
Flexure (5.6.3.2, 5.6.3.3)	Pass
Shear (5.7.3.3, 5.7.2.5, 5.7.2.6, 5.7.3.5)	Pass
Deflection (5.6.3.5.2)	Pass

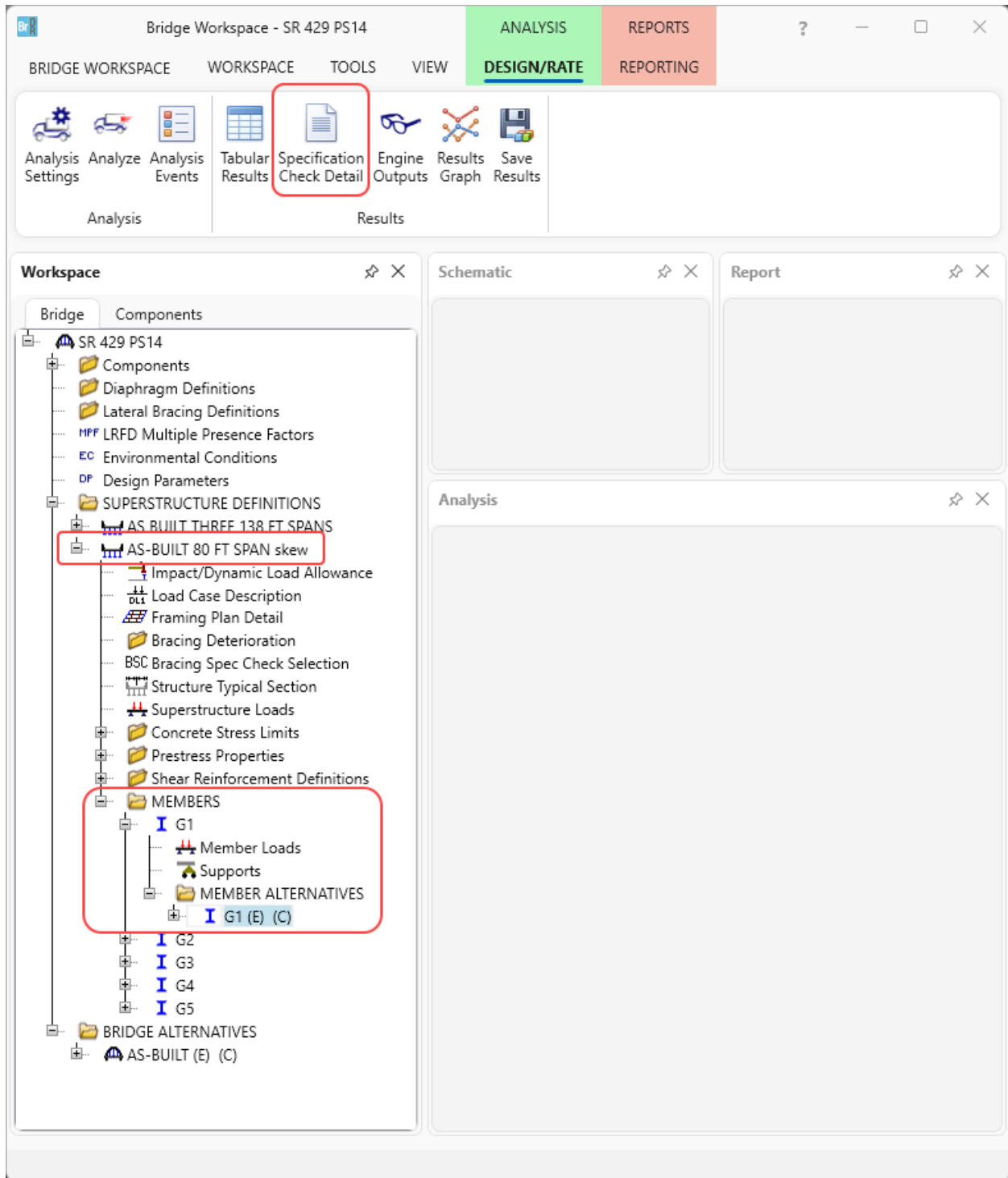
Initial Compression Stress At Transfer of Prestress

Location (ft)	Allowable Stress (ksi)	Actual Stress Top of Beam (ksi)	Actual Stress Bot of Beam (ksi)	Design Ratio	Code
0.000	-3.900	-0.101	-0.841	4.639	Pass
2.250	-3.900	-0.434	-3.330	1.171	Pass
6.267	-3.900	-0.473	-3.290	1.185	Pass
13.658	-3.900	-0.544	-3.217	1.212	Pass
27.315	-3.900	-0.570	-3.190	1.222	Pass
40.973	-3.900	-0.479	-3.284	1.188	Pass
53.705	-3.900	-0.290	-3.479	1.121	Pass
54.630	-3.900	-0.298	-3.471	1.124	Pass

PS14 – Prestressed Concrete I Beam 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.



PS14 – Prestressed Concrete I Beam Example

Articles: All articles
Format: Bullet list

Loss calcs, creep/shrinkage calcs

Specification reference	Limit State	Flex. Sense	Pass/Fail
✓ 2.5.2.6.2 Criteria for Deflection		N/A	Passed
✓ 5.4.2.1 Compressive Strength		N/A	Passed
5.4.2.5 Poisson's Ratio		N/A	General Comp.
5.4.2.6 Modulus of Rupture		N/A	General Comp.
5.4.2.8 Concrete Density Modification Factor		N/A	General Comp.
✓ 5.5.3.1 Fatigue Limit State - General		N/A	Passed
NA 5.5.3.2 Reinforcing Bars and Welded Wire Reinforcement		N/A	Not Required
5.5.4.2 PS Strength Limit State - Resistance Factors		N/A	General Comp.
5.6.2.2 Rectangular Stress Distribution		N/A	General Comp.
✓ 5.6.3.2 PS Flexural Resistance (Prestressed Concrete)		N/A	Passed
✓ 5.6.3.3 Minimum Reinforcement		N/A	Passed
✓ 5.7.2.5 Minimum Transverse Reinforcement		N/A	Passed
✓ 5.7.2.6 Maximum Spacing of Transverse Reinforcement		N/A	Passed
✓ 5.7.3.3 Nominal Shear Resistance		N/A	Passed
5.7.3.4 Procedures for Determining Shear Resistance		N/A	General Comp.
✓ 5.7.3.5 Longitudinal Reinforcement		N/A	Passed
✓ 5.7.4 Interface Shear Transfer		N/A	Passed
✓ 5.7.4.2 Minimum Area of Interface Shear Reinforcement		N/A	Passed
✓ 5.9.2.3.2a Compressive Stresses		N/A	Passed
✗ 5.9.2.3.2b Tensile Stresses		N/A	Failed
5.9.4.3.2 Bonded Strand		N/A	General Comp.
Computation of Vp		N/A	General Comp.
Cracked_Moment_of_Inertia Section Property Calculations		N/A	General Comp.
PS_Basic_Properties Calculation		N/A	General Comp.
PS_Gross_Composite_Section_Properties PS Gross Composite Section		N/A	General Comp.

PS14 – Prestressed Concrete I Beam Example

Open the spec check detail window for the flexural resistance (**5.6.3.2 PS Flexural Resistance (Prestressed Concrete)**) at the middle of the simple span (**38.98 ft**). The following is noted for this window, other spec articles are similar:

1. For each spec check location, both the left and right sides of the point are evaluated. The Deflection article is an exception to this since deflection must be the same between the left and right sides of a point.
2. The design ratio is printed out for the article. The design ratio is the ratio of capacity to demand. A design ratio less than one indicates the demand is greater than the capacity and the spec article fails. A design ratio equal to 99.0 indicates the section is subject to zero demand.
3. The Strength-I, Service-I, Service III and Fatigue limit states are the only limit states investigated. For each limit state, the max and min force effect is checked. Thus, each limit state shows two rows of data.
4. The LL load combination is shown in this column. If the location is not at a node in the FE model (e.g., the node is at a point where the rebar is fully developed), this column will list two load combinations separated by a comma. The first load combination is the combination considered at the left end and the second load combination is the combination considered at the right end of the FE element that contains this location. The resulting load displayed is a linear interpolation between the two displayed load cases.

5.6 Design for Flexural and Axial Effects - B Regions
 5.6.3 Flexural Members
 5.6.3.2 Flexural Resistance
 (AASHTO LRFD Bridge Design Specifications, Ninth Edition)

PS I Narrow - At Location = 38.9827 (ft) - Left Stage 3 **1**

Cross Section Properties

Name: AASHTO TYPE III
 Girder f'c = 5.00(ksi) Girder f'ci = 4.20(ksi)
 Slab f'c = 4.00(ksi)

Effective Slab Width = 83.75(in)
 Effective Slab Thickness = 7.75(in)
 Haunch Width = 16.00(in)
 Haunch Thickness = 0.50(in)
 Beam Height = 45.00(in)

Total Aps = 3.98(in²)
 Total CGS = 4.19(in)

Eff Aps = 3.98(in²)
 Eff CGS = 4.19(in)

Allow Moment Redistribution Control Option: No
 Moment Redistribution Qualified: No, redistribution did not occur.

Note: If the capacity has been overridden, the Resistance is computed as override phi*override capacity.
 Otherwise the Resistance is computed as per the Specification.

Limit State	Load Combination	Mu kip-ft	DeltaMu kip-ft	Phi	Mn kip-ft	-- Override --		Mr= Phi * Mn kip-ft	Mr/Mu	NA Depth in	Ac in ²	Max Conc Stress ksi
						Phi	Mn kip-ft					
STR-I	1	3788.52	---	1.000	4115.98	---	---	4115.98	1.086	4.59	347.63	0.00
STR-I	1	1009.68	---	1.000	4115.98	---	---	4115.98	4.077	4.59	347.63	0.00
STR-I	2	3469.92	---	1.000	4115.98	---	---	4115.98	1.186	4.59	347.63	0.00
STR-I	2	1009.68	---	1.000	4115.98	---	---	4115.98	4.077	4.59	347.63	0.00
SER-I	1	2485.40	---	1.000	4115.98	---	---	4115.98	1.656	4.59	347.63	0.00
SER-I	1	1121.86	---	1.000	4115.98	---	---	4115.98	3.669	4.59	347.63	0.00
SER-I	2	2303.34	---	1.000	4115.98	---	---	4115.98	1.787	4.59	347.63	0.00
SER-I	2	1121.86	---	1.000	4115.98	---	---	4115.98	3.669	4.59	347.63	0.00
SER-III	1	2212.69	---	1.000	4115.98	---	---	4115.98	1.860	4.59	347.63	0.00
SER-III	1	1121.86	---	1.000	4115.98	---	---	4115.98	3.669	4.59	347.63	0.00
SER-III	2	2067.05	---	1.000	4115.98	---	---	4115.98	1.991	4.59	347.63	0.00
SER-III	2	1121.86	---	1.000	4115.98	---	---	4115.98	3.669	4.59	347.63	0.00
FAT-I	3	1001.57	---	1.000	4115.98	---	---	4115.98	4.110	4.59	347.63	0.00
FAT-I	3	0.00	---	1.000	4115.98	---	---	4115.98	99.000	4.59	347.63	0.00
FAT-II	3	457.86	---	1.000	4115.98	---	---	4115.98	8.990	4.59	347.63	0.00
FAT-II	3	0.00	---	1.000	4115.98	---	---	4115.98	99.000	4.59	347.63	0.00

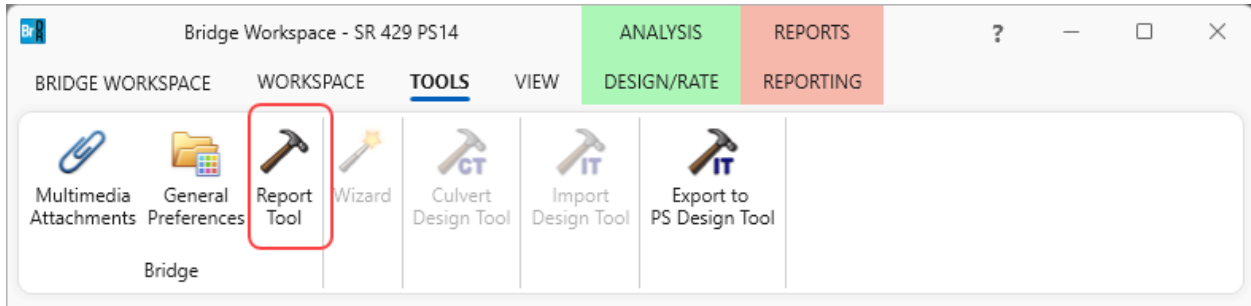
Load Combination Legend:
 Code Vehicle

The loads making up the Mu = 3788.52 k-ft for the maximum Strength-I limit state can be tracked down in Moment Summary report.

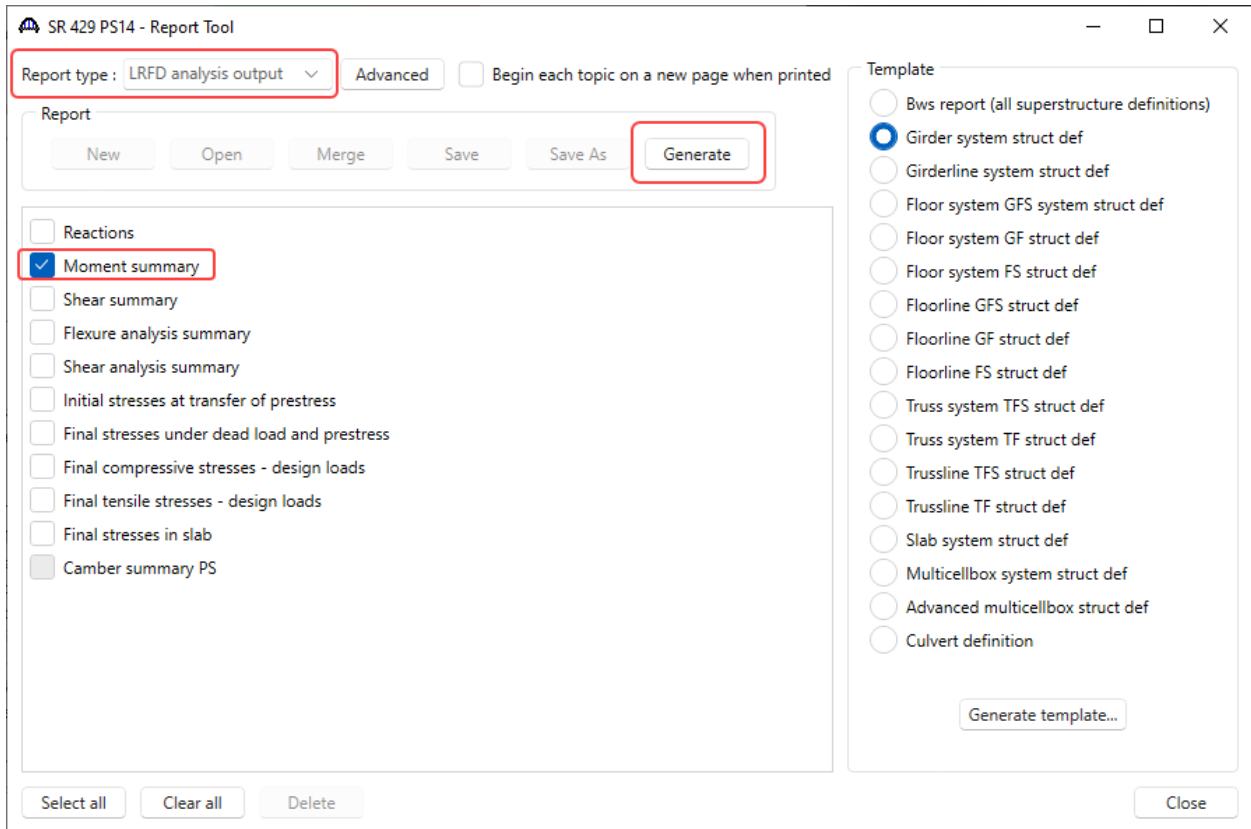
PS14 – Prestressed Concrete I Beam Example

Report Tool – Moment Summary

The **Moment Summary** report can be viewed by selecting the **Report Tool** button from the **Bridge** group of the **TOOLS** ribbon as shown below.



Select the **LRFD analysis output** as the **Report type**. Select the **Moment summary** checkbox and click on the **Generate** button to populate the moment summary report as shown below.



PS14 – Prestressed Concrete I Beam Example

The resulting maximum moment for Strength-I at the midspan is equal to $(1.25 * 1121.86) + (1.75 * 1363.54) = 3788.52$ kft.

Report: LRFD Analysis

Moment Summary
Live Load: HL-93 (US)
Impact = ** %

Span 1

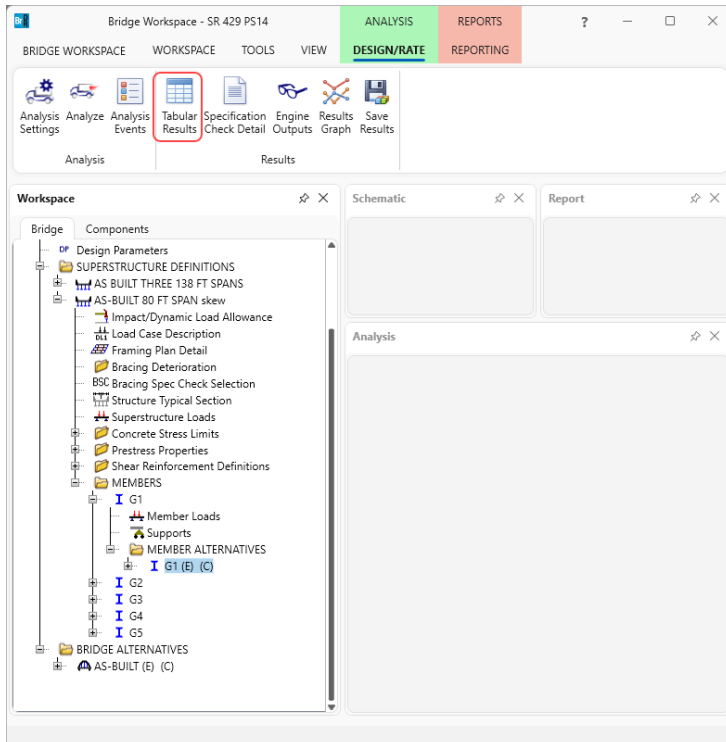
Location (ft)	Percent	DC (kip-ft)	DW (kip-ft)	+(LL+I) (kip-ft)	Controlling Live Load	-(LL+I) (kip-ft)	Controlling Live Load
0.00(R)	0.0	0.00	N/A	0.00	Tandem + Lane	0.00	Tandem + Lane
1.75(B)	2.2	98.46	N/A	128.37	Truck + Lane	0.00	Tandem + Lane
7.80(B)	10.0	403.87	N/A	521.64	Truck + Lane	0.00	Tandem + Lane
15.59(B)	20.0	717.99	N/A	913.69	Truck + Lane	0.00	Tandem + Lane
23.39(B)	30.0	942.37	N/A	1176.14	Truck + Lane	0.00	Tandem + Lane
31.05(B)	39.8	1075.37	N/A	1327.72	Truck + Lane	0.00	Tandem + Lane
31.19(B)	40.0	1076.99	N/A	1329.51	Truck + Lane	0.00	Tandem + Lane
38.98(B)	50.0	1121.86	N/A	1363.54	Truck + Lane	0.00	Tandem + Lane
46.78(B)	60.0	1076.99	N/A	1329.51	Truck + Lane	0.00	Tandem + Lane
47.04(B)	60.3	1073.90	N/A	1326.08	Truck + Lane	0.00	Tandem + Lane
54.58(B)	70.0	942.37	N/A	1176.14	Truck + Lane	0.00	Tandem + Lane
62.37(B)	80.0	717.99	N/A	913.69	Truck + Lane	0.00	Tandem + Lane
70.17(B)	90.0	403.87	N/A	521.64	Truck + Lane	0.00	Tandem + Lane
76.34(B)	97.9	91.58	N/A	119.41	Truck + Lane	0.00	Tandem + Lane
77.97(L)	100.0	0.00	N/A	0.00	Tandem + Lane	0.00	Tandem + Lane

Note:
"N/A" indicates not applicable
"***" indicates not available

Note:
Impact and distribution factors included in above live load moments.

Tabular Results

To review the dead load and live load analysis results, click on the **Tabular Results** button from the **Results** group of the **DESIGN/RATE** ribbon as shown below.




PS14 – Prestressed Concrete I Beam Example


The **Analysis Results** window will open as shown below.

Note: These values include dynamic load allowance, distribution factors and any live load scale factor entered on the **Analysis Settings** window.

Analysis Results - G1
— □ ×



Print



Print

Report type: Dead Load Actions Stage: Non-composite (Stage 1) Dead Load Case: Load Case 1 - Self Load(Stage 1)

Span	Location (ft)	% Span	Side	Moment (kip-ft)	Shear (kip)	Axial (kip)	Torsion (kip-ft)	Reaction (kip)	X Deflection (in)	Y Deflection (in)
1	0.00	0.0	Right	0.00	22.72	0.00	0.00	22.72	0.0000	0.0000
1	1.75	2.2	Both	38.87	21.70	0.00	0.00		0.0000	-0.0646
1	7.80	10.0	Both	159.42	18.18	0.00	0.00		0.0000	-0.2827
1	15.59	20.0	Both	283.41	13.63	0.00	0.00		0.0000	-0.5348
1	23.39	30.0	Both	371.98	9.09	0.00	0.00		0.0000	-0.7322
1	31.05	39.8	Both	424.48	4.63	0.00	0.00		0.0000	-0.8560
1	31.19	40.0	Both	425.12	4.54	0.00	0.00		0.0000	-0.8575
1	38.98	50.0	Both	442.83	0.00	0.00	0.00		0.0000	-0.9005
1	46.78	60.0	Both	425.12	-4.54	0.00	0.00		0.0000	-0.8575
1	47.04	60.3	Both	423.90	-4.70	0.00	0.00		0.0000	-0.8546
1	54.58	70.0	Both	371.98	-9.09	0.00	0.00		0.0000	-0.7322
1	62.37	80.0	Both	283.41	-13.63	0.00	0.00		0.0000	-0.5348
1	70.17	90.0	Both	159.42	-18.18	0.00	0.00		0.0000	-0.2827
1	76.34	97.9	Both	36.15	-21.77	0.00	0.00		0.0000	-0.0600
1	77.97	100.0	Left	0.00	-22.72	0.00	0.00	22.72	0.0000	0.0000

AASHTO LRFD Engine Version 7.5.0.3001
 Analysis preference setting: None

Close

