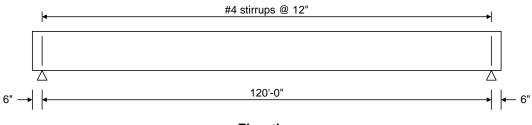
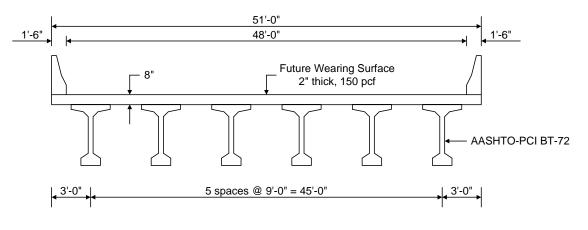
AASHTOWare BrDR 7.5.1 Prestress Tutorial 1 PS1 - Simple Span Prestressed I Beam Example

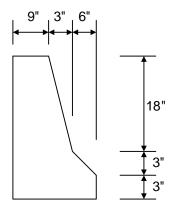
#### PS1 - Simple Span Prestressed I Beam Example





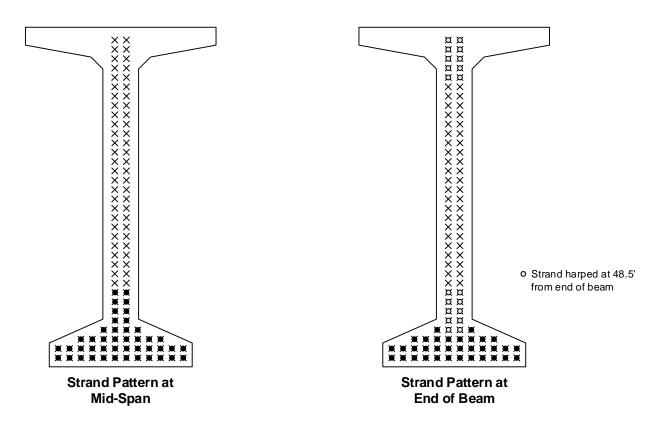


**Typical Section** 



Weight = 300 plf





#### **Material Properties**

Beam Concrete: f'c = 6.5 ksi, f'ci = 5.5 ksi Deck Concrete: f'c = 4.5 ksi Prestressing Strand: 1/2" dia., 7 Wire strand, Fu = 270 ksi, Low Relaxation

### BrDR Training

## PS1 – Simple Span PS I Beam Example

From the **Bridge Explorer** create a **new bridge** by clicking on the **New** button from the **BRIDGE** tab as shown below.

Br	AASHTOWare Bridge Design and Rating	?	_	×
BRIDGE EXPLORER BRIDGE	FOLDER RATE TOOLS VIEW			
New Open C Batch ~	Find Copy Paste Copy Remove Delete To~ From			
Bridge	Manage			

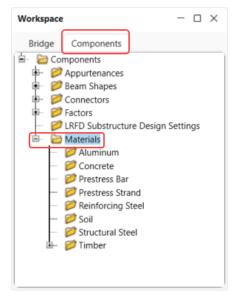
#### Enter the following description data.

S Training Bridg	ge1							- 0
ridge ID: PS T	Training	Bridge1	NBI structu	rre ID (8): PS Tr.Bridge1		Template Bridge comp	oletely defined	Bridge Workspace View Superstructures Culverts Substructures
Description	Descr	iption (cont'd)	Alternative	s Global reference poir	nt Traffic	Custom agency f	ields	
Name:		PS1 Training Bri	dge			Year built:		
Description:		This is PCI deisg	gn example 9.	9.3, which uses the Load F	actor Design (	(LFD).		
Location:	ĺ					Length:		ft
Facility carried	d (7):					Route number	: -1	
Feat. intersect	ted (6):					Mi. post:		

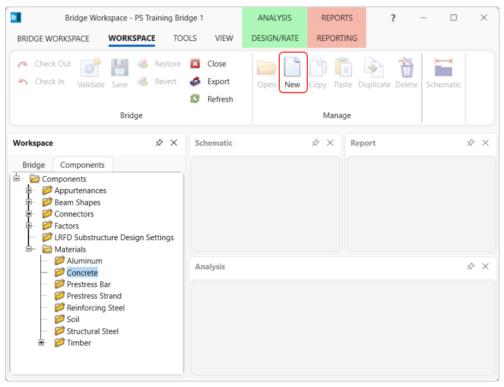
Click **OK** to apply the data and close the window.

#### Bridge Materials

To enter the materials to be used by members of the bridge, navigate to 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, click on **Concrete**, and select **New** from the **Manage** group of the **WORKSPACE** ribbon (or right mouse click on **Concrete** and select **New**). The window shown below will open.



A Bridge Materials - Concrete			-		×
Name:					
Description:					
Compressive strength at 28 days (f'c):		ksi			
Initial compressive strength (f'ci):		ksi			
Composition of concrete:	Normal				
Density (for dead loads):		kcf			
Density (for modulus of elasticity):		kef			
Poisson's ratio:	0.200				
Coefficient of thermal expansion (α):	0.0000060000	] 1/F			
Splitting tensile strength (fct):	0.000000000	ksi			
		1			
LRFD Maximum aggregate size:		in			
Compute					
Std modulus of elasticity (Ec):		ksi			
LRFD modulus of elasticity (Ec):		ksi			
Std initial modulus of elasticity:		ksi			
LRFD initial modulus of elasticity:		ksi			
Std modulus of rupture:		ksi			
LRFD modulus of rupture:		ksi			
Shear factor:	1.000				
Сору	to library Copy	from library OK Ap	ply	Canc	al

Enter the values shown above the **Compute** button and click the **Compute** button to compute the remaining values below them. Click the **Copy to library...** button to save this concrete material to the library.

🗛 Bridge Mat	terials - Concrete			_		$\times$
Name:	PS 6.5 ksi					
Description:	PS 6.5 ksi (f'ci=5.5 ksi)					
Compressive	strength at 28 days (f'c):	6.5	ksi			
Initial compre	essive strength (f'ci):	5.5	ksi			
Composition	of concrete:	Normal ~				
Density (for o	dead loads):	0.15	kcf			
Density (for r	modulus of elasticity):	0.15	Bridge Design & Rating X			
Poisson's rati	io:	0.2				
Coefficient of	f thermal expansion (α):	0.000006	The Concrete Material was successfully copied to the library.			
Splitting tens	sile strength (fct):					
LRFD Maximu	um aggregate size:		ОК			
	Compute					
Std modulus	of elasticity (Ec):	4887.73337	ksi			
LRFD modulu	us of elasticity (Ec):	5007.548587	ksi			
Std initial mo	odulus of elasticity:	4496.060776	ksi			
LRFD initial m	nodulus of elasticity:	4738.96446	ksi			
Std modulus	of rupture:	0.604669	ksi			
LRFD modulu	us of rupture:	0.611882	ksi			
Shear factor:		1				
			Copy to library Copy from library OK Ap	oply	Cancel	

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

Bridge Mat	terials - Concrete					-	- 🗆	×
Name:	Deck Concrete							
Description:	Deck Concrete							
Compressive	strength at 28 days (f'c)	: 4.5		ksi				
Initial compr	essive strength (f'ci):			ksi				
Composition	of concrete:	Normal	~					
Density (for o	dead loads):	0.15		kcf				
Density (for r	modulus of elasticity):	0.15		kcf				
Poisson's rati	io:	0.2						
Coefficient o	f thermal expansion (α):	0.000006		1/F				
Splitting tens	sile strength (fct):			ksi				
LRFD Maxim	um aggregate size:			in				
	Comput	e						
Std modulus	of elasticity (Ec):	4066.83998	39	ksi				
LRFD modulu	us of elasticity (Ec):	4435.30912	22	ksi				
Std initial mo	odulus of elasticity:			ksi				
LRFD initial n	nodulus of elasticity:			ksi				
Std modulus	of rupture:	0.503115		ksi				
LRFD modulu	us of rupture:	0.509117		ksi				
Shear factor:		1						
	Сору	to library	Copy fr	om library	ОК	Apply	Cano	:el

Add concrete material for the deck using the same technique. See below for deck concrete material.

**Reinforcement** material and **Prestress strand** material can be added by using the **Copy from library** option and selecting the materials shown below.

#### **Reinforcing Steel**

Bridge Materials - Reinforcing	Steel	_	×
Name:			
Description:			
Material properties			
Specified yield strength (fy):	ksi		
Modulus of elasticity (Es):	ksi		
Ultimate strength (Fu):	ksi		
Туре			
O Plain			
С Ероху			
Galvanized			

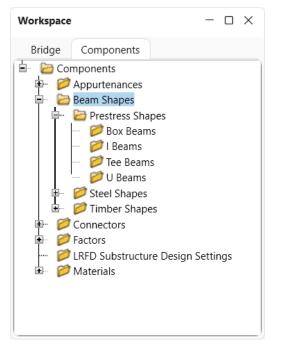
	Name	Descri	otion	Library	Units	Fy	Fu	Es	
Grade 300		300 MPa reinforcing s	eel	Standard	SI / Metric	300	500	199948	
Grade 350		350 MPa reinforcing s	eel (rail-steel)	Standard	SI / Metric	350	550	199948	
Grade 40		40 ksi reinforcing stee		Standard	US Customary	40.0	70.00	29000.0	
Grade 400		400 MPa reinforcing s	eel	Standard	SI / Metric	400	600	199948	
Grade 50		50 ksi reinforcing stee	(rail-steel)	Standard	US Customary	50.0	80.00	29000.0	
Grade 500		500 MPa reinforcing st	eel	Standard	SI / Metric	500	700	199948	
Grade 60		60 ksi reinforcing stee		Standard	US Customary	60.0	90.00	29000.0	
Grade 75		75 ksi reinforcing stee		Standard	US Customary	75.0	100.0	29000.0	
Structural or uni	known grade prior 19	54 Structural or unknown	grade prior to 1954	Standard	US Customary	33.0	60.00	29000.0	
						OK	A	pply	Cano
						OK	A	pply	Cano
🔊 Bridge Mat Name:	erials - Reinforc Grade 60	ing Steel				OK	A	pply	Cano
-				]		OK	A		
Name:	Grade 60 60 ksi reinforci				(	OK			
Name: Description: Material prop	Grade 60 60 ksi reinforci		ksi	]		OK	A		
Name: Description: Material prop	Grade 60 60 ksi reinforci erties d strength (fy):	ng steel	ksi			OK	A		
Name: Description: Material prop Specified yield Modulus of e	Grade 60 60 ksi reinforci erties d strength (fy): lasticity (Es):	ng steel 60.0000087 29000.004206	ksi	]		ОК	_		
Name: Description: Material prop Specified yield Modulus of e Ultimate stree	Grade 60 60 ksi reinforci erties d strength (fy): lasticity (Es):	ng steel 60.000087	-	]		OK			
Name: Description: Material prop Specified yield Modulus of e	Grade 60 60 ksi reinforci erties d strength (fy): lasticity (Es):	ng steel 60.0000087 29000.004206	ksi	]		OK			
Name: Description: Material prop Specified yield Modulus of e Ultimate stree	Grade 60 60 ksi reinforci erties d strength (fy): lasticity (Es): ngth (Fu):	ng steel 60.0000087 29000.004206	ksi			ОК			
Name: Description: Material prop Specified yiel Modulus of e Ultimate strer Type	Grade 60 60 ksi reinforci erties d strength (fy): lasticity (Es): ngth (Fu):	ng steel 60.0000087 29000.004206	ksi			ОК	4		
Name: Description: Material prop Specified yiel Modulus of e Ultimate strer Type Type Plain Epox	Grade 60 60 ksi reinforci erties d strength (fy): lasticity (Es): ngth (Fu):	ng steel 60.0000087 29000.004206	ksi			OK	-		

### Similarly, copy the following **Prestress strand** material.

	rials - PS Strand					_	X
Name: 1	1/2" (7W-270) L	R					
Description: L	ow relaxation 1	/2"/Seven	Wire/fpu =	270			
Strand diamete	er:	0.5	in				
Strand area:		0.153	in^2				
Strand type:		Low Relaxa	ation $\vee$				
Ultimate tensile	e strength (Fu):	270	ksi				
Yield strength (	(fy):	243	ksi				
Modulus of ela	sticity (E):	28500	ksi				
	Compute	:					
Transfer length	(Std):	25	in				
Transfer length	(LRFD):	30	in				
Unit load per le	ength:	0.52	lb/ft				
		Ероху	coated				

#### Beam Shapes

To enter a prestress beam shape, 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.

Bridge Wor	kspace - PS Traiı	ning Bridge 1		ANALYSIS	REPORTS	?	-		×
BRIDGE WORKSPACE	WORKSPACE	TOOLS	VIEW	DESIGN/RATE	REPORTIN	G			
Check Out Check In Validate		estore 🛛 evert 🍻	Close Export Refresh	Open New	Copy Paste		elete Sch	nematic	
	впаде				wanage				
Workspace	x	? × So	hematic		\$? × F	Report		\$	×
Bridge Components	New Analyze View Sun View Det	imary Report ailed Report Preferences dge Workspa						æ :	×

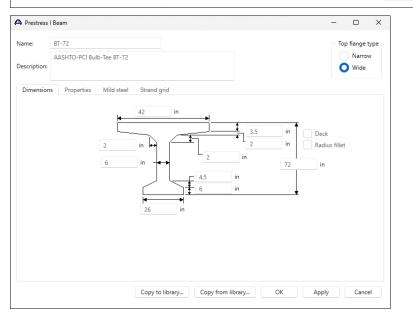
Prestress   Beam		- 🗆 X
Name:		Top flange type Narrow Wide
Dimensions Propert	ties Mild steel Strand grid	in Deck in Radius fillet in
	Copy to library Copy from library	OK Apply Cancel

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.

	Name	Description	Library	Units	Depth	Top flange thickness	Top flange width	Bottom flange thickness	Bottom flange width	Top hauch height	Bottom haunch height	Top ł
	BT-63	AASHTO-PCI Bulb-Tee BT-63	Standard	US Customary	63	3.5	42	6	26	2	4.5	
>	BT-72	AASHTO-PCI Bulb-Tee BT-72	Standard	US Customary	72	3.5	42	6	26	2	4.5	
	I-28x66	I-28×66	Standard	US Customary	66	5	42	8	28	3	10	
	I-28x78	I-28x78	Standard	US Customary	78	5	42	8	28	3	10	
	I-28x84	I-28x84	Standard	US Customary	84	5	42	8	28	3	10	



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

#### Bridge - Appurtenances

To enter the appurtenances, 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).

Bridge Workspace - PS	Fraining Bridg	e 1	ANALYSIS	REPORTS	?	-	
BRIDGE WORKSPACE WORKSPA	CE TOOL	S VIEW	DESIGN/RATE	REPORTIN	IG		
Check Out Check In Validate Save	Revert	<ul> <li>Close</li> <li>Export</li> <li>Refresh</li> </ul>	Open New	Copy Paste	Duplicate Del	ete Sch	ematic
Bridge				Manage			
Workspace	\$ ×	Schematic		\$ × I	Report		\$ ×
Components  Appurtenances  Components  Appurtenances  Components  Appurtenances  Components  Appurtenances  Components  Appurtenances  Components  Appurtenances  Appurten							
i	Settings	Analysis					\$ X

Enter the parapet details as shown below.

Name: 300 PLF Parapet Description: All dimensions are in inches Additional load: kip/ft 9 Additional load: kip/ft 9 Reference Line Back Front 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4	🕰 Bridge A	ppurtenances - Parapet		-	
All dimensions are in inches  All dimensions are in inches  Additional load: kip/ft Parapet unit load: 0.15 kcf  Galculated properties Net centroid (from reference line): 6.344 in Total load: 0.300 kip/ft	Name:	300 PLF Parapet			
Additional load:	Description	:			
9 8 9 8 9 10 10 10 10 10 10 10 10 10 10		All dimensions are in inches			
3 9 Reference Line 0 18 3 18 3 Calculated properties Net centroid (from reference line): 6.344 in Total load: 0.300 kip/ft		Additional load:	kip/ft	Parapet unit load:	
9 Reference Line 0 18 3 Calculated properties Net centroid (from reference line): 6.344 in Total load: 0.300 kip/ft				0.15 kcf	
Reference				Calculated properties	
6.344 in 18 18 10 10 10 10 10 10 10 10 10 10			Roadway		
3 0.300 kip/ft					
		18		Total load:	
Back Front I 3		····· ∖ <u>-</u> ‡ ├──		0.300 kip/ft	
		Back Front 🖡 3	<b>\</b>		

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

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

#### Superstructure definition

Returning to the **Bridge** tab of the **Bridge Workspace**, double click on **SUPERSTRUCTURE DEFINITIONS** (or click on **SUPERSTRUCTURE DEFINITIONS** and select **New** from the **Manage** group of the **WORKSPACE** ribbon or right mouse click on **SUPERSTRUCTURE DEFINITIONS** and select **New** from the popup menu) to create a new structure definition. The window shown below will appear.

A New Superstructure Definition		×
Girder system superstructure Girder line superstructure	Superstructure definition wizard	
Floor system superstructure		
Truss system superstructure		
Truss line superstructure     Reinforced concrete slab system superstructure		
Concrete multi-cell box superstructure Advanced concrete multi-cell box superstructure		
	OK Cancel	

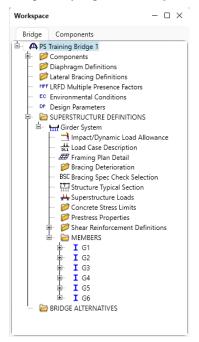
Select Girder system superstructure, click OK

	structure Definition		-	- 0
Definition Analys	sis Specs Eng	jine		
Name:	Girder System		Modeling Multi-girder system	
Description:			Deck type:	nplified definitio
efault units: lumber of spans:	US Customary V	Enter span lengths along the reference line:	For PS/PT only Average humidity:	
lumber of girders:	6 🗘	Span Length (ft)	70 %	
Horizontal curvatu	ire along reference li	> 1 120	Member alt. types Steel P/S R/C Timber P/T	
Horizontal cu	rvature	Distance from PC to first support line:	ft	
	alignment	Start tangent length:	ft	
Superstructure Curved	curved, tangent curved	Radius: Direction: End tangent length: Distance from last support line to PT: Design speed: Superelevation:	ft Left   ft	

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

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

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



Navigate to the **Bridge Alternatives** node in the **Bridge Workspace** tree and create a new **Bridge Alternative**, a new **Structure**, and a new **Structure Alternative** as shown below.

#### BRIDGE ALTERNATIVES

Navigate to the **BRIDGE ALTERNATIVES** node in the **Bridge Workspace** tree and create a new bridge alternative by double-clicking on **BRIDGE ALTERNATIVES** (or click on **BRIDGE ALTERNATIVES** and select **New** from the **Manage** group of the **WORKSPACE** ribbon). Enter the following data.

ridge Alternative			- 0
ernative name: Bridge	Alternative #1		
Description Substruc	tures		
Description:			
Horizontal curvatur	e	Global positioning	
Reference line length:	ft	Distance: 0	ft
Start bearing	End bearing	Offset: 0	ft
Starting station:	ft	Elevation:	ft
Bearing:	N 90^ 0' 0.00" E		
Bridge alignment		Start tangent length:	ft
Curved		Curve length:	ft
Tangent, curved,		Radius:	ft
Tangent, curved		Direction:	~
<ul> <li>Curved, tangent</li> </ul>		End tangent length:	ft
Superstructure wizard	Culvert wizard		
		ОК	Apply Cancel

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

Expand the **Bridge Alternative #1** 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							-		×
Superstructure name	Structure	:1							
Description Al	ternatives	Vehicle path	Engine	Substructures					
Description:									
Reference line									
Distance:	0	ft							
Offset:	0	ft							
Angle:	0	Degrees							
Starting statio	n:	ft							
					ОК	Anal	_	Canc	-1
					UK	Appl	<b>/</b>	Canc	ei

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

Expand the **Structure 1** 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. Select the superstructure definition **Girder System** as the current superstructure definition for this **Superstructure Alternative**.

<b>A</b>	Superstru	ucture Alternati	/e	-		×
Alte	ernative r	name:	Structure Alternative 1			
Des	cription:					
Sup	erstruct	ure definition:	Girder System $\lor$	]		
Sup	erstructi	ure type:	Girder			
Nu	mber of I	main members:	6			
	Span	Length (ft)				
>	1	120	A			
			V			
			ОК	Apply	Cance	2

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

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

A Superstructure Superstructure name: Structure 1  Description Alternatives Vehicle path Engine Substructures  Existing Current Superstructure alternative name Description  V V Structure Alternative 1  OK Apply Cancel						 					
Description Alternatives Vehicle path Engine Substructures	Sup	perstructure							-		×
Existing       Current       Superstructure alternative name       Description         Image: Construct of the second sec	upers	tructure na	me: Struc	ture 1							
Structure Alternative 1	Des	scription	Alternativ	ves Vehicle path Engine	Substructures						
Structure Alternative 1		Existing	Current	Superstructure alternative name	Description						
	>		$\checkmark$	Structure Alternative 1						1	
OK Apply Cancel											
							OK	Apply		Cance	1

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

Bridge Components	
i ti i i i i i i i i i i i i i i i i i	
Diaphragm Definitions	
Point Contraction     Contraction     Point Contraction     P	
C Environmental Conditions	
P     Design Parameters     SUPERSTRUCTURE DEFINITIONS	
<ul> <li>BRIDGE ALTERNATIVES</li> <li>ABridge Alternative #1 (E) (C)</li> </ul>	
E SUPERSTRUCTURES	
SUPERSTRUCTURE ALTERNATIVES	

#### Load Case Description

Navigate back to the superstructure definition – **Girder System**. Double-click on the **Load Case Description** node in the **Bridge Workspace** tree to open the **Load Case Description window** and define the dead load cases as shown below. The completed **Load Case Description** window is shown below.

	Load case name	Description	Stage			Туре		Time (day:	
>	Parapets		Composite (long term) (Stage 2)	$\sim$	D,DC		$\sim$		
	Future wearing surface		Composite (long term) (Stage 2)	$\sim$	D,DW		$\sim$		
		Add default lo							

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

#### Structure Framing Plan Detail – Layout

Double-click on **Framing Plan Detail** in the **Bridge Workspace** tree to describe the framing plan in the **Structure Framing Plan Details** window. Enter the data as shown below and click **Apply** to apply the data and not close the window.

<b>A</b> 9	Struc	ture Framin	ig Plan Det	ails									-		×
Nu	mbe	r of spans:	1	Number of gi	rders:	6									
L	.ayoı	ut Diapł	hragms												
					G	irder spac	ing orient	ation							
		Support	Skew (degrees				ndicular to support	girder							
	>	1		o 🔷											
		2		ט		Girder	Girder s (f								
						bay	Start of girder	End of girder							
					>	1	9	9	A						
						2	9	9							
						3	9	9							
						4	9	9							
						5	9	9							
				v											
											OK	Ap	ply	Canc	el

#### 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.

A Diaphragm Wizard X	A Diaphragm Wizard X
Select the desired framing plan system:	Diaphragm spacing  Diaphragm spacing  Enter number of equal spaces per span  Enter equal spacing per span  Enter groups of equal spacing
	Support diaphragm load: kip Interior diaphragm load: kip
	Span Length Number of equal spaces
	> 1 120 2
< Back Next > Cancel	< Back Finish Cancel

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

irde	er ba	ay: 1		~	Copy bay to			nragm ard				
	Support number		dis	tart tance (ft)	Diaphragm spacing	Number of spaces	Length (ft)	dis	ind tance (ft)	Load (kip)	Diaphragm	
			Left girder	Right girder	(ft)			Left girder	Right girder	()		
	1	$\sim$	0	0	0	1	0	0	0		Not Assigned 🗸	
	1	$\sim$	0	0	60	1	60	60	60		Not Assigned 🗸	
	1	$\sim$	120	120	0	1	0	120	120		Not Assigned $~~$	
											New Duplicate	Delete

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

#### 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 in as shown below and click **Apply**.

Veck       Deck (cont'd)       Parapet       Median       Railing       Generic       Sidewalk       Lane position       Striped lanes       Wearing surface         Superstructure definition reference line is       within       v       the bridge deck.         Start       End         Distance from left edge of deck to       To contended       To contended	Structure Typical Section								-	
Beck       Deck (cont'd)       Parapet       Median       Railing       Generic       Sidewalk       Lane position       Striped lanes       Wearing surface         Superstructure definition reference line:       within       the bridge deck.       Start       End         Distance from right edge of deck to superstructure definition reference line:       25.5       ft       25.5       ft         Distance from right edge of deck to superstructure definition reference line:       25.5       ft       25.5       ft         Left overhang:       3       ft       3       ft       ft       1	superstructure definition ref. line	superstructu	ure definit ucture Di	tion ref. line	<sup>to</sup>					
Superstructure definition reference line is within $\checkmark$ the bridge deck. Start End Distance from right edge of deck to superstructure definition reference line: Left overhang: 3 ft 3 ft	overhang	dian Raili	ina	Generic			Striped Janes	Wearing surface		
Start     End       Distance from left edge of deck to upperstructure definition reference line:     25.5     ft       25.5     ft     25.5     ft       upperstructure definition reference line:     25.5     ft       25.5     ft     3     ft			-			cane posicion	outped tailes	Treating Surface		
Distance from left edge of deck to upperstructure definition reference line:       25.5       ft       25.5       ft         Distance from right edge of deck to upperstructure definition reference line:       25.5       ft       25.5       ft         Left overhang:       3       ft       3       ft	Superstructure definition reference line is				-					
superstructure definition reference line:	Distance from left edge of deck to superstructure definition reference line:									
		25.5	ft	25.5	ft					
Computed right overhang: 3 ft 3 ft	Left overhang:	3	ft	3	ft					
	Computed right overhang:	3	ft	3	ft					

#### 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.

A Structure Typical Section				-		×
Distance from left edge superstructure definition De <u>4 thin</u> teft overhang	n ref. line	tance from right edge of deck to erstructure definition ref. line Superstructure Definition Reference Line Right overhang				
Deck Deck (cont'd) Parap	oet Mediar	Railing Generic Sidewalk Lane position Striped lanes Wea	aring surface			
Deck concrete:	Deck Concre	× ×				
Total deck thickness:	8	in				
Load case:	Engine Assig	ed 🗸				
Deck crack control parameter:	130	kip/in				
Sustained modular ratio factor:	2					
Deck exposure factor:						
			ОК Арр	ly	Cance	:

#### Structure Typical Section – Parapets

sk       Front         eck       Deck (cont'd)       Parapet       Median       Railing       Generic       Sidewalk       Lane position       Striped lanes       Wearing surface         Image: Sidewalk       Load case       Measure to       Edge of deck dist. measured from       Distance at start (ft)       Distance at end orientation       Front face orientation         300 PLF Parapet       V       Parapets       V       Back       Left Edge       0       0       Right $\leq$ 300 PLF Parapet       V       Parapets       V       Back       Right Edge       0       0       Left       V	truci	ture Typical Section											-	
Name     Load case     Measure to     Edge of deck dist. measured dist. measured from     Distance at from (ft)     Distance at end (ft)     Front face orientation       >     300 PLF Parapet     Parapets     Back     Left Edge     0     0     Right        300 PLF Parapet     Parapets     Back     Right Edge     0     0     Left	*	Fro	ant											
Name     Load case     Measure to from     dist. measured (ft)     start (ft)     end (ft)     Prontrace orientation       300 PLF Parapet     Parapets     Back     Left Edge     0     0     Right <	eck	Deck (cont'd)	Parapet	Median	Railing Ge	eneric	: Side	walk	Lane position	Striped la	nes Weari	ng surface		
300 PLF Parapet     V     Back     V     Right Edge     0     0     Left     V		Name	e	L	.oad case		Measure	e to	dist. measured	start	end			
	>	300 PLF Parapet	~	Parapets		~	Back	$\sim$	Left Edge 🛛 🗸	0	0	Right $\sim$		
New Duplicate Delete		300 PLF Parapet	~	Parapets		~	Back	$\sim$	Right Edge 🗸 🗸	0	0	Left $\sim$		

#### 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.

¢	Compute Lar	ne Positions				×
	Travelway number	Distance from left edge of travelway to superstructure definition reference line at start (A) (ft)	Distance from right edge of travelway to superstructure definition reference line at start (B) (ft)	Distance from left edge of travelway to superstructure definition reference line at end (A) (ft)	Distance from right edge of travelway to superstructure definition reference line at end (B) (ft)	
>	1	-24	24	-24	24	
					Anth	•
					Apply Cance	el

	Travelw		re Definition Reference Line				
λ			<u>/</u>				
eck	Deck (co	nt'd) Parapet Median	Railing Generic Sidev	valk Lane position Strip	ed lanes Wearing surface		
	Travelway number	Distance from left edge of travelway to superstructure definition reference line at start (A) (ft)	Distance from right edge of travelway to superstructure definition reference line at start (B) (ft)	Distance from left edge of travelway to superstructure definition reference line at end (A) (ft)	Distance from right edge of travelway to superstructure definition reference line at end (B) (ft)		
>	1	-24	24	-24	24		
- L	RFD fatigue						
	-	ailable to trucks: Truck fraction:	Compute		New Dup	licate	Delete

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

#### Structure Typical Section – Wearing surface.

#### Enter the data shown below.

A Structure Typical Section	-		×
Distance from left edge of deck to superstructure definition ref. line Deck thickness Ceft overhang			
Deck Deck (cont'd) Parapet Median Railing Generic Sidewalk Lane position Striped lanes Wearing surface			
Wearing surface material: Bituminous Description:			
Wearing surface thickness:     2     in     Thickness field measured (DW = 1.25 if checked)       Wearing surface density:     150     pcf			
Load case: Future wearing surface V Copy from library			
ОК	Apply	Cance	el

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

#### 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 **PS 6.5 ksi** 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. Enter the value shown below for the **LFD Final allowable slab compression**.

A Stress Limit Sets -	Concrete							-		×
Name:	6.5 ksi Cond	rete Stress Li	mit							
Description:	Stress limit	for 6.5 ksi cor	ncrete used i	in beam						
Corrosion condition:	Moderate		~							
Final allowable te	ension stress	limit coef. (US	) override:							
Concrete material:	PS 6.5 ksi		~							
	Compute									
		LFD			LRFD					
Initial allowable comp	pression:	3.3	ksi		3.575	ksi				
Initial allowable tensi	on:	0.2	ksi		0.2	ksi				
Final allowable comp	ression:	3.9	ksi		3.9	ksi				
Final allowable tensio	on:	0.4844069	ksi		0.4844069	ksi				
Final allowable DL co	mpression:	2.6	ksi		2.925	ksi				
Final allowable slab c	ompression:	2.4	ksi			ksi				
Final allowable comp (LL+1/2(Pe+DL))	ression:	2.6	ksi		2.6	ksi				
					C	ж	Apply		Cance	4

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

### Prestress Properties

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

A Prestress Properties				_		×
Name: 1/2" LR AASHTO	Loss					
General P/S data Los	ss data - lump sum Loss data - PCI					
P/S strand material:	1/2" (7W-270) LR	Jacking stress ratio:	0.750	]		
Loss method:	AASHTO Approximate	P/S transfer stress ratio:	0.690			
		Transfer time:	24.0	Hours		
		Age at deck placement:	60.00	Days		
		Final age:	36525.00	Days		
Loss data - AASHTO Percentage DL: 0.0	%					
			OK	Apply	Cance	:I

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

#### Shear Reinforcement

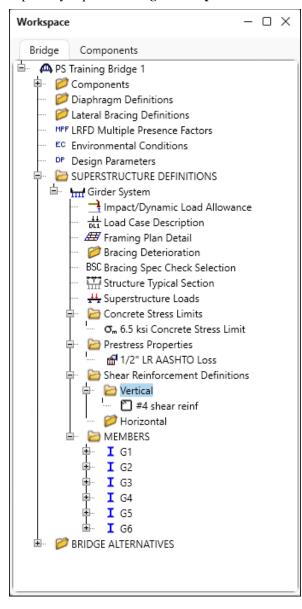
Define shear reinforcement to be used by the girders. Expand the **Shear Reinforcement Definitions** on the **Bridge Workspace** tree, select the **Vertical** node and click on **New** from the **Manage** group of the **WORKSPACE** ribbon (or double click on **Vertical**).

Bridge Workspace - PS Training Bridge 1 BRIDGE WORKSPACE WORKSPACE TOOLS	VIEW	ANALYSIS DESIGN/RATE	REPORTS			?	-		×
A Check Out		g 🖻	New Copy	Paste Duplicate	Delete Schemat	ic			
Workspace       Bridge       Components       Image: PS Training Bridge 1       Image: PS Training Plan Detail	\$ X	Schematic		\$ X	Report				\$ X
Porticing Deterioration     Porticing Spec Check Selection     Tructure Typical Section     H Structure Typical Section     Generate Stress Limits     Generate Stress Limits     Generate Stress Limit     Generate Stress     Ge		Analysis						:	×

Define the stirrup as shown below. Click **OK** to apply the data and close the window.

A Shear Reinforcement Definition - Vertic	al	_		×
Name: #4 shear reinf				
Vertical Shear Reinforcement	Material: Bar size: Number of legs: Inclination (alpha):	pply	Cance	1

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



#### 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.

A Member									-		×
Member name: G1				Link with	: None	~	·				
Description:											
E	kisting	Current	Member alte	rnative name	Description						
											-
Number of spans: 1		Span no.	Span length (ft)								
	>	1	120	-							
				-							
							OK	Ар	ply	Cance	el

#### 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**.

A New Member Alternative	×
Material type:	Girder type:
Post tensioned concrete	PS Precast Box
Prestressed (pretensioned) concrete	PS Precast I
Reinforced concrete	PS Precast Tee
Steel	PS Precast U
	OK Cancel
	OK Cancel

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

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

Member alternative:       Precast I Beam Alternative         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       V         Girder property input method       Official self load       Default rating method:       LFR       V         Additional self load:       %       Default rating method:       LFR       V         Crack control parameter (Z)       Exposure factor       Top of beam:       Use creep         Bottom of beam:       kip/in       Bottom of beam:       Use creep	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       Default rating method:         Load case:       Engine Assigned         Additional self load:       %         Crack control parameter (Z)       Exposure factor         Top of beam:       Use creep		-					scription	rnative Des	Member Alter
Description:       Material type:       Prestressed (Pretensioned)         Girder type:       PS Precast I         Modeling type:       Multi Girder System         Default units:       US Customary         ©       Schedule based         Cross-section based       Default rating method:         Load case:       Engine Assigned         Additional self load:       %         Crack control parameter (Z)       Exposure factor         Top of beam:       kip/in       Top of beam:	Description:       Material type:       Prestressed (Pretensioned, Girder type:         Girder type:       PS Precast 1         Modeling type:       Multi Girder System         Default units:       US Customary v         Girder property input method       Schedule based         Cross-section based       Default rating method:         Load case:       Engine Assigned v         Additional self load:       %         Crack control parameter (Z)       Exposure factor         Top of beam:       Use creep						Alternative	cast I Beam	tive: Pred	Member alterna
Girder type: PS Precast I Modeling type: Multi Girder System Default units: US Customary V Girder property input method Schedule based Cross-section based Self load Load case: Engine Assigned Additional self load: kip/ft Additional self load: % Crack control parameter (Z) Exposure factor Top of beam: Use creep	Girder type: PS Precast I Modeling type: Multi Girder System Default units: US Customary v Girder property input method Schedule based Cross-section based Self load Load case: Engine Assigned Lifk v Additional self load: kip/ft Additional self load: % Crack control parameter (Z) Exposure factor Top of beam: Use creep				Control options	Import	Engine	Factors	Specs	Description
Modeling type: Multi Girder System   Default units: US Customary     Girder property input method   Schedule based   Cross-section based     Self load   Load case:   Engine Assigned   LFR     Additional self load:   %     Crack control parameter (Z)   Exposure factor   Top of beam:     Use creep	Modeling type: Multi Girder System   Default units: US Customary     Girder property input method   Schedule based   Cross-section based     Self load   Load case:   Engine Assigned   LFR     Additional self load:   %     Crack control parameter (Z)   Exposure factor   Top of beam:     Use creep			Prestressed (Pretensioned)	Material type:					Description:
Girder property input method   Schedule based   Cross-section based     Self load   Load case:   Engine Assigned   LFR     Additional self load:   %     Crack control parameter (Z)   Top of beam:     Use creep	Girder property input method   Schedule based   Cross-section based     Self load   Load case:   Engine Assigned   Lift   Additional self load:   %     Crack control parameter (Z)   Exposure factor   Top of beam:     Use creep			PS Precast I	Girder type:					
Girder property input method   Schedule based   Cross-section based     Self load   Load case:   Engine Assigned   Additional self load:   %     Crack control parameter (Z)   Top of beam:     Use creep	Girder property input method   Schedule based   Cross-section based     Self load   Load case:   Engine Assigned   Additional self load:   %     Crack control parameter (Z)   Top of beam:     Use creep			Multi Girder System	Modeling type:					
Schedule based   Cross-section based     Self load   Load case:   Engine Assigned   LFR     Additional self load:   %     Crack control parameter (Z)   Top of beam:     Use creep	Schedule based   Cross-section based     Self load   Load case:   Engine Assigned   Additional self load:   kip/ft   Additional self load:   %     Crack control parameter (Z)   Top of beam:     Use creep			US Customary V	Default units:					
Load case: Engine Assigned   Additional self load: kip/ft   Additional self load: %    Crack control parameter (Z)  Crack control parameter (Z)  Top of beam:  Use creep	Load case:       Engine Assigned          Additional self load:       kip/ft         Additional self load:       %         Crack control parameter (Z)       Exposure factor         Top of beam:       Use creep			thod:	Default rating me					Cross
Additional self load:       kip/ft         Additional self load:       %         Crack control parameter (Z)       Exposure factor         Top of beam:       Top of beam:         Use creep	Additional self load:       kip/ft         Additional self load:       %         Crack control parameter (Z)       Exposure factor         Top of beam:       Use creep					~	signed	Engine As	:	
Additional self load:     %       Crack control parameter (Z)     Exposure factor       Top of beam:     Use creep	Additional self load:     %       Crack control parameter (Z)     Exposure factor       Top of beam:     Use creep								I self load:	Additiona
Top of beam: Top of beam: Use creep	Top of beam: Top of beam: Use creep						=		l self load:	Additiona
Use creep	Use creep				re factor	Exposu		eter (Z)	trol param	Crack cont
					beam:	Top of	kip/in		am:	Top of bea
				Ose creep	n of beam:	Bottom	kip/in		f beam:	Bottom of
	OK Apply	Cancel	Apply	ОК						

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

#### Beam Details

Expand the newly added member alternative in the workspace. 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.

pan	detail	Stress lin	nit ranges	Slab int	terface Web e	nd block				Beam r	projection	
	Span number		Beam shape		Girde mater		Prestress properties		n	Left end (in)	Right end (in)	
>	1	BT-72		$\sim$	PS 6.5 ksi	~	1/2" LR AASHTO Loss	~		6	6	1

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

ean									
par	n detail	Stress limit ranges Slab interface	e Web e	nd block					
	Span number	Name	Start distance (ft)	Length (ft)	End distance (ft)				
>	1 ~	6.5 ksi Concrete Stress Limit $$	0	121	121				-
									~
						New	Duplicate	Dele	ete
						New	Duplicate	Dele	

A	Beam Details			-		×
	Span detail	Stress limit ranges	Slab interface	Web end block		
	Interface type	:	Intentionally	Roughened 🗸		
	Default interfa	ace width to beam widt	ths: 🔽			
	Interface widt	h:		in		
	Cohesion fact	or:	0.1	ksi		
	Friction factor	:	1			
	K1:		0.3			
	K2:		1.8	ksi		
				OK Apply	Cancel	

Navigate to the **Slab interface** tab and enter data as shown below.

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

#### Strand Layout

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. Strands can now be defined at the middle of the span by selecting strands in the right hand schematic. Select the bottom 44 strands in the schematic so that the CG of the strands is 5.82 inches and click the **Apply** button.

🕰 Strand Layout - Span 1				-	×
Description type	NMC				Ŧ
	5W5		Showd positions generated by the ORIGINAL method. Pleases refer to Prage for a description of the method.		
Strand configuration type	Symmetry		$\times \times$		
Straight/Debonded					
Harped					
O Harped and straight debonded					
Mid span					
Left end	Harp point locations		×× ××		
Right end Right	Distance (ft)	Radius (in)			
Left	0.00	0.0000			
Right	0.00	0.0000			
	OK A	pply Cancel	<image/>		

Now select the **Left end** radio button to enter the following harped strand locations at the left end of the precast beam. Place the cursor in the schematic view on the right side of the screen. The strands can be defined at the left end of the span by selecting strand locations in the right hand schematic. Select the top 10 strand locations in the schematic so that the CG of the strands is 18.09 inches.

🕰 Strand Layout - Span 1			_	×
Description type			🗈 🕟 🔍 🔍 🔶 🗃 😽 🗮 100% 🔽	
O P and CGS only       Strands in rot	WS		Nafasi: Strand pusitions generated by the CHOGNUL, mathod, Pieces where to help for a description of the method.	
Strand configuration type	✓ Symmetry		••	
Straight/Debonded	_ , ,			
Harped				
<ul> <li>Harped and straight debonded</li> </ul>			××	
O Mid span				
Left end	Harp point locations			
Right end Right	Distance (ft)	Radius (in)		
Left	48.50	0.0000 -		
Right	48.50	0.0000	×× ××	
	ОК Аррі	/ Cancel	with a state of the s	

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

#### Deck Profile

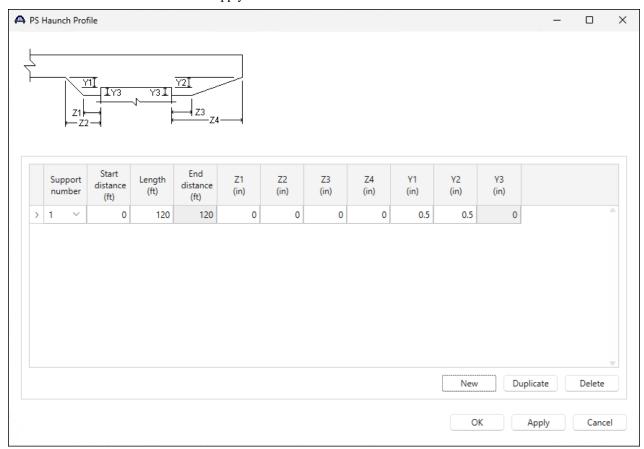
Next open the **Deck Profile** window by double-clicking the **Deck Profile** node in the **Bridge Workspace** tree and enter the data describing the structural properties of the deck. The window is shown below.

4	Dec	k Profile													-		×
-		PS Precast k concrete	Reinfo	rcem	ent												
		Mat	rial	Su	upport umber	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)				
	>	Deck Cond	rete 🗸	1	~	0	120	120	7.5		90					-	
		Compute fr typical secti												New Duplicate		Delete	
														OK Apply		Cance	ł

No reinforcement is described. 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.



#### Shear Reinforcement Ranges

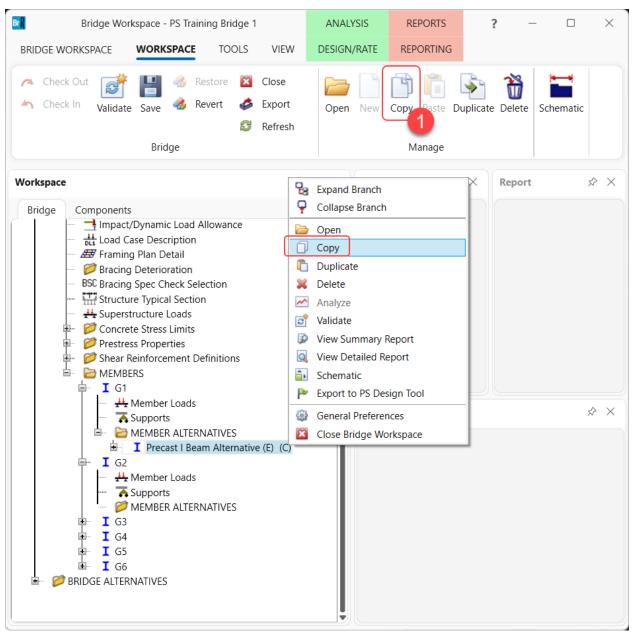
Double-click on the **Shear Reinforcement Ranges** node in the **Bridge Workspace** tree to open the **PS Shear Reinforcement Ranges** window. The shear reinforcement ranges are entered as described below. The vertical shear reinforcement is defined as extending into the deck on the **Vertical** tab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

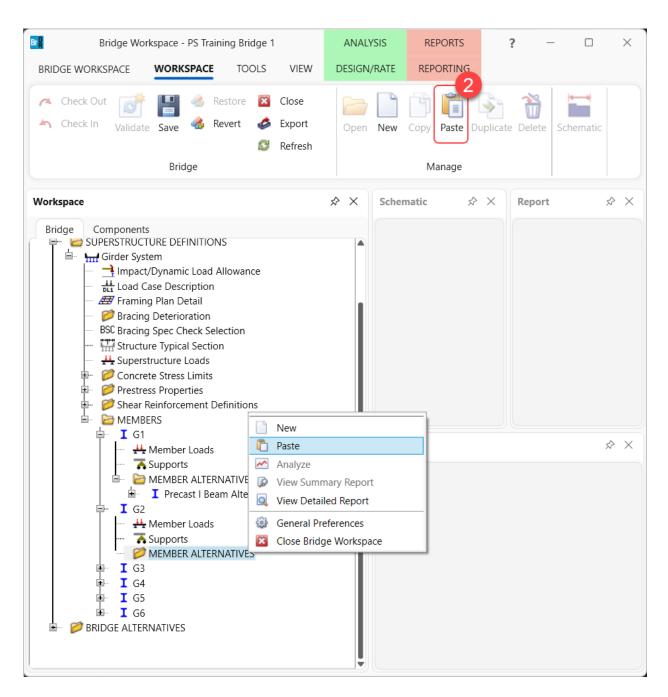
-	△ Start Distance	Spacir	na						
Verti	ical Horizontal								
spar	n: <u>1 ~</u>								
	Name	Extends into deck	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)		
>	#4 shear reinf $\sim$		0.5	1	0	0	0.5		-
	#4 shear reinf $\sim$	$\sim$	0.5	120	12	120	120.5		
S	Stirrup wizard	Stirrup desig	gn tool	View calcs			New	Duplicate	Delete

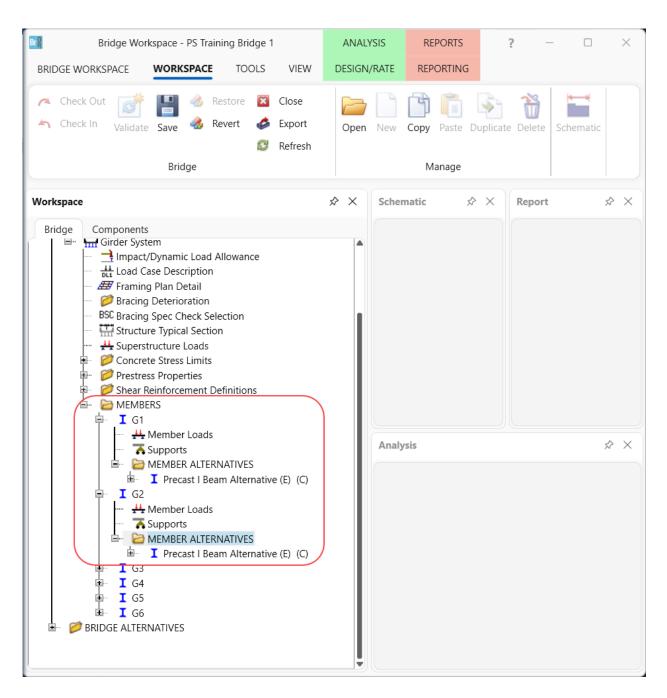
Click **OK** to apply the data and close the window.

#### Live Load Distribution

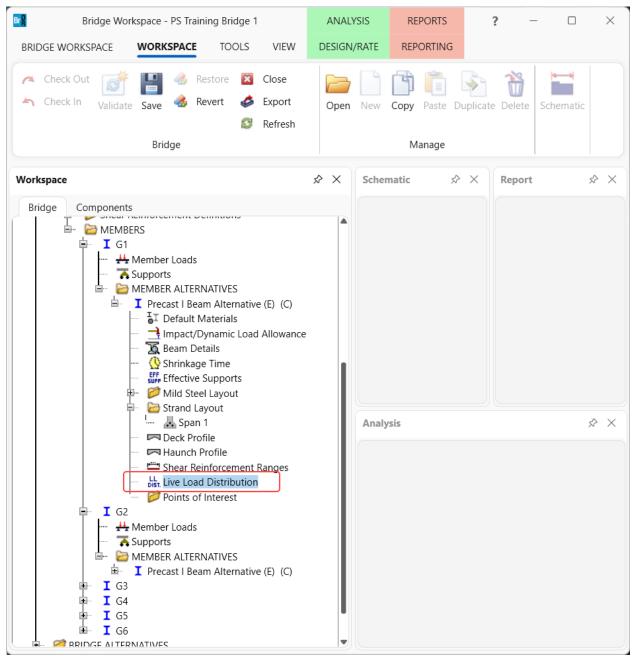
To compute the LRFD live load distribution factors, the interior girder adjacent to exterior girder must be defined. BrDR uses the beam shape assigned to this member alternative and the beam shapes assigned to the adjacent member alternatives to compute the distribution factors. If the **Compute from typical section...** button is used on this window without the adjacent girder defined, BrDR will throw a warning message indicating that since beam shapes are not assigned to adjacent member alternative, BrDR cannot calculate the distribution factors. In this case, the factors will have to be manually entered. For this example, copy the **Precast I Beam** member alternative of member **G1** and paste to **G2** as a member alternative.







Double click on the Live Load Distribution node in the Bridge Workspace tree for member G1 to open the Live Load Distribution window.



Navigate to the **LRFD** tab of this window. Click the **Compute from typical section . . .** button to compute the LRFD live load distribution factors.

A Live Load Distribution	- 🗆 X
Standard LRFD	
Distribution factor input method	
O Use simplified method Use advanced method	
Allow distribution factors to be used to compute effects of permit loads with rout	ine traffic
Action: Deflection V Sufficiently connected to act as a unit	
Support Start Length End distance Distribution factor (Janes)	
number (ft) (ft) (ft) (lanes) (lanes) (lanes)	
	<u></u>
Compute from typical section View calcs	New Duplicate Delete
	OK Apply Cancel

The LRFD Distribution Factor Progress window opens as shown below.

А	LRFD Distribution Factor Progress	×
	<ul> <li>Info: Generating model domain for line girder analysis</li> <li>Info: Finished generating model domain for line girder analysis</li> <li>Info: Computing contraflexure ranges for Stage 3 Span Model</li> <li>FEA - Beam Contraflexure Ranges - Initiating finite element analysis</li> <li>FEA - Beam Contraflexure Ranges - Creating nodes</li> <li>FEA - Beam Contraflexure Ranges - Creating genemets</li> <li>FEA - Beam Contraflexure Ranges - Creating support constraints</li> <li>FEA - Beam Contraflexure Ranges - Creating support constraints</li> <li>FEA - Beam Contraflexure Ranges - Verifying finite element model</li> <li>FEA - Beam Contraflexure Ranges - Verifying finite element model</li> <li>FEA - Beam Contraflexure Ranges - Preparing linear solution</li> <li>FEA - Beam Contraflexure Ranges - Performing linear solution</li> <li>FEA - Beam Contraflexure Ranges - Successful finite element analysis</li> <li>Info: Finished computing contraflexure ranges for Stage 3 Span Model</li> <li>Info: Finished computing LRFD live load distribution factors</li> <li>Info: Finished processing live load distribution factors</li> <li>Info: Finished processing live load distribution factor ranges for Stage 3 Span Model</li> <li>Info: Finished processing live load distribution factors</li> <li>Info: Finished processing live load distribution factor stage 3 Span Model</li> <li>Info: Finished processing live load distribution factor stage 3 Span Model</li> <li>Info: Finished processing live load distribution factor stage 3 Span Model</li> <li>Info: Finished processing live load distribution factor stage 3 Span Model</li> <li>Info: Finished processing live load distribution factor stage 3 Span Model</li> <li>Info: Finished processing live load distribution factor stage 3 Span Model</li> <li>Info: Finished processing live load distribution factor stage 3 Span Model</li> <li>Info: Finished processing live load distribution factor stage 3 Span Model</li> <li>In</li></ul>	< > >
	Print OK	

Once the analysis is complete, click **OK** to close this window. The **Live Load Distribution** window is now populated with the distribution factors. Uncheck the **Allow distribution factors to be used to compute effects of permit loads with routine traffic checkbox** and click **OK** to apply these factors and close the window. If these are left blank, BrDR will compute them during the analysis runtime.

🗛 Live	Load Distrib	oution							-		×
Stan	idard LR	FD									
	Distribution	factor input	method								
	🔘 Use sim	plified met	hod	Use advanced	method						
	Allow distr	ibution fact	ors to be u	sed to compute	offects of r	permit loads w	vith routine traffic				
							with routine traine				
Act	ion: Deflect	tion ~	Su	fficiently conne	cted to act	as a unit					_
	Support	Start distance	Length	End distance		ition factor anes)					
	number	(ft)	(ft)	(ft)	1 lane	Multi-lane					
	1 ~	0	120	120	0.2	0.4333333				4	
										1	
ty	ompute fron pical sectior	n V	iew calcs					New Duplicat	te	Delete	
								ОК Ар	ply	Cance	<u>+</u>

The description of an exterior beam for this structure definition is complete.

### LRFR Analysis

The member alternative for girder G1 can now be analyzed. To perform an LRFR rating, select the Analysis Settings button on the Analysis group of the DESIGN/RATE ribbon.

Bridge Works	pace - PS Training Bridge	1	ANALYSIS	REPORTS	?	_	×
BRIDGE WORKSPACE	WORKSPACE TOOLS	VIEW	DESIGN/RATE	REPORTING			
a 🛤		☞ 🕉	2 🖪				
Analysis Analyze Analysis Settings Events	Tabular Specification Results Check Detail C						
Analysis	Res	ults					

#### Click the **Open template** button.

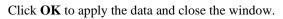
Analysis Settings						_		×
Design review	Rating		Rating method:		LFR	~		
Analysis type:								
Lane / Impact loading type:	As Requested	~	Apply pret	erence setting:	None	~		
Vehicles Output Er	ngine Description							
Traffic direction: Both direction	rections ~			Refresh	Temporary vehicles	Advanced	)	
Vehicle selection			N	/ehicle summar	y			
└	itary Loading		Add to >> Remove from <<	E Rating vehi Inventor Operatin Legal op Permit i Permit c	ry ng perating			
Reset Clear	Open template	Save	template		ОК	Apply	Canc	el

	Templates	Description	Analysis	Owner	Public / Private	
	HL 93 Design Review	HL 93 Design Review	LRFD		Public	
	HS 20 LFR Rating	HS 20 LFR Rating	LFR		Public	
Γ	LRFR Design Load Rating	LRFR Design Load Rating	LRFR		Public	
T	LRFR Legal Load Rating	LRFR Legal Load Rating	LRFR		Public	

### Select the LRFR Design Load Rating to be used in the rating and click Open.

The Analysis Settings window will be populated as shown below.

Analysis Settings			-	×
Design review <b>O</b> Rating	Rating me	thod: LRFR	~	
nalysis type: Line Girder ane / Impact loading type: As Requested	<ul> <li>Apply pre-</li> </ul>	ference setting: None	~	
Vehicles Output Engine Description		Refresh Temporary vehicles	Advanced	
Vehicle selection		Vehicle summary		
	Add to >> Remove from <<	⊨ Rating vehicles ⇒ LRFR → Design load rating → Inventory ↓ -HL-93 (US) → Operating ↓ -HL-93 (US) → Fatigue ↓ -LFRD Fatigue Truck (I → Legal load rating → Routine → Specialized hauling → Permit load rating	12) (51	

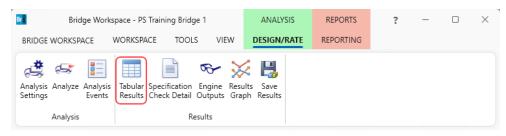


#### Tabular Results

With member alternative **Precast I Beam Alternative** for member **G1** selected, click the **Analyze** button on the **Analysis** group of the **DESIGN/RATE** ribbon to perform the rating.

Bridge Work	space - PS Training Brid	ge1	ANALYSIS	REPORTS	?	_	$\times$
BRIDGE WORKSPACE	WORKSPACE TOOL	S VIEW	DESIGN/RATE	REPORTING			
a 🖙 🗉		∞ 🖗	2 📙				
Analysis Analyze Analysis Settings Events	Tabular Specification Results Check Detail						
Analysis	R						

When the rating is finished results can be reviewed by clicking the **Tabular Results** button on the **Results** group of the ribbon.



The window shown below will open. Select **Rating Results Summary** as the **Report Type** and **Single rating level per row** as the **Display Format** option to have the ratings arranged as shown below.

🗛 Analysis Re	sults - Precast I Bea	am Alternative								- 0	Х
Print Print											
Report type:		C Lane/Impact	loading typ	e	Display Forma	t					
Rating Results	Summary 🗸		uested	Detailed	Single rating	level per ro	w ~				
Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane	
HL-93 (US)	Truck + Lane	LRFR	Inventory	42.44	1.179	60.00	1 - (50.0)	SERVICE-III PS Tensile Stress	As Requested	As Requested	1
HL-93 (US)	Truck + Lane	LRFR	Operating	62.30	1.731	60.00	1 - (50.0)	STRENGTH-I Concrete Flexure	As Requested	As Requested	
HL-93 (US)	Tandem + Lane	LRFR	Inventory	50.32	1.398	60.00	1 - (50.0)	SERVICE-III PS Tensile Stress	As Requested	As Requested	
HL-93 (US)	Tandem + Lane	LRFR	Operating	73.86	2.052	60.00	1 - (50.0)	STRENGTH-I Concrete Flexure	As Requested	As Requested	
ASHTO LRFR E	ngine Version 7.5.1	.3001									
Analysis prefere	nce setting: None										
										Clo	se
							0.0.0				

### LRFD Design Review

An LRFD design review of this girder for **HL93** loading can be performed by AASHTO LRFD. To perform an LRFD design review, enter the **Analysis Settings** window as shown below or select the **HL 93 Design Review** template from the Open Template button as shown in the previous section.:

Analysis Settings	- 0	×
Design review Rating	LRFD	
Analysis type:		
Lane / Impact loading type: As Requested  Apply preference setting	g: None v	
Vehicles Output Engine Description		
Traffic direction:     Both directions     Refresh       Vehicle selection     Vehicle summa	Temporary vehicles Advanced	
Image: Vehicles       Image: Design velocity         Image: Provide the standard       Image: Design velocity         Image: Provide the standard       Image: Provide the standard         Image: Provide the standard <t< td=""><td>- n loads - 93 (US) : loads</td><td></td></t<>	- n loads - 93 (US) : loads	
Reset         Clear         Open template         Save template	OK Apply Can	ncel

#### Analysis Settings - Output

O Design review	Rating	Design method:	LRFD	~	
alysis type:	Line Girder ~				
ane / Impact loading type: As Requested		Apply preference setting:	~		
Vehicles Output Er	ngine Description				
Tabular results		AASHTO engine rep	ports		
Dead load action	report	🚞 Miscellaneous r	eports:		
Live load action re		Girder prop	perties		
	te summary report	🔽 Summary ir	nfluence line loading		
LRFD critical loads		Detailed int	fluence line loading		
		Capacity su	immary		
LRFD specification		Capacity de	etailed computations		
PS concrete stress		FE model fo	or DL analysis		
RC service stress r			or LL analysis		
Steel limit state su	ummary report		e lines FE model		
			e lines FE actions		
			actor computations		
			actor summary		
		Regression	-		
		Camber	uata		
		Fatigue stre	in ranges		
			ress ranges		
		Service if st	-		
			conc article detailed		
Select all Clear	all	Select all Cle	ear all		

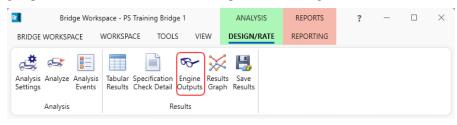
Navigate to the **Output** tab and enter the **Analysis Settings** as shown below.

#### **Engine Outputs**

Next with member alternative **Precast I Beam Alternative** for member **G1** selected click the **Analyze** button on the **Analysis** group of the **DESIGN/RATE** ribbon to perform the design review.



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



A PS Training Bridge 1	_	×
-PS Training Bridge 1 -Girder System -G1 -AASHTO_LRFD -Stage 3 Infl Lines Span Model -Stage 1 Span Model -Stage 1 Span Model -Stage 2 Span Model -Stage 2 Span Model -Stage 3 Spac Actions -Stage 3 Span Model Actions -Stage 3 Span Model Actions -Stage 3 Span Model Actions -Log File -Details -AASHTO_LRFR		

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

The following file opens.

