AASHTOWare BrDR 7.5.0 Floor System Tutorial FS1 – Girder Floorbeam Stringer Example



Concrete curb & railing = 0.3k/ft each side

### Fy = 36ksi

### f'c = 3ksi

Composite stringers & girders, 8.5" effective slab thickness



Lateral Bracing = ST 6WF20 (typ)



Elevation FB1





Stiffeners =  $6" \times 3/8"$ 







Diaphragms 10 [ 20

### BrDR Tutorial

### **Topics Covered**

- Superstructure composed of girders, floorbeams and stringers.
- System superstructure definition
- Rolled beam stringers.
- Plate girder floorbeams.
- Plate girder Girders.

## Superstructure composed of girders, floorbeams and stringers.

							- 🗆
ridge ID: FSys GFS	TrainingBridge 1	NBI structur	e ID (8): GFSTrainingBrdg		Template Bridge comple	tely defined	<ul> <li>Superstructures</li> <li>Culverts</li> <li>Substructures</li> </ul>
Description De	scription (cont'd)	Alternatives	Global reference point	Traffic	Custom agency field	ls	
Name:	FloorSystem GF	S Training Bridg	je 1		Year built:		
Description:	Girder-Floorbea	m-Stringer Trai	ning Bridge entered using s	ystem app	roach		
Location:					Length:		ft
Facility carried (7):					Route number:	-1	
Feat. intersected (6	i):				Mi. post:		
Default units:	US Customary	~					
Bridge assoc	iation V B	rR 🗹 BrD 🗌	] BrM				

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

Close the window by clicking **OK**.

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



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

#### Bridge Materials

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

The tree with the expanded Materials branch is shown below.



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

Bridge Workspace - FSys GFS TrainingBrid	dge 1	ANALYSIS	REPORTS	?	– 🗆 ×
BRIDGE WORKSPACE WORKSPACE TOOLS	VIEW	DESIGN/RATE	REPORTING		^
Check Out Check In Validate Save Close E	🎸 <table-cell> Export Refre</table-cell>	sh Open Ne	Copy Pas	te Duplicate Dele	tee Schematic
Bridge			Manag	je	
Workspace # ×	Schem	iatic	я × R	eport	щ×
Bridge Components					
Components     Appurtenances     Appurtenances     Source Connectors     Factors     Connectors     Contect Design Settings     Advarials     Materials     Concrete     Concrete					
📁 Prestress Strand	Analys	is			Ψ×
📁 Reinforcing Steel 🎾 Soil 🎾 Structural Steel		1			
E. 📁 Timber 📄 New					
Analyze	Report				
Q View Detailed R	1 C C C C C C C C C C C C C C C C C C C				
General Prefere	ences				
Close Bridge W	orkspace				

#### Enter the structural steel material as shown below.

🗣 Bridge Mat	terials - Structural Steel					-		×
Name:	FY 36ksi Steel							
Description:	Built after 1963 - 36 ksi stee	el						
Material prop	perties							
Specified mir	nimum yield strength (fy):	36.000	ksi					
Specified mir	nimum tensile strength (Fu):		ksi					
Coefficient o	f thermal expansion:	0.0000065000	1/F					
Density:		0.4900	kcf					
Modulus of e	elasticity (E):	29000.00	ksi					
	Copy to library	Copy from libra	у	ОК	Apply	/	Cance	el

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

Add a new concrete material, by clicking on **Materials**, **Concrete**, and select **New** from the **Manage** group of the **WORKSPACE** ribbon (or right mouse click on **Concrete** and select **New**). The window shown below will open.

Bridge Workspa	ace - FSys GFS TrainingBr	idge 1	ANALYSIS	REPORTS	? — 🗆 🗄	×
BRIDGE WORKSPACE	WORKSPACE TOOLS	VIEW	DESIGN/RATE	REPORTING		^
Check Out Check In Validate S	Ave Restore Restore Close	Export Refre	sh Open New	Copy Paste	Duplicate Delete	c
	Bridge			Manage		
Workspace	ά×	Schem	atic	я × Rep	port #>	ĸ
Bridge Components						
Components     Organization     Components     Organization     Organ	cture Design Settings					
Concrete		III Analvs	is		ф >	ĸ
···· ···· ···	New     Analyze     View Summary Repc     View Detailed Repor     View Detailed Repor     General Preferences     Close Bridge Worksp	t				

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

\land Bridge Mat	erials - Concrete			-		Х
Name:	3 ksi Cement Concrete					
Description:	Class A cement concrete	e 3 ksi				
Compressive	strength at 28 days (f'c):	3	ksi			
Initial compre	essive strength (f'ci):		ksi			
Composition	of concrete:	Normal				
Density (for d	lead loads):	0.15	kcf			
Density (for n	nodulus of elasticity):	0.145	kcf			
Poisson's rati	0:	0.2				
Coefficient of	f thermal expansion (α):	0.000006	1/F			
Splitting tens	ile strength (fct):		ksi			
LRFD Maximu	um aggregate size:		in			
	Compute	]				
Std modulus	of elasticity (Ec):	3155.924251	ksi			
LRFD modulu	is of elasticity (Ec):	3625.494616	ksi			
Std initial mo	dulus of elasticity:		ksi			
LRFD initial m	nodulus of elasticity:		ksi			
Std modulus	of rupture:	0.410792	ksi			
LRFD modulu	is of rupture:	0.415692	ksi			
Shear factor:		1				
	Сору	to library Cop	y from library OK A	pply	Canc	el

Click  $\mathbf{OK}$  to apply the data and close the window

### Beam Shapes

To enter a steel beam shape to be used in this bridge expand the tree labeled **Beam Shapes** and **Steel Shapes** as shown below. The partially expanded **Components** tree with the **Steel Shapes** node expanded is shown below.



To add a new steel I shape, click on the **I Shapes** node in the **Components** tree and select **New** from the **Manage** group of the **WORKSPACE** ribbon (or right mouse click on **I Shapes** and select **New** or double click on **I Shapes** in the **Components** tree). The window shown below will open.



Select the **Rolled shape type** as **W shape** and click the **Copy from library...** button. The **Steel Shape Selection** window will appear.



This window displays all the steel shapes available in the library. The list can be sorted by clicking on any of the column headers (e.g., **Shape**, **Year**, **Depth** etc.). Select **W26x62** (**Year** – **1994**) and click **OK**.

					brary ) Standard ) Agency define	Unit system SI I US
	Shape	Year	Depth (in)	Load (lb/ft)	Sxx (in^3)	
	W 21x55	2011	20.8000	55.000	109.615	*
	W 21x57	2011	21.1000	57.000	110.900	
	W 21x57	1994	21.0600	57.000	111.111	
Þ	W 21x62	1994	20.9900	62.000	126.727	
	W 21x62	2011	21.0000	62.000	126.667	
	W 21x68	1994	21.1300	68.000	140.085	
	W 21x68	2011	21.1000	68.000	140.284	
	W 21x73	2011	21.2000	73.000	150.943	*

Steel   Sh	ape	- □ >
lame:	W 21x62	Rolled shape type
escription	W 21x62 Imported from AISC Tables (1994)	<ul> <li>W shape</li> <li>M shape</li> <li>S shape</li> <li>HP shape</li> </ul>
Dimensio	Properties	
	0.6150 in 0.6000 in 0.4000 in V I 20.9900 in V I 8.2400 in V I 8.2400 in V I V I V	
	Copy to library Copy from library O	K Apply Cancel

The beam properties are copied to the Steel I Shape window as shown below.

Click  $\mathbf{OK}$  to apply the data and close the window

Similarly add a W6x20 (Year – 1994) steel I shape. The Steel I Shape window will be updated as shown below.

🕰 Steel I Sha	pe	-	
Name:	W 6x20	Rolled shape	type
Description:	W 6x20 Imported from AISC Tables (1994)	W shape S shape	○ M shape ○ HP shape
Dimension	ns Properties		
	Copy to library Copy from library OK	Apply	Cancel

Click  $\boldsymbol{O}\boldsymbol{K}$  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 generic barrier, select **Generic** and click on **New** from the **Manage** button on the **WORKSPACE** ribbon (or double click on **Generic** in the **Components** tree).



Enter the data as shown below.



Click OK to apply the data and close the window

#### 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		
Floor line superstructure		
<ul> <li>Truss system superstructure</li> </ul>		
<ul> <li>Truss line superstructure</li> </ul>		
Reinforced concrete slab system superstructure		
Concrete multi-cell box superstructure		
Advanced concrete multi-cell box superstructure		
		-
	OK Cancel	

Selecting **Floor system superstructure** displays three types of floor system superstructure definitions. Select the **Girder Floorbeam Stringer** and click **OK**.

A New Superstructure Definition	×
Girder system superstructure	
<ul> <li>Girder line superstructure</li> </ul>	Superstructure definition wizard
Floor system superstructure	
Floor line superstructure	
<ul> <li>Truss system superstructure</li> </ul>	
Truss line superstructure	
Reinforced concrete slab system superstructure	
Concrete multi-cell box superstructure	
Advanced concrete multi-cell box superstructure	
Girder Floorbeam Stringer	Girder Floorbeam
	OK Cancel

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

ø	Girder Floorbeam Stringer Floor S	stem Superstructure Definition			-		×
	Definition Analysis Engine						
	Name: Description:	Floor System GFS with Deck Girder-Floorbeam-Stringer bridge enter	ed using system approach.				
	Default units: Number of main members: Main member number of spans: Main members support the deck: Main member configuration: Number of stringers: Stringers frame into floorbeam: Number of stringer units:		Aain member span engths along the eference line: Span     Lengt h (ft)       1     80.00       2     80.00	Deck type: Concrete Deck V Member alt. types Steel P/S R/C Timber			
				ОК Арр	ly	Cance	el 🛛

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

The following describes some of the terminology on this window. As shown in the sketch below, this structure has 2 main members (girders) and 4 stringers.



Stringer units are the portions of the structure where the stringers are to be analyzed as structurally continuous units. In this structure, the stringers are 2 span continuous and there are 4 stringer units.



The partially expanded Bridge Workspace tree is 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.

ernative name: Alternative #1			
Description Substructures			
Description:			
Horizontal curvature	Global positioning		
Reference line length: 160.00 ft	Distance:	ft	
Start bearing     Dearing	Offset:	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, tangent	Radius:		ft
<ul> <li>Tangent, curved</li> <li>Curved, tangent</li> </ul>	Direction:	Left V	
0,,	End tangent length:		ft
Superstructure wizard			

Click OK to apply the data and close the window

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

Bridge Workspace - FSys GF	S TrainingBrid	dge 1	ANALYSIS	REPO	RTS	? – 🗆 X
BRIDGE WORKSPACE WORKSPACE	TOOLS	VIEW	DESIGN/RAT	REPOR	TING	^
Check Out Check In Validate Save	ert 🎦 I	🎸 🛱 Export Refre	sh Open		Paste Duplicate	Delete
Bridge				M	anage	
Workspace	щ×	Schem	atic	<b></b> щ ×	Report	<b>т</b> ×
Bridge Components						
Components     Superstanding of the second sec	TIONS					
BRIDGE ALTERNATIVES		Analys	is			<del>й</del> ×
Alternative #1 (E) (C)						
** Y Stiffness Analysis	New			1		
🗭 Piers 🎾 Culverts	-	ze Summary Rep Detailed Rep				
		al Preference Bridge Work				

Superstructure							_		×
perstructure name	e: Two Span	GFS							
Description A	Iternatives	Vehicle path	Engine	Substructures					
Description:					]				
Reference line	:				_				
Distance:	0.00	ft							
Offset:	0.00	ft							
Angle:	0.00	Degrees							
Starting station	n:	ft							
						OK	Apply	Cano	ol.
						UK	Apply	Cano	.ei

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

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



Select the Superstructure definition Floor System GFS with Deck as the current superstructure definition for this

Superstructure Alternative.

A Superstructure Alternativ	re	_		×
Alternative name:	Alternative #1			
Description:				
Superstructure definition:	Floor System GFS with Deck			
Superstructure type:	GirderFloorBeamStringer			
Number of main members:	2			
Span Length (ft)				
	80.00			
2	80.00			
	ОК	Apply	Canc	el

Click OK to apply the data and close the window

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

🗛 s	Superstructure	e						-		×
Sup	erstructure na	ame: Two S	Span GFS							
[	Description	Alternativ	ves Vehicle path Engine	Substructures						
	Existing		Superstructure alternative name Alternative #1	Description						
						ОК	Apply		Cance	el

Click **Cancel** to close the window.

The partially expanded Bridge Workspace tree is shown below.



### Load Case Description

Navigate to the Floor System GFS with Deck superstructure definition and double-click on the Load Case Description node in the Bridge Workspace tree to open the Load Case Description window. Click on the Add default load case description button to create the following load cases.

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

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

### Structure Framing Plan Detail – Layout

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

Structure Framing Plan Details     vumber of main member spans: 2	Number of main members: 2	Numbe	r of stringe	rc: 1		_		2
Layout Diaphragms Main member support skew:	Member spacing orientation		nger spacir	ng:				
Support Skew (degrees)	Along support Main member spacing:		Stringer bay		t) End of stringer			
1         0.000           2         0.000           3         0.000	Girder     Member spacing (ft)       bay     Start of member     End of member       ▶     1     30.00     30.00		1 2 3	6.00 6.00 6.00	6.00 6.00	A		
	r	•		C	DK A	Apply	Canc	cel

The Main Member and Stringer Bays are labeled as follows.



### Structure Framing Plan Detail – Diaphragms

Switch to the **Diaphragms** tab to enter the lateral bracing between the girders. Enter the data as shown below.

I         Composition           1         ~         0.           1         ~         0.           1         ~         0.           1         ~         0.	Start distance (ft) girder Right girder	Diaphragm spacing (ft)	Number		-	nd			
▶     1     ▼     0.       1     ▼     0.       1     ▼     0.       1     ▼     20.		(π)	of spaces	Length (ft)		tance (ft)	Load (kip)	Diaphragm	
1 · 0. 1 · 20.	0.00 20.00				Left girder	Right girder			
1 - 20.	0.00 20.00	0.00	1	0.00	0.00	20.00	0.7200	Not Assigned 👻	
	0.00 20.00	20.00	7	140.00	140.00	160.00	0.7200	Not Assigned 🔻	
1 20.	20.00 0.00	0.00	1	0.00	20.00	0.00	0.7200	Not Assigned 🔹	
	20.00 0.00	20.00	7	140.00	160.00	140.00	0.7200	Not Assigned 🔹	

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



The load of each brace is computed as follows.

Length =  $\sqrt{20^2 + 30^2} = 36'$ 

Load of each brace = 36'\*20 lb/ft = 720 lb

#### 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.

Distance from left edge of deck to justance from right edge of deck to superstructure definition ref. line superstructure Definition Alternative Definition Alte		
stringer		
Deck 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 superstructure definition reference line: 17.00 ft 17.00 ft		
Distance from right edge of deck to superstructure definition reference line: 17.00 ft 17.00 ft		
Left edge of deck to first main member: 2.00 ft 2.00 ft		
Left edge of deck to first stringer: 8.00 ft 8.00 ft		
	a	
OK Apply	Ca	ncel

### 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 of deck to superstructure definition ref. line 			
Deck Deck (cont'd) Parapet Median Railing Generic Sidewalk Lane position Striped lanes Wearing surface			
Deck concrete:       3 ksi Cement Concrete         Total deck thickness:       9.000 in         Load case:       Engine Assigned v         Deck crack control parameter:       130.000 kip/in         Sustained modular ratio factor:       3.000			
OK	Apply	Cance	el

### Structure Typical Section – Generic

Click the **New** button to add a row to the table. The **Name** of the generic barrier defaults to the only barrier described for the bridge. The competed tab is shown below.

🕰 Stri	ucture Typical Section								-		×
Back	Front	ic Shape									
Dec	k Deck (cont'd) Parapet	Median Railing	Generic	Sidewalk	Lane position	Striped lanes	Wearing su	rface			
	Name	Load case	Measure to	Edge of deck dist. measure from		Distance at end (ft)	Front face orientation				
	2' Parapet with Curb 🔹	DC2 -	Front *	Left Edge	- 0.00	0.00	Left -			4	
Þ	2' Parapet with Curb 🔹	DC2 -	Front *	Right Edge	· 0.00	0.00	Right -				
							New	Duplicate	(	Delete	
							ОК	Apply	/	Canc	el

#### Structure Typical Section – Lane Positions

Select the **Lane position** tab. This tab defines the locations that the vehicles can move or travelways. 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.

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	-15.00	15.00	-15.00	15.00	

truc	ture Typical S	Section				-	
	Travelw		ture Definition Reference Line Travelway 2				
eck	Deck (co	ont'd) Parapet Median	Railing Generic Sidewa	alk Lane position Striped	l 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	-15.00	15.00	-15.00	15.00		
- L		ilable to trucks:	Compute		New Dupl	icate	Delete

The Lane Position tab is populated as shown below.

Click OK to apply the data and close the window

#### Stiffener Definitions – Transverse

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



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

🗛 New Transv	A New Transverse Stiffener Definition								
	Stiffener Type:								
	Trans. Plate Stiffener	~							
	Trans. Plate Stiffener								
	Trans. Angle Stiffener								
	OK	Cancel							

Define the stiffener as shown below.

A Transverse St	ffener Definition				_		×
Name: 3/8" Pl	ate Stiffener						
Stiffener typ Single Pair	2		Top gap: in Width:				
Plate			6.0000 in	$\longleftrightarrow$			
Thickness: Material:	0.3750 in FY 36ksi Steel	~	Bottom gap:				
Welds			in				
Тор:	None 🗸						
Web:	None 🗸						
Bottom:	None 🗸						
			ОК	Арр	bly	Cance	el

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

Repeat this process to define another stiffener as shown below.

A Transverse St	iffener Definition			_		×
Name: 1/2" P	ate Stiffener					
Stiffener typ Single Pair Plate Thickness: Material: Welds	0.5000 in FY 36ksi Steel	>	Top gap: Width: 7.0000 in Bottom gap: in			
Top: Web:	None					
Bottom:	None 💙					
			OK	Apply	Canc	el

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

#### Stiffener Definitions – Bearing

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



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

A New Bearing Stiffener Definition	Х
Stiffener Type:	
Plate Stiffener	
Plate Stiffener	
Angle Stiffener	
	_
OK Cancel	

### Define the stiffener as shown below.

🕰 Bearing Stiffe	ner Definition		– 🗆 X
Name: Bearing Plate Thickness: Material: Welds Top: Web: Bottom:	g Stiffener 0.7500 in FY 36ksi Steel V None V None V	in in 8.0000 in in	
		OK	Apply Cancel

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

### Floorbeam Member Locations

Double click on the **Floorbeam Member Locations** node in the **Bridge Workspace** tree to open the **Floorbeam Member Locations** window as shown below.

•	Floorbeam Mer	mber Locatio	ns				-		×
	Floorbeam name	Reference distance (ft)	Offset (ft)	Location (ft)	Skew (degrees)				
									*
ſ	Floorbeam	ו							Ŧ
l	location wizard	J				New Dup	licate	Delet	a
						OK A	pply	Cano	el

Click the **Floorbeam location wizard...** button and enter the following spacing to add floorbeams for the entire structure. Click **OK** to add the floorbeams.

ø	D. F	loorbeam l	ocation Wizar	rd						×
I	Pre	fix for syste	m to use whe	n naming g	enerated flo	orbeams:	Floorbear	n		
					Floorbea	m spacing				
		Start distance (ft)	Number of spaces	Spacing (ft)	End distance (ft)					
	×.	0.00	1	0.00	0.00					-
		0.00	8	20.00	160.00					
										*
							New	Duplicate	Delete	
								OK	Cancel	

Floorbeam name	Reference distance (ft)	Offset (ft)	Location (ft)	Skew (degrees)		
Floorbeam1	0.00	0.00	0.00	0.0000		
Floorbeam2	0.00	20.00	20.00	0.0000		
Floorbeam3	20.00	20.00	40.00	0.0000		
Floorbeam4	40.00	20.00	60.00	0.0000		
Floorbeam5	60.00	20.00	80.00	0.0000		
Floorbeam6	80.00	20.00	100.00	0.0000		
Floorbeam7	100.00	20.00	120.00	0.0000		
Floorbeam8	120.00	20.00	140.00	0.0000		
Floorbeam9	140.00	20.00	160.00	0.0000		
	140.00	20.00	100.00	0.0000		
	140.00	20.00	100.00	0.0000		

The floorbeam member locations created for the structure are shown below.

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

#### Stringer Group Definition Geometry – Stringer span lengths

A stringer group definition contains data regarding a portion of the structure where the stringers are structurally continuous. The stringers in this structure all have the same span data. They are 2 span continuous and are supported by 3 floorbeams. Create one stringer group definition containing this geometry data and then apply this stringer group definition to all the 4 stringer units in this structure. Double click on the **STRINGER GROUP DEFINITION GEOMETRY** in the **Bridge Workspace** tree to define the geometry for a stringer group definition as shown below.

Stringer Group Definition Geometry								_	
me: Def 1 Description:									
Stringer span lengths Diaphragms									
Number of floorbeams that support this string All floorbeams are perpendicular to the structu	-			Ver 🔍 No					
Floorbeam spacings		indon referen							
Select the floorbeam spacings which can be used to define the stringer span lengths in this stringer group definition:		Floorbeam spacing (ft)	Skew angle (degrees)	Stringer support	Offset/ cantilever length (ft)				
Possible floorbeam spacing		0.0000	0.000 -	Simple *	0.0000				<b>A</b>
(ft)		20.0000	• 0.000	Continuous *	0.0000				
20.0000,20.0000		20.0000	• 0.000	Simple *	0.0000				
	Com	puted result	ing stringer	span lengths					$\nabla$
	:	Span Leng (ft							
		1 20.00	000						-
		2 20.00	000						
									w
						Ok	C App	ly	Canc



Enter the following data in the **Floorbeam spacings** grid to describe the span lengths of the stringer members that will be in the stringer units to which this stringer group definition is assigned in the **Floor System Geometry** window later. In this example, define the lengths of the stringers in detail, including the  $\frac{1}{2}$ " offset between the end of the stringer and the centerline of the floorbeam. If the user wishes to not enter all the details, the end Stringer support type can be selected as **Simple** and the offset length in the grid will default to zero.

A Stringer Group Definition Geometry	-		×
Name: Def 1 Description:			
Stringer span lengths Diaphragms			
Number of floorbeams that support this stringer group definition:			
All floorbeams are perpendicular to the structure definition reference line:   Yes  No Floorbeam spacings Offset/			
Select the floorbeam spacings which can be used to define the stringer span lengths in this stringer group definition:     Floorbeam spacing (ft)     Skew angle (ft)     Ottset/ cantilever (degrees)			
Possible floorbeam spacing 0.0000 0.000 - Simple, Offset - 0.0417			
(ft) 20.0000 0.000 - Continuous - 0.0000			
20.0000,20.0000 20.0000 0.000 Simple, Offset • 0.0417			
Computed resulting stringer span lengths          Span       Length       Cantilever         \$ 1       19.9583		× ×	
ΟΚΑ	pply	Cance	
	עיאא	Cance	1

Click Apply to compute and save the stringer span length data before navigating to the Diaphragms tab.

Click **F1** on this window to open the **AASHTOWare BrDR Help** for this window to view some examples illustrating how to define stringer group definitions.

### Stringer Group Definition Geometry – Diaphragms

Navigate to the **Diaphragms** tab to enter the diaphragm spacing for the stringer group definition. **Diaphragm Bay 1** is the bay between the left most girder and the first stringer.



### Enter the following diaphragms for **Diaphragm Bay 1**.

<b>A</b> 9	Stringer	r Group Defin	ition Geometry							- 🗆 X
Na	me: [	Def 1	Descr	iption:						
9	Stringer	r span length	s Diaphragr	ms						
	Diaph	nragm Bay:	- ×	Copy bay	to	Diaphrag	m wizard			
	(ft) sr			Diaphragm spacing	Number of spaces	Number Length of spaces (ft)		End distance (ft)		
		Left	Right	(ft)			Left	Right	(kip)	
	>	0.96	0.96	0	1	0	0.96	0.96	0.12	A
		0.96	0.96	19.4783	2	38.9566	39.9166	39.9166	0.12	
										New Duplicate Delete
										Duplicate Delete
										OK Apply Cancel

Click the **Copy bay to...** button to copy the diaphragms entered for Bay 1 to the other bays. The following window appears. Select all the bays by holding the **Shift** key and Click **Apply** as shown below.

🕰 Copy Diaphragm B	×	
Select the new bay(s):	Bay 2 Bay 3 Bay 4 Bay 5	
	Apply Can	cel

The following message appears indicating that the diaphragms have been copied. Click **OK** to close this window and update the diaphragms for each bay.



### Assigning Stringer Group Definitions to Stringer Units – Floorbeam Member Locations

Double click on the **Floor System Geometry** node in the **Bridge Workspace** tree to assign stringer group definitions to stringer units in the floor system superstructure definition.

Before opening this window, the total number of stringers in this structure is known i.e., 16 since there are 4 stringer units and each unit contains 4 stringers. However, the location of these stringer members along the length of the structure and the length of the stringer is not known. The stringer members in the structure are all located at the beginning of the structure and do not have any length to them until a stringer group definition is assigned to the stringer units. The stringer group definition defines the stringer span lengths. Assigning stringer group definitions to the stringer units also locates the stringer members along the length of the structure. Click **F1** while this window is open to open the **AASHTOWare BrDR Help** to view examples illustrating how to assign stringer group definitions to stringer units.



Enter the data as shown below.

		Geometry						_	)
	Include floo	rbeams in unit refere	ence	25					
	Stringer unit number	Stringer group definition		Unit referenced from left end of superstructure or end of previous unit	Distance to stringer group definition workpoint (ft)	Mirror group definition	Include in analysi	-	
	Unit 1	Def 1	Ŧ	Left end of structure *	0.00	None *	$\checkmark$		4
	Unit 2	Def 1	*	Left end of structure *	40.00	None *	$\checkmark$		
	Unit 3	Def 1	*	Left end of structure *	80.00	None *	$\checkmark$		
Þ	Unit 4	Def 1	Ŧ	Left end of structure *	120.00	None *	$\checkmark$		

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

### Describing a Floorbeam Member Definition – Floorbeam Definition (FB1) (Plate girder floorbeams)

Expand the **MEMBER DEFINITION** node in the **Bridge Workspace** tree and double click on the **FLOORBEAM DEFINITIONS** node (or select **FLOORBEAM DEFINITIONS** and click **New** from the **Manage** group of the **WORKSPACE** ribbon) to open the **New Floorbeam Definition** window as shown below.



Select Steel as the Material type and Plate for Girder type as shown below.

A New Floorbeam Definition	×
Material type:	Girder type:
Steel	Built-up
	Detailed Steel Truss
	Plate
	Rolled
	OK Cancel

Click **OK** to close the window and create a new member definition.
The Floorbeam Definition window will open. Enter the data as shown below. Select Schedule-based as the Floorbeam property input method. This definition is used to describe FB1 in the structure.

A Floorbeam Definition	– – ×
Name: Floorbeam Def 1	
Description Specs Factors Engine Control options	
Description:	Material type: Steel Floorbeam type: Plate Default units: US Customary
Floorbeam property input method       Self load         Schedule-based       Load case:       Engine Assigned         Cross-section based       Additional self load:       0.005       kip/ft         Additional self load:       %	
Default rating method: LFR	Floorbeam length between main members Span Length (ft) 1 30.00
	OK Apply Cancel

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

### Floorbeam Profile

Expand the **Floorbeam Def 1** node in the **Bridge Workspace** tree and double click on the **Floorbeam Profile** node in the **Bridge Workspace** tree to open the **Floorbeam Profile** window as shown below.



### Describe the web as shown below.

e: P	late Gird													
Neb	Top fla	ange	Bottom	flange										
	Begin depth (in)	Dept	h vary	End depth (in)	Thickness (in)	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld at right				
)	48.0000	None	÷	48.0000	0.3750	0.00	30.00	30.00	FY 36ksi Steel	None	•			*
														•
										New [	Duplic	ate	Delete	
											, abur			

Describe the flanges as shown below.

	Top fla		ttom flange				1				
	Begin width (in)	End width (in)	Thickness (in)	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld	Weld at right		
Þ	12.0000	12.0000	1.0000	0.00	30.00	30.00	FY 36ksi Steel 🔻	None	None	-	

_	Plate Girde			_								
Veb	Top fla	nge Bo	ttom flange									
	Begin width (in)	End width (in)	Thickness (in)	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld		Weld right		
Þ	12.0000	12.0000	1.0000	0.00	30.00	30.00	FY 36ksi Steel	 - None	Ŧ	None	*	



## Stiffener Ranges

Double click on the **Stiffener Ranges** node in the **Bridge Workspace** to open the **Stiffener Ranges** window. Enter the transverse stiffener range as shown below.

Stiff	ener Ranges							-		
•	Start Distance	ng								
Trar	nsverse stiffener ranges	Longitudinal	stiffener range	es						
	Name	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)				
Þ	3/8" Plate Stiffener	- 0.00	9	36.0000	27.00	27.00				A.
							New Duplie	ate	Delete	~

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

The description of the floorbeam definition is complete. Repeat the process for another floorbeam definition.

### Describing a Floorbeam Member Definition – Floorbeam Definition (FB2)

Double click on the **FLOORBEAM DEFINITIONS** node in the **Bridge Workspace** tree. Select **Steel** for the **Material type** and **Plate** for the **Girder type**. Click **OK** to create a new member definition. The **Floorbeam Definition** window will open. Enter the data as shown below. Select **Schedule-based Floorbeam property input method**. This definition is used to describe **FB2** in the structure.

A Floorbeam Definition			_		×
Name: Floorbeam Def 2					
Description Specs Factors Engine	Control options				
Description:		Material type:	Steel		
		Floorbeam type:	Plate		
		Default units:	US Customary	~	
Floorbeam property input method <ul> <li>Schedule-based</li> <li>Cross-section based</li> </ul> Default rating method:                  LFR <ul> <li>             LFR             </li></ul>	Self load Load case: Engine Assigned V Additional self load: 0.005 kip/ft Additional self load: % Cantilever Cantilever lengths Left: ft	Floorbeam lengt members Span Leng (ft; ) 1 30	gth		
Left Floorbeam Span Right Cantilever Cantilever	Right: ft	ОК	Apply	Cano	el

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

### Floorbeam Profile

Expand the **Floorbeam Def 2** node in the **Bridge Workspace** tree and double click on the **Floorbeam Profile** node in the **Bridge Workspace** tree to open the **Floorbeam Profile** window. Describe the web as shown below.

ate Girde	er												
Top fla	nge	Bottom	flange										
lepth	Depth	vary	End depth (in)	Thickness (in)	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld at right				
8.0000	None	-	48.0000	0.3750	0.00	30.00	30.00	FY 36ksi Steel 🔻	None	Ŧ			^
													•
	Begin depth (in)	Begin depth Depth	Begin Jepth Depth vary (in)	Begin End Bepth Depth vary depth (in) (in)	Begin Jepth Depth vary End depth (in) (in) (in) (in)	Begin Jepth Depth vary End depth (in) Thickness Start distance (in) (in) (in) (in)	Begin Jepth Depth vary End (in) End depth Thickness (in) Chickness Start (in) Chickness (in) Chickness (in) Chickness (in) Chi	Begin Jepth Depth vary End (in) End Thickness Start (in) (in) (in) (in) (in) (in) (in) (in)	Begin Jepth Depth vary End (in) Link Constant Co	Begin Jepth Depth vary End depth (in) Thickness Start (in) (ft) (ft) (ft) (ft) Material Weld at right	Begin Jepth Depth vary (in) Thickness (in) Start (in) End depth (in) Charter (in) C	Begin Jepth Depth vary (in) End depth (in) Thickness (in) Start distance (ft) (ft) End distance (ft) (ft) Material Weld at right	Begin Jepth Depth vary (in) End depth (in) (in) (in) (in) (in) (in) (in) (in)

## Describe the flanges as shown below.

	Begin width	End width	Thickness (in)	Start distance	Length (ft)	End distance	Material	Weld		Weld at right		
Þ	(in) 12.0000	(in) 12.0000	1.5000	(ft) 0.00	30.00	(ft) 30.00	FY 36ksi Steel 🔻	None	+	None	+	-

Veb	~	er		_									
	Top fla	nge Bo	ttom flange										
	Begin width (in)	End width (in)	Thickness (in)	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld		Weld at right			
F	12.0000	12.0000	1.5000	0.00	30.00	30.00	FY 36ksi Steel 🔹	None	Ŧ	None	-		-
_	Copy to	top flange							New	Dupli	cate	Delete	-

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

### Stiffener Ranges

Double click on the **Stiffener Ranges** node in the **Bridge Workspace** to open the **Stiffener Ranges** window. Enter the transverse stiffener range as shown below.

Start Distance       Spacing         Transverse stiffener ranges       Longitudinal stiffener ranges         Name       Start       Number of       Spacing       Length       distance (ft)         > 3/6* Plate Stiffener       0.00       9       36.0000       27.00       27.00	Stiffener Ranges						- 0
Name     Start distance (ft)     Number of spaces     Spacing (in)     Length (ft)     End distance (ft)       > 3/8* Plate Stiffener     •     0.00     9     36.0000     27.00     27.00	I I	<u> </u>	tiffener range	5			
		Start distance	Number of	Spacing		distance	
New Duplicate Delte	> 3/8" Plate Stiffener	· 0.00	9	36.0000	27.00	27.00	4

Click  $\mathbf{OK}$  to apply the data and close the window

The description of the second floorbeam definition is complete.

### Describing a Stringer Member Definition – Stringer Definition (Rolled beam stringers)

Expand the **MEMBER DEFINITION** node in the **Bridge Workspace** tree and double click on the **STRINGER DEFINITIONS** node (or select **STRINGER DEFINITIONS** and click **New** from the **Manage** group of the **WORKSPACE** ribbon) to open the **New Stringer Definition** window as shown below.



Select Steel as the Material type and Rolled for Girder type as shown below.

A New Stringer Definition	×
Material type:	Girder type:
Steel	Built-up
	Plate
	Rolled
	OK Cancel

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

The **Stringer Definition** window will open. Enter the data as shown below. Select **Schedule-based** as the **Stringer property input method**. Select the **Associate with stringer group definition** button so that the stringer span lengths will be populated based on the stringers span lengths specified in the **Stringer Group Definition Geometry** window.

A Stringer Definition	- (	X
Name: Stringer Def 1		
Description Specs Factors Engine Control options		
Description       Specs       Factors       Engine       Control options         Description:	Material type: Steel Stringer type: Rolled Default units: US Customary   Default rating method: LFR End bearing locations Left: in Right: in	
	OK Apply	Cancel

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

#### Stringer Profile

Expand the **Stringer Def 1** node in the **Bridge Workspace** tree and double click on the **Stringer Profile** node in the **Bridge Workspace** tree to open the **Stringer Profile** window as shown below.



### Describe the shape as shown below.

•		_	rofile						_		×
	pe: Shap		ed Shap		ate Botte	om cover plate					
			Shape	2	Start distance (ft)	Length (ft)	End distance (ft)	Material			
	>	W 2	1x62	~	0	39.9166	39.9166	FY 36ksi Steel 🗸 🗸		-	
										Delete	
									OK Apply	Cance	

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. Enter the data describing the structural properties of the deck.

pe: R	olled									
Deck c	oncrete Reinforceme	ent	Shear con	nectors						
	Material		Start distance (ft)	Length (ft)	End distance (ft)	Structural thickness (in)	Effective flange width (Std) (in)	Effective flange width (LRFD) (in)	n	
> 3	ksi Cement Concrete	~	0	39.9166	39.9166	8.5	59.875	59.875		

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

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

Decl	k concrete	Reinfor	cement	Shear connectors					
	Start distance (ft)	Length (ft)	End distance (ft)	Connector ID	Number per row	Number of spaces	Transverse spacing (in)		
>	0	39.9166	39.9166	Composite 🗸					1

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

### Haunch Profile

Double click on the **Haunch Profile** node in the **Bridge Workspace** tree and enter data in the **Haunch Profile** window as shown below.



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

#### Lateral Support

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

ater	al Support			-	>
		7////			
	01 1 01 1	1	I		
	Start Distanc	e ¦ L	ength 🙀		
ang		M	ength <b>H</b>		
ang		M	ength <b>H</b>		
ang	es Locat	M	End distance (ft)		

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

The description of the stringer is complete.

### Describing a girder member (Plate girder Girders)

Expand the **GIRDER MEMBERS** node in the **Bridge Workspace** tree and double click on **Girder 1** (or select **Girder 1** and click on **Open** from the **Manage** group of the **WORKSPACE** ribbon) The **Member** window shows the data that was generated when the superstructure definition was created. Change the name to **Left Girder**. The first Member Alternative created will automatically be assigned as the **Existing** and **Current member alternative** for this Member.

🕰 Member									_		×
Member name:	Left Girder			Link w	th: None	~					
Description:											
	Existing	Current	Member alte	rnative name		Des	scription				
											-
											v
Number of span	s: 2 🗘	Span	Span length								
		no.	(ft)								
		1	80.								
		2	00.								
	l			-							
							ОК	Apply	,	Cance	el

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

### Defining a Girder Member Alternative

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

🕰 New Member Alternative		>
Material type:	Girder type:	
Steel	Built-up	
	Plate	
	Rolled	
	OK Cano	el

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

The **Member Alternative Description** window will open. Enter the data as shown below. Select **Schedule based Girder Property input method**.

	viember Alte	rnative De	scription				-	
escription: escription: Girder type: Girder type: Plate Default units: US Customary Girder property input method Schedule based Left: Right: In Self load Load case: Engine Assigned Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Right: Lift: Lift: Lift: Right: Lift: Lift: Lift: Right: Lift: L	mber alterna	ative: Lef	t Plate Girde	er				
Girder type: Plate Default units: US Customary V Girder property input method Schedule based Cross-section based Self load Load case: Engine Assigned Additional self load: 0.010 kip/ft	Description	Specs	Factors	Engine	Import	Control options	)	
Girder property input method Schedule based Cross-section based Self load Load case: Engine Assigned V Additional self load: 0.010 kip/ft	escription:							
Schedule based   Cross-section based     Left:   in     Right:     in     Self load      Default rating method:   Load case:   Engine Assigned   Left:   In   Default rating method:   LFR						Default units:	US Customary	
Schedule based   Cross-section based          Self load	- Girder pro	perty inpu	it method	End be	aring locat	tions	Simple DL, continuous LL	
Self load Default rating method: Load case: Engine Assigned V LFR V Additional self load: 0.010 kip/ft	Schedu	ile based		Left:				
Load case: Engine Assigned V LFR V Additional self load: 0.010 kip/ft	O Cross-s	section bas	sed	Right:		in		
Load case: Engine Assigned V LFR V Additional self load: 0.010 kip/ft	C 161 - 1							
Additional self load: 0.010 kip/ft						-		
					~	LFR		
Additional self load: %								
	Additional	self load:		%				
OK Apply Cance								

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

## Girder Profile

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

## Web

We	b Top fla	ange Bottom flar	ige										
	Begin depth (in)	Depth vary	_	End depth (in)	Thickness (in)	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Material	Weld at right		
	72.0000	None	Ŧ	72.0000	0.5000	1 *	0	55.00	55.00	FY 36ksi Steel 🔻	None	-	A
	72.0000	Parabolic Concave	-	108.0000	0.5000	1 *	55.00	24.25	79.25	FY 36ksi Steel 🔻	None	-	
	108.0000	None	*	108.0000	0.5000	1 *	79.25	1.50	80.75	FY 36ksi Steel 🔻	None	-	
Þ	108.0000	Parabolic Concave	Ŧ	72.0000	0.5000	2 -	0.75	24.25	25.00	FY 36ksi Steel 🔻	None	-	
	72.0000	None	*	72.0000	0.5000	2 -	25.00	55.00	80.00	FY 36ksi Steel 🔻	None	-	
													4
										New Dup	licate	Delet	te

## Describe the flanges as shown below.

## Top flange

		flange	Bottom flang	je										
	Begin width (in)	End width (in)	Thickness (in)	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Material		Weld		Weld at right		
	16.0000	16.0000	1.5000	1 *	0.00	55.00	55.00	FY 36ksi Steel	Ŧ	None	Ŧ	None	-	\$
Þ	16.0000	16.0000	2.0000	1 -	55.00	50.00	105.00	FY 36ksi Steel	Ŧ	None	Ŧ	None	*	
	16.0000	16.0000	1.5000	2 -	25.00	55.00	80.00	FY 36ksi Steel	Ŧ	None	Ŧ	None	Ŧ	
														÷

## **Botton flange**

	Begin width (in)	End width (in)	Thickness (in)	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Material		Weld	Weld at right		
	16.0000	16.0000	1.5000	1 -	0.00	55.00	55.00	FY 36ksi Steel	Ŧ	None 🔻	None	-	4
	16.0000	16.0000	2.0000	1 *	55.00	50.00	105.00	FY 36ksi Steel	Ŧ	None 🔻	None	*	
Þ	16.0000	16.0000	1.5000	2 -	25.00	55.00	80.00	FY 36ksi Steel	-	None 🔻	None	*	

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. Deck effective flange width is calculated according to AASHTO Article 10.38.3, the effective flange width shall not exceed one-fourth of the span length of the girder, 80'/4 = 20' = 240'', the distance center to center of girders, 30'/2+2' = 17' = 204'', and twelve times the least thickness of the slab, 12x8.5'' = 102''. Twelve times the least thickness of the slab, 102'' controls. The window is shown below.

Dec	ck concrete Reinforcemer	nt Shear	connectors	;						
	Material	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Structural thickness (in)	Effective flange width (Std) (in)	Effective flange width (LRFD) (in)	n	
Þ	3 ksi Cement Concrete 💌	1 *	0.00	160.00	160.00	8.5000	102.0000			

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

e:	Plate ck concrete	Reinfor	cement	Shear cor	nectors			
	LK CONCrete	Keinior	cement	Shear cor	inectors			
	Support number	Start distance (ft)	Length (ft)	End distance (ft)	Connector ID	Number of spaces	Number per row	Transverse spacing (in)
Þ	1 *	0.00	160.00	160.00	Composite -			

Click  $\mathbf{OK}$  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.

🗛 Steel Haunch Profi	e						-		×
Haunch type:	Embedded flange	Y2 Z3 Z4							
	Support Start number (ft)	Length (ft) (ft)	Z1 Z2 (in) (in)	Z3 (in)	Z4 (in)	Y1 (in)	Y2 (in)		
	▶ <u>1</u> - 0.00	160.00 160.00	0.0000 0.0000	0.0000	0.0000	1.0000	1.0000		^
					New	Dupl	icate	Delete	V
					OK	A	oply	Cance	el 🛛

Click  $\mathbf{OK}$  to apply the data and close the window

## Lateral Support

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

🕰 Lateral Suppor	t				-		×
	Z		Z				
Start Dista	nce 🙀	Length	- <b>i</b>		2	Z	
Ranges Lo	cations						
Top flange							
Support number	Start distance (ft)	Length (ft)	End distance (ft)				
▶ 1	0.00	160.00	160.00				

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

### Stiffener Ranges

Double click on the **Stiffener Ranges** node in the **Bridge Workspace** to open the **Stiffener Ranges** window. Enter the transverse stiffener ranges as shown below.

Ŧ	Start Distan	ce	Spacing	•							
rans	sverse stiffe	ener ran	ges La	ongitudinal	stiffener ran	ges				 	 
		Name		Support number	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)		
<pre>}</pre>	1/2" Plate S	Stiffener	Ŧ	1 -	0.00	31	60.0000	155.00	155.00		

Click  $\mathbf{OK}$  to apply the data and close the window

## Bearing Stiffener Locations

The **Bearing Stiffener Location – Support 1** window is opened by expanding the **Bearing Stiffener Locations** node in the **Bridge Workspace** tree and double clicking on the **Support1** node. The assignment for support 1 is shown below.

A Bearing Stiffener Location - Support 1	_		×
Pairs of bearing stiffeners at this support: 1 X:			
Stiffener Name Offset (in)			
1 Bearing Stiffener      0.0000			-
			Ŧ
ОК Арр	ly	Cance	2

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

Repeat this process for **Support2** and **Support3**.

### Live Load Distribution

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

Standard       LRFD         Distribution factor input method       Use advanced method       Use advanced method with 1994 guide specs         Allow distribution factors to be used to compute effects of permit loads with routine traffic       Image: Compute from typerate in the second sec	ve L	oad Distributio	on							_	
Compute from       Use advanced method       Use advanced method with 1994 guide specs	and	lard LRFD									
We simplified method       Use advanced method       Use advanced method with 1994 guide specs         Allow distribution factors to be used to compute effects of permit loads with routine traffic       Image: Compute field to compute advanced method         Lanes       Distribution factor       Image: Compute field to compute advanced method         1 Lane       1.6666667       1.6666667         2 1 Lane       1.6666667       1.666667         3 1 Lane       1.6666667       1.666667         4 1 Lane       1.6666667       1.666667         5 1 Lane       2.5333333       2.5333333         5 1 Lane       1.6666667       1.666667         6 1 Lane       1.6666667       1.666667         6 1 Lane       1.6666667       1.666667         6 1 Lane       1.6666667       1.6666667<	- Di	istribution fact	or input method								
Allow distribution factors to be used to compute effects of permit loads with routine traffic         Lanes       Distribution factor (wheels)         Joaded       Shear         Shear       Shear at supports         Moment       Deflection         J       Lane         1.6666667       1.6666667         Multi-lane       2.5333333         2.5333333       2.5333333         2       5333333         Shear       Shear         Shear       Shear at supports         Multi-lane       2.5333333         Zongute from       View caler.		-		Use advanced m	ethod	advanced m	ethod with 1	004 quide s	necs		
Lanes loaded         Distribution factor (wheels)           > 1 Lane         1.6666667         1.6666667         1           Multi-lane         2.5333333         2.5333333         2		J Use simpli		Use advanced m		auvanceu m	ethod with i	554 guide s	pecs		
Lanes         (wheels)           3 ILane         1.6666667         1.6666667         1           Multi-lane         2.5333333         2.5333333         2		Allow distribut	ion factors to be used	d to compute effe	ects of permit loads	s with routine	traffic				
Compute from         View calcy           View calcy         View calcy		Lanes									
Multi-lane         2.5333333         2.5333333         2           Compute from         View rafer		loaded	Shear		Moment	Deflection					
Compute from	>	1 Lane	1.6666667	1.6666667	1.6666667	1					ĥ
		Multi-lane	2.5333333	2.5333333	2.5333333	2					
(produced)											

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

The description of the girder member is complete.

### Member – Girder 2

Expand the **GIRDER MEMBERS** node in the **Bridge Workspace** tree and double click on **Girder 2**. The **Member** window shows the data that was generated when the superstructure definition was created. Change the name to **Right Girder** and select **Left Girder** from the options under the **Link with** menu. A warning message will appear to remind that both members must share the exact same definition if they are to be linked. Click **Continue** to link the two members.

A Member	-		$\times$
Member name: Description:	: Right Girder Link with: None 👻		
	Existing Current Member alternative name Description		
Number of spar	All of the calculations for this member, or select Cancel if you down to link the member.     OK Apply	e iginal n't	4

The **Member** window will be updated as shown below.

A Member							-		×
Member name:	Right Girder		Link w	ith: Left Girder	~				
Description:									
	Existing Curre	nt Member alte	rnative name		Desci	ription			
	V V	Left Plate Girde	er						<b></b>
									-
Number of spar	is: 2 🗘	Span							
		length							
		1 80.	0						
		2 80.							
		- ,							
			-						
						OK	Apply	Can	ncel

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

The description of the second girder member is complete.

#### Describing a Stringer Member – STRINGER UNIT LAYOUT

Expand the Floor System Geometry, STRINGER UNIT LAYOUT, Stringer Unit 1 Layout and STRINGER MEMBERS in the Bridge Workspace tree. Double click on the Unit1 Stringer1 node to open the Stringer Member window (or select Unit Stringer1 and click the Open button from the Manage group of the WORKSPACE ribbon, or right click and select Open) as shown below.



Include the stringer in analysis by making sure that the Include in analysis option is checked. The first Stringer Member Alternative created will automatically be assigned as the **Existing** and **Current** Member Alternative for this member.

🕰 Stringer Member		-	_		×
Name:	Unit1 Stringer1	in analysis			
Description:					
	Existing Current Member alternative name Description				
					^
					~
	OK	Apply		Cancel	

Click OK to apply the data and close the window

#### Defining a Stringer Member Alternative

There are two methods to create stringer member alternatives for the stringer members in the structure:

- 1. Manually create a stringer member alternative in the **Bridge Workspace** tree and assign a stringer definition to this alternative.
- Use the Stringer Unit Layout Wizard to quickly create stringer member alternatives for all the stringer members in the structure. This wizard can be accessed by selecting the Wizard button from the TOOLS ribbon while the STRINGER UNIT LAYOUT is selected in the Bridge Workspace tree.



This example uses the manual approach in Option 1 to create stringer member alternatives for the stringer members in this structure.

Double click on the **STRINGER MEMBER ALTERNATIVES** node in the **Bridge Workspace** tree to create a new member alternative for **Unit1 Stringer1**. The **Stringer Member Alternative** window shown below will open. Enter **Alt1** for the **Name** of the alternative. Note that **Stringer Def 1** is assigned as the **Stringer definition** for this alternative. Click **Apply** to create the member alternative.

A Stringer Member Alternative	_	×
Name: Alt 1 Stringer definition: Stringer Def 1		
Analysis locations Live load distribution Web loss Top flange loss Bottom flange loss Top cover plate loss Bottom cover plate	late loss	
Distance from left end (ft) Side		
		<u> </u>

### Stringer Member Alternative – Live load distribution

Navigate to the **Live load distribution** tab of this window. Use the **Compute from typical section** button to compute the **Standard** (LFR) distribution factors.

me:	Alt 1			String	ger definition: Str	inger Def 1	~				
nalys	sis locations	Live load di	stribution	Web loss	Top flange los	s Bottom flange	e loss Top co	over plate loss	Bottom co	ver plate loss	
Sta	indard										
~	Allow distrib	ution factors	to be used	l to compute	effects of permit l	oads with routine to	affic				
			Distribution	n factor (whe	els)		Compu	te from			
	Lanes loaded	Shear	Support shear	Moment	Deflection		typical				
>	1-lane	0.8571429	1	0.8571429	0.3333333		View	colec			
	Multi-lane	1.0909091	1				view	Calcs			
- LRF	FD	oution factors			0.66666667 effects of permit l	bads with routine to	affic				
	FD Allow distrib tion: Deflection	oution factors	to be used	to compute	effects of permit l	l to act as a unit	affic	Compute fi	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
	FD Allow distrib	oution factors	to be used	I to compute	effects of permit l ficiently connected	d to act as a unit	affic	Compute fi typical sect			
	FD Allow distrib tion: Deflection Start dista	on V	to be used	I to compute	effects of permit l ficiently connected	d to act as a unit	affic		ion		
	FD Allow distrib tion: Deflection Start dista	on V	to be used	I to compute	effects of permit l ficiently connected	d to act as a unit	affic	typical sect	ion		

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

The description of the stringer member is complete. Repeat this process for **Unit1 Stringer2**, **Unit1 Stringer3**, and **Unit1 Stringer4** of **Stringer Unit 1 Layout**.

The partially expanded Bridge Workspace tree for Stringer Unit 1 Layout is shown below.



Double click on the **Stringer Unit 1 Layout** node in the **Bridge Workspace tree** to include all stringers in analysis as shown below.

	Stringer Unit Layo	ut							_	×
St	tringer group defin	ition:	Def 1		Mirrored statu	is: None				
N	umber of stringers	in unit:	4							
	Stringer member		ing stringer er alternative	Existing stringer definition	Current stringer member alternative	Current stringer definition	Include in analysis			
•	Unit1 Stringer1	Alt 1		Stringer Def 1	Alt 1	Stringer Def 1	V			-
	Unit1 Stringer2	Alt 1		Stringer Def 1	Alt 1	Stringer Def 1	<b>V</b>			
	Unit1 Stringer3	Alt 1		Stringer Def 1	Alt 1	Stringer Def 1	<b>V</b>			
	Unit1 Stringer4			Stringer Def 1		Stringer Def 1	<b>V</b>			

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

The description of the Stringer Unit 1 Layout is complete.

Repeat the process for describing a stringer member to all stringers in **Stringer Unit 2 Layout**, **Stringer Unit 3 Layout**, and **Stringer Unit 4 Layout**. Include all stringers in analysis. Describing a Floorbeam Member – FLOORBEAM MEMBERS

Expand the Floor System Geometry, and double click on Floorbeam1 (or select Floorbeam1 and click Open from the Manage group of the WORKSPACE ribbon or right click and select Open) to open the Floorbeam Member window.



Include the floorbeam in analysis by making sure that the **Include in analysis** option is checked. The first floorbeam member alternative created will automatically be assigned as the **Existing** and **Current** Member Alternative for this member.

A Floorbeam Me	nber				-		×
Name: Floorbea	n1	Include in analysis					
Description							
[							
Description:							
	l l l l l	am member					
	Existing Current Altern	ative name Description					
			<u></u>				
			-				
L							
				OK	Analy	Cano	
				UK	Apply	Cano	ei

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

#### Defining a Floorbeam Member Alternative

There are two methods to create floorbeam member alternatives for the floorbeam members in the structure:

- 1. Manually create a floorbeam member alternative in the **Bridge Workspace** tree and assign a floorbeam definition to this alternative.
- Use the Floorbeam Unit Layout Wizard to quickly create stringer member alternatives for all the floorbeam members in the structure. This wizard can be accessed by selecting the Wizard button from the TOOLS ribbon while the FLOORBEAM MEMBERS is selected in the Bridge Workspace tree (or right click FLOORBEAM MEMBERS and select Wizard from the menu).



This example uses the manual approach in Option 1 to create floorbeam member alternatives for the floorbeam members in this structure.

Double click on the **FLOORBEAM MEMBER ALTERNATIVES** node in the **Bridge Workspace** tree to create a new member alternative for **Floorbeam1**. The **Floorbeam Member Alternative** window shown below will open. Enter **Alt1** for the **Name** of the alternative. Select **Floorbeam Def 1** as the **Floorbeam definition** for this alternative.

A Floorbeam Member Alternative		-	×
Name: Alt #1	Floorbeam definition: Floorbeam Def 1		
Analysis locations Web loss	Top flange loss Bottom flange loss		
Distance from left end Side (ft)			

Click OK to apply the data and close the window

The description of the floorbeam member is complete. Repeat the process for describing a floorbeam member to **Floorbeam2**, **Floorbeam3**, **Floorbeam4**, **Floorbeam5**, **Floorbeam6**, **Floorbeam7**, **Floorbeam8**, and **Floorbeam9**. Since **Floorbeam5** is located at the interior pier, the floorbeam definition assigned for the alternative is **Floorbeam Def 2**.

The partially expanded Bridge Workspace tree for FLOORBEAM MEMBERS is shown below.

Workspace	_	×
Bridge Components		
FSC Floor System Geometry FILOORBEAM MEMBERS FLOORBEAM MEMBERS FLOORBEAM MEMBER ALTERNATIVES FICORBEAM MEMBER ALTERNATIVES BRIDGE ALTERNATIVES		
···· 📔 CULVERT DEFINITIONS		~

The description of the bridge is complete.

#### 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).



The following schematic will be displayed.



#### Schematic - Framing Plan Detail

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



The following schematic will be displayed.



## LFR Analysis

The perform a rating for all the girder, floorbeam and stringer member alternatives, select the superstructure definition **Floor System GFS with Deck** in the **Bridge Workspace** tree and click the **Analysis Settings** button on the **Analysis** group of the **DESIGN/RATE** ribbon. The window shown below opens.



### Click the **Open Template** button and select the **HS 20 LFR Rating** to be used in the rating and click **Open**.

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	
LRFR Design Load Rating	LRFR Design Load Rating	LRFR		Public	
LRFR Legal Load Rating	LRFR Legal Load Rating	LRFR		Public	

O Design	review (	Rating			Rating m	ethod:	LFR	~		
nalysis type ane / Impac			Girder	>	Apply pr	eference setting:	None	~		
Vehicles	Output	Engine	Description							
Traffic dire	ection: Bo	h directio	ns	~		Refresh	Temporary vehicles	Advanced	]	
Vehicle se	lection					Vehicle summar	у			
	andard	Legal Typ Legal Typ Legal Typ Permit Ve Legal Typ Legal Typ Legal Typ MIT Tandem	e 3 e 3-2 e 3-2 e 352 hicle e 3 e 3-2		Add to >> Remove from <<		ry 10-44 ng 10-44			

The Analysis Settings window will be populated as shown below.

Click OK to save the analysis settings to memory and close the window.

#### **Tabular Results**

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



When the rating is finished results can be reviewed by selecting the **Left Plate Girder** member alternative in the **Bridge Workspace** tree and clicking the **Tabular Results** button on the **Results** group of the ribbon.



#### The window shown below will open.

۵	Analysis R	esults - Left	Plate Girder								- 🗆	$\times$
	Print Print											
٩	port type:		- Lan	e/Impact loa	ding type	Display F	ormat					
Ra	ating Results	Summary	¥ ()	As requested	d 🔿 Detailed	Single ra	ting level p	per row	$\checkmark$			
					~							
	Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane	
	HS 20-44	Axle Load	LFR	Inventory	75.62	2.101	128.00	2 - (60.0)	Design Flexure - Steel	As Requested	As Requested	-
	HS 20-44	Axle Load	LFR	Operating	126.29	3.508	128.00	2 - (60.0)	Design Flexure - Steel	As Requested	As Requested	
	HS 20-44	Lane	LFR	Inventory	98.36	2.732	80.00	1 - (100.0)	Design Flexure - Steel	As Requested	As Requested	
	HS 20-44	Lane	LFR	Operating	164.26	4.563	80.00	1 - (100.0)	Design Flexure - Steel	As Requested	As Requested	
												T
	SHTO LFR E	naine Versia	n 7.5.0.3001									
ДĄ		-										
	alvsis prefer	ence setting	I: INONE									
	alysis prefer	ence setting	: None									lose