AASHTOWare BrDR 7.4.1 Steel Flange Lateral Bending Stress Tutorial STL13 – Flange Lateral Bending Example

BrDR Training

Overview

User input flange lateral bending stresses can be defined for steel girders in girder line and girder system superstructure definitions. These lateral bending stresses are defined separately for the top and bottom flange and are used when evaluating a member for flexure using the 9th Edition AASHTO LRFD specifications. The lateral stresses must be defined at diaphragm locations. Load cases are defined specifically for the lateral bending stresses and include options for construction loads, wind loads, dead loads, live load, and proportioned loads.

The input flange lateral bending stresses are added to any lateral bending stresses resulting from the analysis. This input can be used to:

- Approximate lateral bending stresses from skew effects while running a line girder analysis.
- Add lateral stresses from components not explicitly modeled, such as deck overhang brackets, while running a line girder or 3D analysis.
- Define temporary lateral stresses occurring during construction on the non-composite model.

From the Bridge Explorer create a copy of the Splice Example (BID 29) bridge from the sample database.

To copy the bridge, first select the **Splice Example** bridge in the bridge explorer table. Select copy in the top ribbon to copy the bridge.

		AASHTOWare Bridge Design and Rating					?	- 0
IDGE EXPLORER BRIDGE	R RATE TOOLS VIEW							
W Open	aste Copy Remove Delete							
Bridge	Manage							
- 🊖 Favorites Folder	E 🛋 Bridge ID	Bridge Name	District	County	Facility	Location	Route	Feature Int
Recent Bridges	1 TrainingBridge1	Training Bridge 1(LRFD)	Unknown	Unknown (P)	SR 0051	Pittsburgh	0051	SR 6060
All Bridges	2 TrainingBridge2	Training Bridge 2(LRFD)	Unknown	Unknown (P)	N/A	N/A	-1	N/A
E Plates	3 TrainingBridge3	Training Bridge 3(LRFD)	Unknown	Unknown (P)	1-79	Pittsburgh	0079	Ohio River
Deleted Bridges	4 PCITrainingBridge1	PCI TrainingBridge1(LFD)					-1	
	5 PCITrainingBridge2	PCITrainingBridge2(LRFD)					-1	
	6 PCITrainingBridge3	PCI TrainingBridge3(LFD)					-1	
	7 PCITrainingBridge4	PCITrainingBridge4(LRFD)					-1	
	8 PCITrainingBridge5	PCI TrainingBridge5(LFD)					-1	
	9 PCITrainingBridge6	PCITrainingBridge6(LRFD)					-1	
	10 Example7	Example 7 PS (LFD)					-1	
	11 RCTrainingBridge1	RC Training Bridge1(LFD)					-1	
	12 TimberTrainingBridge1	Timber Tr. Bridge1 (ASD)					-1	
	13 FSys GFS TrainingBridge1	FloorSystem GFS Training Bridge 1	Unknown	Unknown (P)	NJ-Turnpike	NJCity	-1	
	14 FSys FS TrainingBridge2	FloorSystem FS Training Bridge 2	Unknown	Unknown (P)	1-95	NYC	-1	
	15 FSys GF TrainingBridge3	FloorSystem GF Training Bridge 3	Unknown	Unknown (P)	1-95	ATL	-1	
	16 FLine GFS TrainingBridge1	FloorLine GFS Training Bridge 1	Unknown	Unknown (P)	1-75	JAX	-1	
	17 FLine FS TrainingBridge2	FloorLine FS Training Bridge 2	Unknown	Unknown (P)	1-75	GNV	-1	
	18 FLine GF TrainingBridge3	FloorLine GF Training Bridge 3	Unknown	Unknown (P)	1-95	NY	15	
	19 TrussTrainingExample	Truss Training Example					5	
	20 LRFD Substructure Example 1	LRFD Substructure Example 1						
	21 LRFD Substructure Example 2	LRFD Substructure Example 2			SR 4034	ERIE COUNTY	4034	FOUR MIL
	22 LRFD Substructure Example 3	LRFD Substructure Example 3						
	23 LRFD Substructure Example 4	LRFD Substructure Example 4 (NHI Hammer Head)					-1	
	24 Visual Reference 1	Visual Reference 1	Unknown	Unknown (P)	1-76	WAITSFIELD	1-76	MAD RIVE
	25 Culvert Example 1	Culvert Example 1					STH60	
	26 LFD Curved Guide Spec	LFD Curved Guide Spec Example					1	
	27 MultiCell Box Examples	Multi Cell Box Examples					100	
	28 Gusset Plate Example	Gusset Plate Example	Unknown			Some Highway		
<	Part 29 Splice Example	Splice Example						
	30 Simple DL-Cont LL-Splice	Simple DL Splice	Unknown	Unknown (P)	N/A	N/A	-1	N/A
	31 MetalCulvertExample1	MetalCulvertExample 1					1	
	4							

		AASHTOWare Bridge Design and Rating					?	- 0
	DER RATE TOOLS VIEW							
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Bridge	To From Manage							
	E A Bridge ID	Bridge Name	District	County	Facility	Location	Route	Feature Inte
🧭 Recent Bridges	3 TrainingBridge3	Training Bridge 3(LRFD)		Unknown (P)		Pittsburgh	0079	Ohio River
All Bridges	4 PCITrainingBridge1	PCI TrainingBridge1(LFD)	UNKNOWN	UNKNOWN (P)	1-75	Fittsburgh	-1	Onio River
🖮 🏓 Templates	5 PCITrainingBridge2	PCITrainingBridge2(LRFD)					-1	
📁 Deleted Bridges	6 PCITrainingBridge3	PCI TrainingBridge3(LFD)					-1	
	7 PCITrainingBridge4	PCITrainingBridge4(LRFD)					-1	
	8 PCITrainingBridge5	PCI TrainingBridge5(LFD)					-1	
	9 PCITrainingBridge6	PCITrainingBridge6(LRFD)					-1	
	10 Example7	Example 7 PS (LFD)					-1	
	11 RCTrainingBridge1	RC Training Bridge1(LFD)					-1	
	12 TimberTrainingBridge1	Timber Tr. Bridge1 (ASD)					-1	
	13 FSys GFS TrainingBridge1	FloorSystem GFS Training Bridge 1	Unknown	Unknown (P)	NJ-Turnpike	NICity	-1	
	14 FSys FS TrainingBridge2	FloorSystem FS Training Bridge 2		Unknown (P)		NYC	-1	
	15 FSys GF TrainingBridge3	FloorSystem GF Training Bridge 3		Unknown (P)		ATL	-1	
		FloorLine GFS Training Bridge 1		Unknown (P)		JAX	-1	
	17 FLine FS TrainingBridge2	FloorLine FS Training Bridge 2		Unknown (P)		GNV	-1	
	18 FLine GF TrainingBridge3	FloorLine GF Training Bridge 3		Unknown (P)		NY	15	
		Truss Training Example					5	
	20 LRFD Substructure Example 1							
	21 LRFD Substructure Example 2	LRFD Substructure Example 2			SR 4034	ERIE COUNTY	4034	FOUR MIL
	22 LRFD Substructure Example 3	LRFD Substructure Example 3						
	23 LRFD Substructure Example 4	LRFD Substructure Example 4 (NHI Hammer Head)					-1	
	24 Visual Reference 1	Visual Reference 1	Unknown	Unknown (P)	1-76	WAITSFIELD	1-76	MAD RIVE
	25 Culvert Example 1	Culvert Example 1					STH60	
	26 LFD Curved Guide Spec	LFD Curved Guide Spec Example					1	
	27 MultiCell Box Examples	Multi Cell Box Examples					100	
	28 Gusset Plate Example	Gusset Plate Example	Unknown			Some Highway		
	29 Splice Example	Splice Example					-1	
	30 Simple DL-Cont LL-Splice	Simple DL Splice	Unknown	Unknown (P)	N/A	N/A	-1	N/A
	31 MetalCulvertExample1	MetalCulvertExample 1					1	
	32 M3701-STSP-Splice	Steel Splice-Line girder			1-75	Dayton, OH	75	Carillon Bl
	33 M3702-STSP-Splice	4 span-Only look at two splices in G1				Washington, M	47	
	4	14						1

Next, click **Paste** in the top ribbon to create a duplicate of the bridge.

The Copy Bridge window will open. Rename the bridge and select OK to save the bridge copy to the database.

🗛 Copy Bridge	×
Bridge ID:	FLB Example Add to current folder
NBI Structure ID (8):	FLB Example
Name:	Steel Flange Lateral Bending Stress Example
Description:	
	OK Cancel Help

Bridge Workspace

Open the newly created bridge model and expand the bridge workspace tree.

Support Skew

Update the support skew within the Framing Plan Detail window.



Assign a skew of 20° to each support.

ucture Framing Plan Details					-	
	ber of girders:	5				
Support Skew (degrees)	•	der spacing orier Perpendicular to Along support				
1 20 2 20 3 20			spacing ft) End of			
) E	girder 1 9.75	girder 9.75	A		
		2 9.75 3 9.75 4 9.75	9.75 9.75 9.75			
	Ÿ			÷		
					OK Apply	Car

Use **OK** to save the data to memory and close the window.

Flange Lateral Bending

Define flange lateral bending stresses for G1. Expand the **Bridge Workspace Tree** to show the *Varying Flange Thickness 1* member alternative for G1.

First, set the control option for the member alternative to consider user-input flange lateral bending stresses. Open the **Member Alternative** window for the *Varying Flange Thickness 1* member alternative.



Open the **Control options** tab within the window.

ember alterna	ative: Var	ying Flange	Thickness	1]				
Description	Specs	Factors	Engine	Import	Control option					
Description:					Material typ	: Steel				
					Girder type:	Plate				
					Modeling ty	e: Multi Girder Syst	em			
					Default unit	: US Customary	~			
Girder pro	ile based		End be Left:	earing location	in] Simple DL, continue	ous LL			
O Cross-s	section bas	ed	Right:	12.0000	in					
Self load					Default rating m	thod:				
Load case:		Engine Ass	igned	~	LFD	~				
Additional	self load:		kip/ft							
Additional	self load:		%							

Select the checkboxes labeled *Must consider user input lateral bending stress* for both LRFD and LRFR. When this control option is selected, the analysis engine will verify that the user has input flange lateral bending stresses. If no stresses are defined, the validation will fail and the analysis will stop. When not selected, the option is interpreted to mean must NOT consider user input lateral bending stress, so any user input lateral stresses are ignored during the analysis. Select **OK** to save the control option selections to memory and close the window.



s.	ANALYSIS	Bridge Workspace - FLB Example	? – 🗆	;
BRIDGE WORKSPACE WORKSPACE TOOLS VIEW	DESIGN/RATE			
Check Cut Check In Validate Save Revert Close Export Refresh	Open New	Copy Pase Duplicate Delete Schematic		
Bridge		Manage		
Workspace	7 ×	Schematic # × Report		щ×
Bridge Components				
FLB Example Components Diaphragm Definitions Diaphragm Definitions Superstructure 1-Splice difference Description difference Definitions Superstructure Loads Difference Definitions MEMBERS final G1	~			
		Analysis		щ×
MEMER ALTERNATIVES IVarying Flange Thickness 1 (E) (C) GT Default Materials Impact/Dynamic Load Allowance Impact/Dynamic Load Allowance Side Locations Model Default Materials Solice Locations Model Default Materials Model Default Materials				
 I G2 I G3 I G4 I G5 	~			

The flange lateral bending stresses are defined within the Lateral Support window.

Select th	ne Flange late	ral bending (ab within t	he Lateral S	upport window.
Dereet u	ie i iunge iuve	i ui semaning	ao minin t	ne Laterar o	apport minaons

steral Support	
Start Distance Length	
anges Locations Flange lateral bending	
op flange	
Support Start Length distance (m) (m) (m)	
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	v
	New Duplicate Delete
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steral Support	OK Apply Cancel
anges Locations Flange lateral bending	
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Lateral Bending Stress Load Cases

The first table in the lateral bending stress window defines the load cases for flange lateral bending stresses. These load cases are not the same as the load cases created within the **Load Case Description** window of the

superstructure definition.

Use the Add default load case descriptions button to populate the default load cases.

inges Locations													×
	Flange latera	al bending											
ateral bending stress	load cases												
Load case name	Description	Stage Type	Include in Line girder		Consider for design review	Consider for LRFR rating							
												^	
												~	
Add default load ase descriptions)								New	Duplica	ate)elete	
	upport umber			actored late ending stree (ksi)				St	upport adj	r reaction ustment actor			
			Top flang	ge Bottor	m flange								
Add diaphragm locations					New	Duplicat	Delete						
									OK	A	pply	Cancel	

The default load cases for an exterior girder are shown below, including overhang bracket dead load, overhang construction load and skew effect. The default load cases for interior girders do not include the overhang brackets. The columns for **Stage** and **Type** include options not available for superstructure load cases.

Construction (Stage 1) loads are considered during stage 1 spec checking only, whereas *Non-composite (Stage 1)* loads are considered during stage 1 and all subsequent loading stages.

Proportioned (Stage 1 + Stage 3) loads are proportioned into dead load and live load components in the same proportion as the unfactored major axis dead load and live load moments at the section under consideration.

The load type column determines the load factors which are applied to the user-defined unfactored lateral bending stress.

Use the provided checkboxes to indicate the analysis types for which to consider the lateral stresses.

era	l bending stre	ss load case	s					Include in	analysis	Consider for			
	Load	case name	C	Description	Stage		Туре	Line girder	1	design review	Consider for LRFR rating		
0	verhang brack	et dead load	d		Construction (Stage 1)	-	D,DC *	J	1	1			
0	verhang brack	et construct	tion load		Construction (Stage 1)	*	Construction *	1	1	v			
Sk	ew effect				Proportioned (Stage 1 + Stage	3) *	DL+LL *	1		1	V		
se	default load descriptions eral bending st	tress load ca	ise: Skew effe	ct						New	Duplic	ate	Delete
	Diaphragm	Support number	Distan (ft)	ice	Unfactored lateral bending stress (ksi)					Support ad	ler reaction ljustment factor		
					Top flange Bottom flange					1			-
										2 3			
	Add diaphrag				٨	lew	Duplicate	Delete					

Lateral Bending Stress Load Case – Overhang bracket dead load

Compute the lateral stress transferred to the bottom flange of the exterior girder from the deck overhang brackets. Assume the brackets support the weight of the parapet.

Select the first row in the **Lateral bending stress load cases** table so the bottom left table title reads: *Lateral bending stress load case: Overhang bracket dead load*. Use the *Add diaphragm locations*... button to open a diaphragm locations tool.

eral bending stress load cases								
Load case name	Description	Stage	Туре	Include in	-	Consider for design	Consider for	
				Line girder		review	LRFR rating	
Overhang bracket dead load		Construction (Stage 1)	0,00	1	1	v		
Overhang bracket construction load Skew effect		Construction (Stage 1) Proportioned (Stage 1 + Stage 3)	Construction * DL+LL *	✓ ✓	1	✓ ✓	v	
dd default load						New	Duplicat	e Delet
se descriptions areral bending stress load case: Overha	ng bracket de							Delet
Support Dist	ance	Unfactored lateral bending stress					der reaction djustment	
	ft)	(ksi)					factor	
		Top flange Bottom flange				1		
				î		2 3		
Add diaphragm				v				
locations		New	Duplicate	Delete				

Select Add to add all diaphragm locations without estimating the skew effect stresses.

🗛 Add Diaphragm Lo	cations		×
Estimate stresses	due to skew effe	ects	
Estimation method:	AASHTO	O Based on FDOT Report BE535, Omin/bf	
Diaphragm layout:	Contiguous	O Discontinuous/Staggered	
		Add Cancel	

The table now includes all diaphragm locations.

ter	al bendir	ng stre	ss load cases										
									Include in	analysis	Consider for	Consider for	
		Load	case name	Description		Stage		Туре	Line girder	3D FEM	design review	LRFR rating	
C	verhang	brack	et dead load		Constructio	on (Stage 1)	-	D,DC *	- J	1	J		
C	verhang	brack	et constructio	n load	Construction	on (Stage 1)	*	Construction	1	1	1		
S	kew effe	ct			Proportion	ed (Stage 1 + Sta	age 3) 🔹 👻	DL+LL *	v		1	1	
ase	default I descript eral ben Diaphi	ions ding st	Support	: Overhang bracket de Distance	Unfact bend	ored lateral ing stress (kei)						Duplica ler reaction ljustment factor	ate Delete
	Diapin	ugin	number	(ft)	Top flange	(ksi) Bottom flange					1	factor	
•	1-1	Ŧ	1	0	0	0					2		
	1-2	Ŧ	1	13.333333	0	0	1		Π		3		
	1-3	*	1	26.666666	0	0							
	1-4	*	1	39.999999	0	0	1						
	1-5	*	1	53.333332	0	0							
	1-6	*	1	66.666665	0	0			=				
	1-7	-	1	79.999998	0	0							
	1-8	-	1	93.333331	0	0							
	1-9	Ŧ	1	106.666664	0	0							
	1-10	*	1	119.999997	0	0							
	1-11	Ŧ	2	13.333333	0	0							
	1-12	-	2	26.666666	0	0							
	1-13	*	2	39.999999	0	0							
	1-14	*	2	53.333332	0	0			-				
	Add dia loca	iphrag tions					New	Duplicate	Delete				

From the weight of the parapet, the diaphragm spacing, structure typical section and girder profile the following stresses can be computed for the bottom flange.

Diaphra	agm	Support number	Distance (ft)	bend	ored lateral ing stress (ksi)	
				Top flange	Bottom flange	
1-1	*	1	0	0	5.85	
1-2	*	1	13.333333	0	11.7	
1-3	*	1	26.666666	0	11.7	
1-4	*	1	39.999999	0	11.7	
1-5	-	1	53.333332	0	11.7	
1-6	*	1	66.666665	0	11.7	
1-7	*	1	79.999998	0	11.7	
1-8	*	1	93.333331	0	7.45	
1-9	٣	1	106.666664	0	7.45	
1-10	*	1	119.999997	0	3.72	
1-11	*	2	13.333333	0	7.45	
1-12	*	2	26.666666	0	7.45	
1-13	*	2	39.999999	0	11.7	
1-14	*	2	53.333332	0	11.7	
1-15	*	2	66.666665	0	11.7	
1-16	*	2	79.999998	0	11.7	
1-17	*	2	93.333331	0	11.7	
1-18	*	2	106.666664	0	11.7	
1-19	*	2	119.999997	0	5.85	

Select Apply to save the data to memory and keep the window open.

Lateral Bending Stress Load Case – Overhang bracket construction load

Compute the lateral stress transferred to the bottom flange of the exterior girder from the deck overhang brackets during construction. Assume the brackets support a 75plf load applied on the deck overhang.

Select the second row in the **Lateral bending stress load cases** table so the bottom left table title reads: *Lateral bending stress load case: Overhang bracket construction load*. Use the *Add diaphragm locations*... button to open a diaphragm locations tool.

Loa Overhang brac Overhang brac Skew effect			scription	Stage Construction (Stage 1)		Туре			_	Consider for design	Consider for		
Overhang brac		in load		Construction (Stage 1)			Line gire	er 3D	EM	review	LRFR rating		
	ket constructio	in load			*	D,DC	- J		1	1			
Skew effect				Construction (Stage 1)	*	Construction	- J		1	v		•	
				Proportioned (Stage 1 + Stage	3) *	DL+LL	- J			1	1		
ld default load													
se descriptions											New	Duplicate	Dele
ateral bending	stress load case	e: Overhang bra	racket con	nstruction load									
Diaphragm	Support	Distance (ft)		Unfactored lateral bending stress (ksi)						Sup	Girder re port adjustr fact	ment	
	number	(11)	_	Top flange Bottom flange									
									-	2	2		
			Ĩ										
			1							3	>		
			1							3			
										-			
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Add diaphra	am					New	Duplicate	Detet	×.		•		

Select Add to add all diaphragm locations without estimating the skew effect stresses.

🗛 Add Diaphragm Lo	cations	×
Estimate stresses	s due to skew effects	
Estimation method:	AASHTO Based on FDOT Report BE535, Omin/bf	
Diaphragm layout:	Contiguous Discontinuous/Staggered	
	Add Cancel	

The table now includes all diaphragm locations.

			ess load cases							Include in	analysis	Consider for					
		Load	l case name	Description		Stage		Туре	ľ	Line girder	1	design review		sider for R rating			
C	verha	ang brack	et dead load		Constructi	on (Stage 1)	Ŧ	D,DC	•	1	1	1					
• 0	verha	ang brack	et construction	n load	Constructi	on (Stage 1)	*	Construction	•	1	\checkmark	1					
S	kew e	effect			Proportion	ed (Stage 1 + Stage 3)	*	DL+LL ·	•	1		7		1			
		ult load riptions												New	Dupl	icate	Delete
Lat	eral b	ending s	tress load case	: Overhang bracket cor	nstruction lo	ad											
						ored lateral								Girder rea			
	Dia	phragm	Support number	Distance (ft)		ing stress (ksi)						Sup	port	adjustm facto			
					Top flange	Bottom flange						1					A
	1-1	*	1	0	0	0					<u>~</u>	2					
	1-2	*	1	13.333333	0	0						3	;				
	1-3	*	1	26.666666	0	0											
	1-4	*	1	39.999999	0	0											
	1-5	*	1	53.333332	0	0											
	1-6	*	1	66.666665	0	0											
	1-7	*	1	79.999998	0	0											
	1-8	*	1	93.333331	0	0											
	1-9	*	1	106.666664	0	0											
	1-10	0 -	1	119.999997	0	0											
	1-11		2	13.333333	0	0											
	1-12		2	26.666666	0	0											
	1-13		2	39.999999	0	0											
	1-14		2	53.333332	0	0											
	1-14		2	66.666665	0	0											
		-															
	1-16	•	2	79.999998	0	0											
	1-17		2	93.333331	0	0											
	1-18		2	106.666664	0	0											
	1-19	9 -	2	119.999997	0	0											
											V						
		diaphrag ocations						New D	Dup	olicate	Delete	1					

From the diaphragm spacing, structure typical section and girder profile the following stresses can be computed for the bottom flange.

	Diaphra	agm	Support number	Distance (ft)	bend	ored lateral ing stress (ksi)	
					Top flange	Bottom flange	
r	1-1	٣	1	0	0	0.83	
	1-2	*	1	13.333333	0	1.65	
	1-3	*	1	26.666666	0	1.65	
	1-4	Ŧ	1	39.999999	0	1.65	
	1-5	*	1	53.333332	0	1.65	
	1-6	٣	1	66.666665	0	1.65	
	1-7	*	1	79.999998	0	1.65	
	1-8	*	1	93.333331	0	1.05	
	1-9	*	1	106.666664	0	1.05	
	1-10	*	1	119.999997	0	0.53	
	1-11	٣	2	13.333333	0	1.05	
	1-12	*	2	26.666666	0	1.05	
	1-13	*	2	39.999999	0	1.65	
	1-14	Ŧ	2	53.333332	0	1.65	
	1-15	*	2	66.666665	0	1.65	
	1-16	Ŧ	2	79.999998	0	1.65	
	1-17	*	2	93.333331	0	1.65	
	1-18	*	2	106.666664	0	1.65	
	1-19	*	2	119.999997	0	0.83	

Select Apply to save the data to memory and keep the window open.

Lateral Bending Stress Load Case – Skew effect

Approximate the lateral stress transferred to the exterior girder from the skew effects as specified in the AASHTO LRFD commentary.

Select the third row in the **Lateral bending stress load cases** table so the bottom left table title reads: *Lateral bending stress load case: Skew effect*. Use the *Add diaphragm locations*... button to open a diaphragm locations tool.

Overh Skew	hang brack	l case name et dead load et construction		n Stage Construction (Stage 1) Construction (Stage 1) Proportioned (Stage 1 + Stage	*	Type	Include in Line girder	1	Consider for design	Consider for LRFR rating		
Overh Skew	hang brack effect			Construction (Stage 1)	*	D,DC			review	Livin raung		
Skew	effect	et construction	on load		~ ~		J	1	1			
dd defa				Proportioned (Stage 1 + Stage	2) -	Construction *		J	V			
	ault load				(5)	DL+LL •	✓		\checkmark	✓		
co doc										New	Duplicate	Dele
_	scriptions bending st	tress load cas	se: Skew effect							new	Dupicate	Dele
Di	iaphragm	Support number	Distance (ft)	Unfactored lateral bending stress (ksi)					Supp	Girder re port adjustr facto	ment	
		number	(11)	Top flange Bottom flange					1			_
				1				-	2	2		
									3	3		
	ld diaphrag							v				

Select Add to approximate lateral stresses all diaphragm locations using the AASHTO commentary.

Add Diaphragm Locations	×
Estimate stresses due to skew effects	
Estimation method: AASHTO Based on FDOT Report BE535, Omin/bf	
Diaphragm layout: O Contiguous Discontinuous/Staggered	
Add Cance	el

Diaphragm	Support number	Distance (ft)	bend	ored lateral ing stress (ksi)	
			Top flange	Bottom flange	
1-1 *	1	0	7.5	7.5	
1-2 *	1	13.333333	7.5	7.5	
1-3 *	1	26.666666	0	0	
1-4 -	1	39.999999	0	0	
1-5 *	1	53.333332	0	0	
1-6 *	1	66.666665	0	0	
1-7 -	1	79.999998	0	0	
1-8 *	1	93.333331	0	0	
1-9 -	1	106.666664	7.5	7.5	
1-10 -	1	119.999997	7.5	7.5	
1-11 *	2	13.333333	7.5	7.5	
1-12 -	2	26.666666	0	0	
1-13 -	2	39.999999	0	0	
1-14 -	2	53.333332	0	0	
1-15 -	2	66.666665	0	0	
1-16 -	2	79.999998	0	0	
1-17 -	2	93.333331	0	0	
1-18 *	2	106.666664	7.5	7.5	
1-19 -	2	119.999997	7.5	7.5	

The table now includes approximate lateral stresses at all diaphragm locations.

Select **OK** to save the data to memory and close the window.

LRFR Rating

To perform an **LRFR** rating, click the **Analysis Settings** button on the **Analysis** group of the **DESIGN/RATE** ribbon which opens the **Analysis Settings** window.

			ANALYSIS
BRIDGE WORKSPACE	WORKSPACE	TOOLS VIE	W DESIGN/RATE
* = =		A C	XA
Analysis Analyze Analysi		ification Engine	Results Save
Gettings Event	s Results Chec	k Detail Outputs	Graph Results
Analysis		Results	

Select the vehicles to be used in the rating as shown below and click **OK**.

O Design review R	ating		Rating metho	od:	LRFR	*	
nalysis type:	Line Girder	*					
ane / Impact loading type:	As Requested	~	Apply prefer	ence setting:	None	~	
Vehicles Output E	ngine Description						
Traffic direction: Both d	lirections	~		Refresh	Temporary vehicles	Advanced	
Vehicle selection			Vel	hicle summan	/		
	e Truck (US) Truck (US) e Truck (US)~1 en Pair	×	Add to >> Remove from <<	- F - F - F - F - F - F - F	Iles gn Ioad rating nventory IHL-93 (US))perating IHL-93 (US) atigue ILRFD Fatigue Truck (US) I Ioad rating toutine pecialized hauling hit Ioad rating		

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



Tabular Results

When the rating is finished results can be reviewed by clicking the **Tabular Results** button on the **Results** group of the **DESIGN/RATE** ribbon. The window shown below will open.

y 👻 💿	As requested	O Detailed	Single ratin	g level per ro	w v						
Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane		
Truck + Lane	LRFR	Inventory	22.14	0.615	106.67	1 - (88.9)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested		
Truck + Lane	LRFR	Operating	28.60	0.795	106.67	1 - (88.9)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested		
(Truck Pair + Lane)	LRFR	Inventory	17.43	0.484	106.67	1 - (88.9)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested		
(Truck Pair + Lane)	LRFR	Operating	22.92	0.637	106.67	1 - (88.9)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested		
Tandem + Lane	LRFR	Inventory	25.55	0.710	106.67	1 - (88.9)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested		
Tandem + Lane	LRFR	Operating	33.04	0.918	106.67	1 - (88.9)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested		
	Type Truck + Lane Truck + Lane Truck Pair + Lane) Truck Pair + Lane) Tandem + Lane	Type Method Truck + Lane LRFR Truck + Lane LRFR Truck Pair + Lane) LRFR Truck Pair + Lane) LRFR Tandem + Lane LRFR	Type Method Level Truck + Lane LRFR Inventory Truck + Lane LRFR Operating Truck Pair + Lane) LRFR Inventory Truck Pair + Lane) LRFR Operating Tandem + Lane LRFR Inventory	Type Method Level (Ton) Truck + Lane LRFR Inventory 22.14 Truck + Lane LRFR Operating 28.60 Truck Pair + Lane) LRFR Inventory 17.43 Truck Pair + Lane) LRFR Operating 22.92 Tandem + Lane LRFR Inventory 25.55	Type Method Level (Ton) Factor Truck + Lane LRFR Inventory 22.14 0.615 Truck + Lane LRFR Operating 28.60 0.795 Truck Pair + Lane) LRFR Inventory 17.43 0.484 Truck Pair + Lane) LRFR Operating 22.92 0.637 Tandem + Lane LRFR Inventory 25.55 0.710	Type Method Level (Ton) Factor (tt) Truck + Lane LRFR Inventory 22.14 0.615 106.67 Truck + Lane LRFR Operating 28.60 0.795 106.67 Truck Pair + Lane) LRFR Inventory 17.43 0.484 106.67 Truck Pair + Lane) LRFR Operating 22.92 0.637 106.67 Tandem + Lane LRFR Inventory 25.55 0.710 106.67	Type Method Level (Ton) Factor (th) Span-(%) Truck + Lane LRFR Inventory 22.14 0.615 106.67 1.68.9) Truck + Lane LRFR Operating 28.60 0.795 106.67 1.68.9) Truck Pair + Lane) LRFR Inventory 17.43 0.484 106.67 1.68.9) Truck Pair + Lane) LRFR Operating 22.92 0.637 106.67 1.68.9) Tandem + Lane LRFR Inventory 25.55 0.710 106.67 1.68.9)	Type Method Level (Ton) Factor (th) Span-(%) Limit State Truck + Lane LRFR Inventory 22.14 0.615 106.67 1-88.99 STRENGTH-1 Steel Flexure Stress Truck + Lane LRFR Operating 22.86 0.795 106.67 1-88.99 STRENGTH-1 Steel Flexure Stress Truck Pair + Lane) LRFR Operating 22.92 0.637 106.67 1-88.99 STRENGTH-1 Steel Flexure Stress Truck Pair + Lane) LRFR Operating 22.92 0.637 106.67 1-88.99 STRENGTH-1 Steel Flexure Stress Tandem + Lane LRFR Inventory 25.55 0.710 106.67 1-88.99 STRENGTH-1 Steel Flexure Stress	Type Method Level (Ton) Factor (ft) Span-(%) Lumit State Impact Truck + Lane LRFR Inventory 22.14 0.615 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested Truck + Lane LRFR Operating 22.60 0.795 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested Truck Pair + Lane) LRFR Operating 22.92 0.637 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested Truck Pair + Lane) LRFR Operating 22.92 0.637 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested Tandem + Lane LRFR Inventory 22.55 0.710 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested	Type Method Level (Ton) Factor (ft) Span-(%) Limit State Impact Lane Truck + Lane LRFR Inventory 22.14 0.615 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested As Requested Truck + Lane LRFR Operating 28.06 0.795 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested As Requested Truck Pair + Lane) LRFR Operating 22.92 0.637 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested Tandem + Lane LRFR Operating 22.92 0.637 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested Tandem + Lane LRFR Inventory 22.92 0.637 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested Tandem + Lane LRFR Inventory 22.55 0.710 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested	Type Method Level (Ton) Factor (ft) Span-(%) Limit State Impact Lane Truck + Lane LRFR Inventory 22.14 0.615 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested As Requested Truck + Lane LRFR Operating 22.60 0.795 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested As Requested Truck Pair + Lane) LRFR Operating 22.92 0.637 106.67 1-(88.9) STRENGTH-1 Steel Flexure Stress As Requested As Requested <td< th=""></td<>