AASHTOWare BrDR 7.5.0 Feature Tutorial LS1 – Limit State Selection This example describes the selection of limit states for an LRFD spec check analysis. This example assumes you have access to **TrainingBridge1 (BID1)** provided in the sample database included with the software installation.

### Select limit states for LRFD spec check analysis

From the **Bridge Explorer**, double click on **BID1** - **TrainingBridge1** (or select and click **Open** from the **Bridge** group of the **BRIDGE** ribbon ) to open the bridge.

ar <b>P</b>	AASHTOWare Bridge Desigr	and Rating ?	- o x
BRIDGE EXPLORER BRIDGE FO	DLDER RATE TOOLS VIEW		1
New Open Batch V Bridge	Copy Paste Copy Remove Delete To Kanage		4
		<b></b>	
······································		Bridge Name	Dist
All Bridges	1 TrainingBridge1	Training Bridge T(LKFD)	Unkm
\cdots 👮 Template Bridge	2 TrainingBridge2	Training Bridge 2(LRFD)	Unkn
🗄 📁 Templates	3 TrainingBridge3	Training Bridge 3(LRFD)	Unk
💬 📁 Deleted Bridges	4 PCITrainingBridge1	PCI TrainingBridge1(LFR)	
	5 PCITrainingBridge2	PCITrainingBridge2(LRFD)	
	6 PCITrainingBridge3	PCI TrainingBridge3(LFR)	
	7 PCITrainingBridge4	PCITrainingBridge4(LRFD)	<
	4		
		_	1

From the **Bridge Workspace** tree, expand the **Components** folder and double click ok the **LRFD** factors window – **1994 AASHTO LRFD Specifications** as shown below.



₽ Fa	acto	ors - Ll	RFD								-		×
Nar	ne:		1994 AASHTO	LRFD Spe	cification	s							
Des	crip	otion:	AASHTO LRFD Edition, 1994 i Specifications	Bridge De	esign Spe 1996 and	cification: 1997 Inte	s, First rim						
Lo	oad	facto	rs Load fact	ors (cont'o	d) Lim	it states	Concre	te Steel	Wood	Buried st	ructures	Load	modif
		L	imit state	DC min	DC max	DW min	DW max	LL max	CE max	BR max	PL max	LS max	W
	>	ST	TRENGTH-I	0.9	1.25	0.65	1.5	1.75	1.75	1.75	1.75	1.75	
		ST	RENGTH-II	0.9	1.25	0.65	1.5	1.35	1.35	1.35	1.35	1.35	
		ST	RENGTH-III	0.9	1.25	0.65	1.5	0	0	0	0	0	
		ST	RENGTH-IV	1.5	1.5	0.65	1.5	0	0	0	0	0	
		ST	RENGTH-V	0.9	1.25	0.65	1.5	1.35	1.35	1.35	1.35	1.35	
		5	SERVICE-I	1	1	1	1	1	1	1	1	1	
		5	SERVICE-II	1	1	1	1	1.3	1.3	1.3	1.3	1.3	
		S	ERVICE-III	1	1	1	1	Table 3.4.1-4	0.8	0.8	0.8	0.8	
		F	FATIGUE-I	0	0	0	0	0.75	0.75	0	0	0	
		EXTR	REME EVENT-I	0.9	1.25	0.65	1.5	0.5	0.5	0.5	0.5	0.5	
		EXTR	EME EVENT-II	0.9	1.25	0.65	1.5	0.5	0.5	0.5	0.5	0.5	
				۰									
													Сору

Navigate to the Limit Sates tab. Default limit state selections are as shown below.



actors - El	RFD										-	>
me:	1994 AASHTC	LRFD Specifi	cations									
scription:	AASHTO LRFE Edition, 1994 Specifications	) Bridge Desig including 199	n Specificatior 6 and 1997 Int	ns, First erim								
oad facto	rs Load fact	tors (cont'd)	Limit states	Со	ncrete	Steel	Wood	Buried structures	Load modifiers	Specifications		
L	Limit state	Reinforced concrete	Prestressed concrete	Steel	Timber							
ST	TRENGTH-I			$\checkmark$	$\checkmark$							-
ST	TRENGTH-II	$\checkmark$		$\checkmark$	$\checkmark$							
ST	RENGTH-III			$\checkmark$								
ST	RENGTH-IV											
ST	TRENGTH-V			$\checkmark$								
	SERVICE-I			<u> </u>		h						
> 9	SERVICE-II					Ļ						
S	SERVICE-III					-						
F	FATIGUE-I					-						
EXTR	REME EVENT-I					_						
	REME EVENT-II											

#### Uncheck SERVICE-II limit state in the Steel column.

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

Open the member alternative window of **Simple Span Structure/G1/Plate Girder**, select the **Spec** tab, and change the LRFD spec selections as shown in the following windows.



	ate Girder			
ription Specs	Factors Engine Import	Control options		
Analysis method type	Analysis module	Selection type	Spec version	Factors
ASR	AASHTO ASR $\sim$	System Default 🗸	MBE 3rd 2023i, Std 17th $\sim$	N/A 🗸
LFR	AASHTO LFR $\sim$	System Default 🗸 🗸	MBE 3rd 2023i, Std 17th 🛛 🗸	2002 AASHTO Std. Specifications 🗸 🗸
LRFD	AASHTO LRFD $\sim$	Override $\vee$	LRFD 5th 2010i V	1994 AASHTO LRFD Specifications $\sim$
LRFR	AASHTO LRFR $\sim$	System Default 🗸 🗸	MBE 3rd 2023i, LRFD 9th 🖂	2018 (2022 Interim) AASHTO LRFR Spec. $$
	Analysis method type ASR LFR LRFD LRFR	Analysis module      type      ASR      ASR      AASHTO ASR      LFR      AASHTO LFR      LRFD      AASHTO LRFD      LRFR      AASHTO LRFR	Analysis module    Selection type      ASR    AASHTO ASR    System Default       LFR    AASHTO LFR    System Default       LRFD    AASHTO LRFD    Override      LRFR    AASHTO LRFR    System Default	Analysis method type    Analysis module    Selection type    Spec version      ASR    AASHTO ASR    System Default     MBE 3rd 2023i, Std 17th       LFR    AASHTO LFR    System Default     MBE 3rd 2023i, Std 17th       LRFD    AASHTO LRFD    Override    LRFD 5th 2010i      LRFR    AASHTO LRFR    System Default     MBE 3rd 2023i, LRFD 9th

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

#### From the Analysis group of the DESIGN/RATE ribbon, click on the Analysis Settings button as shown below.



Click on the **Open template** button in the **Analysis Settings** window. Select the **HL 93 Design Review** template. The updated **Analysis Settings** window is shown below.

Analysis Settings						×	
🔵 Design review ( Rat	ling	F	Rating method:	LFR	~	]	
Analysis type: Line	Girder	✓ Analysis option: []		DL, LL and Spec-Checking V			
Lane / Impact loading type: As R	Requested	✓ A	Apply preference setting:	ng: None		]	
Vehicles Output Engine	e Description						
Traffic direction: Both direction	ons 🗸		Refresh Tem	porary vehicles	Advanced		
Vehicle selection			Vehicle summary				
Alternate Military I	Loading Open template	Add to >> Remove from << Save template	Inventory Operating Legal operating Permit invento Permit operatin	g ry ng DK Appl	y Cancel		
Open Template							
Templates	Descri	ption	Analysis	Ow	ner Public	c / Private	
> HL 93 Design Review	HL 93 Design F	Review	LRFD		Public		
HS 20 LFR Rating	HS 20 LFR Rati	ng	LFR		Public		
LRFR Legal Load Rating LRFR Legal Load		d Rating			Public		
Delete						Open	Cancel

O Design review	Rating		Design method:	LRFD	~
nalysis type:	Line Girder	$\sim$	Analysis option:	DL, LL and Spec-Checking	~
ane / Impact loading type:	As Requested	$\sim$	Apply preference se	etting: None	~
Vehicles Output E	ngine Description				
Traffic direction: Both di	rections	~	Refresh	Temporary vehicles Advan	ced
Vehicle selection			Vehicle summary		
		Add t	Design k 	aads 3 (US) aads oads Fatigue Truck (US)	
		>> Remove f	rom		
		~~			

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

To analyze, right click on Plate Girder and select Analyze.



After the LRFD analysis is completed, click on the **Specification Check Detail** button from the **Results** group of the **DESIGN/RATE** ribbon and navigate to **Stage 3->Plate Girder->Span 1 96.60 ft. -> 6.10.4.2.2 Flexure**.



A Specification Checks for Plate	Girder - 42 of 932			- 0	×
Properties Generate	Articles All articles Format Bullet list Report				
🔺 🚞 Superstructure Component	Specification reference	Limit State	Flex. Sense	Pass/Fail	
Stage 1	1.3.2.1 Design Philosophy - Limit State - General		N/A	General Comp.	
🕨 🚞 Stage 2	✓ 2.5.2.6.2 Criteria for Deflection		N/A	Passed	- II
🔺 🚞 Stage 3	4.6.2.7.1 I-Sections - Lateral Wind Load Distribution in Multibeam Brid		N/A	General Comp.	- II
🔺 🚞 Plate Girder	5.4.2.6 Modulus of Rupture		N/A	General Comp.	- II
🚞 Span 1 - 0.00 ft.	6.10.1.1.1b Stresses for Sections in Positive Flexure		N/A	General Comp.	- II
🚞 Span 1 - 13.66 ft	🗎 6.10.1.10.1 Hybrid Factor, Rh		N/A	General Comp.	- H
i Span 1 - 16.10 ft	6.10.1.10.2 Web Load-Shedding Factor, Rb		N/A	General Comp.	- II
Span 1 - 27.31 ft	✓ 6.10.1.6 Flange Stress and Member Bending Moments		N/A	Passed	- II
Span 1 - 32.20 ft	✓ 6.10.1.7 Minimum Negative Flexure Concrete Deck Reinforcement		N/A	Passed	- II
i Span 1 - 40./3 π	6.10.1.9.1 Webs without Longitudinal Stiffeners		N/A	General Comp.	- II
Span 1 - 40.50 ft	✓ 6.10.11.1.2 Transverse Stiffeners - Projecting Width		N/A	Passed	- II
	✓ 6.10.11.1.3 Transverse Stiffeners - Moment of Inertia		N/A	Passed	- II
Span 1 - 67.56 ft	✓ 6.10.2 Cross-Section Proportion Limits		N/A	Passed	- II
Span 1 - 80.50 ft	NA 6.10.4.2.2 Flexure		N/A	Not Applicable	
in Span 1 - 80.98 ft	NA 6.10.5.3 Special Fatigue Requirement for Webs		N/A	Not Applicable	
in Span 1 - 94.39 ft	6.10.6.2.2 Composite Sections in Positive Flexure		N/A	General Comp.	
📇 Span 1 - 96.60 ft	6.10.6.2.3 Composite Sections in Negative Flexure and Noncomposite		N/A	General Comp.	
i Span 1 - 107.81	t. NA 6.10.7.1.1 General		N/A	Not Applicable	
🚞 Span 1 - 112.70 f	t. NA 6.10.7.1.2 Nominal Flexural Resistance		N/A	Not Applicable	
🚞 Span 1 - 121.23	t. 🗙 6.10.7.2.1 General		N/A	Failed	
🚞 Span 1 - 128.80	t. 🔋 6.10.7.2.2 Nominal Flexural Resistance		N/A	General Comp.	
🚞 Span 1 - 134.64 f	t. 6.10.7.3 Flexural Resistance - Ductility Requirement		N/A	Passed	
🚞 Span 1 - 144.90 f	t. NA 6.10.8.1.1 Discretely Braced Flanges in Compression		N/A	Not Applicable	
🚞 Span 1 - 147.82 f	t. NA 6.10.8.1.2 Discretely Braced Flanges in Tension		N/A	Not Applicable	
🚞 Span 1 - 161.00	t. NA 6.10.8.1.3 Continuously Braced Flanges in Tension or Compression		N/A	Not Applicable	
	■ 6.10.8.2.1 General		N/A	General Comp.	-

Since Service –II limit state is not selected for LRFD spec check, article 6.10.4.2.2 is not applicable.

Spec Check Detail for 6.10.4.2.2 Flexure	_		×
Evaluate Equation 4:			
Except for composite sections in positive flexure where D/tw <= 150 (6.10.2.2-1)			
fc <= Fcrw (6.10.4.2.2-4)			
D/tw = 0.000			
RESULT:			
Service II limit state was not evaluated. Article is not applicable.			
Load Combination Legend:			
Code Vehicle			
1 HL-93 (US) - Design Truck + Lane			
3 LRFD Fatigue Truck (US) - Fatigue Truck			
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