AASHTOWare BrDR 6.8

Steel Tutorial STL6 – Two Span Plate Girder Example





Framing Plan









Composite Section at Pier





Parapet Detail

Haunch Detail

Material Properties

Structural Steel: AASHTO M270, Grade 50W uncoated weathering steel with Fy = 50 ksi Deck Concrete: f'c = 4.0 ksi, modular ratio n = 8 Slab Reinforcing Steel: AASHTO M31, Grade 60 with Fy = 60 ksi

Cross Frame Connection Plates: 3/4" x 6" Bearing Stiffener Plates: 7/8" x 9"

Topics Covered

- 2 span steel plate girder input as girder system.
- Selection of Specification Edition
- Steel Member Alt Control Options
 - Moment redistribution
 - Use Appendix A6 for flexural resistance
 - Allow plastic analysis
 - Ignore longitudinal reinforcement in negative moment capacity
- Export of steel girders to the AASHTO LRFD analysis engine
- AASHTO LRFD specification checking
- Output review
- Additional reporting (from VI5023)
- Moment redistribution
- New LRFR features
 - Specialized hauling vehicles, overriding legal load factors, permit lane loads and gapping out the lane load.

Selection of Specification Edition

BrDR Version 6.8 allows you to pick from several versions of the AASHTO Specifications for the AASHTO analysis engines. The following LRFD and LRFR specifications are supported by the AASHTO engines:

- AASHTO LRFD Bridge Design Specifications, 4th Edition, with 2008 interims
- AASHTO LRFD Bridge Design Specifications, 4th Edition, with 2009 interims
- AASHTO LRFD Bridge Design Specifications, 5th Edition
- AASHTO LRFD Bridge Design Specifications, 5th Edition, with 2010 interims
- AASHTO LRFD Bridge Design Specifications, 6th Edition
- AASHTO LRFD Bridge Design Specifications, 6th Edition, with 2013 interims
- AASHTO LRFD Bridge Design Specifications, 7th Edition
- AASHTO LRFD Bridge Design Specifications, 7th Edition, with 2015 interims
- AASHTO LRFD Bridge Design Specifications, 7th Edition, with 2016 interims
- AASHTO Manual for Bridge Evaluation, 1st Edition
- AASHTO Manual for Bridge Evaluation, 1st Edition, with 2010 interims
- AASHTO Manual for Bridge Evaluation, 2nd Edition
- AASHTO Manual for Bridge Evaluation, 2nd Edition, with 2011 interims

- AASHTO Manual for Bridge Evaluation, 2ndEdition, with 2013 interims
- AASHTO Manual for Bridge Evaluation, 2ndEdition, with 2014 interims
- AASHTO Manual for Bridge Evaluation, 2ndEdition, with 2015 interims
- AASHTO Manual for Bridge Evaluation, 2ndEdition, with 2016 interims

Along with this new feature, Factors are now associated with versions of the specification. This was done since different versions of the spec can have different limit states and load factors. Below is the Library LRFD Factors window for the factors that correspond to the Fourth Edition with 2009 interims specifications.

BR E	Bridge	e Desi	gn/Ratin	g - [Facto	rs - LRFD]					
, ,,,,	File	Edit	View	Bridge	Substructure	Tools	Window	Help		- 8 ×
) 🚅		61 🏷	₩ %	B C 4) 🤣 🕴	B. 🎁 🗞	Prelimina	ry v 🔍	7. 🕅 🕈 🛛
	,	Σ		R ALL	NXT 🛛 🌇 🖻	0 🔨		•		
P	Ē	R		B , 60'	h ⊡ ×	7es 7e		ð i		
		Name	2007 (2	009 interin) AASHTO LRF	D Spei				
	Desci	ription:	AASHT) Edition 2	D LRFD B 2007, inclu	ridge Design Sp iding up to 2009	ecification interims	is, Fourth	*		
	.oad F	actors	Elimit St	ates Co	norete Steel	Wood	Load Modifi	ers Specificatio	ns	
	This : versio	set of ons of	Factors is the Specil	associated lications:	l with the follow	ing				
		Na	me			Descripti	on			
		RFD 4	4th 2008i	AASHTO) LRFD Specific	ation - 4th	Edition with	2008 Interims		
	V I	_RFD 4	4th 2009i	AASHTO) LRFD Specific	ation - 4th	Edition with	2009 Interims		
	V I	RFD	5th	AASHTO) LRFD Specific	ation - 5th	Edition			
	V I	RFD	5th 2010i	AASHTO) LRFD Specific	ation - 5th	Edition with	2010 Interims		
	V	_RFD (Sth	AASHTO) LRFD Specific	ation - 6th	Edition			
		_RFD (5th 2013i	AASHTO) LRFD Specific	ation - 6th	Edition with	2013 Interims		
	Se	elect A		Clear All						
						Copy from	n Library	OK	Apply	Cancel
•										+
For H	Help,	press	F1							h.

This set of factors cannot be applied to any versions of the specification prior to 2009 since they contain Fatigue I and Fatigue II limit states that were revised in the 2009 interims.

System Default specifications can be set as follows:



The default specifications and factors selected above will be used when new member alternatives are created.

Import and open the Bridge Workspace for 'STL6 - AASHTO Steel Plate Girder.xml. Expand the Bridge Workspace tree to show the member alternative for Member G2. The Bridge Workspace is shown below.



Select the Member Alternative for Member G2 and go to the Specs tab.

Make sure the analysis engines are set to the AASHTO engines for all analysis methodologies.

🗛 Member Alternati	ve Description				- • •
Member Alternative:	Plate Girder				Î
Description Specs	Factors Engine Impo	ort Control Options			
Analysis Method Type	Analysis Module	Selection Type	Spec Version	Factors	
ASD	AASHTO ASD	💌 System Default 💌	MBE 2nd 2016i, Std 1 💌	N/A	-
LFD	AASHTO LFD	💌 System Default 💌	MBE 2nd 2016i, Std 1 💌	2002 AASHTO Std. Specif	-
LRFD	AASHTO LRFD	💌 System Default 📼	LRFD 7th 2016i 🛛 💌	2014 (2016 interim) AASH	-
LRFR	AASHTO LRFR	💌 System Default 💌	MBE 2nd 2016i, LRFD 👻	2011 (2016 Interim) AASH	-
					E
				OK Apply	Cancel

You will end up with the following:

Analysis Method Type	Analysis Module		Selection Type	Spec Version		Factors
ASD	AASHTO ASD	•	System Default 💌	MBE 2nd 2016i, Std 1	Ŧ	N/A 💌
LFD	AASHTO LFD 🔹	•	System Default 💌	MBE 2nd 2016i, Std 1	Ŧ	2002 AASHTO Std. Specit 👻
LRFD	AASHTO LRFD 🗾	•	System Default 💌	LRFD 7th 2016i	Ŧ	2014 (2016 interim) AASH 👻
LRFR	AASHTO LRFR 🚽	•	System Default 💌	MBE 2nd 2016i, LRFD	•	2011 (2016 Interim) AASH 🕶

The table above provides an analysis engine for each analysis method. With each engine there may be various specification editions to choose from. Each specification edition may provide various load factor sets the user may choose from.

The Control Options tab allows you to select the following control features.



Allow moment redistribution

This control allows you to consider moment redistribution as per Appendix B6 of the Specifications. In the moment redistribution process, some of the negative moment at the pier is redistributed along the beam. This option will first initiate the spec checks in Appendix B6.2 to determine if moment redistribution is permissible as per the specifications. If redistribution is not permissible then it will not occur even if this option is selected.

Use Appendix A6 for flexural resistance

This control allows you to consider Appendix A6 of the Specifications for flexural resistance. Using Appendix A6 can result in flexural resistances greater than the yield moment, My, for certain types of sections. The program will first check if Appendix A6 is permissible by checking the requirements in Article 6.10.6.2.3. If the use of Appendix A6 is not permissible then it will not be used even if this option has been selected.

Allow plastic analysis

This control allows you to consider the plastic moment capacity for compact, composite sections in positive flexure. If you select this option, the program will evaluate Articles 6.10.7.1.1 and 6.10.7.1.2. If you do not select this option, Articles 6.10.7.1.1 and 6.10.7.1.2 will not be evaluated and all positive flexure sections will be considered non-compact.

Ignore long. reinforcement in negative moment capacity

This control allows you to ignore the contribution of the longitudinal deck reinforcement when computing the negative moment capacity of the section.

Distribution Factor Application Method

Select the method to be used for the application of live load distribution factors.

- By axle causes the distribution factor at the location of the axle to be used for each axle.
- By POI causes the distribution factor at the location of the point of interest to be used for all axles.

Similar behavior applies for lane load.

To perform a design review, select the View Analysis Settings button on the toolbar to open the window shown below. Use the "HL-93 Design Review" template to select the vehicles to be used.

Design Review	Rating	Design Method	LRFD
Analysis Type:	-		
Lane/Impact Loading Ty As Requested	e Description	Apply Preference Setting	: None
Vehicle Selection: Vehicles Standard - Atemate h - HL-93 (SI) - HS 20 (SI) - HS 20 (SI) - HS 20 44 - RFD Fai - Agency - User Defined Temporary	Military Loading) J gue Truck (SI) gue Truck (US)	iaffic Direction:	Refresh Temporary Vehicles Advanced Vehicle Summary: Design Vehicles Design Loads HL-33 (US) Permit Loads Fatigue Loads LRFD Fatigue Truck (US) is Is Is Is Iteration Iteration

On the Output tab, you can select the reports that you would like to have generated during the analysis.

Analysis Settings	
Design Review	Design Method: LRFD 💌
Analysis Type:	
Line Girder 🔹	
Lane/Impact Loading Type:	
As Requested 💌	Apply Preference Setting: None
/ehicles Output Engine Description	
Tabular Results:	AASHTO Engine Reports:
Concrete Limit State Summary Report Dead Load Action Report Live Load Action Report LRFD Critical Loads Report LRFD Specification Check Report P S Concrete Stress Report RC Service Stress Report Steel Limit State Summary Report	 Miscellaneous Reports: Girder Properties Summary Influence Line Loading Detailed Influence Line Loading Capacity Detailed Computations FE Model for DL Analysis FE Model for LL Analysis LL Influence Lines FE Model LL Influence Lines FE Actions LL Distrib. Factor Computations
Select All Clear All	Select All Clear All
Reset Clear Open Template	Save Template OK Apply Cancel

Next, click the Analyze button on the toolbar to perform the design review. The Analysis Progress dialog will appear and should be reviewed for any warning messages.

Analysis Progress		
- I Analysis Event I I Plate Girder	 Location - 18.0000 (ft) Location - 27.0000 (ft) Location - 36.0000 (ft) Location - 45.0000 (ft) Location - 53.0000 (ft) Location - 63.0000 (ft) Location - 72.0000 (ft) Location - 81.0000 (ft) Location - 90.0000 (ft) Location - 90.0000 (ft) Location - 108.0000 (ft) Location - 117.0000 (ft) Location - 117.0000 (ft) Location - 126.0000 (ft) Location - 126.0000 (ft) Location - 126.0000 (ft) Location - 135.0000 (ft) Location - 135.0000 (ft) Location - 144.0000 (ft) Location - 153.0000 (ft) Location - 163.0000 (ft) Location - 180.0000 (ft)	
View Rating Log	Print OK	

The following steps are performed when doing a design review of a steel girder using the AASHTO LRFD analysis engine:

 Finite element models are generated for the dead load and live load analyses. A Stage 1 FE model is generated for the beam dead load and non-composite dead loads. A Stage 2 FE model is generated for dead loads applied to the long-term composite section properties. A Stage 3 FE model is generated for the live load analysis.

Stage 2 models contain section properties corresponding to the sustained modular ratio factor entered in BrD (e.g., 3n). Stage 3 models contain section properties corresponding to the modular ratio (n). The FE model will take into account the presence of shear connectors when setting the composite properties in the FE models. Regions that do not contain shear connectors will use non-composite section properties in the Stage 2 and 3 FE models.

In addition to the points selected on the Member Alternative: Control Options tab, the model generated by the export to the AASHTO LRFD analysis engine will always contain node points at brace point locations and locations midway between the brace points. Only the articles required to compute stresses are processed at these points if the point is not being processed for one of the options chosen on this tab. The stresses at these locations are required when determining the flexural capacity of the steel girders.

2. The specification checking occurs in two phases. The first phase determines the type of flexure present at each point for each controlling load combination. This is necessary because the flexural articles to be considered in the Specification are dependent on the type of the flexure the beam is subject to. The second phase performs the specification checks taking into consideration the flexure type determined in the first phase.

Phase 1:

Positive flexure is defined as the bending condition that produces compressive stress (denoted by a negative sign in the program) in the slab for composite construction or the top flange for non-composite construction. Negative flexure is defined as the bending condition that produces tensile stress (denoted by a positive sign) in the slab or top flange. As per Article 6.10.1.1.1b, the stress in the top of the slab (or top flange for non-composite construction) is first computed using the positive flexure section properties. If this stress is compressive, the stresses in each component of the beam (slab, longitudinal reinforcement, flanges, cover plates, and web) are computed using the positive flexure section properties. If the stress in the top of the slab (or top flange for non-composite construction) is tensile, the stresses in each component of the beam are computed using the negative section properties.

If the resulting computed stress in the bottom flange is tensile, the beam is considered to be in positive flexure for the load combination. If the resulting computed stress in the bottom flange is compressive, the beam is considered to be in negative flexure for the load combination.

Phase 2:

The remaining articles are evaluated taking into consideration the flexure type determined in the first phase.

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

🚞 Beam Shapes 🔹	ridge							
Appurtenances	rainin	CAR	Willcore) othan wond		2.4			
Connectors	rainin	(F)OL	. (Osers (ethan. dong		ers\ethan.u	iong\Docu ×		
Diaphragm Definitions	rainin	🗙 🔛 Snagit	2 2					
Lateral Bracing Definitions	CI Tra	Bridge ID · 34			N	BI Structure ID · S	tl6 Training	
Timpact/ Dynamic Load Anowarce	Crirai	Bridge : 2 Span P	late Girder Training	Į	В	ridge Alt :		^
A Stl6_Training		Superstructure De	ef : 2 Span, 4 Girder	system		-		
		Member : G2	a Catting North		N	lember Alt : Plate (Girder	
⊡-Sti6_Traning ⇔ 2 Span_4 Girder austern		Analysis Pielelen	ice Setting . None					
Er 2 3par, 4 dilder system		AASHTO LRFD	Specification, Editi	on 7, Interim 2016				
- Plate Girder								
Lifd Deck Reinf Dev Length Calcs Log File		Specificatio	on Check Su	mmary				
E- AASHTO_LRFD				-				
- Stage 1 Span Model Stage 1 Span Model Actions			Article		Status			
- Stage 2 Span Model		Flex	xure (6.10.7.1.1, 6.1	0.7.2.1)	Pass			
Stage 2 Span Model Actions			Shear (6.10.9)		Fail			
			Fatigue (6.10.5.	3)	NA			
Detailed calculations of computed Simplified distribution fa	ictors	5	Serviceability (6.10.	4.2.2)	Pass			
Spec Check Results (Friday Jun 17, 2016 11:00:14)		Constructabil	lity (6.10.3.2.1, 6.10).3.2.2, 6.10.3.2.3)	Pass			
I Log File		Transverse	Stiffeners (6.10.11.	1.2, 6.10.11.1.3)	Fail			
		Longitudina	1 Stiffeners (6.10.11	.3.1, 6.10.11.3.2,	274			
		Ŭ	6.10.11.3.3)		INA			
		Bearing Stiffene	ers (6.10.11.2.2, 6.1	0.11.2.3, 6.10.11.2.4)	Pass			
		Shear C	Connector (6.10.10.	1, 6.10.10.4)	NA			
		Field Splice (6.1	13.6.1.4a, 6.13.2.6,	6.13.2.7, 6.13.6.1.4b,	NA			
			6.13.6.1.4c)		INA			
🖥 Default Materials								
📑 Impact / Dynamic Load Allowance		Girder Me	mber Propo	rtions and Co	mpacti	1ess (Stage 3	5)	
bist. Live Load Distribution								
Hinge Locations		Location	Composite	Proportion	Code	Compact	Code	
Salias Lasations		(ff)		Code	Cneck		Спеск	
- Sprice Locations		0.000	Yes	Pass		Compact	E	
I Haunch Profile		9.000	Yes	Pass		Compact	E	4
📛 Lateral Support		18.000	Yes	Pass		Compact	E	1
📖 🕮 Stiffener Ranges		27.000	Yes	Pass		Compact	E	

The specification checks can be viewed by selecting the "View Spec Check" button.



We can then use the Filter to limit the articles shown to just the Shear Resistance article by hitting "Clear All" and then selecting just the 6.10.9 article. Then hit OK to close the Filter.

🖆 📴 📓 🖩 🖉 🔯 🖝 🖛 🔍 🖄 🖹 🖬 🖉 Preliminary 🔹 🕅	* 7. 秋 4 2 2 3 4 5 1 4
Didae Waterasa Wi Training	
B- A Stl6_T A Specification Checks for Plate Order - 21 of 1517	
B Superstructure Component Specification Referen	ice Limit State Flex. Sense Pass/Fail
B Glug State 1	tance N/A Passed
I Brand Stage Stag	tance N/A Passed
B Plate Girder	tance de
→ Span 1 - 0.00 ft. ✓ 6.18.9 Shear Resis	tance Flar Name (Default Filter)
CC B	tance d
□ □ Span 1 - 18.00 ft. ✓ 6.10.9 Shear Reis	tance New Open Save Delete d
□ Span 1 - 32.00 ft. ✓ 6.10.9 Shear Resis	tance divides busicities
→ Span 1 - 36.00 ft. ✓ 6.10.9 Shear Resis	tance derived vector Marces prescription
→ Span 1 - 43.00 ft. ✓ 6.10.9 Shear Resis	tance Reference Article A
- Span 1 - 54.00 ft. 🗸 6.10.9 Shear Resis	tance G.10.8.2.3 Lateral Torsional Buckling Resistance d
	tance 6.10.8.2.3.Cb Lateral Lorssonal Buckling Resistance - Cb Calculati d
- Span 1 - 70.50 ft. 6.10.9 Shear Resis	tance 6.10.8.3 Tension-Flange Flexural Resistance d
→ Span 1 - 72.00 ft. ✓ 6.10.9 Shear Resis	tance To 6.10.9 Shear Resistance - General d
→ Span 1 - 77.00 ft. ✓ 6.10.9 Shear Resis	tance 6.10_General_FL
- Span 1 - 83.50 ft.	tance ☐ 6.6.1.2.2 Design Criteria ☐ 6.9.4.1 Bearing Stiffener Nominal Resistance d
- □ Span 1 - 90.00 ft. → ○ Span 2 - 6.50 ft.	tance 🗌 APPD6.1 Plastic Moment 👻 d
- Span 2 - 9.00 ft.	< »
- Span 2 - 13.00 ft.	Select All Clear All
🔁 Span 2 - 26.00 ft.	
Span 2 - 27.00 ft.	
- Span 2 - 42.00 ft.	
Span 2 - 54.00 ft.	
🔁 Span 2 - 63.00 ft.	
- 🔄 Span 2 - 81.00 ft.	
B- 🖬 🚺	

Opening this article shows the following:

```
Spec Check Detail for 6.10.9 Shear Resistance
 (AASHTO LRFD Bridge Design Specifications, Seventh Edition - 2014, with 2016 Interims)
                                                                                                      .
 Steel Plate - At Location = 90.0000 (ft) - Left Stage 3
 Section at Brace Point
 Article 6.10.9.2-1 Unstiffened Panels
 INPUT:
 Top Flange bf = 16.0000 (in)
Top Flange tf = 1.2500 (in)
Web D = 46.0000 (in)
Web tw = 0.5000 (in)
                                                                                                      Ε
 Bot Flange bf = 18.0000 (in)
Bot Flange tf = 1.5000 (in)
 Fyw = 50.0000 (ksi)
 do = 192.0000 (in)
 phi = 1.0000
 SUMMARY:
 k = 5.0
 D/tw = 92.0000
 Limit 1: 1.12*SQRT(E*k/Fyw) = 60.3138
 Limit 2: 1.40*SQRT(E*k/Fyw) = 75.3923
 D/tw > Limit2 therefore
      1.57*(E*k/Fyw)
 C = -----
                                                   (6.10.9.3.2-6)
       (D/tw)^2
 C = 0.5379
 Vp = 0.58*fyw*D*tw
                                                   (6.10.9.3.2-3)
 Vp = 667.0001 (kip)
 Vn = Vcr = C * Vp
                                                   (6.10.9.2-1)
 Vn = 358.7962 (kip)
 Vr = phi*Vn = 358.80
 Note: If the capacity has been overridden, the Resistance is computed as override phi*override capa
     Otherwise the Resistance is computed as per the Specification.
                                   --- Override --- Design
Vu Phi Vn Vr Ratio Code
(kip) (kip) (kip)
 Limit
                  Load
 State
                  Combo
                                         _____
                                                                -358.80 3.44 Pass
  STR-I
                     1
                                    -104.19
 STR-I
                     1
                                    -361.84
                                                               -358.80
                                                                             0.99
                                                                                          Fail
  STR-I
                      2
                                     -104.19
                                                                -358.80
                                                                               3.44
                                                                                          Pass
  STR-I
                     2
                                     -322.22
                                                                 -358.80
                                                                               1.11
                                                                                          Pass
  ٠ 📃
                                               111
                                                                                         þ.
                                                                                                 OK .
```

Open the Girder Profile window and revise the web thickness to 0.5625" in the region near Pier 1. Re-run the HL93 Design Review and review the Spec Check summary report.

Girde	r Prof	ile											-	
ype: Web	Plate Top	Girder Flange	Bot	tom Flange	9									
Be De	egin epth (in)	Depth Va	ary	End Depth (in)	Thickness (in)	Suppo Numb	ort er	Start Distance (ft)	Length (ft)	End Distance (ft)	Material		Weld at Right	
46.0	0000	None	-	46.0000	0.5000	1	Ŧ	0.00	63.00	63.00	Grade 50W	•	-	
46.0	0000	None	•	46.000	0.5625)1	•	63.00	54.00	117.00	Grade 50W	-	-	
46.0	0000	None	•	46.0000	0.5000	2	Ŧ	27.00	63.00	90.00	Grade 50W	-	-	
										New	Duplicat	e	Delete	
										OK	Ap	ply	Car	ncel

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🗙 🛄 Snagit 🧮 📷	
Bridge ID : 466 Bridge : 2 Span Plate Girder Training Superstructure Def : 2 Span 4 Girder system	NBI Structure ID : Stl6_Training Bridge Alt :
Member : G2 Analysis Preference Setting : None	Member Alt : Plate Girder
AASHTO LRFD Specification, Edition 7, Interim 2016	

Specification Check Summary

Article	Status
Flexure (6.10.7.1.1, 6.10.7.2.1)	Pass
Shear (6.10.9)	Pass
Fatigue (6.10.5.3)	NA
Serviceability (6.10.4.2.2)	Pass
Constructability (6.10.3.2.1, 6.10.3.2.2, 6.10.3.2.3)	Pass
Transverse Stiffeners (6.10.11.1.2, 6.10.11.1.3)	Pass
Longitudinal Stiffeners (6.10.11.3.1, 6.10.11.3.2, 6.10.11.3.3)	NA
Bearing Stiffeners (6.10.11.2.2, 6.10.11.2.3, 6.10.11.2.4)	Pass
Shear Connector (6.10.10.1, 6.10.10.4)	NA
Field Splice (6.13.6.1.4a, 6.13.2.6, 6.13.2.7, 6.13.6.1.4b, 6.13.6.1.4c)	NA

Open the spec check detail window for Article 6.10.8.1.3 at the 90' location. The following is noted for this window, other spec articles are similar:

Steel Plat	ce - At Loca	tion = 90.00	00 (ft) - Lef	t Stage	3					
ection at	: Brace Poin	5		1						
NPUT: hif = 1.0	000									
ection Ty op Flange llow Mome oment Rec	/pe: Composi E Laterally ent Redistri distribution	te Supported: Y bution Contr : No, Momer	es ol Option: No t Redistribut	ion did not	occur					
MMARY:										
bu <= Phi	lf * Rh * Fy	£	(6.10.8	.1.3-1)						
esist = 1	Phif * Rh *	Fyf								
esign Rat	io = Resist	/fbu								
Limit	Load	Flexure			5				2 Design	
State	Combo	Туре	Component	fbu (ksi)	frd (ksi)	Rh	Fyf (ksi)	Resist (ksi)	Ratio	Status
STR-I	1	Neg	Top Flange	19.88		1.00	50.00	50.00	2.52	Pass
STR-I	1 3	Neg	Top Flange	42.98		1.00	50.00	50.00	1.16	Pass
TR-I	2	Neg	Top Flange	19.88		1.00	50.00	50.00	2.52	Pasi
STR-I	2	Neg	Top Flange	40.85		1.00	50.00	50.00	1.22	Pas.
STR-I	3	Neg	Top Flange	19.88		1.00	50.00	50.00	2.52	Pas
TR-I	3	Neg	Top Flange	48.66		1.00	50.00	50.00	1.03	Pas
TR-III	1	Neg	Top Flange	19.88		1.00	50.00	50.00	2.52	Pas
TR-III	1	Neg	Top Flange	28.57		1.00	50.00	50.00	1.75	Pas
TR-III	2	Neg	Top Flange	19.88		1.00	50.00	50.00	2.52	Pas
TR-III	2	Neg	Top Flange	28.57		1.00	50.00	50.00	1.75	Pas
IR-III	3	Neg	Top Flange	19.88		1.00	50.00	50.00	2.52	Pas
TD_V	-	Neg	Top Flange	10.97		1.00	50.00	50.00	2.52	263
TD_U	1.1	Neg	Top Flange	39.60		1.00	50.00	50.00	1.26	Pas
TR-V	2	Neg	Top Flange	19.88		1.00	50.00	50.00	2.52	Das
TR-V	2	Neg	Top Flange	38.05		1.00	50.00	50.00	1.31	Pas
STR-V	3	Neg	Top Flange	19.88		1.00	50,00	50.00	2.52	Pas
STR-V	3	Neg	Top Flange	44.07		1.00	50.00	50.00	1.13	Pass
SIR-V	3	Neg	Top Flange	44.07		1.00	50.00	50.00	1.13	Pat
Code	Nabicle									
Lode	venicie									
1	HL-93 (US)	- Iruck + La	ine							
1 2	HL-93 (US) HL-93 (US)	 Truck + La Tandem + I 	ine Jane							

- 1. For each spec check location, both the left and right sides of the point are evaluated. The Deflection article is an exception to this since deflection must be the same between the left and right sides of a point.
- 2. The design ratio is printed out for the article. The design ratio is the ratio of capacity to demand. A design ratio less than one indicates the demand is greater than the capacity and the spec article fails. A design ratio equal to 99.0 indicates the section is subject to zero demand.
- 3. For steel members, the Strength-I, Strength-II (for Permit vehicles), Strength-III, Strength-V, Service II and Fatigue limit states are the only limit states investigated. For each limit state, the max and min force effect is checked for each vehicle. Thus each limit state shows two rows of data for each vehicle.
- 4. The LL vehicle is identified by the load combination is shown in this column.

5. The 'frd' column displays the stresses due to the redistribution moments. If moment redistribution was not processed, this column shows '---'.

рокту	ре			Sta	ge)ead Load Case	
ead Lo	ad Actions			·▼ No	n-comp	osite (S	itage 1)	▼	Self Load (Stage 1:D,DC).	-
1_	Location	%		Moment	Shear	Axial	Reaction	X Deflection		
Spar	(ft)	Span	Side	(kip-ft)	(kip)	(kip)	(kip)	(in)	(in)	
1	0.00	0.0	Right	-0.00	5.88	0.00	5.88	0.0000	-0.0000	
1	9.00	10.0	Both	45.63	4.26	0.00		0.0000	-0.0645	
1	16.00	17.8	Both	71.02	3.00	0.00		0.0000	-0.1078	
1	18.00	20.0	Both	76.65	2.64	0.00		0.0000	-0.1185	
1	27.00	30.0	Both	93.06	1.01	0.00		0.0000	-0.1545	
1	32.00	35.6	Both	95.87	0.11	0.00		0.0000	-0.1652	
1	36.00	40.0	Both	94.86	-0.61	0.00		0.0000	-0.1686	
1 1	45.00	50.0	Both	82.06	-2.23	0.00		0.0000	-0.1606	
1	48.00	53.3	Both	74.55	-2.78	0.00		0.0000	-0.1533	
1	54.00	60.0	Both	54.65	-3.86	0.00		0.0000	-0.1332	
1 1	63.00	70.0	Both	12.63	-5.48	0.00		0.0000	-0.0932	
1 1	64.00	71.1	Both	7.02	-5.73	0.00		0.0000	-0.0884	
1 1	70.50	78.3	Both	-35.45	-7.34	0.00		0.0000	-0.0572	
1 1	72.00	80.0	Both	-46.74	-7.71	0.00		0.0000	-0.0503	
1 1	77.00	85.6	Both	-88.40	-8.95	0.00		0.0000	-0.0291	
1	81.00	90.0	Both	-126 20	-9.94	0.00		0.0000	-0.0151	
1 1	83.50	92.8	Both	-151.83	-10.56	0.00		0.0000	-0.0082	
1	90.00	100.0	Leff	-225 74	-12.18	0.00	24 35	0.0000	-0.0000	
	0.00	0.0	Right	-225.14	12.10	0.00	24.00	0.0000	-0.0000	
1 1	6.50	7.2	Both	151.83	10.56	0.00	27.00	0.0000	0.0082	
	0.00	10.0	Both	106.00	0.04	0.00		0.0000	0.0151	
1	12.00	14.4	Both	00 40	0.05	0.00		0.0000	0.0101	
	40.00	14.4	Doth	-00.40 4C 74	7 74	0.00		0.0000	0.0231	
4 4	10.00	20.0	Dotri	-40.74	7.04	0.00		0.0000	0.0503	
	19.50	21.7	Douri	-35.45	6 70	0.00		0.0000	0.0072	
4	26.00	20.9	Both	7.02	5.73	0.00		0.0000	0.0004	
4 4	27.00	30.0	Both	12.63	5.48	0.00		0.0000	-0.0932	
4	36.00	40.0	Both	54.65	3.86	0.00		0.0000	-0.1332	
4 2	42.00	46./	Both	/4.55	2.78	0.00		0.0000	-0.1533	
4 2	45.00	50.0	Both	82.06	2.23	0.00		0.0000	-0.1606	
4 2	54.00	60.0	Both	94.86	0.61	0.00		0.0000	-0.1686	
4 2	58.00	64.4	Both	95.87	-0.11	0.00		0.0000	-0.1652	
4 2	63.00	/0.0	Both	93.06	-1.01	0.00		0.0000	-0.1545	
42	72.00	80.0	Both	76.65	-2.64	0.00		0.0000	-0.1185	
4 2	74.00	82.2	Both	71.02	-3.00	0.00		0.0000	-0.1078	
42	81.00	90.0	Both	45.63	-4.26	0.00		0.0000	-0.0645	
1 2	90.00	100.0	Left	0.00	-5.88	0.00	5.88	0.0000	-0.0000	

Tabular dead load and live load analysis results are available in the Analysis Results window.

port Typ	e			Stage				Live L	oad			Live Load Type	e				
/e Load	Actions		-	Compo	site (shor	term) (Sta	age 3) 🔻	HL-9	3 (US)		•	Axle Load		-			
												Axle Load					
1			Dositiva	Negative	Dositiva	Negative	Dositiva	Negotive	Dositive	Negative	Positive	Truck + Lane			1	-	
Span	Location	%	Moment	Moment	Shear	Shear	Axial	Axial	Reaction	Reaction	X Deflection	1 ruck Pair 190%(Truck Pai	r+Lane)		% Impact	% Impact	
-	(ft)	Span	(kip-ft)	(kip-ft)	(kip)	(kip)	(kip)	(kip)	(kip)	(kip)	(in)	Tandem	, · Editoj		Pos Reaction	Neg Reaction	
1	0.00	0.0	0.00	0.00	79.17	-9.06	0.00	0.00	79.17	-9.06	0.0000	Tandem + Lan	е	j	33.000	33.000	
1	9.00	10.0	476.60	-63.72	67.80	-9.06	0.00	0.00			0.0000	Lane	0.0000 ;	-0.1003	1		
1	16.00	17.8	739.18	-113.27	59.15	-10.31	0.00	0.00			0.0000	0.0000	0.0972	-0.2744	ŀ		
] 1	18.00	20.0	797.39	-127.43	56.72	-12.58	0.00	0.00			0.0000	0.0000	0.1084	-0.3036)		
1	27.00	30.0	976.81	-191.15	46.20	-22.69	0.00	0.00			0.0000	0.0000	0.1536	-0.4111			
1	32.00	35.6	1032.63	-226.54	40.57	-28.76	0.00	0.00			0.0000	0.0000	0.1744	-0.4513	}		
1	36.00	40.0	1050.04	-254.86	36.26	-33.62	0.00	0.00			0.0000	0.0000	0.1882	-0.4719)		
1	45.00	50.0	1021.90	-318.58	27.18	-44.24	0.00	0.00			0.0000	0.0000	0.2084	-0.4807			
] 1	48.00	53.3	996.34	-339.82	24.31	-47.64	0.00	0.00			0.0000	0.0000	0.2113	-0.4713	1		
1	54.00	60.0	912.08	-382.29	18.95	-54.17	0.00	0.00			0.0000	0.0000	0.2107	-0.4352	2		
1	63.00	70.0	707.26	-446.01	11.77	-63.37	0.00	0.00			0.0000	0.0000	0.1916	-0.3463	}		
1	64.00	71.1	680.53	-453.09	11.10	-64.32	0.00	0.00			0.0000	0.0000	0.1880	-0.3344			
1	70.50	78.3	500.68	-514.07	6.94	-70.28	0.00	0.00			0.0000	0.0000	0.1588	-0.2521			
1	72.00	80.0	450.85	-525.01	6.06	-71.58	0.00	0.00			0.0000	0.0000	0.1505	-0.2323	}		
1	77.00	85.6	272.99	-561.47	3.47	-75.81	0.00	0.00			0.0000	0.0000	0.1184	-0.1650)		
1	81.00	90.0	149.26	-590.64	2.29	-78.90	0.00	0.00			0.0000	0.0000	0.0875	-0.1114			
1	83.50	92.8	107.64	-608.87	1.60	-80.75	0.00	0.00			0.0000	0.0000	0.0658	-0.0788	}		
1	90.00	100.0	0.00	-656.26	-0.00	-85.17	0.00	0.00	89.82	0.00	0.0000	0.0000	0.0000	0.0000	33.000	0.000	
2	0.00	0.0	0.00	-656.26	85.17	0.00	0.00	0.00	89.82	0.00	0.0000	0.0000	0.0000	0.0000	33.000	0.000	
2	6.50	7.2	107.64	-608.87	80.75	-1.60	0.00	0.00			0.0000	0.0000	0.0658	-0.0788	}		
2	9.00	10.0	149.26	-590.64	78.90	-2.29	0.00	0.00			0.0000	0.0000	0.0875	-0.1114			
2	13.00	14.4	272.99	-561.47	75.81	-3.47	0.00	0.00			0.0000	0.0000	0.1184	-0.1650)		
2	18.00	20.0	450.85	-525.01	71.58	-6.06	0.00	0.00			0.0000	0.0000	0.1505	-0.2323	3		
2	19.50	21.7	500.68	-514.07	70.28	-6.94	0.00	0.00		••••••	0.0000	0.0000	0.1588	-0.2521			
2	26.00	28.9	680.53	-453.09	64.32	-11.10	0.00	0.00		· · · · · · · · · · · · · · · · · · ·	0.0000	0.0000	0.1880	-0.3344			
2	27.00	30.0	707.26	-446.01	63.37	-11.77	0.00	0.00			0.0000	0.0000	0.1916	-0.3463	}		
2	36.00	40.0	912.08	-382.29	54.17	-18.95	0.00	0.00			0.0000	0.0000	0.2107	-0.4352	2		
2	42.00	46.7	996.34	-339.82	47.64	-24.31	0.00	0.00			0.0000	0.0000	0.2113	-0.4713	}		
2	45.00	50.0	1021.90	-318.58	44.24	-27.18	0.00	0.00			0.0000	0.0000	0.2084	-0.4807	,		
2	54.00	60.0	1050.04	-254.86	33.62	-36,26	0.00	0.00		· · · · · · · · · · · · · · · · · · ·	0.0000	0.0000	0.1882	-0.4719	1		
1 2	58.00	64.4	1032.63	-226.54	28.76	-40.57	0.00	0.00			0.0000	0.0000	0.1744	-0.4513	}		
1 2	63.00	70.0	976.81	-191 15	22.69	-46.20	0.00	0.00	-		0 0000	0.0000	0.1536	-0 4111			
1 2	72.00	80.0	797.39	-127 43	12.58	-56.72	0.00	0.00			0 0000	0.0000	0 1084	-0.3036	1		
1 5	74.00	82.2	739.18	-113.27	10.31	-59.15	0.00	0.00			0.0000	0.0000	0.0972	-0.2744			
1 5	81.00	90.0	476.60	-63.72	9.06	-67.80	0.00	0.00			0.0000	0.0000	0.0560	-0.1609	1		
1 5	90.00	100.0	0.00	0.00	30.P	-79.17	0.00	0.00	79 17	30.0-	0.0000	0.0000	0.0000	0.0000	33,000	33,000	
I 2 SHTO L alysis Pr	RFD Engi	ine Ver Setting:	sion 6.8.1 None	.2001	9.06	-79.17	0.00	0.00	1 79.17	<u>;</u> -9.06	1 0.0000	I U.UUUU I	0.0000 ;	0.0000) i 33.000	33.000	Close

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

You may find different live load values between various analysis engines due to a difference in how the live load distribution factors are applied. For example, the BRASSTM engine (which is no longer supported) applies the LL distribution factor based on the region where the analysis point is located. The AASHTO engines have a choice to do the same thing or it applies the LL distribution factor based on the region where the axle is positioned. This can be defined by the user in the System Defaults and in the Control Options for a member.

General Bridge Workspace Control Options Supe	retructure Analusia Specificatio	na Substructure Analusia Tolerance
LRFD Distribution Factor Application Method	LRFR Distribution Factor Ap	pplication Method
LFD Distribution Factor Application Method		
Include bearing stifteners in rating		



Explanation of the Distribution Factor Application Method

The user will select the method to be used for the application of live load distribution factors. The choices are:

- By axle causes the distribution factor at the location of the axle to be used for each axle.
- By POI causes the distribution factor at the location of the point of interest to be used for all axles.

Similar behavior applies for lane load.

The FE model output that we turned on in the Analysis Settings window is available from the Analysis Output window:

Impact / Dynamic Load Allowance Impact / Dynamic Load All	C:\Use	rs\gcolgrove	\Docume	ints\AASHTO
Std5_Training Std5_Training Std5_Training C 2 Span, 4 Girder system C 62 Plate Girder AASHT0_LBE0 Stage 1 Span Model (Tuesday Jul 19 Stage 1 Span Model Actions Stage 2 Span Model Stage 2 Span Model Stage 2 Span Model Stage 3 Span Mod	Bridge II Bridge : Superstr Member User : V Descript	D :27 2 Span Plat ucture Def :: G2 irtis ion: Stage 1	te Girder 2 Span 1 Span N	r Training , 4 Girder system Aodel
- Summary of computed distribution fac	Node	X (ft)	Y (ft)	Z (ft)
 Detailed calculations of computed dis — Spec Check Results 	1	0.000	0.000	0.000
Log File	2	9.000	0.000	0.000
	3	16.000	0.000	0.000
	4	18.000	0.000	0.000
	5	27.000	0.000	0.000
	6	32.000	0.000	0.000
	7	36.000	0.000	0.000
	8	45.000	0.000	0.000
Splice Lo	9	48.000	0.000	0.000
- 🖂 Deck Pro	10	54.000	0.000	0.000
- 🖂 Haunch	11	63.000	0.000	0.000
Stiffener	12	64.000	0.000	0.000
⊕— 🧰 Bearing :	13	70.500	0.000	0.000
- Points of Deteriora	14	72.000	0.000	0.000
⊕- I Plate Girder -	15	77.000	0.000	0.000
I G3	16	81.000	0.000	0.000
	17	83.500	0.000	0.000
Bridge Alternative 1 (E) (C)	18	90.000	0.000	0.000
SUPERSTRUCTURES	19	96.500	0.000	0.000

Additional reporting has been added to the Report Tool for steel beams. Select the 'LRFD Analysis Output' report in the Report Tool, click 'Clear All' and then select the last 3 reports. Click 'Generate' to generate these 3 reports.

🗛 Stl6_Training - LRFD Repo	ort	
Report Type: LRFD Analys	sis Output 🔻 Advanced	Begin each topic on a new page when printed
New Open	Merge Save	Save As Generate
 Reactions Moment Summary Shear Summary Flexure Analysis Summary Shear Analysis Summary Camber Summary Design Review Summary Spec Check Summary Bearing Design Summary Diaphragm Forces 	, 	
Clear All Select All	Delete	Close

Design Review Summary:

This report contains the minimum design ratio at each analysis point along the beam.

Spec Check Summary:

This report lists a summary of the spec check results for each article for each loading at each analysis point.

Bearing Design Summary:

This report lists factored and unfactored bearing reactions and rotations to be used in a bearing design.

											_	- • •
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🗴 🛄 Snagit 🧮 🛃	-											
												_
Bridge Name: 2 Span Plate Girder 7 NBI S tructure ID: Stl6_Training Bridge ID: Stl6_Training	Training											
Analyzed By: Bridge Analyze Date: Tuesday, August 09 Analysis Engine: AASHTO LRFD Analysis Preference Setting: Non	9, 2016 13:10:) Engine Versi ae	25 on 6.8.1.20	01									
Report By: bridge Report Date: Tuesday, August 09, 2	2016 13:33:14	4										
S tructure Definition Name: 2 Spa Member Name: G2 Member Alternative Name: Plate	an, 4 Girder sj Girder	ystem										
			G	irder De	esign Re	eview S	ummarv					
Span 1					2		·					
Span 1												
	Location	Percent	Туре	Article	LS	Stage	Units	Action	Resist.	Ratio		
	9.00	10.0	Shear	6.10.9	STR-I STR-I	3	kip kin	204.02	358.80	1.50		
	18.00	20.0	Perm	610422	SER-II	3	r kai	22.65	47.50	2.10		
	27.00	30.0	Deformations Perm	6 10 4 2 2	SER-II	3	ksi	27.75	47 50	1.71		
	26.00	40.0	Deformations Perm	610422	SED II	2	luni	20.19	47.50	1.62		
	45.00	40.0	Deformations Perm	6.10.4.2.2	OFD H	,	K31	25.10	47.50	1.05		
	45.00	50.0	Deformations	0.10.4.2.2	SER-II	,	K31	20.98	47.50	1./0		
	54.00	60.0	Shear	6.10.9	STR-I	3	kap	-1/8.73	-358.80	2.01		
	72.00	20.0	Shear	6 10 0	SIR-I STD I	2	kip	-223.48	-328.80	1.09		
	81.00	90.0	Flexure	610811	STR-I	3	ksi	-48.51	-50.00	1.00		
	83.50	92.8	Min	61017	01101	3	in^2	9.60	10.41	1.05		
	90.00	100.0	Reinforcement Flexure	6 10 8 1 3	STR-I	3	ksi	48.66	50.00	1.03		
Span 2	50.00	100.0	1 Ichard	0.10.0.1.5	01101	2		10.00	50.00	1.05		
	Logation	Panant	Tuma	Antiala	15	Stars	Tinite	Action	Posist	Patio		
	6.50	7.2	Min	6 10 1 7	1.5	3 tage	in (12	0.60	10.41	1.00		
	0.00	10.0	Reinforcement	6 10 0 1 1	OTD I	2	III 2	9.00	50.00	1.00		
	9.00	20.0	r iexure Shear	6 10 9	SIR-I STR-I	3	KS1 kin	-48.01 070.11	-30.00	1.05		
	27.00	30.0	Shear	6 10 9	STR-I	3	kin	225.48	358.80	1.50		
	36.00	40.0	Shear	6.10.9	STR-I	3	kip	178.73	358.80	2.01		
	45.00	50.0	Perm	6.10.4.2.2	SER-II	3	ksi	26.98	47.50	1.76		
	54.00	60.0	Perm Deformations	6.10.4.2.2	SER-II	3	ksi	29.18	47.50	1.63		
	63.00	70.0	Perm Deformations	6.10.4.2.2	SER-II	3	ksi	27.75	47.50	1.71		~
	72.00	00.0	Perm	610422	CED II	2	Ini	22.65	47.50	2.10		

A copy of the AASHTO LRFD engine Method of Solution manual is available.

📲 Br	idge D	esign/	Rating -	StI6_T	raining							
File	Edit	View	Bridge	Sub	structure	Tools	Window	Help			-	
	2 🔒	P	b A	* *	B B	a	i 🖪 🝏		Help Topics		L NXT 🚹 🎦	
									Frequently Asked Questions			
			ſ	_					Support			
				🖳 Bri	idge Explo	orer (376	Bridge Des	i	Facility Hale Configuration		lder, all rows retrie	eved)
					a All Brid	ges		1	Engine Help Configuration	•		Bridge
				Ē	3 💼 Sam	nple Brid	ges		AASHTO ASD Help	•		RCSL-0965-RCSS
						AISI LRFI) Example E		AASHTO Culvert LFD Help	+		RCSL-0966-RCSS
						Concrete	2 Example E		AASHTO Culvert LRFD Help	+		
						Jimhar F	imple briug ivamole Bri]	AASHTO Culvert LRFR Help	+		
					Deleted	l Bridaes	.xampic bii]	AASHTO LED Heln	+	ns	
				-							Engine Hele	
											Engine help	
									AASHTO ERFR Help	· '	Method of 3	solution
									AASHTO Truss LFD Help	•	gn Settings	
									AASHTO Truss LRFR Help	•	ns	
									Madero ASD Help	+	NITIONS	
									BrD Substructure	×	stem amic Load Allowa	ince
									About Bridge Design/Rating		scription	

Moment Redistribution

Run an HL93 Design Review for the member alternative "Plate Girder – Allow moment redistribution". This is a streamlined version of the previous alternative. It does not contain any flange transitions. View the spec check summary and see that flexure fails for this beam.

(<>)⊖] □ c	:\Users\ethan.uong\I	🔎 – 🖒 🎑 C:\Use	rs\ethan.uor	ng\Docu ×		🔐 🛧 🔅
🗙 🛄 Snagit 🛔	i 🖻					
Bridge ID : 466 Bridge : 2 Span Plate Superstructure Def : Member : G2 Analysis Preference	e Girder Training 2 Span, 4 Girder syste Setting : None	NBI Structure ID Bridge Alt : m Member Alt : Pla	: Stl6_Traini ite Girder - Al	ng llow Moment Redistr	ibution	^
AASHTO LRFD Sp	ecification, Edition 7, 1	interim 2016				
Specification	Check Summ	ary				
	Article		Status			
F	lexure (6.10.7.1.1, 6.1	0.7.2.1)	Fail			
	Shear (6.10.9)		Pass			
	Fatigue (6.10.5.3)	NA			
	Serviceability (6.10.4	4.2.2)	Pass			
Constructa	bility (6.10.3.2.1, 6.10	.3.2.2, 6.10.3.2.3)	Pass			
Transver	se Stiffeners (6.10.11.1	1.2, 6.10.11.1.3)	Pass			
Longitudinal St	iffeners (6.10.11.3.1, 6	.10.11.3.2, 6.10.11.3.3)	NA			
Bearing Stiffe	eners (6.10.11.2.2, 6.10	.11.2.3, 6.10.11.2.4)	Pass			
Shea	r Connector (6.10.10.1	, 6.10.10.4)	NA			
Field Splice (6.13.6	.1.4a, 6.13.2.6, 6.13.2.	7, 6.13.6.1.4b, 6.13.6.1.4	c) NA			
Girder Mem	ber Proportion	ns and Compact Proportion Code	Code Code Check	age 3) Compact	Code Check]
0.000	Yes	Pass		Compact	E	
9.000	Yes	Pass		Compact	E	
18.000	Yes	Pass		Compact	E	
27.000	Yes	Pass		Compact	E	
36.000	Yes	Pass		Compact	E	
45.000	Yes	Pass		Compact	E	
54.000	Yes	Pass		Compact	E	
63.000	Yes	Pass		Compact	E	~
		1		1 .		1

In the Member Alternative: Control Options tab, select the box to allow moment redistribution. Run the HL93 Design Review analysis again.

A Member Alternative Description
Member Alternative: Plate Girder - Allow Moment Redistribution Description Specs Factors Engine Import Control Options
LRFD LRFR Points of Interest Generate at tenth points Generate at section change points Generate at user-defined points Genetate at user-defined points
LFD ASD Points of Interest Generate at tenth points Generate at section change points Generate at section change points Generate at section change points Generate at section change points Allow moment redistribution Include bearing stiffeners in rating Allow plastic analysis Ignore long. reinf in negative moment capacity Distribution Factor Application Method
OK Apply Cancel



The spec check results summary now shows all articles passing.

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🗴 🛄 Snagit 📃 🖆					
Bridge ID : 466 Bridge : 2 Span Plate Girder Training Superstructure Def : 2 Span, 4 Girder system Member : G2 Analysis Preference Setting : None	NBI Structure ID : Bridge Alt : Member Alt : Plat	: Stl6_Trainir e Girder - All	ng Iow Moment Redistr	ribution	^
AASHTO LRFD Specification, Edition 7, Interim 2	2016				
Specification Check Summary					
Article		Status			
Flexure (6.10.7.1.1, 6.10.7.2.1)		Pass			
Shear (6.10.9)		Pass			
Fatigue (6.10.5.3)		NA			
Serviceability (6.10.4.2.2)		Pass			
Constructability (6.10.3.2.1, 6.10.3.2.2, 6	.10.3.2.3)	Pass			
Transverse Stiffeners (6.10.11.1.2, 6.10	.11.1.3)	Pass			
Longitudinal Stiffeners (6.10.11.3.1, 6.10.11.3	.2, 6.10.11.3.3)	NA			
Bearing Stiffeners (6.10.11.2.2, 6.10.11.2.3,	6.10.11.2.4)	Pass			
Shear Connector (6.10.10.1, 6.10.1	0.4)	NA			
Field Splice (6.13.6.1.4a, 6.13.2.6, 6.13.2.7, 6.13.6	5.1.4b, 6.13.6.1.4c) NA			
Girder Member Proportions and Location Composite P	d Compacts	ness (Sta ^{Code} Check	ge 3) Compact	Code Check	
0.000 Yes	Pass		Compact	E	
9.000 Yes	Pass		Compact	E	
18.000 Yes	Pass		Compact	E	
27.000 Ver	Pass		Compact	E	
27.000 163			· ·		
36.000 Yes	Pass		Compact	E	
36.000 Yes 45.000 Yes	Pass Pass		Compact Compact	E E	
21:000 Yes 36:000 Yes 45:000 Yes 54:000 Yes	Pass Pass Pass		Compact Compact Compact	E E E	

Moment redistribution takes some of the negative moment at the pier and distributes it to the positive moment regions.

After the elastic stresses are computed in the first phase of spec checks, the articles in Appendix B6.2 are evaluated to determine if moment redistribution is permissible. If it is permissible, the effective plastic moment at the piers is determined. This moment is then used to compute the redistribution moments, Mrd, at the piers and at all other points using linear interpolation. After the redistribution moments are computed, the stresses due to the redistribution moments are computed. The redistribution stresses are then combined with the elastic stresses and the flexure type is re-determined for this total stress.

The specification articles then take into account the redistribution stresses when computing the design ratios.



The following sketch shows the elastic moment envelope for Strength I and the computed Mrd envelope.

The following sketch shows how the redistribution moments increase the positive moments and reduce the negative moments.



The following article shows the effects of moment redistribution:

Spec Check De	tail for 6.10.8.1.	.3 Continuously	/ Braced Flanges in	Tension or Cor	npression									
6 Steel St 6.10 I-Sec 6.10.8 Fld 6.10.8.1 (6.10.8.1.3 (AASHTO LH Steel Plat	tructures ction Flexur exural Resis General 3 Continuous RFD Bridge D te - At Loce	al Members stance-Compo sly Braced F Design Speci ation = 72.0	site Sections langes in Tens fications, Sev 000 (ft) - Lef	in Negative ion or Compu enth Edition t Stage	Flexure ar ression n - 2014, t 3	nd Noncompos with 2016 In	ite Section	8						
INPUT: Phif = 1.(000													H
Section Ty Top Flange Allow Mome Moment Rec	ype: Composi e Laterally ent Redistri distribution	te Supported: bution Cont i : Yes, Mom	Yes rol Uption: Ye ent Redistribu	s tion did occ	our									
SUMMARY:														
fbu <= Ph:	if * Rh * Fy	ŗÉ	(6.10.8	.1.3-1)										
Resist = 1	Phif * Rh *	Fyf												
Design Rat	tio = Resist	:/fbu		1										
Note: If 1 Othe	the capacity erwise the F	y has been o Resistance i	verridden, the s computed as	Resistance per the Spec	is compute ification.	ed as overri	de phi*over.	ride capaci	ty.					
Limit	Load	Flexure			-			Overr	ide		Design			
State	Combo	Type	Component	fbu (ksi)	frd (ksi)	Rh	Fyf (ksi)	Phi (ksi)	Fyf (ksi)	Resist (ksi)	Ratio	Status		
STR-I	1	Pos*												
STR-I	1	Neg	Top Flange	15.50	-2.49	1.00	50.00			50.00	3.84	Pass		
STR-I	2	Pos*												
STR-1 STR-T	2	Neg	Top Flange Top Flange	13.60	-2.49	1.00	50.00			50.00	4.50	Pass		
STR-I	3	Neg	Top Flange	14.50	-2.49	1.00	50.00			50.00	4.16	Pass		
STR-III	1	Neg	Top Flange	3.56	0.00	1.00	50.00			50.00	14.04	Pass		
STR-III	1	Neg	Top Flange	5.61	0.00	1.00	50.00			50.00	8.91	Pass		
STR-III	2	Neg	Top Flange	3.56	0.00	1.00	50.00			50.00	14.04	Pass		
STR-III	2	Neg	Top Flange	5.61	0.00	1.00	50.00			50.00	8.91	Pass		
STR-III	3	Neg	Top Flange	3.91	0.00	1.00	50.00			50.00	12.78	Pass		
SIR-III gTD_V	3	Neg Pogt	Top Flange	5.61	0.00	1.00	50.00			50.00	8.91	Fass		
STR-V STR-V	1	POS*	Ton Flance	13.24	-1 49	1.00	50.00			50.00	4 25	Page		
STP_V	2	Post	TOP Flange	13.24	-1.49	1.00	30.00			30.00	4.23	rass		
STR-V	2	Nea	Top Flange	11.77	-1.49	1.00	50.00			50.00	4.86	Pass		
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Specialized Hauling Vehicles (SHV's)

A new category of Legal Loads is available as per the MBE specifications:

	· · · · · · · · · · · · · · · · · · ·				Library	
Name:	2011 AASHTO) LRFR Specific	ations		Standard	
Description:	2011 AASHTO) LRFR Specific	ations	~ ~	Agency Defined	
Load Factors	Legal Loads	Permit Loads	Concrete Steel	Wood Specifications		
Table 6A.4.4	4.2.3a-1		(Table 6A.4.4.2.3b-1		
- Routine Tr	raffic			Specialized Hauling Vehic	les	
Traffic	/olume (one dir	ection) Load F	actor	Traffic Volume (one dir	rection) Load Factor	
	Unknown	1	.800	Unknown	1.600	
Rece	ent ADTT >= 50	00 1	.800	Recent ADTT >= 50	000 1.600	
Rec	ent ADTT = 100	00 1	.650	Recent ADTT = 10	00 1.400	
Rec	ent ADTT <= 10	00 1	.400	Recent ADTT <= 1	00 1.150	
I				J		
			(



Permit Lane Load and "Gapping"

New to Version 6.3 is the ability to enter a lane load to be applied with a permit truck as specified by the MBE. Where the truck is placed the lane load is to be removed or "gapped." The MBE does also allow the lane load to be superimposed on top of the permit vehicle for ease of analysis.

The permit lane load is applied as follows:

- For negative moment lane load should always be applied for negative moment regions regardless of span length.
- For positive moment apply the lane load for span length between 200 and 300 feet regardless where the point of interest is.

The following illustrates this procedure for positive moment.



To exclude the lane load where the permit truck is placed, click on "Exclude permit lane load from permit vehicle location."

Image: Strategy of the strate	 Image: Image: Ima	B. ∰ ∧ E 		. []]] 2]		MA S	3 ALL NXT	2 0 [°] -].牌2	× ₩ ● 0	•	' Ba 🖰		
An Drogs Sample Bridges Deleted Bridges	Design Review					Rating Method: LRFR							
ľ	Vehicles Output Engine Description Traffic Direction: Both directions Vehicle Selection: Vehicle Properties Vehicle Properties												
	Vehicle	Tandem Train	Scale Factor	Impact	Single Lane Loaded	Legal Pair	Override	Legal Live Load Factor	Frequency	Loading Condition	Override	Permit Live Load Factor	OK Cancel
	HL-93 (US) Lane-Type Legal Load		1			 			Single Trip 💌 Single Trip 💌	Escorted •			
	LRFD Fatigue Truck (U NRL		1		6	>		1.1	Single Trip 💌	Escorted •			
	Type 3 Type 3-3		1	-	<u> </u>	(E)		-	Single Trip	Escorted •			
	Type 3S2		1						Single Trip	Escorted 💌			
						m						Þ	

The user may also override the internal Legal Load Live Load Factor as shown above.