AASHTOWare Bridge Rating Training - (BrR 6.4)

Field Verified Wearing Surface Thickness

Topics Covered

• Field verified wearing surface thickness for LRFR analysis.

Note: Field measured wearing surface thickness is used only in the LRFR analysis. LFD and ASD analysis do not use this feature.

Virtis/Opis/OpisSub - [Bridge Explorer (24	Virtis/Op	is bridges retrieved for the current fo	older, all rows	retrieve	d)]										x
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All Bridges	PID	Bridge Id	Bridge Name	District	County	Facility	Location	Douto	Feat.	Mi. Post	Owner	Maintainar	Area	Length	
🖬 💼 Sample Bridges	00	Bildge la	Bridge Name	District	County	raciiity	Location	Roule	Intersected	(mi)	Owner	Maintainer	Area	(ft)	Duik
Deleted Bridges	1	TrainingBridge1	Training Brid	11	01	SR 005	Pittsburg	0051	SR 6060	17.00	1	1	-2	161.00	999
	2	TrainingBridge2	Training Brid	-1	-1	N/A	N/A	-1	N/A	0.00	-1		-1	0.00	996
	3	TrainingBridge3	Training Brid	11	01	⊦ 79	Pittsburg	0079	Ohio River	125.00	1	1	-1	455.00	999
	4	PCITrainingBridge1	PCI TrainingB					-1		0.00			µ-1	0.00	0
	5	PCITrainingBridge2	PCITrainingBr					-1		0.00			-1	0.00	0
	6	PCITrainingBridge3	PCI TrainingB					-1		0.00			-1	0.00	0
	7	PCITrainingBridge4	PCITrainingBr					-1		0.00			-1	0.00	0
	8	PCITrainingBridge5	PCI TrainingB					-1		0.00			-1	0.00	0
	9	PCITrainingBridge6	PCITrainingBr					-1		0.00			-1	0.00	0
	10	Example7	Example 7 PS					-1		0.00			-1	0.00	0
	11	RCTrainingBridge1	RC Training B					-1		0.00			-1	0.00	0
	12	TimberTrainingBridge1	Timber Tr. Bri					-1		0.00			-1	0.00	0
	13	FSys GFS TrainingBridge1	FloorSystem	06	15	NJ-Tur	NJCity	-1		0.00			-1	0.00	002
	14	FSys FS TrainingBridge2	FloorSystem	11	333	1-95	NYC	-1		0.00	1	2	-1	0.00	998
	15	FSys GF TrainingBridge3	FloorSystem	07	06	1-95	ATL	-1		0.00	2		-1	0.00	998
	16	FLine GFS TrainingBridge1	FloorLine GF	01	01	I-75	JAX	-1		0.00	1	1	-1	0.00	001
	17	FLine FS TrainingBridge2	FloorLine FS	02	02	I-75	GNV	-1		0.00	1	1	-1	0.00	000
	18	FLine GF TrainingBridge3	FloorLine GF	01	01	I-95	NY	15		2200.00	2	-1	-1	0.00	999
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	20	LRFD Substructure Example 1	LRFD Substr							0.00				0.00	0
	21	LRFD Substructure Example 2	LRFD Substr			SR 403	ERIE CO	4034	FOUR MILE	8.12				095.80	002
	22	LRFD Substructure Example 3	LRFD Substr							0.00				0.00	0
	23	LRFD Substructure Example 4	LRFD Substr					-1		0.00				240.00	004
	24	Visual Reference 1	Visual Refer	01	12	I-76	WAITSFI	I-76	MAD RIVER	1199.25	1	1	-1	168.00	938
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For Help, press F1													N	UM	

Fig 1. Bridge Explorer

From the Bridge Explorer (Fig 1) select TrainingBridge1 (BID 1) and double click (or right click and select open) to open it.

Once Bridge Workspace tree shows up, expand "Simple Span Structure" under "SUPERSTRUCTURE DEFINITIONS" in the tree by clicking on "+". Then expand "MEMBERS" and select "G2". Expand "G2" and select "Plate Girder (E) (C)" under "MEMBER ALTERNATIVES". Expand "Plate Girder (E) (C)" by clicking on the "+". Then the Bridge Workspace tree will be as shown in Fig 2.



Fig 2. Bridge Workspace Tree - G2 - Girder Member Alternative

After selecting the member alternative "Plate Girder (E) (C)", go to toolbar and click on the "View Analysis Setting" button (Fig 3).



Fig 3. View Analysis Setting Button

nalysis Settings				- • ×
◯ Design Review	ating Method:	LFD	•	
Analysis Type: Line Girder Lane/Impact Loading Type: As Requested Analysis Type:	ence Settina:	None	•	
Vehicles Output Engine Description Traffic Direction: Both directions Vehicle Selection:		Refresh Vehicle Summary:	Temporary Vehicles)	Advanced
- Vehicles Standard Alternate Military Loading - H 15-44 - H 20-44 - HS 15-44 - HS 20 (SI) - HS 20 (SI) - HS 20-44 - Type 3 - Type 3.3 - Type 3S2 - Agency - User Defined - Temporary	Add to Rating >> Remove from Analysis	□- Rating Vehicles □ Inventory □ Operating		
Reset Clear Open Template Save Template	e		OK Apply	Cancel

Fig 4. Analysis Settings Window

Once "Analysis Setting" button is clicked "Analysis Settings" window will pop up (Fig 4). Click on "Open Template" button to open Template Library (Fig 5). Select LRFR Design Load Rating Template from Template Library. Click on "Open" button to apply it to Analysis Settings (Fig 6).

pen Template				X
Templates	Description	Analysis	Owner	Public/Private
HL 93 Design Review HS 20 Rating LRFR Design Load Rating LRFR Legal Load Rating	HL 93 Design Review HS 20 Rating LRFR Design Load Rating LRFR Legal Load Rating	Design-Review Rating Rating Rating		Public Public Public Public
Delete			Open	Cancel

Fig 5. Open Template Window

Analysis Settings			
 Design Review Rating Analysis Type: 	Rating Method: LRFR	•	
Line Girder Lane/Impact Loading Type: As Requested Vehicles Output Engine Description	Apply Preference Setting: None	•	
Vehicle Selection:	Traffic Direction: Both directions	Refresh Vehicle Summary:	Temporary Vehicles Advanced
→ Vehicles → Standard → H 15-44 → H 2044 → H-93 (SI) → H× 15-44 → H× 20 (SI) → LRFD Fatigue Truck (US) → NRL → SU4 → SU5 → SU6 → SU6 → SU7 → Type 3.3 → Type 3.3 → Type 3.3 → Type 3.3 → Type S2 → Agency ∪ Ler Defined → Temporary		Add to Rating - Rating Vehicles - LFRR - Design Load Rating - Inventory - Inve	(US)
Reset Clear Open Template	Save Template		OK Apply Cancel

Fig 6. Analysis Settings Window – With rating vehicles selected

Click on "OK" button to save and close the Analysis Settings window. Go to toolbar and click on "Analyze" button (Fig 7) to run the analysis.



Fig 7. Analyze Button



Fig 8. Analysis Progress Window

Once "Analyze" button is clicked, "Analysis Progress" window (Fig. 8) pops up. After analysis is completed click on "OK" button to close Analysis Progress window. Select the member alternative "Plate Girder (E)(C)" for G2. Click on "View Analysis Report" button (Fig. 9) to open Analysis Results window.



Fig 9. View Analysis Report Button

On Analysis Results window select Display Format as "Single rating level per row" to display analysis results as shown in Fig 10.

🕰 Analysis Results - Plate	e Girder									- • •
Report Type Rating Results Summary	▼ ● As Re	pact Loading equested (Type) Detailed	Display Eq Single rat	rmat ing level per rov	,				
Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HL-93 (US)	Truck + Lane	LRFR	Inventory	17.17	0.477	80.50	1 - (50.0)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested
HL-93 (US)	Truck + Lane	LRFR	Operating	22.26	0.618	80.50	1 - (50.0)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested
HL-93 (US)	Tandem + Lane	LRFR	Inventory	20.37	0.566	80.50	1 - (50.0)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested
HL-93 (US)	Tandem + Lane	LRFR	Operating	26.40	0.733	80.50	1 - (50.0)	STRENGTH-I Steel Flexure Stress	As Requested	As Requested
AASHTO LRFR Engine Ve Analysis Preference Settin	ersion 6.4.0.2002 g: None									Close

Fig 10. Analysis Results Window



Fig 11. View Spec Check Button

Now go to toolbar, select and click on "View Spec Check" button (Fig 11). Spec Check Summary window will pop up. On Spec Check Summary window (Fig 12) expand "Stage 3" on left of the window. Select and click on 'Span 1 - 80.50ft" (midpoint of the span1). This displays a list of articles checked for this location. Select and open article "6A.4.2.1 General Load Rating Equation – Steel Flexure Stress" by double clicking on it.

A Specification Checks for Plate Girder - 43 of 792				_ • ×
Superstructure Component	Specification Reference	Limit State	Flex. Sense	Pass/Fail
🗈 🦲 Stage 1	6.10.6.2.3 Composite Sections in Negative Flexure and Noncomposite Sections		N/A	General Comp.
Stage 2	NA 6.10.7.1.1 General		N/A	Not Applicable
Stage 3	NA 6.10.7.1.2 Nominal Flexural Resistance		N/A	Not Applicable
Plate Girder	× 6.10.7.2.1 General		N/A	Failed
Span 1 - 0.00 ft.	6.10.7.2.2 Nominal Flexural Resistance		N/A	General Comp.
Span 1 - 1610 ft	✓ 6.10.7.3 Flexural Resistance - Ductility Requirement		N/A	Passed
Span 1 - 18.21 ft.	NA 6.10.8.1.1 Discretely Braced Flanges in Compression		N/A	Not Applicable
Span 1 - 31.62 ft.	NA 6.10.8.1.2 Discretely Braced Flanges in Tension		N/A	Not Applicable
Span 1 - 32.20 ft.	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.
- 🗀 Span 1 - 48.30 ft.	6.10.8.2.2 Local Buckling Resistance		N/A	General Comp.
- Span 1 - 58.46 ft.	6.10.8.2.3 Lateral Torsional Buckling Resistance		N/A	General Comp.
— 🛄 Span 1 - 64.40 ft.	6.10.8.2.3.Cb Lateral Torsional Buckling Resistance - Cb Calculation		N/A	General Comp.
— — Span 1 - 71.87 ft.	6.10.8.2.3.rt Lateral Torsional Buckling Resistance - rt and Lp Calculation		N/A	General Comp.
Span 1 - 80.50 ft.	6.10.8.3 Tension-Flange Flexural Resistance		N/A	General Comp.
— Span 1 - 85.29 ft.	✓ 6.10.9 Shear Resistance		N/A	Passed
— — Span 1 - 96.60 ft.	6.10.9.1 Shear Resistance - General		N/A	General Comp.
	× 6.10_General_Flexural_Results		N/A	Failed
- Span 1 - 112.12 ft.	6.6.1.2.2 Design Criteria		N/A	General Comp.
	✓ 6A.4.2.1 General Load Rating Equation - Steel Flexure Moment		N/A	Passed ≡
Span 1 - 123.54 ft.	K6A.4.2.1 General Load Rating Equation - Steel Flexure Stress		N/A	Failed
Span 1 - 138.96 ft.	6A.4.2.1 General Load Rating Equation - Steel Shear		N/A	Passed
Span 1 - 144.90 ft.	■ 6A.4.2.1.fl		N/A	General Comp.
Span 1 - 152.37 ft.	X 6A.6.4.2.2 Service Limit State		N/A	Failed
Span 1 - 156.69 ft.	7.2 Load-Induced Fatigue-Damage Evaluation		N/A	General Comp.
Span 1 - 161.00 ft.	APPD6.1 Plastic Moment		N/A	General Comp.
	APPD6.2 Yield Moment		N/A	General Comp.
	APPD6.3.1 In the Elastic Range (Dc)		N/A	General Comp.
	APPD6.3.2 Depth of the Web in Compression at Plastic Moment		N/A	General Comp.
	Steel Elastic Section Properties		N/A	General Comp.
				-

Fig 12. Spec Check Summary Window

This would open the spec check detail computation of the article. In this spec check details as shown in Fig 13, Load Factors DW-WS is considered as 1.50 according to MBE Table 6A.4.2.2 -1.

omponent: I	op Flange																
Load	Vehicle	Limit State	Flexure Type	LL (kip-ft)	DC	DW	DM-NS	ш	fDC (ksi)	fDW (ksi)	fDW-WS (ksi)	fLL (ksi)	fl (ksi)	Phi	ER (ksi)	RF	Capacity (Ion)
DesignInv	HL-93 (US) - Truck + Lane	SIR-I	Poa	4426.3	1.25	1.50	1.50	1.75	-44.27	-2.44	0.00	-5.51	0.00	1.00	-50.00	0.598	21.52
DesignInv	HL-93 (US) - Truck + Lane	SIR-I	Pos	0.0	1.25	1.50	1.50	1.75	-44.27	-2.44	0.00	0.00	0.00	1.00	-50.00	99.000	3564.00
DesignOp	HL-93 (US) - Truck + Lane	SIR-I	Pos	4426.3	1.25	1,50	1.50	1.35	-44.27	-2.44	0.00	-4.25	0.00	1.00	-50.00	0.775	27.89
DesignOp	HL-93 (US) - Truck + Lane	SIR-I	Pos	0.0	1.25	1.50	1.50	1.35	-44.27	-2.44	0.00	0.00	0.00	1.00	-50.00	99.000	3564.00
DesignInv	HL-93 (US) - Tandem + Lane	STR-I	Pos	3731.7	1.25	1.50	1.50	1.75	-44.27	-2.44	0.00	-4.64	0.00	1.00	-50.00	0.709	25.52
Designinv	HL-93 (US) - Tandem + Lane	SIR-I	Pos	0.0	1.25	1.50	1.50	1.75	-44.27	-2.44	0.00	0.00	0.00	1.00	-50.00	99.000	3564.00
DesignOp	EL-93 (US) - Tandem + Lane	SIR-I	Pos	3731.7	1.25	1,50	1.50	1.35	-44.27	-2.44	0.00	-3.58	0.00	1.00	-50.00	0.919	33.09
DesignOp	HL-93 (US) - Tandem + Lane	STR-I	Pos	0.0	1.25	1.50	1.50	1.35	-44.27	-2.44	0.00	0.00	0.00	1.00	-50.00	99.000	3564.00
mponent: B	HL-93 (U3) - Tandem + Lane Not Flange Vehicle	SIR-I Limit State	Pos Flexure Type	0.0 LL (Kip-ft)	1.25 DC	1.50 DW	1.50 DM-M3	1.35 LL	-44.27 fDC (k#1)	-2.44 fDW (ks1)	0.00 fDM-MS (ksi)	0.00 fLL (k#1)	0.00 fl (ksi)	1.00 Fh1	-50.00 fR (ksi)	99.000 RF	3564.00 Capacity (Ton)
mponent: B .cad	HL-93 (US) - Tandem + Lane	SIR-I Limit State	Pos Flexure Type	0.0 LL (kip-ft)	DC	1.50 DW	1.50 DW-WS	1.35 IL	-44.27 fDC (ksi)	-2.44 fDW (ks1)	0.00 EDM-MS (ksi)	0.00 fLL (ksi)	0.00 fl (ksi)	1.00 Phi	-50.00 fR (kai)	99.000 RF	3564.00 Capacity (Ton)
DesignOp Imponent: 5 Load DesignInv DesignInv	HL-93 (US) - Tandem + Lane Not Flange Vehicle HL-93 (US) - Truck + Lane HL-93 (US) - Truck + Lane	STR-I Limit State STR-I STR-I	Pos Flexure Type Pos	0.0 LL (kip-ft) 4426.3	DC	1.50 DW 1.50	1.50 DM-MS 1.50	1.35 IL 1.75	-44.27 fDC (kmi) 34.87 34.87	-2.44 fDW (ks1) 4.22 4.22	0.00 200-WS (ksi) 0.00	0.00 fLL (kmi) 22.86 0.00	0.00 fl (ksi) 0.00	Ph1	-50.00 fR (ksi) 50.00 50.00	99.000 RF 0.477 99.000	3564.00 Capacity (Ton) 17.17 3564.00
DesignOp component: B Load DesignInv DesignInv DesignDo	HL-93 (US) - Tandem + Lane Not Flange 	SIR-I Limit State SIR-I SIR-I SIR-I	Pos Flexure Type Pos Pos	0.0 LL (kip-ft) 4426.3 0.0 4426.3	1.25 DC 1.25 1.25 1.25	1.50 DW 1.50 1.50	DM-M3	1.35 LL 1.75 1.75 1.35	-44.27 fDC (ksi) 34.87 34.87 34.87	-2.44 fDW (k31) 4.22 4.22 4.22	0.00 fDM-MS (ksi) 0.00 0.00	0.00 fLL (kB1) 22.86 0.00 17.64	0.00 fl (ksi) 0.00 0.00	Ph1 1.00 1.00 1.00	-50.00 FR (ksi) 50.00 50.00 50.00	99.000 RF 0.477 99.000 0.618	3564.00 Capacity (Ton) 17.17 3564.00 22.26
DesignOp component: 5 Load DesignInv DesignOp DesignOp	HL-93 (U2) - Tandem + Lane Not Flange Wehiele HL-92 (U3) - Truck + Lane HL-93 (U3) - Truck + Lane HL-93 (U3) - Truck + Lane HL-93 (U3) - Truck + Lane	SIR-I Limit State SIR-I SIR-I SIR-I SIR-I	Pos Flexure Type Pos Pos Pos Pos	0.0 LL (Kip-ft) 4426.3 0.0 4426.3 0.0	1.25 DC 1.25 1.25 1.25 1.25	1.50 DW 1.50 1.50 1.50 1.50	1.50 DW-MS 1.50 1.50 1.50	1.35 LL 1.75 1.75 1.35 1.35	-44.27 fDC (kmi) 34.87 34.87 34.87 34.87	-2.44 fDW (ks1) 4.22 4.22 4.22 4.22	0.00 200-MS (ksi) 0.00 0.00 0.00	0.00 fLL (kmi) 22.86 0.00 17.64 0.00	11 (ksi) 0.00 0.00 0.00 0.00	Ph1 	-50.00 fR (ksi) 50.00 50.00 50.00 50.00	89.000 RF 0.477 99.000 0.618 99.000	3564.00 Capacity (Ton) 17.17 3564.00 22.26 3564.00
DesignOp omponent: E Load DesignInv DesignOp DesignOp DesignOp	HL-93 (U2) - Tandem + Lane tot Flange 	SIR-I Limit State SIR-I SIR-I SIR-I SIR-I	Pos Flexure Type Pos Pos Pos Pos Pos	0.0 LL (kip-ft) 4426.3 0.0 4426.3 0.0 3731.7	1.25 DC 1.25 1.25 1.25 1.25 1.25	1.50 DW 1.50 1.50 1.50 1.50 1.50	1.50 DW-MS 1.50 1.50 1.50 1.50	1.35 LL 1.75 1.75 1.35 1.35 1.75	-44.27 fDC (kmi) 34.87 34.87 34.87 34.87 34.87	-2.44 fDW (ks1) 4.22 4.22 4.22 4.22 4.22 4.22	0.00 2DM-NS (ksi) 0.00 0.00 0.00 0.00	0.00 flL (ksi) 22.86 0.00 17.64 0.00 15.27	fl (ksi) 0.00 0.00 0.00 0.00 0.00	Ph1 	-50.00 ER (ks1) 50.00 50.00 50.00 50.00 50.00	89.000 RF 0.477 99.000 0.618 99.000 0.566	2564.00 Capacity (Ton) 17.17 3564.00 22.26 3564.00 20.37
DesignOp omponent: B Load DesignInv DesignInv DesignOp DesignOp DesignInv	HL-93 (U2) - Tandem + Lane Mot Flange 	SIR-I Limit State SIR-I SIR-I SIR-I SIR-I SIR-I SIR-I	Pos Flexure Type Pos Pos Pos Pos Pos Pos	0.0 LL (kip-ft) 4426.3 0.0 4426.3 0.0 3731.7 0.0	1.25 DC 1.25 1.25 1.25 1.25 1.25 1.25 1.25	1.50 DW 1.50 1.50 1.50 1.50 1.50	1.50 DM-MS 1.50 1.50 1.50 1.50 1.50	1.35 LL 1.75 1.75 1.35 1.35 1.75 1.75	-44.27 fDC (k#1) 34.87 34.87 34.87 34.87 34.87 34.87	-2.44 fDW (k91) 4.22 4.22 4.22 4.22 4.22 4.22 4.22	0.00 EDN-MS (ksi) 0.00 0.00 0.00 0.00 0.00 0.00	0.00 flL (k#1) 22.86 0.00 17.64 0.00 19.27 0.00	fl (ks1) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Phi 1.00 1.00 1.00 1.00 1.00 1.00	-50.00 fR (ks1) 50.00 50.00 50.00 50.00 50.00 50.00	89.000 RF 0.477 99.000 0.618 99.000 0.566 99.000	3564.00 Capacity (Ton) 17.17 3564.00 22.26 3564.00 20.37 3564.00
DesignOp omponent: 8 Load DesignInv DesignOp DesignOp DesignOp DesignOp DesignOp	HL-93 (U3) - Tandem + Lane Not Flange 	SIR-I Limit State SIR-I SIR-I SIR-I SIR-I SIR-I SIR-I SIR-I	Pos Flexure Type Pos Pos Pos Pos Pos Pos Pos	0.0 LL (Kip-ft) 4426.3 0.0 3731.7 0.0 3731.7	1.25 DC 1.25 1.25 1.25 1.25 1.25 1.25 1.25	1.50 DW 1.50 1.50 1.50 1.50 1.50 1.50	1.50 DM-MS 1.50 1.50 1.50 1.50 1.50 1.50	1.35 IL 1.75 1.75 1.35 1.75 1.75 1.75 1.35	-44.27 EDC (kmi) 34.87 34.87 34.87 34.87 34.87 34.87 34.87 34.87	-2.44 EDW (ks1) 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22	0.00 rDN-WS (ksi) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.00 fIL (ksi) 22.86 0.00 17.64 0.00 15.27 0.00 14.87	fl (ksi) 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Ph1 Ph1 1.00 1.00 1.00 1.00 1.00 1.00	-50.00 fR (ks1) 50.00 50.00 50.00 50.00 50.00 50.00	89.000 RF 0.477 99.000 0.566 99.000 0.733	3564.00 Capacity (Ton) 17.17 3564.00 22.26 3564.00 20.37 3564.00 26.40
DesignOp Imponent: 8 Load DesignInv DesignOp DesignOp DesignInv DesignInv DesignInv DesignInv DesignOp DesignOp	HL-93 (U2) - Tandem + Lane Wehiele HL-93 (U3) - Truck + Lane HL-93 (U3) - Tandem + Lane HL-93 (U3) - Tandem + Lane HL-93 (U3) - Tandem + Lane	SIR-I Limit State SIR-I SIR-I SIR-I SIR-I SIR-I SIR-I SIR-I SIR-I	Pos Flexure Type Pos Pos Pos Pos Pos Pos Pos	0.0 LL (Kip-ft) 4426.3 0.0 4426.3 0.0 3731.7 0.0 3731.7 0.0	1.25 DC 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25	1.50 DW 1.50 1.50 1.50 1.50 1.50 1.50 1.50	1.50 DW-MS 1.50 1.50 1.50 1.50 1.50 1.50 1.50	1.35 LL 1.75 1.75 1.35 1.75 1.75 1.75 1.35 1.35	-44.27 FDC (ks1) 34.87 34.87 34.87 34.87 34.87 34.87 34.87 34.87	-2.44 fDN (ks1) 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22 4.22	0.00 fDN-MS (ksi) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	0.00 fil (ksi) 22.86 0.00 17.64 0.00 19.27 0.00 14.87 0.00	fl (ks1) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	1.00 Fh1 1.00 1.00 1.00 1.00 1.00 1.00 1.00	-50.00 FR (ks1) 50.00 50.00 50.00 50.00 50.00 50.00 50.00 50.00	99.000 RF 0.477 99.000 0.618 99.000 0.566 99.000 0.733 99.000	3364.00 Capacity (Ton) 17.17 3564.00 22.26 3564.00 20.37 3564.00 26.40 3564.00

Fig 13. Speck check details of Article 6A.4.2.1 Steel Flexure Stress



Fig 14. Bridge Workspace Tree for Training Bridge 1

Now go back to Bridge Workspace tree and select "Structure Typical Section" (Fig 14) under "SUPERSTRUCTURE DEFINITIONS". Double click to open on it to open Structure Typical Section window. On Structure Typical Section window go to Wearing Surface tab (Fig 15).

A Structure Typical Section
Distance from left edge of deck to superstructure definition ref. line Deck thickness T
Left overhang
Deck Deck (Cont'd) Parapet Median Railing Generic Sidewalk Lane Position Wearing Surface
Wearing surface material: Asphalt
Description: Asphalt - 25 psf
Wearing surface thickness = 2.7800 in I Theckness field measured (DW = 1.25 if checked)
Wearing surface density = 108.000 pcf
Load case: DW Copy from Library
OK Apply Cancel

Fig 15. Structure Typical Section Window - Wearing Surface Tab

On Wearing Surface tab select field measured wearing surface thickness by checking the check box for "Thickness field Measured" (Fig 15). Click on "OK" button to save and close the Structure Typical Section window. Now re run the analysis by clicking the "Analyze" button (Fig 8).

After analysis is completed click on "OK" button to close Analysis Progress Window (Fig. 9). Now open Spec Check Summary window (Fig 13) by clicking on the View Spec check button (Fig 12).

Select and open spec article "6A. 4.2. 1 General Load Rating Equation – Steel Flexure Stress" (Fig 16). In this article Load factors for DW-WS is now taken as 1.25 according to MBE Table 6A.4.2.2 -1 foot note point 3 (Fig 17).

Load Vehicle Limits Flexure Type LL DC DM DM-MS LL fDM-MS fLL fDL fDM-MS fLL fL fDM MS fLL fDL fDM-MS fLL fDL	fR RF ((kai) -50.00 0.671 -50.00 99.000 3 -50.00 99.000 3	fR (ks1) -50.00	Phi	f1 (k#1)	fLL	enu. 100											
Designinv RL-93 (05) Truck + Lane STR-T Pos 4426.3 1.25 1.35 1.75 -44.27 0.00 -2.03 -5.51 0.00 1.00 Designinv HL-93 (05) Truck + Lane STR-T Pos 6.0 1.25 1.35 1.427 0.00 -2.03 -5.51 0.00 1.00 Designinv HL-93 (05) Truck + Lane STR-T Pos 6.0 1.25 1.35 -44.27 0.00 -2.03 -5.51 0.00 1.00 Designinv HL-93 (05) Truck + Lane STR-T Pos 6.0 1.25 1.35 -44.27 0.00 -2.03 -0.0 1.00 Designinv HL-93 (05) Truck + Lane STR-T Pos 6.0 1.25 1.35 -44.27 0.00 -2.03 -0.00 1.00 Designinv HL-93 (05) Tandem + Lane STR-T Pos 6.0 1.25 1.75 -44.27 0.00 -2.03 -0.00 1.00 Designinv HL-93 (05) Tandem + Lane STR-T Pos 6.0 <th>-\$0.00 0.671 -\$0.00 99.000 1 -\$0.00 0.870 -\$0.00 99.000 1</th> <th>-50.00</th> <th></th> <th></th> <th>(ksi)</th> <th>(kai)</th> <th>fDW (kai)</th> <th>fDC (ksi)</th> <th>LL</th> <th>DW-WS</th> <th>DW</th> <th>DC</th> <th>LL (kip-ft)</th> <th>Flexure Type</th> <th>Limit State</th> <th>Vehicle</th> <th>Load</th>	-\$0.00 0.671 -\$0.00 99.000 1 -\$0.00 0.870 -\$0.00 99.000 1	-50.00			(ksi)	(kai)	fDW (kai)	fDC (ksi)	LL	DW-WS	DW	DC	LL (kip-ft)	Flexure Type	Limit State	Vehicle	Load
mestginty HL-93 (03) - Truck + Lane 3TB-1 Pos 0.0 1.25 1.35 -44.27 0.00 -2.03 0.00 1.00 1.00 mestgindpy HL-93 (05) - Truck + Lane STB-1 Pos 4426.3 1.25 1.35 -44.27 0.00 -2.03 0.00 1.00 1.00 mestgindpy HL-93 (05) - Truck + Lane STB-1 Pos 0.01 1.25 1.35 -44.27 0.00 -2.03 -0.00 1.00 1.00 mestgindpy HL-93 (05) - Truck + Lane STB-1 Pos 0.01 1.25 1.35 -44.27 0.00 -2.03 -0.00 1.00 1.00 mestgindpy HL-93 (05) - Tandem + Lane STB-1 Pos 0.01 1.25 1.75 -44.27 0.00 -2.03 -0.00 1.00 1.00 mestgindpy HL-93 (05) - Tandem + Lane STB-1 Pos 0.01 1.25 1.35 -44.27 0.00 -2.03 -0.00 1.00 1.00 mestgindpy HL-93 (05) - Tandem + La	-50.00 99.000 1 -50.00 0.870 -50.00 99.000 1	-50.00	1.00	0.00	-5.51	-2.03	0.00	-44.27	1.75	1.25	1.50	1.25	4426.3	Pos	STR-I	SL-93 (US) - Truck + Lane	esignInv
EsignDp HL-93 (US) - Truck + Lane STR-1 Poi 4466.3 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 -4.25 0.00 1.00 esignDr HL-93 (US) - Truck + Lane STR-1 Poe 0.0 1.28 1.50 1.25 1.35 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.01 1.25 1.30 1.25 1.35 -44.27 0.00 -2.03 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.01 1.25 1.30 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HL-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.55 1.55 1.55 1.55 1.55 1.55 1.55	-50.00 0.870 -50.00 99.000 3	-20.00	1.00	0.00	0.00	-2.03	0.00	-44.27	1.75	1.25	1.50	1.25	0.0	Pos	STR-I	HL-93 (US) - Truck + Lane	esignInv
EsignDp HI-83 (US) - Truck + Lane STR-1 Poe 0.0 1.28 1.30 1.23 1.35 -44.27 0.00 -2.03 0.00 0.00 1.00 esignDr HI-83 (US) - Tandem + Lane STR-1 Poe 0.0 1.28 1.35 1.50 1.25 1.75 -44.27 0.00 -2.03 -4.64 0.00 1.00 esignDr HI-83 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 -0.00 0.00 1.00 esignDp HI-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 -0.00 0.00 1.00 esignDp HI-93 (US) - Tandem + Lane STR-1 Poe 0.0 1.25 1.50 1.25 1.55 -44.27 0.00 -2.03 -0.00 0.00 1.00	-50.00 99.000 3	-50.00	1.00	0.00	-4.25	-2.03	0.00	-44.27	1.35	1.25	1.50	1.25	4426.3	Pos	SIR-I	HL-93 (US) - Truck + Lane	esignOp
esigniny HL-33 (05) - Tandem - Lane STR-1 Pos 3731.7 1.25 1.30 1.25 1.75 -44.27 0.00 -2.03 -4.64 0.00 1.00 esigniny HL-33 (05) - Tandem - Lane STR-1 Pos 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esigniny HL-33 (05) - Tandem - Lane STR-1 Pos 3731.7 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 0.00 1.00 1.00 esigniny HL-33 (05) - Tandem - Lane STR-1 Pos 0.0 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 0.00 0.00 1.00 esigniny HL-33 (05) - Tandem - Lane STR-1 Pos 0.0 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 0.00 0.00 1.00		-50.00	1.00	0.00	0.00	-2.03	0.00	-44.27	1.35	1.25	1.50	1.25	0.0	Pos	STR-I	HL-93 (US) - Truck + Lane	esignOp
esigning HL-33 (US) - Tandem + Lane STR-I Pos 0.0 1.25 1.50 1.25 1.75 -44.27 0.00 -2.03 0.00 0.00 1.00 esignop HL-33 (US) - Tandem + Lane STR-I Pos 0.0 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 0.00 0.00 1.00 esignop HL-33 (US) - Tandem + Lane STR-I Pos 0.0 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 0.00 0.00 1.00	-50.00 0.796	-50.00	1.00	0.00	-4.64	-2.03	0.00	-44.27	1.75	1.25	1.50	1.25	3731.7	Pos	SIR-I	HL-93 (US) - Tandem + Lane	esignInv
esignOp HL-93 (US) - Tandem + Lane STR-I Pos 3731.7 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 -3.58 0.00 1.00 esignOp HL-93 (US) - Tandem + Lane STR-I Pos 0.0 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 0.00 0.00 1.00 mponent: Not Flange	-50.00 99.000 3	-50.00	1.00	0.00	0.00	-2.03	0.00	-44.27	1.75	1.25	1.50	1.25	0.0	Pos	STR-I	HL-93 (US) - Tandem + Lane	esignInv
esignOp EL-93 (US) - Tendem + Lane STR-I Pos 0.0 1.25 1.50 1.25 1.35 -44.27 0.00 -2.03 0.00 0.00 1.00	-50.00 1.032	-50.00	1.00	0.00	-3.58	-2.03	0.00	-44.27	1.35	1.25	1.50	1.25	3731.7	Pos	STR-I	HL-93 (US) - Tandem + Lane	esignOp
mpohent: Bot Flange	-20:00 33:000 3	-50.00	1.00	0.00	0.00	-2.03	0.00	-44.27	1.35	1.25	1.50	1.25	0.0	103	DIN-1	6L-93 (05) - 16DGER + Lane	eardunb
.ced Vehicle Limit Flexare LL DC DW DM-HS LL fDC fDW fDH-HS fLL fl State Type (Rip-ft) (Rsi) (Rsi) (Rsi) (Rsi) (Rsi) Fhi	fR RF ((ksi)	fR (ksi)	Phi	f1 (k#1)	fLL (ksi)	fDN-WS (ksi)	fDW (ksi)	fDC (ksi)	LL	DW-WS	DW	DC	LL (kip-ft)	Flexure Type	Limit State	Vehicle	.oad
msignInv HL-93 (US) - Truck + Lane STR-I Fes 4426.3 1.25 1.50 1.25 1.75 34.87 0.00 3.52 22.86 0.00 1.00	50.00 0.508	50.00	1.00	0.00	22.86	3.52	0.00	34.87	1.75	1.25	1.50	1.25	4426.3	Pos	SIR-I	HL-93 (US) - Truck + Lane	esignInv
reignInv HL-93 (U3) - Truck + Lane STR-I Pos 0.0 1.25 1.50 1.25 1.75 34.87 0.00 3.52 0.00 0.00 1.00	50.00 99.000 3	50.00	1.00	0.00	0.00	3.52	0.00	34.87	1.75	1.25	1.50	1.25	0.0	Pos	STR-I	HL-93 (US) - Truck + Lane	signInv
esignOp HL-93 (US) - Truck + Lane STR-I Fos 4426.3 1.25 1.50 1.25 1.35 34.87 0.00 3.52 17.64 0.00 1.00	50.00 0.658	50.00	1.00	0.00	17.64	3.52	0.00	34.87	1.35	1.25	1.50	1.25	4426.3	Pos	STR-I	HL-93 (US) - Truck + Lane	asignOp
esignOp HL-93 (US) - Truck + Lane STR-I Pos 0.0 1.25 1.50 1.25 1.35 34.87 0.00 3.52 0.00 0.00 1.00	50.00 99.000 3	50.00	1.00	0.00	0.00	3.52	0.00	34.87	1.35	1.25	1.50	1.25	0.0	Pos	STR-I	HL-93 (US) - Truck + Lane	esignOp
esignInv HL-93 (US) - Tanden + Lane STR-I Pos 3731.7 1.25 1.50 1.25 1.75 34.87 0.00 3.52 19.27 0.00 1.00	50.00 0.602	50.00	1.00	0.00	19.27	3.52	0.00	34.87	1.75	1.25	1.50	1.25	3731.7	Pos	STR-I	HL-93 (US) - Tandem + Lane	esignInv
WesignInv HL-93 (US) - Tandem + Lane STR-I Pos 0.0 1.25 1.50 1.25 1.75 34.67 0.00 3.52 0.00 0.00 1.00	50.00 99.000 3	50.00	1.00	0.00	0.00	3.52	0.00	34.87	1.75	1.25	1.50	1.25	0.0	Pos	STR-I	HL-93 (US) - Tandem + Lane	esignInv
	50.00 0.781	50.00	1.00	0.00	14.87	3.52	0.00	34.87	1.35	1.25	1.50	1.25	3731.7	Pos	STR-I	HL-93 (US) - Tanden + Lane	leaignOp
esignOp HL-93 (U3) - Tandem + Lane STR-I Fos 3731.7 1.25 1.50 1.25 1.35 34.87 0.00 3.52 14.87 0.00 1.00		50.00	1.00	0.00	0.00	3.52	0.00	34.87	1.35	1.25	1.50	1.25	0.0	Pos	STR-I	HL-93 (US) - Tandem + Lane	eaignOp
esignOp HL-93 (US) - Tanden + Lane STR-I Fos 3731.7 1.25 1.50 1.25 1.35 34.67 0.00 3.52 14.87 0.00 1.00 esignOp HL-93 (US) - Tanden + Lane STR-I Fos 0.0 1.25 1.50 1.25 1.35 34.87 0.00 3.52 0.00 0.00 1.00	50.00 99.000 3																



6A.4.2.2-Limit States

C6A.4.2.2

Strength is the primary limit state for load rating; service and fatigue limit states are selectively applied in accordance with the provisions of this Manual. Applicable limit states are summarized in Table 6A.4.2.2-1. Service limit states that are relevant to load rating are discussed under the articles on resistance of structures (see Articles 6A.5, 6A.6, and 6A.7).

				Desig	n Load		
		Dead Load	Dead Load	Inventory	Operating	Legal Load	Permit Load
Bridge Type	Limit State*	YDC	Yow	YLL	YLL	γ_{LL}	YLL
	Strength I	1.25	1.50	1.75	1.35	Tables 6A.4.4.2.3a-1 and 6A.4.4.2.3b-1	_
Steel	Strength II	1.25	1.50				Table 6A.4.5.4.2a-1
	Service II	1.00	1.00	1.30	1.00	1.30	1.00
	Fatigue	0.00	0.00	0.75			
Reinforced	Strength I	1.25	1.50	1.75	1.35	Tables 6A.4.4.2.3a-1 and 6A.4.4.2.3b-1	_
Concrete	Strength II	1.25	1.50	-			Table 6A.4.5.4.2a-1
	Service I	1.00	1.00				1.00
Prosteased	Strength I	1.25	1.50	1.75	1.35	Tables 6A.4.4.2.3a-1 and 6A.4.4.2.3b-1	-
Concrete	Strength II	1.25	1.50	_		—	Table 6A.4.5.4.2a-1
Concrete	Service III	1.00	1.00	0.80		1.00	
	Service I	1.00	1.00	-			1.00
Wood	Strength I	1.25	1.50	1.75	1.35	Tables 6A.4.4.2.3a-1 and 6A.4.4.2.3b-1	_
	Strength II	1.25	1.50	· _ · · · · · · · · · · · · · · · · · ·	_	_	Table 6A.4.5.4.2a-1

Table 64 4 2	2.1 Limi	t States and	I and I	Factors	For I and	Dating
1 abie 0A.4.2.	2-1-L/IIII	t states and	Load	ractors i	tor Load	Rating

* Defined in the AASHTO LRFD Bridge Design Specifications.

Notes:

Shaded cells of the table indicate optional checks.

Service I is used to check the 0.9 F_y stress limit in reinforcing steel.

Load factor for DW at the strength limit state may be taken as 1.25 where thickness has been field measured.

Fatigue limit state is checked using the LRFD fatigue truck (see Article 6A.6.4.1).

Fig 17. MBE Table 6A.4.2.2 -1.