



Steel Bridge Playbook - 2026



Approved
Continuing
Education



- | | |
|------------------|--|
| Feb 24, 1 pm ET | Essential Bridge Design Resources |
| May 7, 1 pm ET | Galvanized Bridge Preservation Tools |
| Sept 10, 1 pm ET | Next-Gen Steel Bridge Design Approaches |
| Dec 10, 1 pm ET | Bridge Success Stories & Lessons Learned |





Essential Bridge Design Resources

Steel Bridge Playbook
Short Span Steel Bridge Alliance
February 24, 2026

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University of Wyoming
Short Span Steel Bridge Alliance



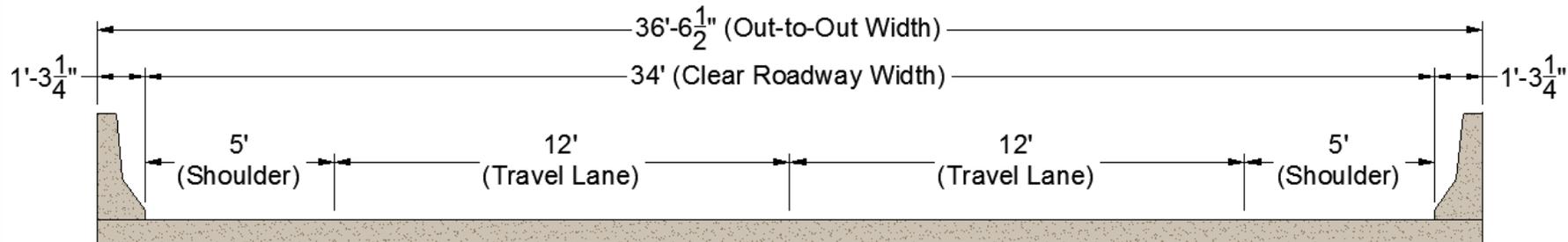
Steel Bridge Design

Design Two-Lane, Simple Span Bridge



Bridge Need and Basic Information

- Decided by Owner/Engineer:
 - 80 ft Simple Span Composite – Steel Girders
 - Two 12 ft Travel Lanes, ADT = 5600 one direction
 - 34 ft Roadway Width
 - Jersey Barriers (1 ft – 3 ¼ in wide)



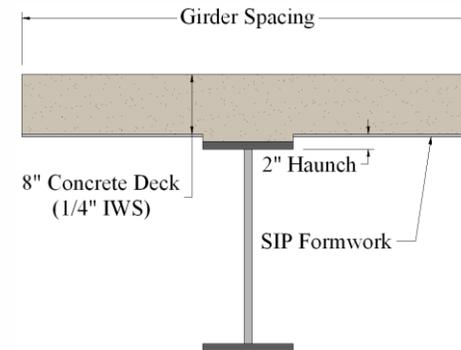
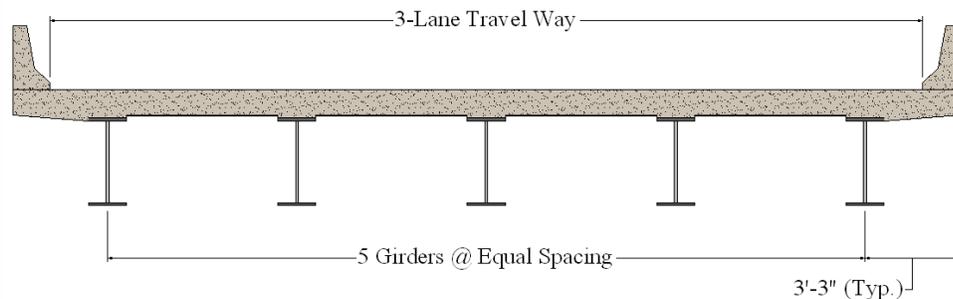
Need a Design for the Bridge SuperStructure

eSPAN140 - Standard Designs Short Span Bridges

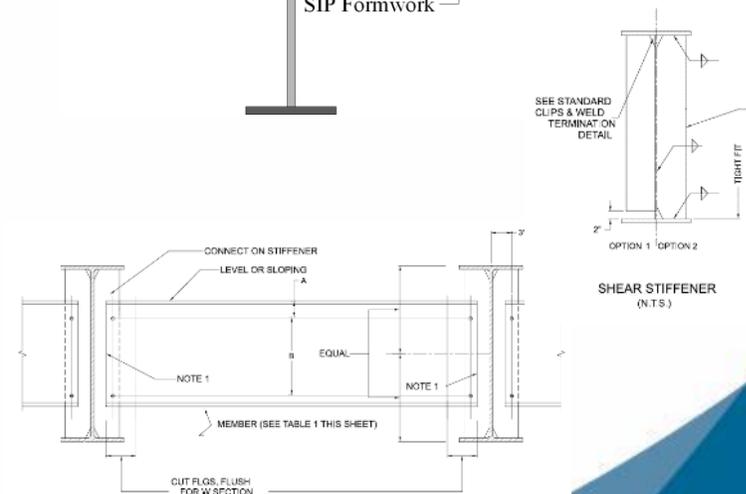
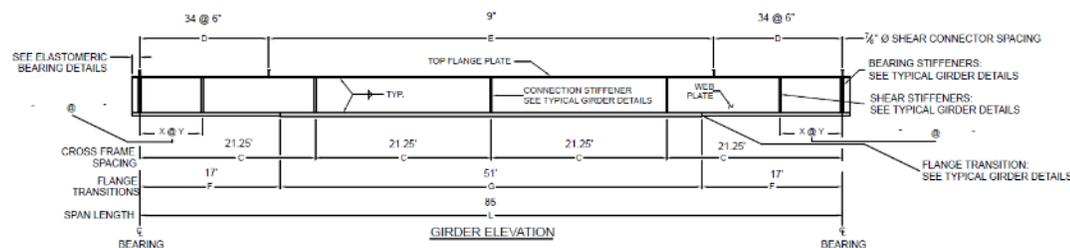
Span lengths 20 ft to 140 ft (in 5 ft increments)

Four girder spacing: 6'-0", 7'-6", 9'-0" and 10'-6",

For each of these increments: Steel girders, Shear stud & stiffener layouts, Welding and fabrication details, Elastomeric bearings, and Concrete deck design



COMPOSITE PLATE GIRDER WITH PARTIALLY STIFFENED WEB - 4 GIRDERS AT 8' 10" GIRDER SPACING, HOMOGENEOUS



eSPAN140 Preliminary Design

Solution Type*	Bridge Span Length								Skew Angle	Overhang Width	
	0'	20'	40'	60'	80'	100'	120'	140'			
Rolled Beam (40' to 100')**			█						+/- 20 degrees	3'3" or less	
Homogeneous Plate Girder (60' to 140')**			█							+/- 20 degrees	3'3" or less
Press Brake Tub Girders (0' to 80')	█									+/- 20 degrees	3'3" or less
Buried Bridges (all)***	█								+/- 35 degrees****	N/A	

* For bridges outside of this range, standard designs will not appear in your solutions book.
 ** Standard designs for rolled beam and plate girder solutions are rounded in five (5) foot increments.
 *** Depending on project requirements this solution will require multiple spans.
 **** Can be greater if site geometry allows.

eSPAN140 Preliminary Design

Project Name*
Example 80 ft Simple Span Bridge

Project Status*
Informational Only

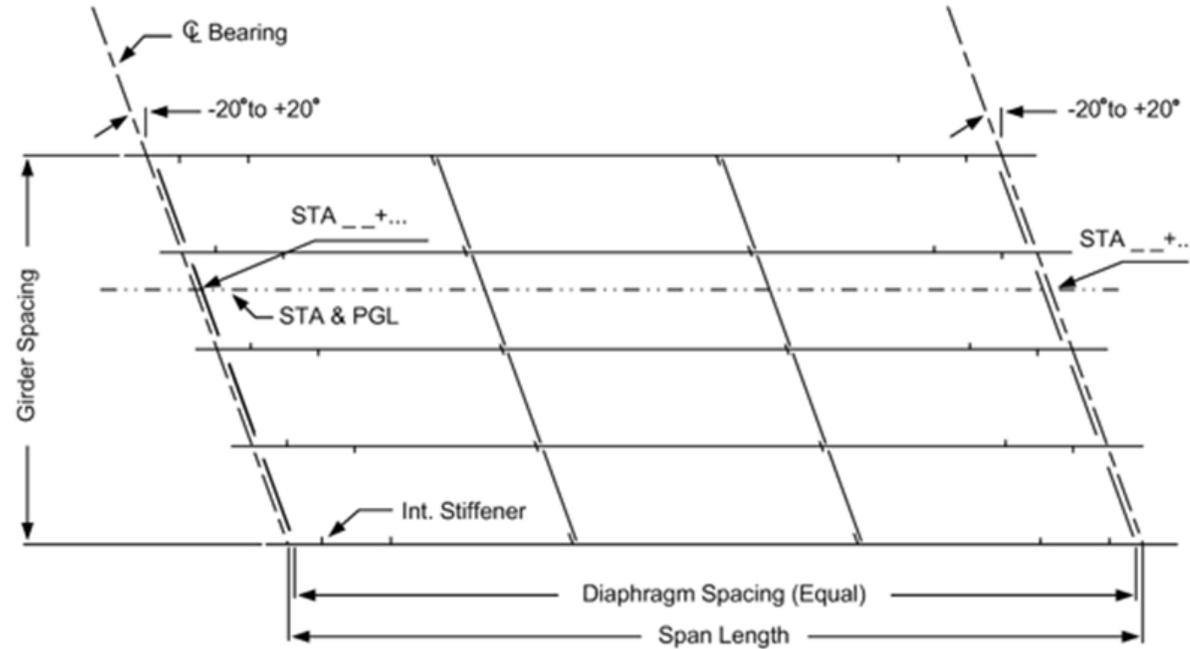
City/County*
Laramie

State/Province* ⓘ
Wyoming

Roadway Name
E 800 South

Bridge Span Length* ⓘ
80 Feet 0 Inches

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Skew Angle (Overhead View)

eSPAN140 Preliminary Design

of Striped Traffic Lanes*

Roadway Width*

Feet Inches

Individual Parapet Width*

Feet Inches

Individual Deck Overhang Width*

Feet Inches

Pedestrian Access?

Skew Angle

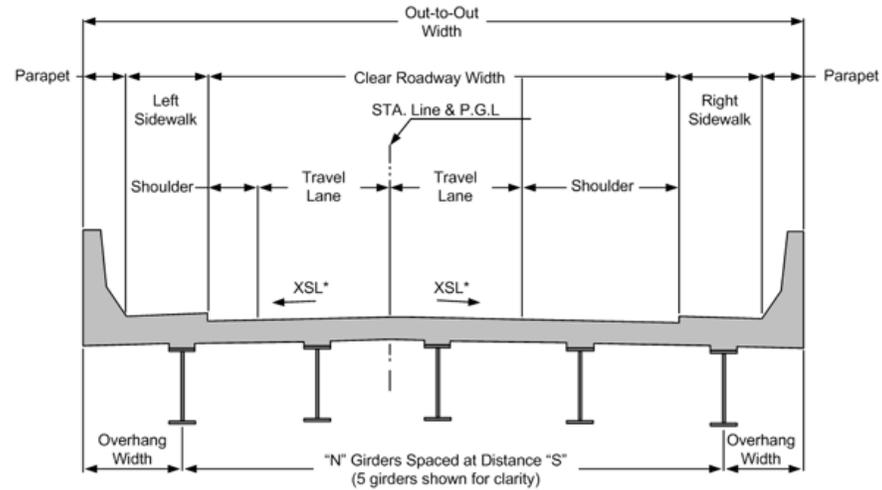
Degrees

Average Daily Traffic

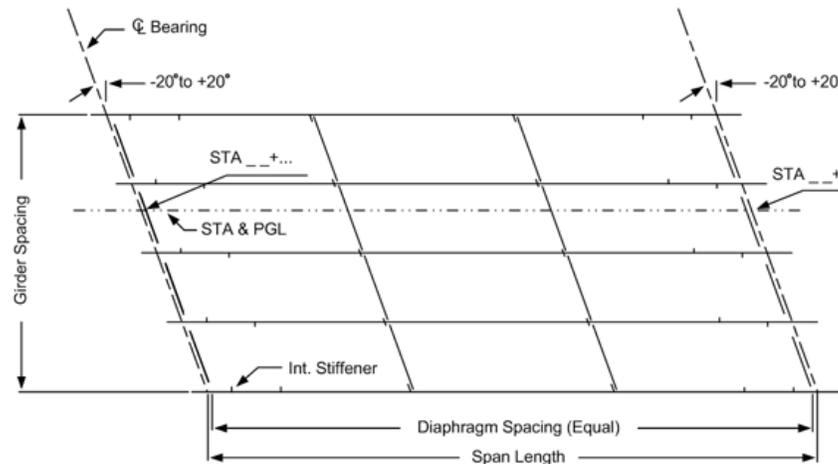
Design Speed

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* Required



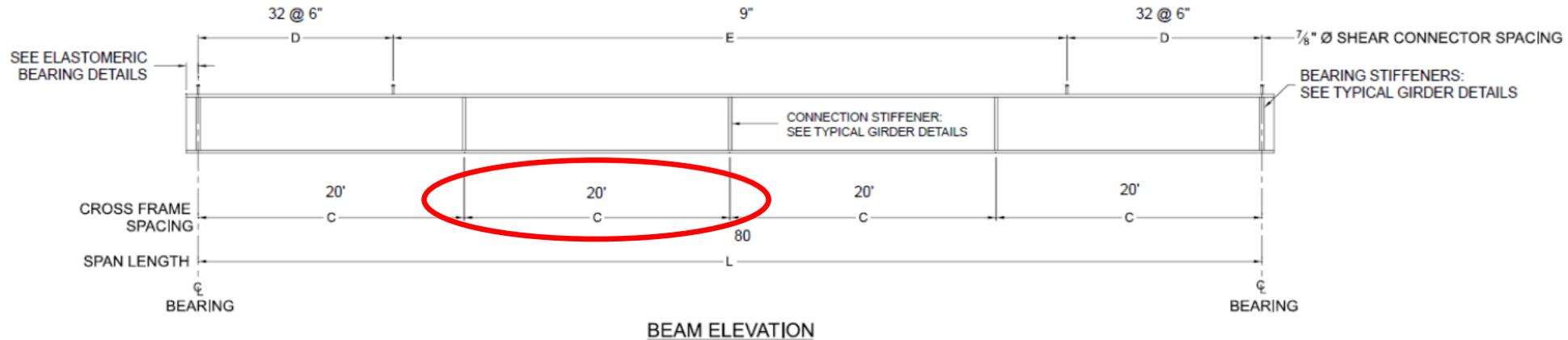
Cross-section of Bridge



Rolled Beam Recommendation

COMPOSITE ROLLED BEAM WITH PARTIALLY STIFFENED WEB - 4 GIRDERS AT 10' 6" GIRDER SPACING, LIGHTEST WEIGHT

The selected rolled beam section is based on the widest (10'-6") girder spacing used in the development of the standards. The steel industry generally recommends the use of the widest girder spacing possible to reduce the potential number of girder lines for optimum economy.



SPAN (L) - ft	ROLLED BEAM	DIAPHRAGM SPACING (C)	SHEAR CONNECTOR MAX. SPACING		WEIGHT
			D	E	
80	W36x210	20'	32 @ 6"	9"	16,800 lbs

STEEL D.L. CAMBER - in					TOTAL D.L. CAMBER - in				
1	2	3	4	5	1	2	3	4	5
0.178"	0.337"	0.461"	0.540"	0.567"	1.255"	2.375"	3.250"	3.807"	3.997"

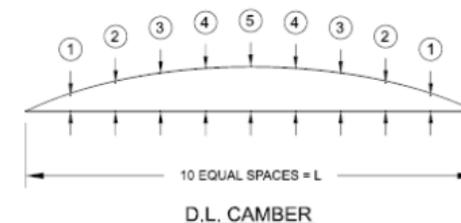
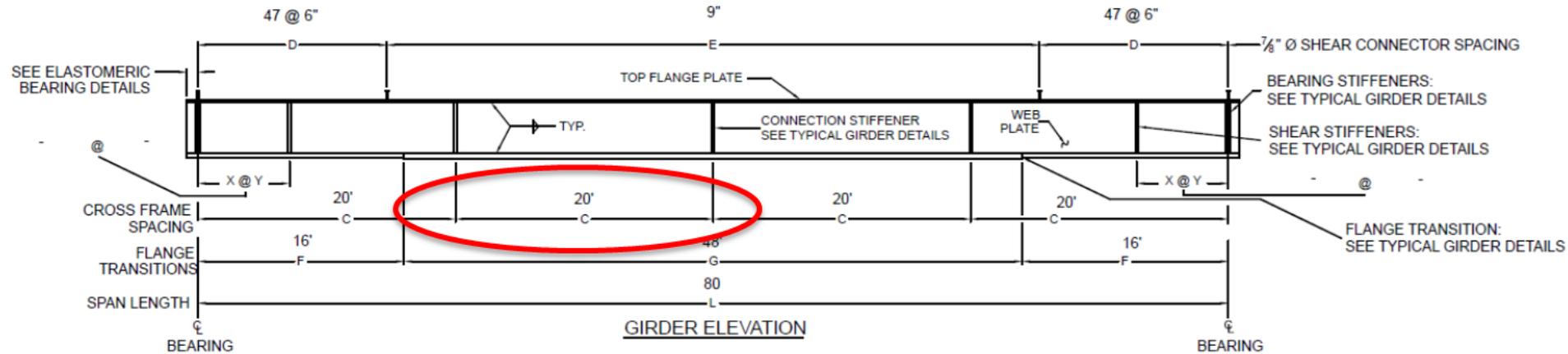


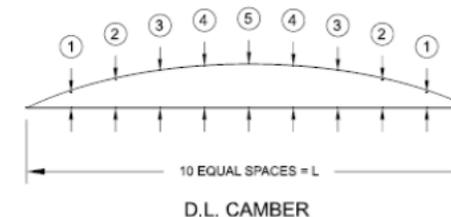
Plate Girder Recommendation

COMPOSITE PLATE GIRDER WITH PARTIALLY STIFFENED WEB - 4 GIRDERS AT 10' 6" GIRDER SPACING, HOMOGENEOUS

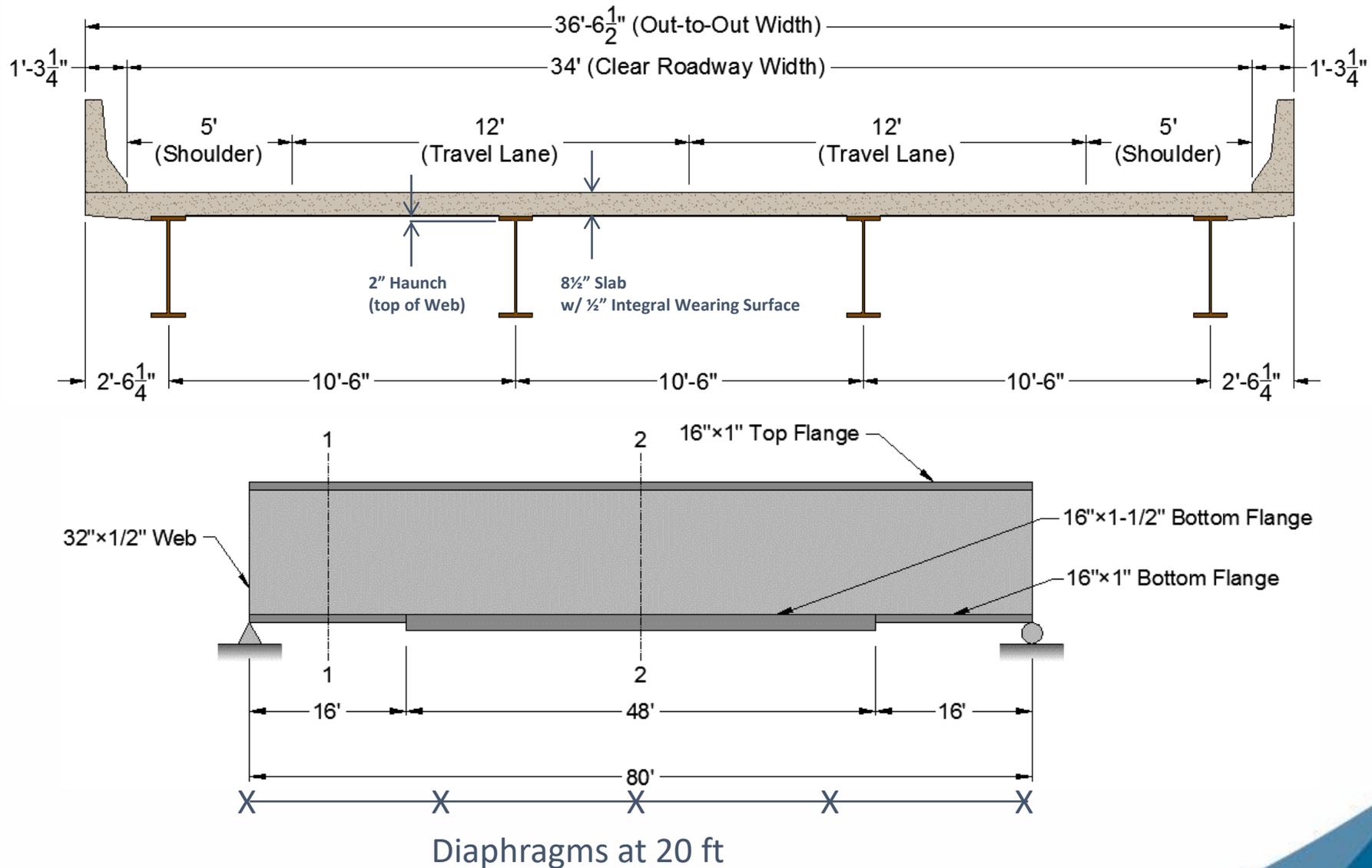


SPAN (L) - ft	PLATE GIRDER SIZE						DIAPHRAGM SPACING (C) - ft	SHEAR STIFFENERS		SHEAR CONNECTOR MAX. SPACING		INDIVIDUAL GIRDER WEIGHT
	TOP FLANGE - in	BOTTOM FLANGE (F)		BOTTOM FLANGE (G)		WEB PLATE - in		X (NO. REQ'd)	Y - ft. (SPACING)	D	E	
		PLATE - in	LENGTH - Ft	PLATE - in	LENGTH - Ft							
80	16 x 1"	16 x 1"	16'	16 x 1 1/2"	48'	32 x 1/2"	20'	-	-	47 @ 6"	9"	14,373 lbs

STEEL D.L. CAMBER - in					TOTAL D.L. CAMBER - in				
1	2	3	4	5	1	2	3	4	5
0.178"	0.334"	0.454"	0.530"	0.557"	1.397"	2.618"	3.554"	4.149"	4.355"



Preliminary Design for Plate Girder Bridge



Steel Bridge Design Resources SSSBA/NSBA



<https://www.espan140.com/>

Short Span Steel Bridge Alliance eSPAN140

Web-based tool that provides preliminary simple-span and modular designs for steel bridges up to 140 feet.

- Rolled Beam Bridges
- Plate Girder Bridges
- Press Brake Tub Girder Bridges
- Buried Bridges



National Steel Bridge Alliance LRFD SIMON

www.steelbridges.org/SoftwareRegistration - Many Resources for Steel Bridges

Optimized Line-Girder analysis design software for simple and multi-span plate girder and tub girder bridges

NEW Short Span Steel Bridge Alliance eBEAM140

Noncomposite and Composite Simple-Span Rolled-Section Steel Bridge Design



Excel Based Rolled Beam Design Software Version 1.0 - Beta

<https://www.shortspansteelbridges.org/ebeam140/>

eBEAM140 Disclaimer: This document has been prepared in accordance with information available to the American Iron and Steel Institute (AISI) and its Short Span Steel Bridge Alliance (SSSBA) program, at the time of preparation. While it is believed to reasonably reflect the present state of knowledge as to the subject, it has not been prepared for conventional use as an engineering or construction document and should not be used or relied upon for any specific application without competent professional examination and verification of its accuracy, suitability, and applicability by a licensed engineer, architect or other professional. AISI and the SSSBA disclaim any liability arising from information provided by others or from the unauthorized use of the information contained in this document, and do not accept any obligation to issue supplements or corrections in the event of errors being discovered or advances being made in the techniques discussed in the document.

Start With Demonstration

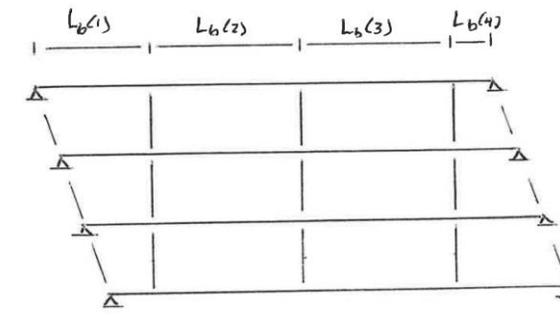
NonComposite Bridge

- 52 ft Length
- Two 12 ft Lanes
- 6 Girders at 5'-6" Spacing
- Overhang 1' - 3"
- Barriers 1' - 0" (50 lb/ft - 50% on Exterior Girder)
- Roadway Width = 28 ft (4 ft of shoulder)
- Bridge Width 30 ft
- Diaphragm (Centerline) at 26 ft
- Unbraced
- Corrugated Metal Deck & Gravel (80 psf)
- No Additional DC1 or DC2 Loading
- No Wearing Surface
- No Construction Load (No Lateral Flange)
- Misc Steel of 5%
- 50 ksi Steel, L/D limit 30, Min d = 12
- L/800 Deflection Limit
- Compression Flange not Braced
- Use AASHTO Appendix A6
- 75 Year Design Life & $ADTT_{SL} = 200$
 - Fatigue II - Finite Life
- No User Defined Vehicle

Design Software

Excel Based Rolled Beam Design Software

- NonComposite & Composite Design
- 33, 36, 50, 65 or 70 ksi Steel
- Bridge Layout
- Diaphragm Variable Along Span
- Any Decking: Wood, Grid, CMD, Noncomposite Concrete, Composite Concrete
- Vehicular Loading: AASHTO HL93 & User Defined Vehicle (i.e., U-80)



SERVICE II near Centerline											
DC1 (ft-k)	108.4	5x-289.0	in ³								
DC2 (ft-k)	7.8	5x-289.0	in ³								
DW (ft-k)	35.5	5x-289.0	in ³								
M (ft-k) LFL=1.75	574.5	5x-289.0	in ³								
Shear II Stress	58.5										
Serv II Allow	40.0										
SERVICE II PR	0.951										
LIVE LOAD DEFLECTION											
LL Deflt (in)	0.65	+1.709									
Allowable (in)	0.75	+1.000									
DEFLECTION PR	0.861										
FATIGUE CR C at Critical Brace											
Fat Moment (ft-k) LFL=0.8	226.7	5x4-316.1	in ³								
Fat Stress (ksi)	6.88										
Fat Allow (ksi)	9.30										
FATIGUE PR	0.740										
STRENGTH U/S SHEAR at Support											
DC1 (k)	13.5										
DC2 (k)	0.6										
DW (k)	2.8										
HL93 LL+M (k) LFL=1.75	56.3										
Vu (k)	120.5										
Vn (k)	447.0										
SHEAR PR	0.270										
Strength Design Uses AASHTO Appendix A6 STRENGTH U/S											
LD (ft)	DC1 (ft-k)	DC2 (ft-k)	DW (ft-k)	HL93 LL+M (ft-k)	Mu (ft-k)	Cb	Mn (ft-k)	Perf Ratio			
1	20	161.7	7.5	34.1	562.9	1247.7	1.36	1284.0	0.972		
2	10	168.4	7.8125	35.5	574.1	1278.3	1.00	1301.0	0.982		
3	20	161.7	7.5	34.1	563.1	1248.0	1.36	1284.0	0.972		
Strength Design Uses AASHTO Appendix A6 CONSTRUCTION											
LD (ft)	Mconstr (ft-k)	Mlat (ft-k)	AF	Atf (ksi)	Perf Ratio	f _{bu} +Atf (ksi)	Perf Ratio	f _u +V ₃ Atf (ksi)	Fnc (ksi)	Perf Ratio	
1	20	389.2	10.8	1.3	11.7	0.39	27.3	0.47	19.5	51.5	0.38
2	10	405.4	3.8	1.0	3.3	0.11	19.6	0.34	17.4	51.2	0.33
3	20	389.2	10.8	1.3	11.7	0.39	27.3	0.47	19.5	51.6	0.38
DEAD LOAD DEFLECTIONS											
Distance (ft)	0	0.10L	0.20L	0.30L	0.40L	0.50L	0.60L	0.70L	0.80L	0.90L	L
I _x (in ⁴) = 4470.0	DC1 (in)	0.000	0.184	0.347	0.475	0.557	0.585	0.557	0.475	0.347	0.184
I _x (in ⁴) = 4470.0	DC2 (in)	0.000	0.009	0.036	0.022	0.027	0.026	0.022	0.016	0.009	0.000
I _x (in ⁴) = 4470.0	DW (in)	0.000	0.039	0.079	0.100	0.117	0.117	0.100	0.079	0.039	0.000
Total (in)	0.000	0.233	0.464	0.60	0.70	0.79	0.79	0.60	0.44	0.233	0.000
NOMINAL ABUTMENT REACTIONS											
DC1 (k)	119.5	At Centerline									
DC2 (k)	2.5	At Centerline									
DW (k)	15.6	At Centerline									
Single Lane LL+M (k)	113.7	At 20.00 From Centerline									
Two Lane LL+M (k)	167.8	At 15.00 From Centerline									
Three Lane LL+M (k)	239.4	At 10.00 From Centerline									
Four Lane LL+M (k)	244.1	At 5.00 From Centerline									
NOMINAL MOMENTS on Girder											
Moment (ft-k)	0	100	200	300	400	500	600	700	800	900	1000
DC1	0	100	200	300	400	500	600	700	800	900	1000
DC2	0	100	200	300	400	500	600	700	800	900	1000
DW	0	100	200	300	400	500	600	700	800	900	1000
HL93 LL+M	0	100	200	300	400	500	600	700	800	900	1000
Fatigue-M	0	100	200	300	400	500	600	700	800	900	1000
ONLY IF COMPOSITE											
0.875 (in) SHEAR STUD SPACING											
Minimum Spacing (in)	5.25										
Maximum Spacing (in)	48										
Minimum Transverse Spacing (in)	3.5										
d (in)	29.8										
lf (in)	10.5										
Singles Pitch (in)	7.17	8.55	9.24	8.55	7.17						
Doubles Pitch (in)	54.96	17.09	18.48	17.09	24.35						
Triples Pitch (in)	21.52	25.64	27.72	25.64	21.52						
Strength Minimum Number of Studs	56										
Fatigue Singles Estimated Number of Studs	75.52657289										
Fatigue Doubles Estimated Number of Studs	76.52657289										
Fatigue Triples Estimated Number of Studs	77.52657289										
SHEAR CONNECTOR PITCH (in)											
Pitch (in)	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00
Single Required	0	10	20	30	40	50	60	70	80	90	100
Single Layout	0	10	20	30	40	50	60	70	80	90	100
Double Required	0	10	20	30	40	50	60	70	80	90	100
Double Layout	0	10	20	30	40	50	60	70	80	90	100
Triple Required	0	10	20	30	40	50	60	70	80	90	100
Triple Layout	0	10	20	30	40	50	60	70	80	90	100

Design Software

Excel Based Rolled Beam Design Software

- **Diaphragm Variable Along Span: up to 7 Unbraced Lengths: Skewed Bridges**
 - Compression Flange Bracing During Construction
 - Compression Flange Bracing for Final State
- **Any Decking: Wood, Grid, CMD, Noncomposite Concrete, Composite Concrete**
 - For Composite: $f'c$, full depth or SIP, haunch, sacrificial surface, shear connector design
 - Additional Dead Load (DC1 – Overhang, Utilities, etc)
 - Variable Bridge Railing
 - Steel Beams Individually Considered in Dead Load
- **Wearing Surface**
- **Additional Dead Load (DC2 – Utilities, etc)**

Design Software

Excel Based Rolled Beam Design Software

- Vehicular Loading
 - AASHTO HL93 truck, Tandem and Lane
 - User Defined Vehicle (i.e., U-80)
 - User Live Load Factor (Strength II)
 - Optional Lane Load
 - Single or Multi-Lane Distribution
 - User Impact Factor
- Live Load Distribution Factors
 - Moment & Shear (Based on Decking)
 - Lever Rule if Necessary
 - Single & Multi-Lane
 - Rigid Rotational Analysis
 - User Input LLDF

Design Software

Excel Based Rolled Beam Design Software

- Limit L/D Ratio
- Minimum Depth (diaphragms)
- Maximum Depth (approaches/clearance)
- Option on W40/44
- User Defined Deflection Limit
- Add % Steel for Miscellaneous
- Applies AASHTO 6.10.8 (conservative) or Appendix A6 (optimal) - **AASHTO 10**
- Calculated C_b for Each Unbraced Length - **AASHTO 10**
 - User defined C_b

Design Software

Excel Based Rolled Beam Design Software

- Fatigue I or Fatigue II Based on $ADTT_{SL}$ – AASHTO 10
 - Variable Design Life
- Performs Dead, Construction & Live Load Analysis for Each Unbraced Length
- Strength I/II & Constructability Design for Each Unbraced Length
- Service II Near Centerline (Maximum Moment)
- Fatigue at Critical Diaphragm Location (Detail C')
- Strength & Fatigue Shear Stud Design for Composite – AASHTO 10

Design Software

Excel Based Non-Composite Rolled Beam Design Software

- Determines all W Shapes that Meet Strength I/II, Service II & Construction Performance Ratios
- Corresponding Fatigue Performance Ratio
- Corresponding Deflection Performance Ratio

Lightest 10 Sections (see to the right for additional Information)						
Str I, Serv II, Constr	Fatigue	Deflection	L/D	Defl	Mn/My	Weight (tons)
W36X135	W36X135	W36X135	17.5	L/1049	0.78	21.1
W33X141	W33X141	W33X141	18.7	L/1002	0.82	22.0
W27X146	W27X146	W27X146	22.8	L/761	1.03	22.8
W30X148	W30X148	W30X148	20.3	L/898	0.82	23.1
W40X149	W40X149	W40X149	16.3	L/1317	0.74	23.2
W36X150	W36X150	W36X150	17.4	L/1215	0.84	23.4
W33X152	W33X152	W33X152	18.6	L/1097	0.86	23.7
W36X160	W36X160	W36X160	17.3	L/1312	0.87	25.0
W27X161	W27X161	W27X161	22.6	L/848	1.05	25.1
W24X162	W24X162	W24X162	25.0	L/695	1.07	25.3

Design Software

Excel Based Rolled Beam Design Software

- Design Summary
 - All Superstructure Design Results Specific to Limit States, Unbraced Lengths, etc.
 - Dead Load Deflections for Camber
 - Abutment Reaction Cases for Multi-Lane
 - If Composite: Strength and Fatigue Stud Design



W44 SERVICE II near Centerline		
DC1 (ft-k)	183.1	Sx=439.0 in ³
DC2 (ft-k)	8.5	Sx=439.0 in ³
DW (ft-k)	0.0	Sx=439.0 in ³
HL93 LL+IM (ft-k)	670.5	Sx=439.0 in ³
Serv II Stress	29.1	
Lane Serv II Allow	40.0	
SERVICE II PR	0.727	
LIVE LOAD DEFLECTION		Ix=7800 in ⁴
LL Defl (in)	0.60	= L/1049
Allowable (in)	0.78	= L/800
DEFLECTION PR	0.763	
FATIGUE Cat C' at Critical Brace		
Fat Moment (ft-k) LLF = 0.8	265.8	Sfat=458.6 in ³
Fat Stress (ksi)	5.57	
Fat Allow (ksi)	9.30	
FATIGUE PR	0.599	
STRENGTH I/II SHEAR at Support		
DC1 (k)	14.1	
DC2 (k)	0.7	
DW (k)	0.0	
HL93 LL+IM (k) LLF = 1.75	60.6	
Vu (k)	124.5	
Vn (k)	591.9	
SHEAR PR	0.210	

Strength Design Uses AASHTO Appendix A6	STRENGTH I/II	Lb (ft)	DC1 (ft-k)	DC2 (ft-k)	DW (ft-k)	HL93 LL+IM (ft-k)	LLF = 1.75	Mu (ft-k)	Cb	Mn (ft-k)	Perf Ratio	
	1	26	183.1	8.45	0.0	670.4		1412.6	1.26	1422.9	0.993	STRENGTH I/II MAX PR
	2	26	183.1	8.45	0.0	670.5		1412.9	1.26	1423.3	0.993	0.993

Strength Design Uses AASHTO Appendix A6	CONSTRUCTION	Lb (ft)	Mconstr (ft-k)	Mlat (ft-k)	AF	Affl (ksi)	Perf Ratio	f _{bu} +Affl (ksi)	Perf Ratio	f _{bu} +1/3Affl (ksi)	Fnc (ksi)	Perf Ratio	
	1	26	228.9	0.0	1.0	0.0	0.00	6.3	0.13	6.3	38.9	0.16	CONSTRUCTION MAX PR
	2	26	228.9	0.0	1.0	0.0	0.00	6.3	0.13	6.3	38.9	0.16	0.161

NOMINAL ABUTMENT REACTIONS			
DC1 (k)	84.5	At Centerline	
DC2 (k)	2.6	At Centerline	
DW (k)	0.0	At Centerline	
Single Lane LL+IM (k)	114.3	At 9.00 From Centerline	
Two Lane LL+IM (k)	190.4	At 4.00 From Centerline	

Modify Demonstration

NonComposite Bridge

- 52 ft Length
- Two 12 ft Lanes
- 6 Girders at 5'-6" Spacing
- Overhang 1' - 3"
- Barriers 1' - 0" (50 lb/ft - 50% on Exterior Girder)
- Roadway Width = 28 ft (4 ft of shoulder)
- Bridge Width 30 ft
- Diaphragm (Centerline) at 26 ft
- Unbraced
- Corrugated Metal Deck & Gravel (80 psf)
- No Additional DC1 or DC2 Loading
- No Wearing Surface
- No Construction Load (No Lateral Flange)
- Misc Steel of 5%
- 50 ksi Steel, L/D limit 30, Min d = 12
- L/800 Deflection Limit
- Compression Flange not Braced
- Use AASHTO Appendix A6
- 75 Year Design Life & $ADTT_{SL} = 200$
 - Fatigue II - Finite Life
- No User Defined Vehicle

Demonstration: 52 ft Span, CMD/Gravel, 6 Girders @ 5.5 ft

NonComposite Bridge: W36 x 135

- What if add additional diaphragm: $L_b = 19, 14, 19$ ft

ENTER W SECTION FOR MORE INFORMATION						Weight (lb/ft)
W36X135	NonComposite					135
OVERALL PERFORMANCE FOR W36X135						
Strength I/II	Service II	Construction	Fatigue	Deflection	Overall	
PR	PR	PR	PR	PR	PR	
0.993	0.727	0.161	0.599	0.763	0.993	
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Strength I/II	
1		1		L/1049		
PERFORMANCE BY UNBRACED LENGTH FOR W36X135						
Inbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II	Mn/My	Cb	
1	26	0 - 26 ft	0.993	0.778	1.255	
2	26	26 - 52 ft	0.993	0.778	1.256	

ENTER W SECTION FOR MORE INFORMATION						Weight (lb/ft)
W33X118	NonComposite					118
OVERALL PERFORMANCE FOR W33X118						
Strength I/II	Service II	Construction	Fatigue	Deflection	Overall	
PR	PR	PR	PR	PR	PR	
0.981	0.883	0.155	0.703	1.009	1.009	
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Deflection	
2		2		L/793		
PERFORMANCE BY UNBRACED LENGTH FOR W33X118						
Inbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II	Mn/My	Cb	
1	19	0 - 19 ft	0.781	1.139	1.391	
2	14	19 - 33 ft	0.981	0.957	1.005	
3	19	33 - 52 ft	0.781	1.140	1.392	

**W33x118 – 5400 lbs Girder Steel Saved
But Additional Diaphragm
And Deflection = L/793**

Demonstration: 52 ft Span, CMD/Gravel, 6 Girders @ 5.5 ft

NonComposite Bridge: W36 x 135

- What if compression flange braced: $L_b = 0$ Corrugated Metal Decking

ENTER W SECTION FOR MORE INFORMATION						Weight (lb/ft)
W36X135	NonComposite					135
OVERALL PERFORMANCE FOR W36X135						
Strength I/II	Service II	Construction	Fatigue	Deflection	Overall	
PR	PR	PR	PR	PR	PR	
0.993	0.727	0.161	0.599	0.763	0.993	
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Strength I/II	
1		1		L/1049		
PERFORMANCE BY UNBRACED LENGTH FOR W36X135						
Inbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II	Mn/My	Cb	
1	26	0 - 26 ft	0.993	0.778	1.255	
2	26	26 - 52 ft	0.993	0.778	1.256	

ENTER W SECTION FOR MORE INFORMATION						Weight (lb/ft)
W30X116	NonComposite					116
OVERALL PERFORMANCE FOR W30X116						
Strength I/II	Service II	Construction	Fatigue	Deflection	Overall	
PR	PR	PR	PR	PR	PR	
0.892	0.963	0.161	0.788	1.207	1.207	
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Deflection	
2		1		L/663		
PERFORMANCE BY UNBRACED LENGTH FOR W30X116						
Compression Flange Laterally Braced for Final State			Strength I/II			
Inbraced Length	Unbraced Length (ft)	Lb Range	PR	Mn/My	Cb	
1	26	0 - 26 ft	0.892	1.149	1.255	
2	26	26 - 52 ft	0.892	1.149	1.256	

**W30x116 – 6000 lbs Girder Steel Saved
But Deflection = L/663**

Demonstration: 52 ft Span, CMD/Gravel, 6 Girders @ 5.5 ft

NonComposite Bridge: W36 x 135

- What if Logging Truck User Vehicle: 160 kips, 5 Axles

ENTER W SECTION FOR MORE INFORMATION						Weight (lb/ft)
W36X135						135
NonComposite						
OVERALL PERFORMANCE FOR W36X135						
Strength I/II	Service II	Construction	Fatigue	Deflection	Overall	
PR	PR	PR	PR	PR	PR	
0.993	0.727	0.161	0.599	0.763	0.993	
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Strength I/II	
1		1		L/1049		
PERFORMANCE BY UNBRACED LENGTH FOR W36X135						
Inbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II	Mn/My	Cb	
1	26	0 - 26 ft	0.993	0.778	1.255	
2	26	26 - 52 ft	0.993	0.778	1.256	

ENTER W SECTION FOR MORE INFORMATION						Weight (lb/ft)
W36X150						150
NonComposite						
OVERALL PERFORMANCE FOR W36X150						
Strength I/II	Service II	Construction	Fatigue	Deflection	Overall	
PR	PR	PR	PR	PR	PR	
0.937	0.736	0.134	0.516	0.658	0.937	
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Strength I/II	
1		1		L/1215		
PERFORMANCE BY UNBRACED LENGTH FOR W36X150						
Inbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II	Mn/My	Cb	
1	26	0 - 26 ft	0.937	0.837	1.255	
2	26	26 - 52 ft	0.937	0.837	1.256	

Strength II: LLF = 1.35, No Lane Load, Single Lane, Unbraced W36x150

Strength II: LLF = 1.35, No Lane Load, Single Lane, Braced W33x130

Another Demonstration

Composite Bridge

- 62 ft Length
- Two 12 ft Lanes
- 4 Girders at 9'-0" Spacing
- Overhang 2' - 0"
- Barriers 1' - 6" (250 lb/ft - 50% on Exterior Girder)
- Roadway Width = 28 ft (4 ft of shoulder)
- Bridge Width 31 ft
- Diaphragms at 21 ft & 41 ft
- 8" Structural Deck, ½" Sacrificial, 2" Haunch
- 2" Stay-in-Place Forms (15 psf)
- 7/8" Shear Studs; $f'_c = 4000$ psi
- Additional DC1 Loading = 40 lb/ft
 - 100% on Girder
- 25 lb/ft² Wearing Surface
- Construction Load ($w = 275$ lb/ft & $p = 3000$ lb)
- Misc Steel of 5%
- 50 ksi Steel, L/D limit 30, Min $d = 12$
- L/800 Deflection Limit
- Compression Flange not Braced - Construction
- Use AASHTO Appendix A6
- 75 Year Design Life & $ADTT_{SL} = 1000$
 - Fatigue I - Infinite Life
- No User Defined Vehicle

Demonstration: 62 ft Span, 8" Deck w/SIP, 4 Girders @ 9 ft

Composite Bridge

Lightest 10 Sections (see to the right for additional information)						
Str I, Serv II, Constr	Fatigue	Deflection	L/D	Defl	Mn/My	Weight (tons)
W36X135	W36X135	W36X135	20.9	L/1295	1.88	16.7
W33X141	W33X141	W33X141	22.3	L/1204	1.78	17.5
W27X146			27.2	L/927	1.66	18.1
W40X149	W40X149	W40X149	19.5	L/1553	1.82	18.5
W36X150	W36X150	W36X150	20.7	L/1421	1.78	18.6
W33X152	W33X152	W33X152	22.2	L/1281	1.75	18.8
W36X160	W36X160	W36X160	20.7	L/1491	1.74	19.8
W27X161	W27X161	W27X161	27.0	L/998	1.62	20.0
W24X162			29.8	L/846	1.64	20.1
W40X167	W40X167	W40X167	19.3	L/1726	1.72	20.7

ENTER W SECTION FOR MORE INFORMATION					Weight (lb/ft)
W36X135	Composite				135
OVERALL PERFORMANCE FOR W36X135					
Strength I/II	Service II	Construction	Fatigue	Deflection	Overall
PR	PR	PR	PR	PR	PR
0.793	0.876	0.947	0.961	0.618	0.961
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Fatigue
2		2		L/1295	
PERFORMANCE BY UNBRACED LENGTH FOR W36X135					
Inbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II	Mn/My	Cb
1	21	0 - 21 ft	0.721	1.883	1.425
2	20	21 - 41 ft	0.793	1.883	1.009
3	21	41 - 62 ft	0.721	1.883	1.425

Demonstration: 62 ft Span, 8" Deck w/SIP, 4 Girders @ 9 ft

Composite Bridge

W36X135	Composite			Consider W40 & W44 Beams? Yes	Minimum Depth Beam W12			
Overall PR = 0.961 - Fatigue				L/D Limited to 25	Maximum Depth Beam W44	SERVICE II near Centerline		
Yield Strength (ksi)	50					DC1 (ft-k)	492.3	Sx=439.0 in ³
Bridge Length (ft)	62		Bridge Width (ft)	31.00		DC2 (ft-k)	60.1	S3n=600.0 in ³
Girder Spacing (ft)	9		Roadway Width (ft)	28.00		DW (ft-k)	84.1	S3n=600.0 in ³
Number of Girders	4	Shoulders (ft) each side - Double for One Sided		2.00		HL93 LL+IM (ft-k)	1093.4	Sn=675.0 in ³
Overhang (22.2% of Girder Spacing) (ft)	2	2 Striped Lanes and 2 Design Lanes						
Barrier Width (ft)	1.5				Lateral Distribution Factors	Serv II Stress	41.6	
Barrier Load on Girder (lb/ft)	125	8 in Structural Deck with 2 in SIP Forms			Single Lane/Multi-Lane	Serv II Allow	47.5	
DC Deck Only Loading (psf)	106.25		Deck f'c (psi)	4000	Moment LLDF = 0.660 , 0.767	SERVICE II PR	0.876	
Wearing Surface (psf)	25		Haunch from Top of Web (in)	2	Fatigue LLDF = 0.550			
Additional DC1 Load on Girder (lb/ft)	40		Nominal Girder DC1 (lb/ft)	1024.6	Shear LLDF = 0.720 , 0.884	LIVE LOAD DEFLECTION	In=21650.2 in ⁴	
Additional DC2 Load on Bridge (lb/ft)	0		Nominal Girder DC2 (lb/ft)	125.0		LL Defl (in)	0.57 = L/1295	
			Nominal Girder DW (lb/ft)	175.0		Allowable (in)	0.93 =L/800	
AT OVERHANG FOR LATERAL FLANGE BENDING	0					DEFLECTION PR	0.618	
Construction w (lb/ft)	275		AASHTO HL93 Loading and					
Construction p (lb)	3000		No User Defined Vehicle			FATIGUE Cat C' at Critical Brace		
1/2 of Deck Overhang Weight (lb/ft)	108.75					Fat Moment (ft-k) LLF = 1.75	380.0	Sfat=692.0 in ³
ADDITIONAL VERTICAL BENDING ON GIRDERS						Fat Stress (ksi)	11.53	
Exterior - Construction p (lb)	3000					Fat Allow (ksi)	12.00	
Exterior - Construction w (lb/ft)	275					FATIGUE PR	0.961	
% Misc Stl for Diaphragms, etc	5%					STRENGTH I/II SHEAR at Support		
						DC1 (k)	31.8	
DEFLECTION LIMIT (x for Deflection Limit in L/x)	800					DC2 (k)	3.9	
						DW (k)	5.4	
Fatigue Design Life (yrs)	75			179298.4375		HL93 LL+IM (k) LLF = 1.75	89.4	
Fatigue ADTSSL	1000	Fatigue I Controls						
						Vu (k)	209.2	
						Vn (k)	591.9	
						SHEAR PR	0.353	

Demonstration: 62 ft Span, 8" Deck w/SIP, 4 Girders @ 9 ft

Composite Bridge

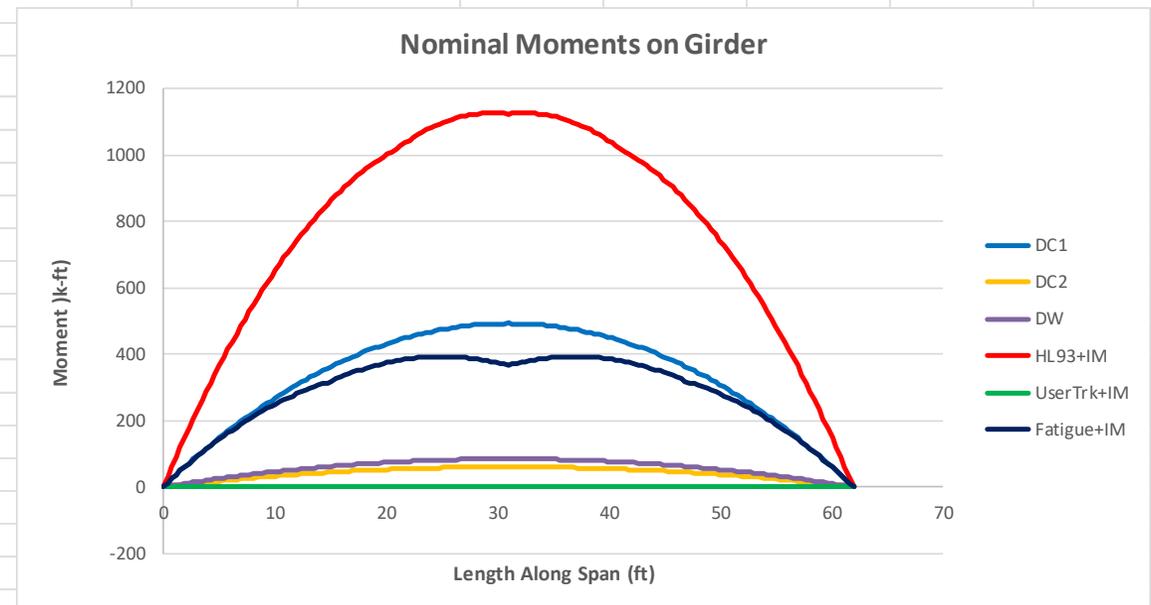
	STRENGTH I/II	Compression Flange Laterally Braced for F LLF = 1.75					Mu (ft-k)	Cb	Mn (ft-k)	Perf Ratio				
		Lb (ft)	DC1 (ft-k)	DC2 (ft-k)	DW (ft-k)	HL93 LL+IM (ft-k)								
	1	21	441.1	53.8125	75.3	1000.4	2482.4	1.42	3444.0	0.721			STRENGTH I/II MAX PR	
	2	20	492.3	60.0625	84.1	1093.4	2730.1	1.01	3444.0	0.793			0.793	
	3	21	441.1	53.8125	75.3	1000.7	2482.8	1.43	3444.0	0.721				
Strength Design Uses AASHTO Appendix A6 CONSTRUCTION														
		Lb (ft)	Mconstr (ft-k)	Mlat (ft-k)	AF	Affl (ksi)	Perf Ratio	f _{bu} +Affl (ksi)	Perf Ratio	f _{bu} +1/3Affl (ksi)	Fnc (ksi)	Perf Ratio		
	1	21	791.4	21.6	1.4	18.6	0.62	40.2	0.80	27.8	55.9	0.50	CONSTRUCTION MAX PR	
	2	20	883.3	19.9	1.8	23.2	0.77	47.4	0.95	31.9	40.9	0.78	0.947	
	3	21	791.4	21.6	1.4	18.6	0.62	40.2	0.80	27.8	55.9	0.50		
DEAD LOAD DEFLECTIONS (Max Loaded Girder)			0	0.10L	0.20L	0.30L	0.40L	0.50L	0.60L	0.70L	0.80L	0.90L	L	
		Distance (ft)	0	6.2	12.4	18.6	24.8	31	37.2	43.4	49.6	55.8	62	
		I _x (in ⁴) = 7800.0	DC1 (in)	0.000	0.473	0.894	1.224	1.434	1.506	1.434	1.224	0.894	0.473	0.000
		I _{3n} (in ⁴) = 15409.5	DC2 (in)	0.000	0.029	0.055	0.076	0.089	0.093	0.089	0.076	0.055	0.029	0.000
		I _{3n} (in ⁴) = 15409.5	DW (in)	0.000	0.041	0.077	0.106	0.124	0.130	0.124	0.106	0.077	0.041	0.000
			Total (in)	0.00	0.54	1.03	1.41	1.65	1.73	1.65	1.41	1.03	0.54	0.00

Demonstration: 62 ft Span, 8" Deck w/SIP, 4 Girders @ 9 ft

Composite Bridge

NOMINAL ABUTMENT REACTIONS

DC1 (k)	123.3	At Centerline
DC2 (k)	15.5	At Centerline
DW (k)	21.7	At Centerline
Single Lane LL+IM (k)	121.4	At 9.00 From Centerline
Two Lane LL+IM (k)	202.4	At 4.00 From Centerline



Demonstration: 62 ft Span, 8" Deck w/SIP, 4 Girders @ 9 ft

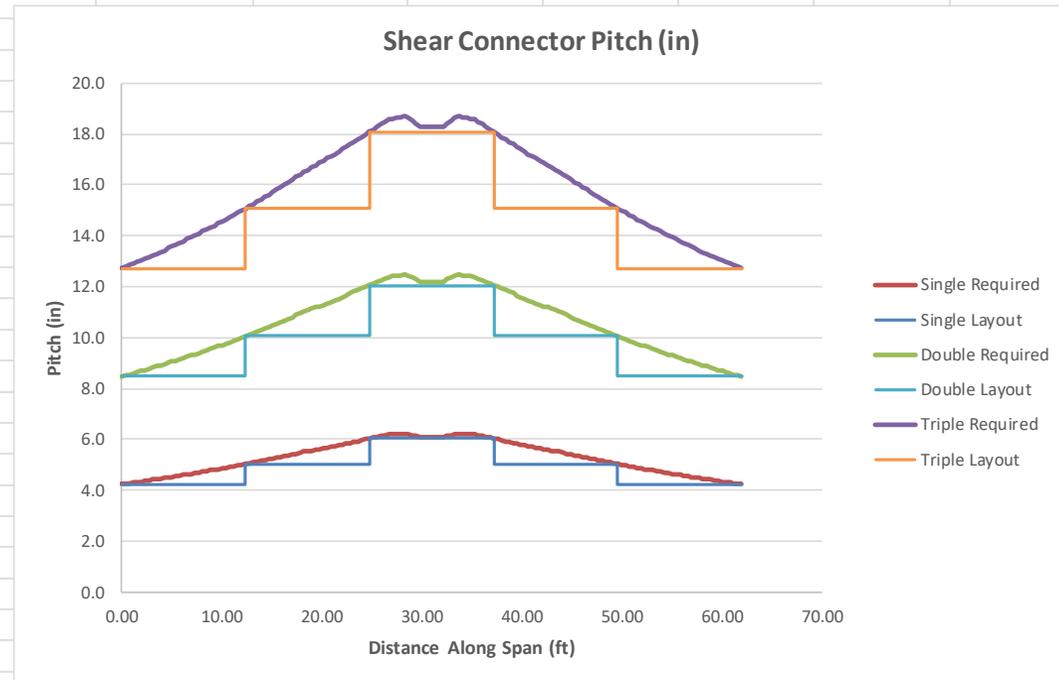
Composite Bridge – Shear Studs

ONLY IF COMPOSITE

0.875 (in) SHEAR STUDE SPACING

	Minimum Spacing (in) 3.5					Maximum Spacing (in) 48
	0 - 12.4 ft	12.4 - 24.8 ft	24.8 - 37.2 ft	37.2 - 49.6 ft	49.6 - 62.0 ft	
Singles Pitch (in)	4.23	5.03	6.03	5.03	4.23	
Doubles Pitch (in)	8.47	10.05	12.06	10.05	8.47	
Triples Pitch (in)	12.70	15.08	18.08	15.08	12.70	
Strength Minimum Number of Studs	127					
Fatigue Singles Estimated Number of Studs	155.172541					
Fatigue Doubles Estimated Number of Studs	156.172541					
Fatigue Triples Estimated Number of Studs	157.172541					

d (in) = 35.6
 bf (in) = 120
 Doubles Transverse Spacing
 Triples Transverse Spacing



eBEAM140 Summary

Rolled Shape Bridge Design: Composite & NonComposite

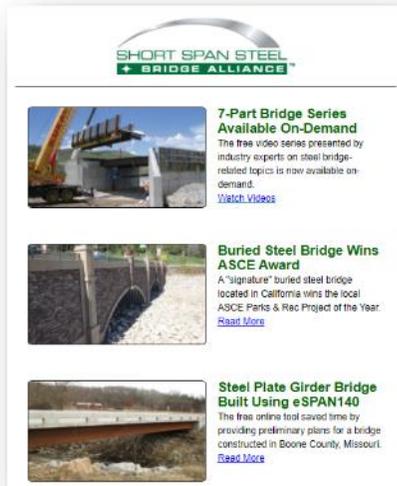
- User Manual & Examples
- Released on www.ShortSpanSteelBridges.org September 2025

<https://www.shortspansteelbridges.org/ebeam140/>

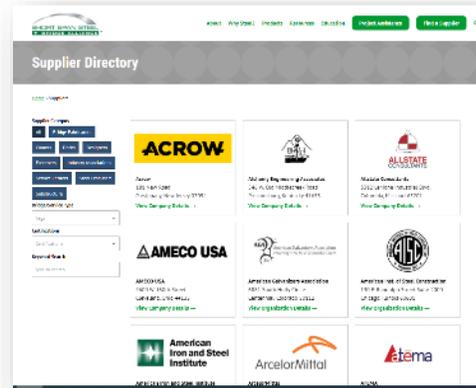
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