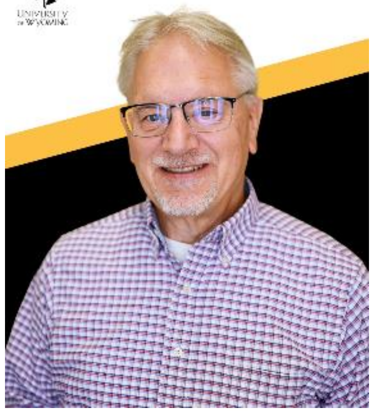
Practical Approaches to Building Cost-Efficient and Accelerated Short Span Steel Bridges

MidAtlantic Region Quality Assurance Workshop
February 9 - 11, 2026

Dr. Michael G. Barker, PE
University of Wyoming &
SSSBA, Director of Education

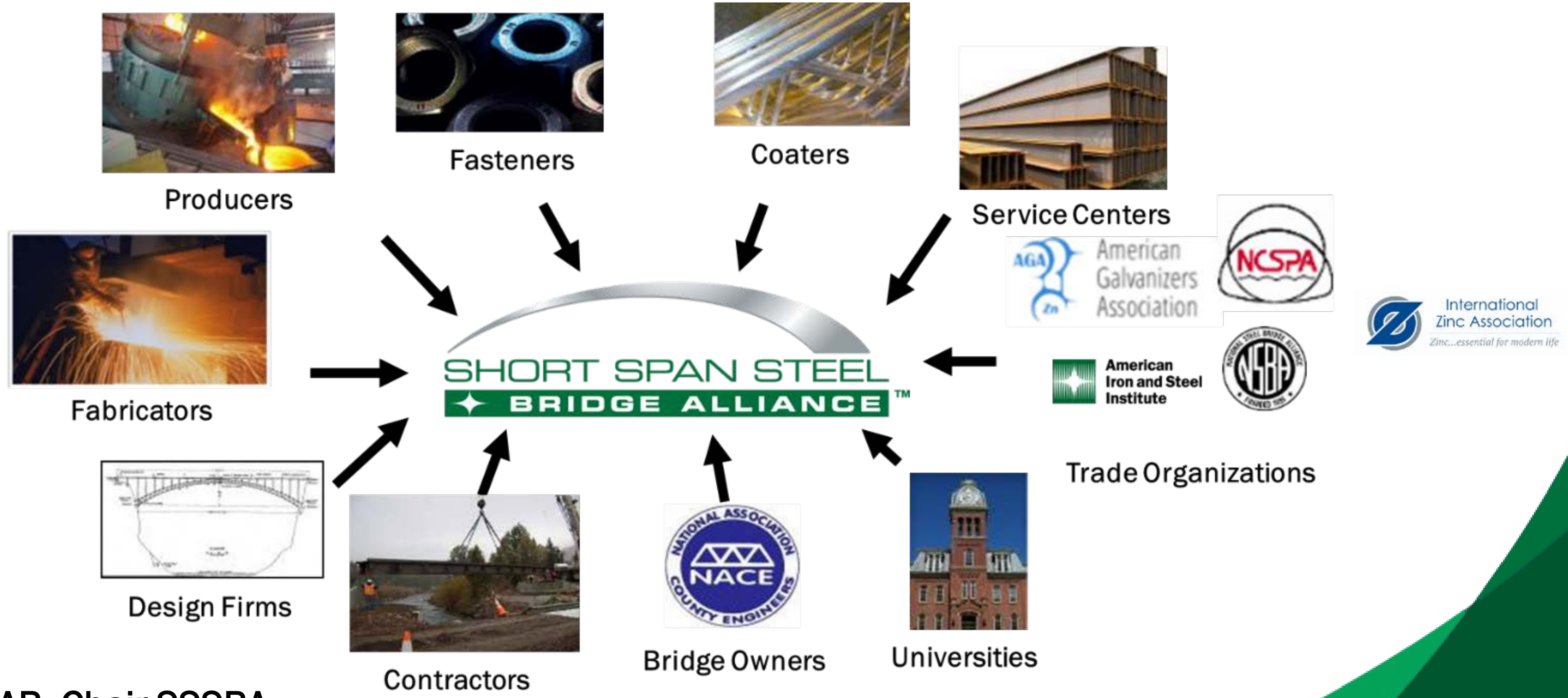


Download Presentation Slides

www.ShortSpanSteelBridges.org

Short Span Steel Bridge Alliance – Who We Are

A group of ***bridge*** *and* ***buried soil structure*** *industry leaders who have joined together to provide* ***educational information*** *on the design and construction of short span steel bridges in installations up to* ***140 feet in length****.*



Myrissa Welch, SSAB, Chair SSSBA

Common Simple Span Steel Bridge Types

Corrugated Steel Pipe
(Buried Steel Bridge)

Corrugated Steel Plate
(Buried Steel Bridge)

Rolled Beam Shape

Plate Girder

Truss

Press-Brake Tub Girder

Short Span Steel Bridge Alliance – Why We Are

Remove Design Obstacles for Short Span Steel Bridges

eSPAN140 & eBEAM140 Design Software

Overcome Preconception that Concrete is Always Less Expensive in Short Span

Initial and Life Cycle Cost Studies

Prefabricated Steel Bridge Systems and Accelerated Bridge Construction

Case Studies and Alliance Members

Develop and Implement Innovative Steel Bridge Systems

Press-Brake Tub Girder Bridges & SDCL Construction

Educate Owners, Engineers & Students in Steel Bridges

Webinars, Presentations, Workshops and On-Line Certificate Programs

Today's Session

eSPAN140 & eBEAM140 Design Tools – *Steel Bridge Design Made Easy*

Bridge Manufacturer Solutions/ABC – *I Need a Bridge, Bring Me One*

Simple for Dead, Continuous for Live Steel Bridge Construction – *Innovative Design*

Press-Brake Formed Tub Girders – *Innovative Design*

Workshops, Resources & Opportunities Through the Short Span Steel Bridge Alliance

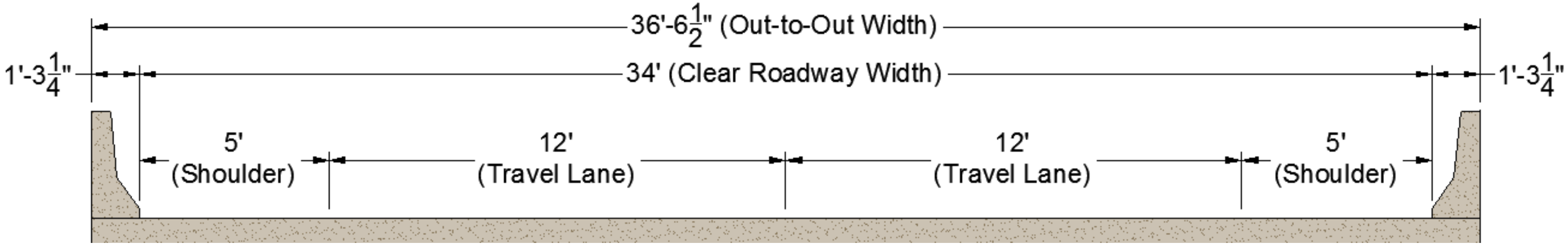
We Only Have Time to Quickly Address These Today:
More Information and Reports at ShortSpanSteelBridges.org

Traditional Fabricated Steel Bridges

Design Superstructure for Two-Lane, 80 ft 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)



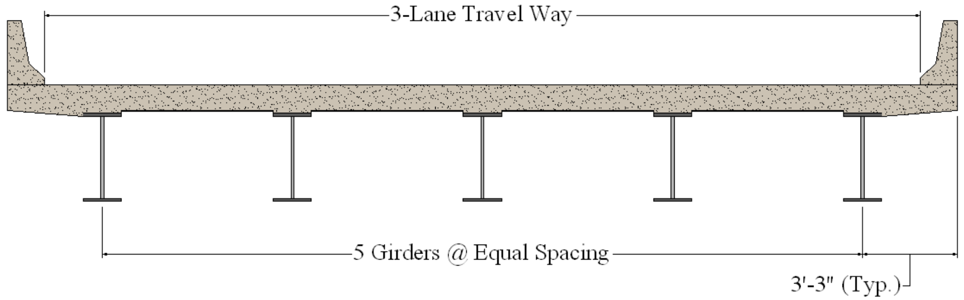
Need an Initial Design for the Bridge SuperStructure

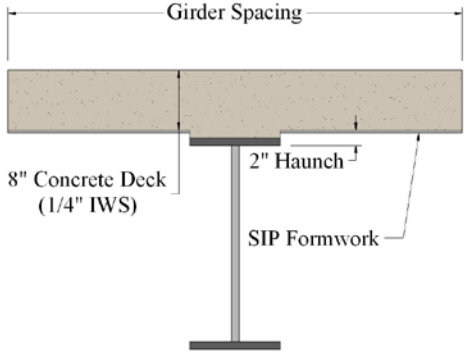
eSPAN140 - Standard Designs for Short Span Steel Bridges - www.ShortSpanSteelBridges.org

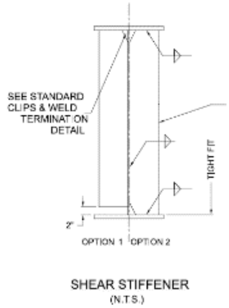
Span lengths 20 ft to 140 ft (in 5 ft increments)

Four girder spacing: 6’-0”, 7’-6”, 9’-0” and 10’-6”,

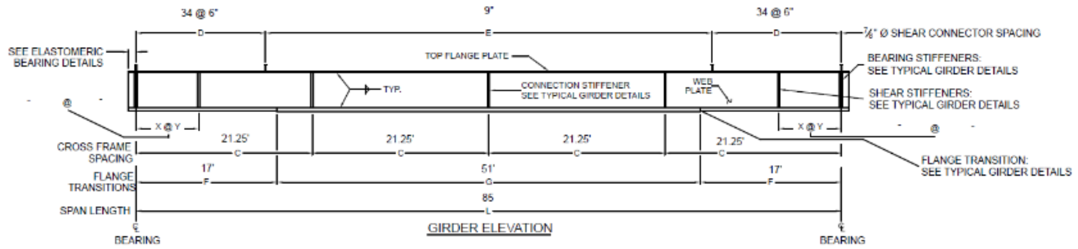
For each of these increments: Steel girders, Shear stud & stiffener layouts, Welding and fabrication details, Elastomeric bearings, and Concrete deck design

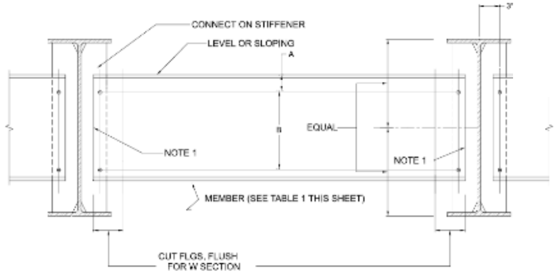






COMPOSITE PLATE GIRDER WITH PARTIALLY STIFFENED WEB - 4 GIRDERS AT 8' 10" GIRDER SPACING, HOMOGENEOUS





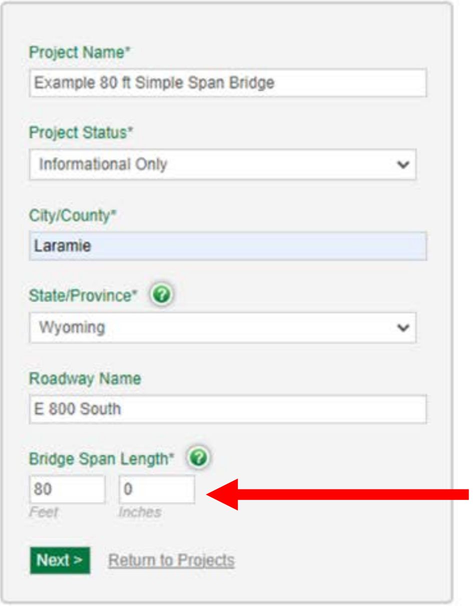
eSPAN140 Preliminary Design

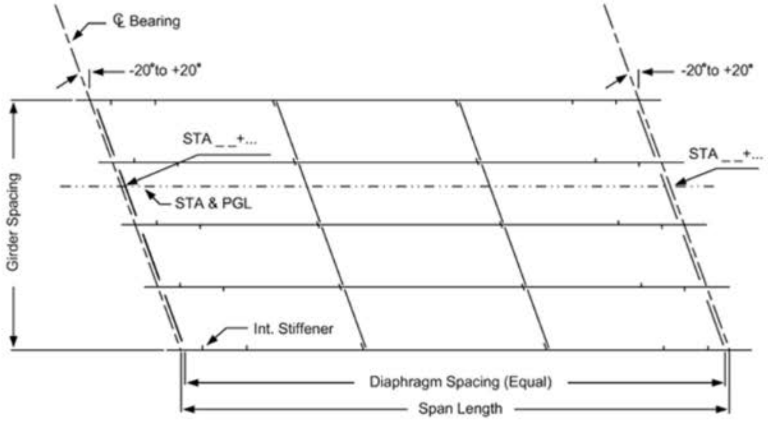
	Bridge Span Length									
Solution Type*	0'	20'	40'	60'	80'	100'	120'	140'	Skew Angle	Overhang Width
Rolled Beam (40' to 100')**									+/- 20 degrees	3'3" or less
Homogeneous Plate Girder (60' to 140')**									+/- 20 degrees	3'3" or less
Press Brake Tub Girders (0' to 80')									+/- 20 degrees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

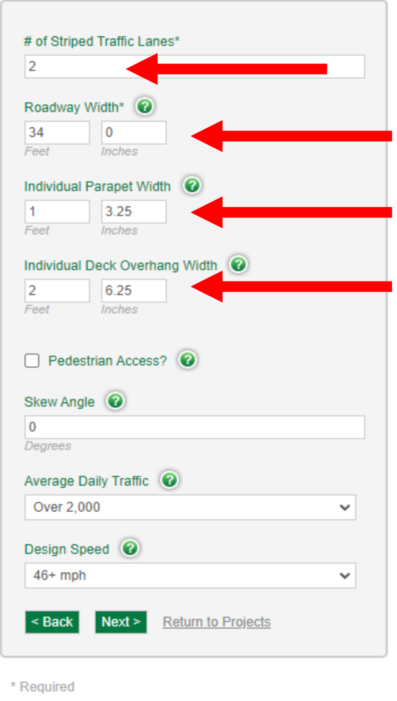
**** Can be greater if site geometry allows.

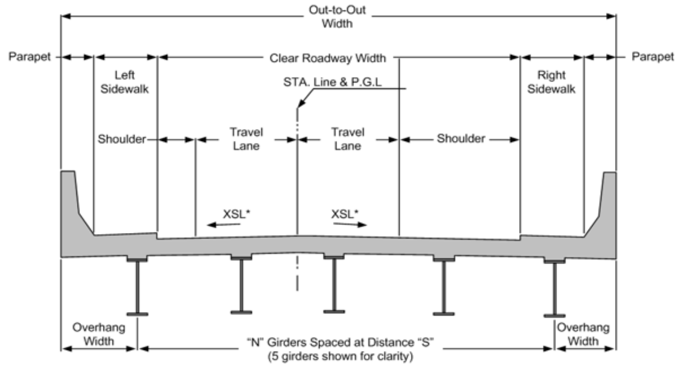
eSPAN140 Preliminary Design



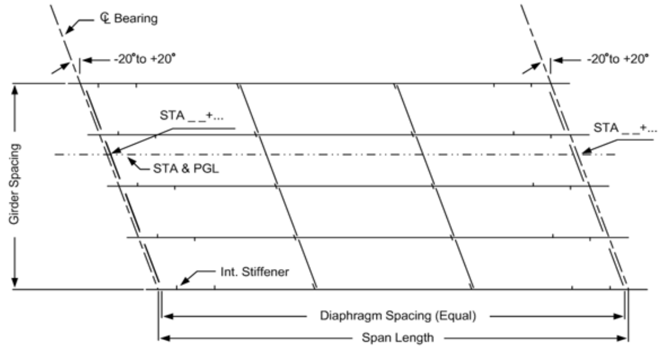


Skew Angle (Overhead View)





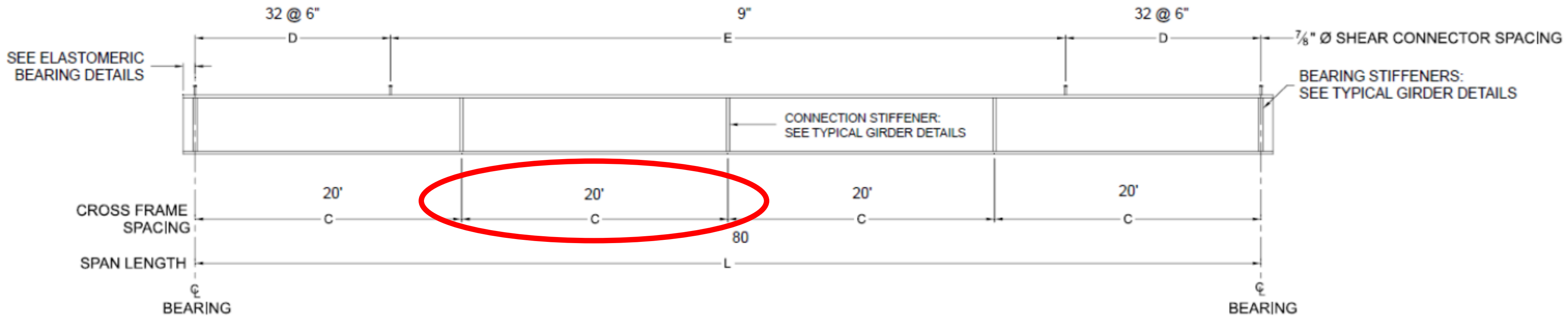
Cross-section of Bridge



Rolled Beam Recommendation

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

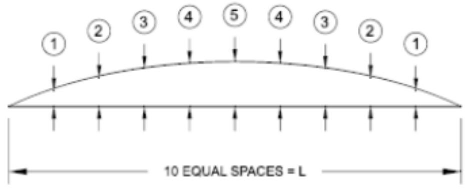
The selected rolled beam section is based on the widest (10'-6") girder spacing used in the development of the standards. The steel industry generally recommends the use of the widest girder spacing possible to reduce the potential number of girder lines for optimum economy.



BEAM ELEVATION

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

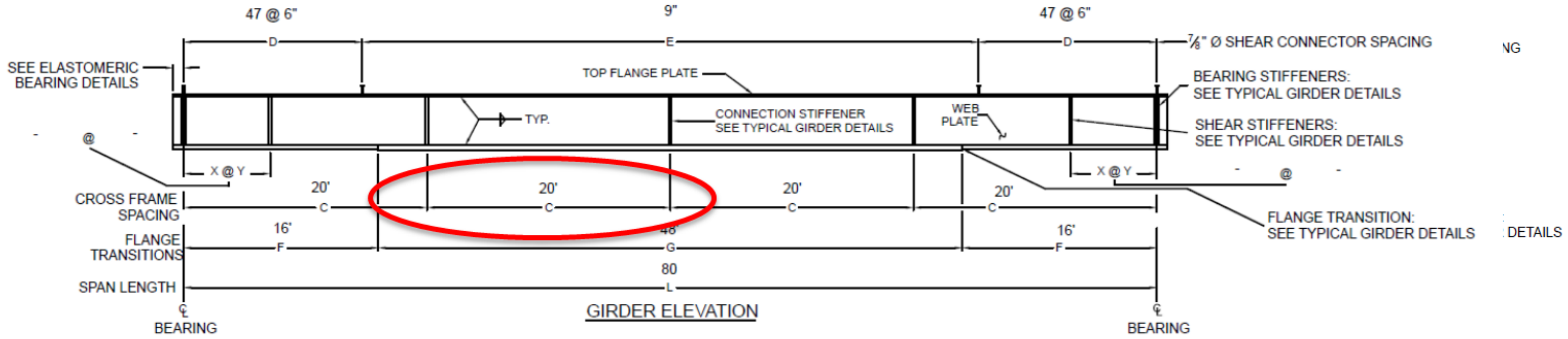
STEEL D.L. CAMBER - in					TOTAL D.L. CAMBER - in				
1	2	3	4	5	1	2	3	4	5
0.178"	0.337"	0.461"	0.540"	0.567"	1.255"	2.375"	3.250"	3.807"	3.997"



D.L. CAMBER

Plate Girder Recommendation

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

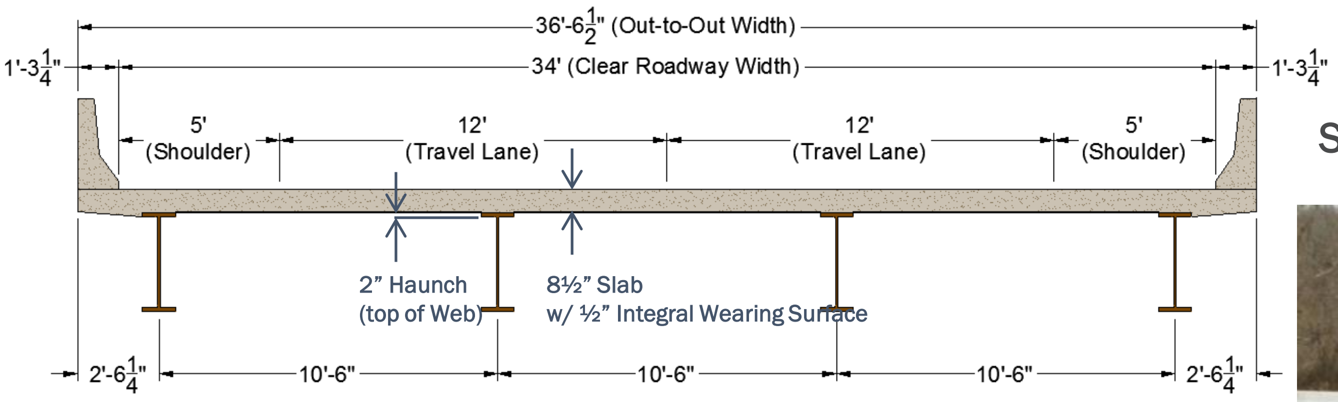


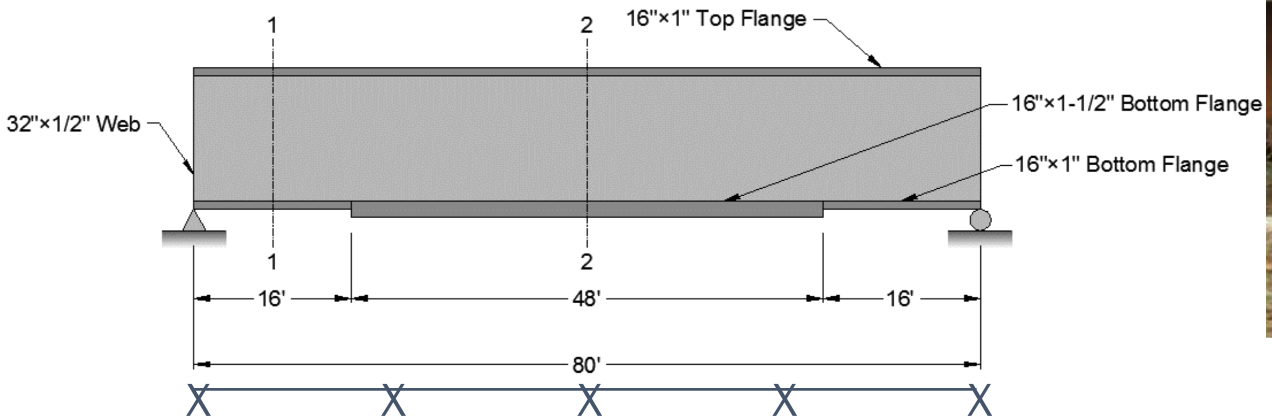
SPAN (L) - ft	PLATE GIRDER SIZE: TOP FLANGE - in	BOTTOM FLANGE (F): PLATE - in	BOTTOM FLANGE (F): LENGTH - Ft	BOTTOM FLANGE (G): PLATE - in	BOTTOM FLANGE (G): LENGTH - Ft	WEB PLATE- in	DIAPHRAGM SPACING (C) - ft	SHEAR STIFFENERS: X (NO. REQ'd)	SHEAR STIFFENERS: Y - ft. (SPACING)	SHEAR CONNECTOR MAX. SPAC-ING: D	SHEAR CONNECTOR MAX. SPAC-ING: E	INDIVIDUAL GIRDER WEIGHT
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"

D.L. CAMBER

Design for Homogeneous Plate Girder Bridge





Diaphragm Bracing at 20 ft

Superstructure Design for Two-Lane, 80 ft Simple Span Bridge

NEW Short Span Steel Bridge Alliance eBEAM140

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

eBEAM140

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

Excel Based Rolled Beam Design Software

Version 1.0 - Beta

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)

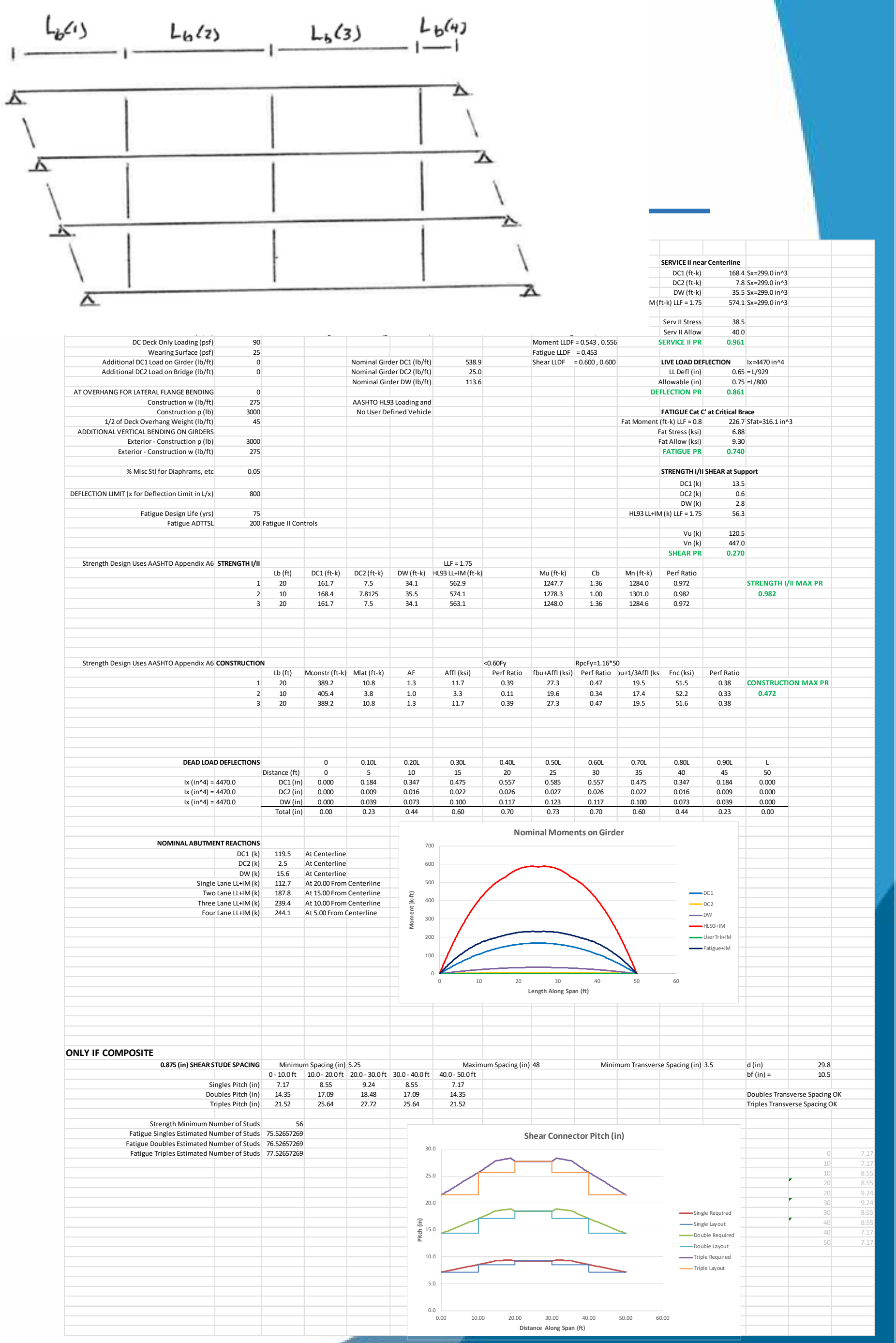
- No Additional DC1 or DC2 Loading
- No Wearing Surface
- No Construction Load (No Lateral Flange)
- Misc Steel of 5%
- 50 ksi Steel, L/D limit 30, Min d = 12
- L/800 Deflection Limit
- Compression Flange not Braced
- Use AASHTO Appendix A6
- 75 Year Design Life & $ADTT_{SL}$ = 200
  - Fatigue II – Finite Life
- No User Defined Vehicle

W36x135 Strength I PR = 0.993

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)
- User Defined Design Characteristics
- “What-If” Analysis



Design Software

Excel Based Rolled Beam Design Software

- o Allows User to Investigate Alternatives to
  - Diaphragm Spacing
  - Lightest Weight Solution
  - Other Readily Available Sections

ENTER W SECTION FOR MORE INFORMATION

W36X135		**NonComposite**			Weight (lb/ft) 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**		
'ERFORMANCE BY UNBRACED LENGTH FOR W36X135						
			Strength I/II			
Jnbraced Length	**Unbraced Length (ft)**	**Lb Range**	**PR**	**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**	

LIST OF ALL W SHAPES RANKED FROM STRENGTH I, SERVICE II & CONSTRUCTION

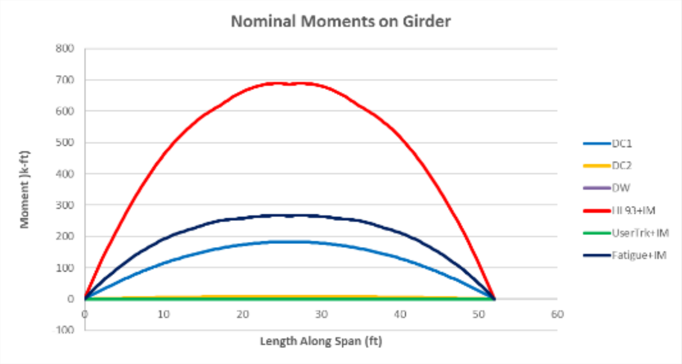
Top 20 That Meet Min Depth, Max Depth & W40 & W44 Limits

Shape	Strength I/II PR	Service II PR	Construction PR	Fatigue PR	Deflection PR	Overall PR
W36X135	**0.99**	**0.73**	**0.16**	0.60	0.76	0.99
W33X141	**0.92**	**0.71**	**0.15**	0.58	0.80	0.92
W27X146	**0.79**	**0.77**	**0.14**	0.62	1.05	1.05
W30X148	**0.95**	**0.73**	**0.16**	0.58	0.89	0.95
W40X149	**0.90**	**0.62**	**0.15**	0.51	0.61	0.90
W36X150	**0.81**	**0.64**	**0.13**	0.52	0.66	0.81
W33X152	**0.81**	**0.66**	**0.14**	0.53	0.73	0.81
W36X160	**0.73**	**0.59**	**0.12**	0.48	0.61	0.73
W27X161	**0.71**	**0.70**	**0.13**	0.55	0.94	0.94
W24X162	**0.77**	**0.78**	**0.14**	0.60	1.15	1.15
W40X167	**0.70**	**0.54**	**0.12**	0.43	0.51	0.70
W33X169	**0.69**	**0.59**	**0.12**	0.46	0.64	0.69
W36X170	**0.66**	**0.56**	**0.11**	0.44	0.57	0.66
W30X173	**0.59**	**0.60**	**0.11**	0.47	0.72	0.72
W24X176	**0.70**	**0.72**	**0.13**	0.54	1.05	1.05
W27X178	**0.63**	**0.64**	**0.12**	0.50	0.85	0.85
W36X182	**0.61**	**0.52**	**0.11**	0.41	0.53	0.61
W40X183	**0.59**	**0.48**	**0.10**	0.38	0.45	0.59
W30X191	**0.53**	**0.54**	**0.10**	0.42	0.65	0.65
W24X192	**0.63**	**0.66**	**0.12**	0.50	0.95	0.95

Design Software

Excel Based Rolled Beam Design Software

- o 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					LLF = 1.75							
		Lb (ft)	DC1 (ft-k)	DC2 (ft-k)	DW (ft-k)	HL93 LL+IM (ft-k)		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						<0.60Fy		RpcFy=1.16*50				
		Lb (ft)	Mconstr (ft-k)	Mlat (ft-k)	AF	Affl (ksi)	Perf Ratio	fbu+Affl (ksi)	Perf Ratio	ou+1/3Affl (ks	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

W36x135 Strength I PR = 0.993

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): 135

W36X135 — **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	

ERFORMANCE BY UNBRACED LENGTH FOR W36X135

nbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II PR	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): 118

W33X118 — **NonComposite**

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	

ERFORMANCE BY UNBRACED LENGTH FOR W33X118

nbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II PR	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
Deflection = L/793

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

NonComposite Bridge: W36 x 135

- What if compression flange braced: Lb = 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		
'ERFORMANCE BY UNBRACED LENGTH FOR			W36X135			
			Strength I/II			
Jnbraced Length	Unbraced Length (ft)	Lb Range	PR	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		
'ERFORMANCE BY UNBRACED LENGTH FOR			W30X116			
Compression Flange Laterally Braced for Final State			Strength I/II			
Jnbraced 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

Deflection = L/663

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/ft^2 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

W36x135 Fatigue PR = 0.961

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 Diaphrams, 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 ADTTSL	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

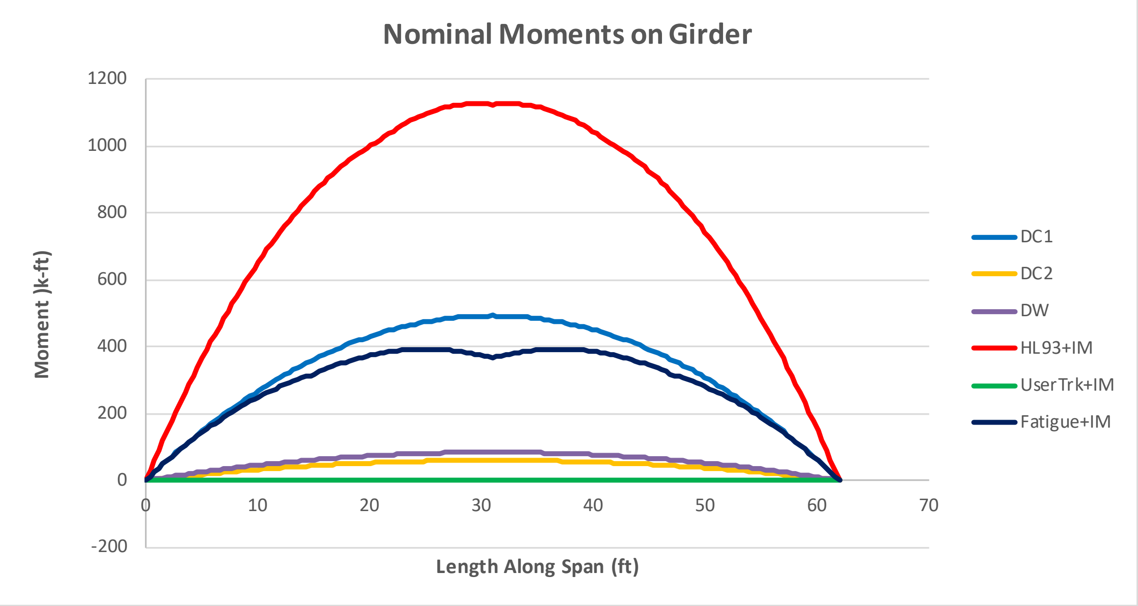
Composite Bridge

	STRENGTH I/II		Compression Flange Laterally Braced for F			LLF = 1.75								
		Lb (ft)	DC1 (ft-k)	DC2 (ft-k)	DW (ft-k)	HL93 LL+IM (ft-k)		Mu (ft-k)	Cb	Mn (ft-k)	Perf Ratio			
	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**						<0.60Fy		RpcFy=1.16*50					
		Lb (ft)	Mconstr (ft-k)	Mlat (ft-k)	AF	Affl (ksi)	Perf Ratio	fbu+Affl (ksi)	Perf Ratio	ou+1/3Affl (ks	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	
Ix (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	
I3n (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	
I3n (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

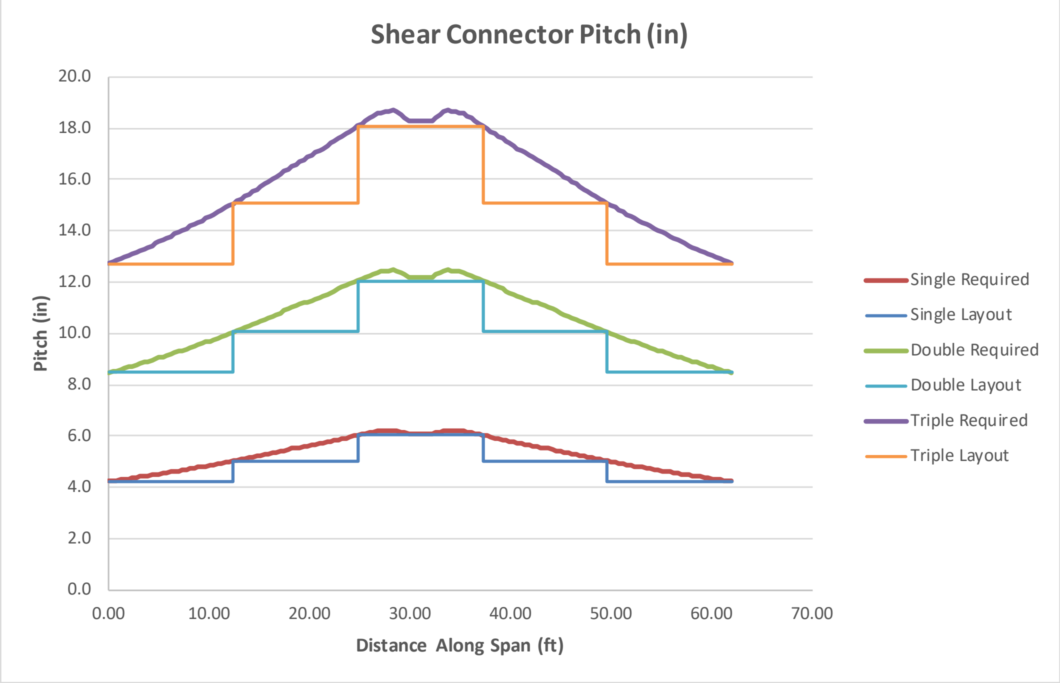


Demonstration: 62 ft Span, 8" Deck w/SIP, 4 Girders @ 9 ft

Composite Bridge – Shear Studs

ONLY IF COMPOSITE

0.875 (in) SHEAR STUDE SPACING	Minimum Spacing (in)	3.5			Maximum Spacing (in)	48		Minimum Transverse Spacing (in)	3.5		d (in)	35.6
	0 - 12.4 ft	12.4 - 24.8 ft	24.8 - 37.2 ft	37.2 - 49.6 ft	49.6 - 62.0 ft						bf (in) =	12
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						Doubles Transverse Spacing	
Triples Pitch (in)	12.70	15.08	18.08	15.08	12.70						Triples Transverse Spacing (	
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											



0
12.4
12.4
24.8
24.8
37.2
37.2
49.6
49.6
62

eBEAM140 Summary

Rolled Shape Bridge Design: Composite & NonComposite

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

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

Plate Girder Bridge Design in 2026

SOON Short Span Steel Bridge Alliance ePLATE140

Noncomposite and Composite Simple-Span Plate-Girder Steel Bridge Design

ePLATE140

Excel Based Rolled Beam Design Software

Version 1.0 - Beta

SIMILAR

eBEAM140 Disclaimer: *This document has been pr… accordance with information available to the American Iron and Steel Institu… Short Span Steel Bridge Alliance (SSSBA) program, at the time of … s believed to reasonably reflect the present state of knowledg… ot been prepared for conventional use as an enginee… and should not be used or relied upon for any specific … t professional examination and verification of its accuracy, … ity by a licensed engineer, architect or other professional. AISI and … any liability arising from information provided by others or from the unauth… the information contained in this document, and do not accept any obligation t… supplements or corrections in the event of errors being discovered or advances being … ade in the techniques discussed in the document.*

ePLATE140 Design Software - 2026

Excel Based Rolled Beam Design Software

- Allows User to Investigate Alternatives to
  - Diaphragm Spacing
  - Lightest Weight Solution
  - Other Readily Available Flanges & Webs

Target L/D:

- Target L/D – 2”
- Target L/D
- Target L/D + 2”
- Target L/D + 4”
- Target L/D + 6””

5100 possible design combinations for 5 different Web Depths

User Specified Solution

ENTER SECTION FOR MORE INFORMATION

bfc	tfc	D	tw	bft	tft	Weight (lb/ft)	Total Wt (tons)
13.00	0.750	38.00	0.500	17.00	0.750	141	22.6

bfc>=D/6 OK
bfc/2tfc<=12 OK
D/tw<=150 OK
2Dcp/tw<=lrw OK
Iyc/Iyt>=0.3 OK

Meets Reqrments for A6?
Yes
Construction Uses A6

OVERALL PERFORMANCE FOR TF:13 x 0.75 Web:38 x 0.5 BF:17 x 0.75

Strength I/II PR	Service II PR	Construction PR	Fatigue PR	Deflection PR	Overall PR
0.917	0.973	0.933	0.703	0.807	0.973
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Service II
3		2		L/992	

PERFORMANCE BY UNBRACED LENGTH FOR TF:13 x 0.75 Web:38 x 0.5 BF:17 x 0.75

Compression Flange Laterally Braced for Final State — Strength I/II

Unbraced Length	Unbraced Length (ft)	Lb Range	PR	Mn/My	Cb
1	20	0 - 20 ft	0.703	1.995	1.509
2	20	20 - 40 ft	0.917	1.995	1.052
3	20	40 - 60 ft	0.917	1.995	1.052
4	20	60 - 80 ft	0.703	1.995	1.509

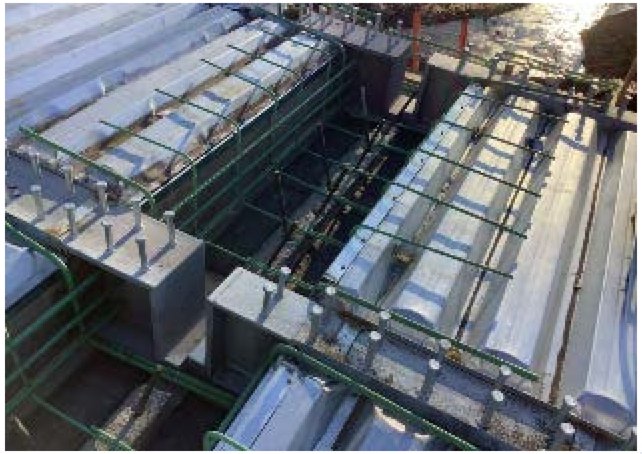
LIST OF GIRDERS RANKED FROM STRENGTH I, SERVICE II & CONSTRUCTION

Shape	Strength I/II PR	Service II PR	Construction PR	Fatigue PR	Deflection PR	Overall PR	Total Wt (tons)
TF:13 x 0.75 Web:38 x 0.5 BF:17 x 0.75	0.92	0.97	0.93	0.70	0.81	0.97	22.6
TF:13 x 0.75 Web:38 x 0.5 BF:13 x 1	0.91	0.97	0.93	0.69	0.80	0.97	22.7
TF:14 x 0.75 Web:36 x 0.5 BF:18 x 0.75	0.95	0.99	0.87	0.72	0.87	0.99	22.9
TF:13 x 0.75 Web:38 x 0.5 BF:18 x 0.75	0.89	0.94	0.93	0.68	0.78	0.94	23.0
TF:14 x 0.75 Web:38 x 0.5 BF:17 x 0.75	0.92	0.97	0.81	0.70	0.81	0.97	23.0
TF:14 x 0.75 Web:34 x 0.5 BF:15 x 1	0.97	0.99	0.93	0.71	0.91	0.99	23.1
TF:14 x 0.75 Web:36 x 0.5 BF:14 x 1	0.94	0.97	0.86	0.70	0.85	0.97	23.1
TF:15 x 0.75 Web:36 x 0.5 BF:18 x 0.75	0.95	0.99	0.78	0.72	0.87	0.99	23.3
TF:13 x 0.75 Web:38 x 0.5 BF:14 x 1	0.88	0.92	0.92	0.66	0.76	0.92	23.3
TF:14 x 0.75 Web:38 x 0.5 BF:18 x 0.75	0.89	0.94	0.81	0.68	0.78	0.94	23.4
TF:15 x 0.75 Web:38 x 0.5 BF:17 x 0.75	0.92	0.97	0.73	0.70	0.81	0.97	23.4
TF:15 x 0.75 Web:34 x 0.5 BF:15 x 1	0.97	0.99	0.83	0.71	0.91	0.99	23.5
TF:14 x 0.75 Web:34 x 0.5 BF:16 x 1	0.94	0.94	0.93	0.68	0.87	0.94	23.7
TF:12 x 1 Web:36 x 0.5 BF:18 x 0.75	0.95	0.99	0.88	0.72	0.87	0.99	23.7
TF:14 x 0.75 Web:36 x 0.5 BF:15 x 1	0.91	0.93	0.86	0.67	0.81	0.93	23.7
TF:16 x 0.75 Web:36 x 0.5 BF:18 x 0.75	0.96	0.99	0.72	0.72	0.87	0.99	23.7
TF:14 x 0.75 Web:38 x 0.5 BF:14 x 1	0.88	0.92	0.80	0.66	0.76	0.92	23.7

Other Innovative Systems
Simple for Dead, Continuous for Life (SDCL)

- Multi-span bridges using simple span wide flange beams, with simple details, made continuous when the deck is cast






Advantages for SDCL

- Ease of construction
- Eliminates the use of traditional field splices
- Flexible & economical span ratios
- Customize beams to the spans
- Simple details make steel fabrication much more competitive
  - Certified Bridge Fabricator – Simple Bridge (SBR)
  - ~~Certified Bridge Fabricator – Intermediate Bridge (IBR)~~
  - ~~Certified Bridge Fabricator – Advanced Bridge (ABR)~~
- Beam Weights
  - Steel W18x158 @ 60' = 9480 lbs. Concrete MoDOT P/S Type 3 @ 60' = 23,869 lbs.
- Shallower depth superstructure (Approach Work Savings, Hydraulics Opening)
  - Steel W18x158 @ 60' Depth = 19.7" Concrete MoDOT Type 3 @ 60' Depth = 39"

Manufacturer Solutions






Prefabricated & ABC Steel Bridges

Showcase of 3 Different Steel Bridges

Bridge Case Studies

- Buried Steel Bridge – Big R
- Modular Beam Bridge - Contech
- Press-Brake Tub Girder – Valmont

The 5 C's

Cost
Convenience
Construction (ABC)
County Built
Carbon Footprint

Prefabricated Bridges
Accelerated Bridge Construction
County Built

Buried Steel Bridge - Corrugated Steel Plate – Contractor Built

VT Route 2B Bridge Replacement, St. Johnsbury, VT

Contractor: JP Sicard

Fabricator: Big R Bridge

28 day max. trail closure / 50 day road closure for all work

Greeley, CO

BIG R BRIDGE

47'11" span x 26'9" rise Arch

Buried Steel Bridge - Corrugated Steel Plate

Buried Steel Bridge - Corrugated Steel Plate

VT Route 2B Bridge Replacement, St. Johnsbury, VT

Corrugated Steel Buried Bridges

Craig, AK
Built by Tribal Workforce

Case Studies - Buried Steel Bridge

CONTECH ENGINEERED SOLUTIONS
West Chester, OH

Contractor & County Built - Innovative Foundations - Fish Passage - No Deck Joints

Corrugated Steel Animal Overpass Reduces Wildlife-Vehicle Collisions

Buried Steel Bridge Saves $500,000 and Three Months Versus Concrete Option

Pre-Fabricated Modular Beam – County Crew Built

Seltice-Warner Bridge, White Road, Whitman County, WA

Fabricator:	BigR/Contech Engineered Solutions
Contractor:	Whitman County Crew
Design Engineer:	Mark Storey, County Engineer

CONTECH ENGINEERED SOLUTIONS

Existing Structure – 30 ft Span, 20 ft Wide

- Wood with Wood Piles & Wood Backwalls
- Wood Deterioration & Susceptibility to Scour

Replacement Structure Requirements

- Increase Hydraulic opening – 30 ft Channel
- Raise Clearance for 100 yr Flood
- Gravel Roadway
- Piles with Alluvium Soils / Scouring

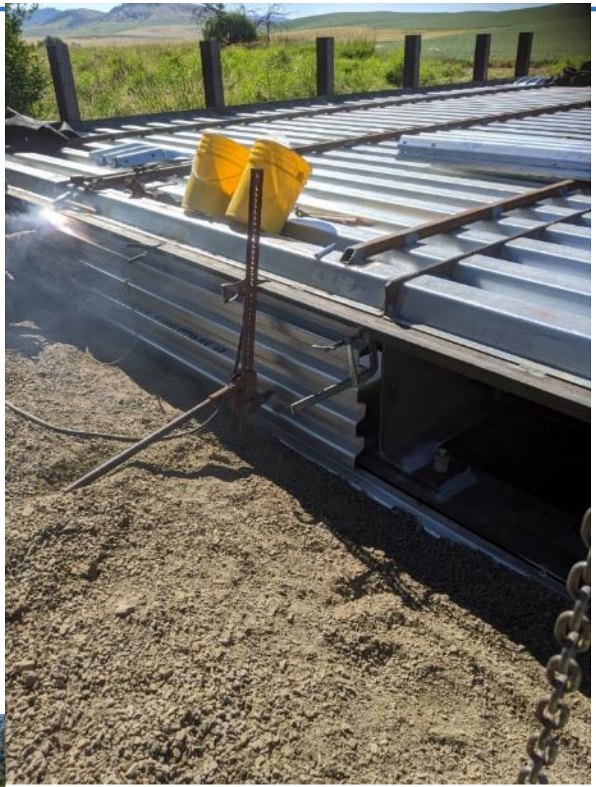
Pre-Fabricated Modular Beam

Bridge Structure

- 35 ft Span x 28 ft Wide
- 2-Girder Modules / 3 Modules
- Shipped on One Truck
- Fully-Assembled
- CSD & Gravel
- Simple Connections

Pre-Fabricated Modular Beam

SuperStructure Erection



Pre-Fabricated Modular Beam

Timing

Excavation, Stream Restoration & Bridge Installation ~ 4 Weeks

Costs

Steel Superstructure	$	**59,000**
Labor & Equipment	$	70,000
Pile Foundations	$	20,000
Permitting	$	10,000
Total	$159,000	
	$ 162.25 / ft^2	

Concrete Superstructure Alternative $ **82,000**

Case Studies Modular Beams

Minneapolis, MN

Sevier River Bridge. Axtell, UT

Fabricator: Wheeler Bridge
Contractor: Gerber Construction

75 ft long, 28 ft wide Modular Rolled Beam

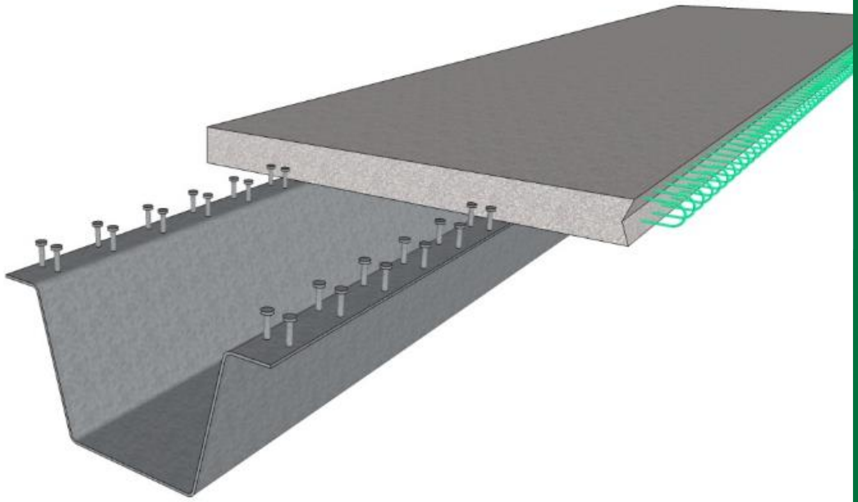
Schoepps Valley Road, Waumandee, WI

Fabricator: **Wheeler**
Contractor: **JF Brennan**

Three-Simple-Span (3 x 48 ft) with 24 ft Roadway
Emergency Replacement During Winter Months

Press-Brake-Formed Steel Tub Girders

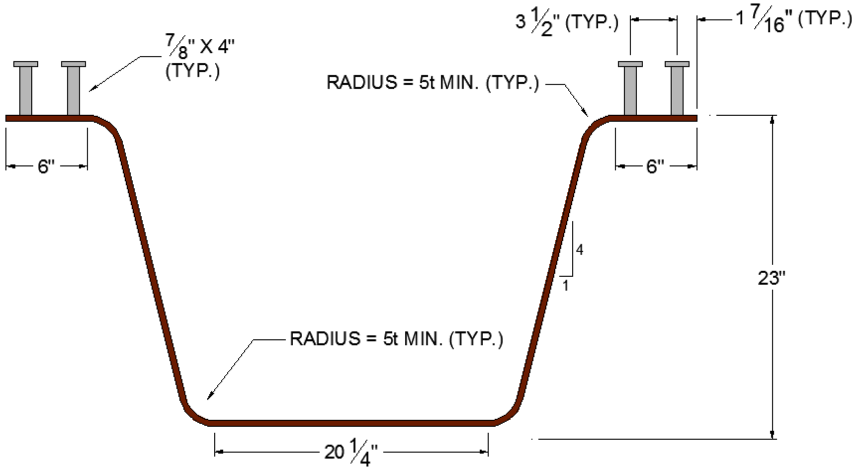
- Modular shallow trapezoidal boxes fabricated from cold-bent structural steel plate
  - o Weathering steel or galvanized.
- Reduction in fabrication costs due to cold-bending versus welding of the section and mass production.
- Reduces need for stiffeners and cross frames.
- Advantages include:
  - o Accelerated with precast deck (install in 1 or 2 days)
  - o Modular
  - o Simple to fabricate and install

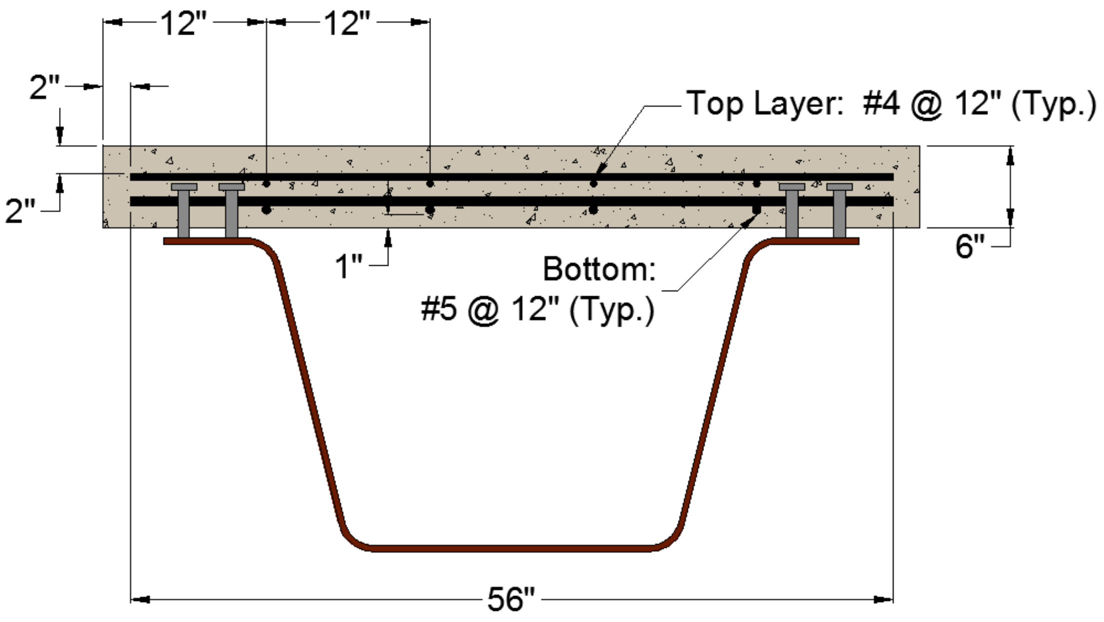


Research Started in 2012
First PBTG Bridge Built in 2015

Experimental Testing & Analytical Modeling

- Testing was conducted on composite, noncomposite, and modular flexural specimens:
  - o 84” × 7/16” PL



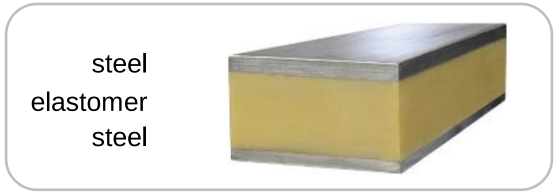


PBFTG Applications

- *Amish Sawmill Bridge (Buchanan County, IA)*
  - $350,000 from FHWA IBRD Program to replace the Amish Sawmill Bridge in Fairbank, Iowa.
  - Construction began in the late summer of 2015 and was completed in December 2015
  - From concept to implementation in under three years.

PBFTG Applications (cont'd)

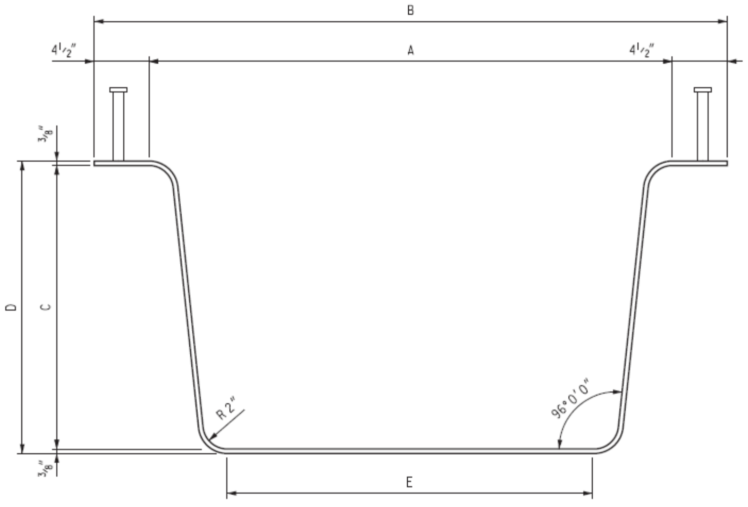
- *Muskingum County, OH*
  - PBFTG combined with SPS deck system.
    - Led to extremely shallow superstructure.
    - Served a significant advantage for hydraulic opening
  - Winner of NSBA 2018 Innovative Bridge Award



2018 Technological Advancement Award Winner!

SPS TECHNOLOGY

Valmont U-Beams



PBFTG STANDARD TUB GIRDER CROSS SECTION

Designation	A	B	C	D	E
U12x89	43"	52"	11 1/4"	12"	32 5/8"
U18x104	43"	52"	17 1/4"	18"	31 3/8"
U24x117	43"	52"	23 1/4"	24"	30 1/8"
U30x131	43"	52"	29 1/4"	30"	28 7/8"
U33x141	45"	54"	32 1/4"	33"	30 1/4"

PBFTG Applications (cont’d)

- *Additional Applications*

Monroe County, MI

Boone County, MI

Spring Gully, TX

AASHTO 2021 Innovation Initiative

AASHTO
AASHTO INNOVATION INITIATIVE

Impediments to PBTG Implementation

- Skewed Capacity
- Fatigue Performance
- Live Load Deflections
- *Live Load Distribution Factors*
    - *Interior Girder*
    - *Exterior Girder*
- *Continuous Spans*

Press-Brake Tub Girder – Contractor Built

Barron County, WS

Fabricator: Valmont
Contractor: Larson Construction

Existing Structure

3-Span Timber Slab
96 ft Length
Deterioration and Deficient

Replacement Structure Requirements

Two Span
104 ft Length
Increased Hydraulic Opening and Clearance

Press-Brake Tub Girder – Contractor Built

valmont

Press-Brake Tub Girder – Contractor Built

Press-Brake Tub Girder

Other Finishing Fabrication

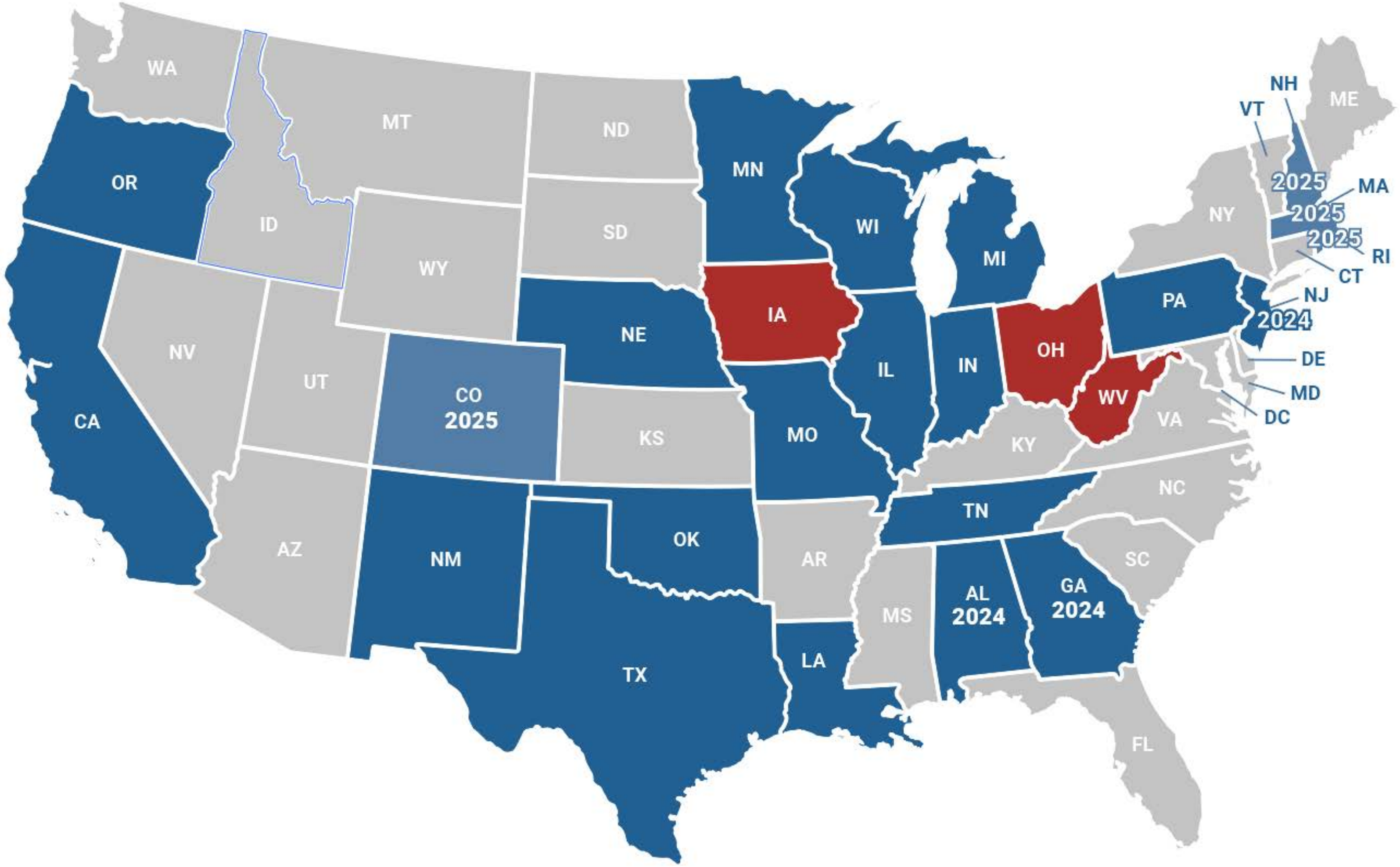
Pre-Decked - Composite

- PBTGs Pre-Decked
- Closure Pours
- CIP Curbs

Field Assembly - Composite

- PBTGs no Deck
- Precast Deck Panels
- Grouted Shear Pockets
- Closure Pours
- CIP Curbs

PBTG Installations



- **Alabama - 2024**
- **California**
- **Colorado - 2025**
- **Georgia - 2024**
- Illinois
- Indiana
- **Iowa**
- Louisiana
- **Massachusetts - 2025**
- Michigan
- Minnesota
- Missouri
- Nebraska
- **New Hampshire - 2025**
- **New Jersey - 2024**
- **New Mexico**
- **Ohio**
- Oklahoma
- Oregon
- Pennsylvania
- **Rhode Island - 2025**
- Tennessee
- Texas
- **West Virginia**
- Wisconsin

- Manitoba, Can.
- Saskatchewan, Can.

Summary: Today’s Steel Bridges

State of the Art & Innovative Designs

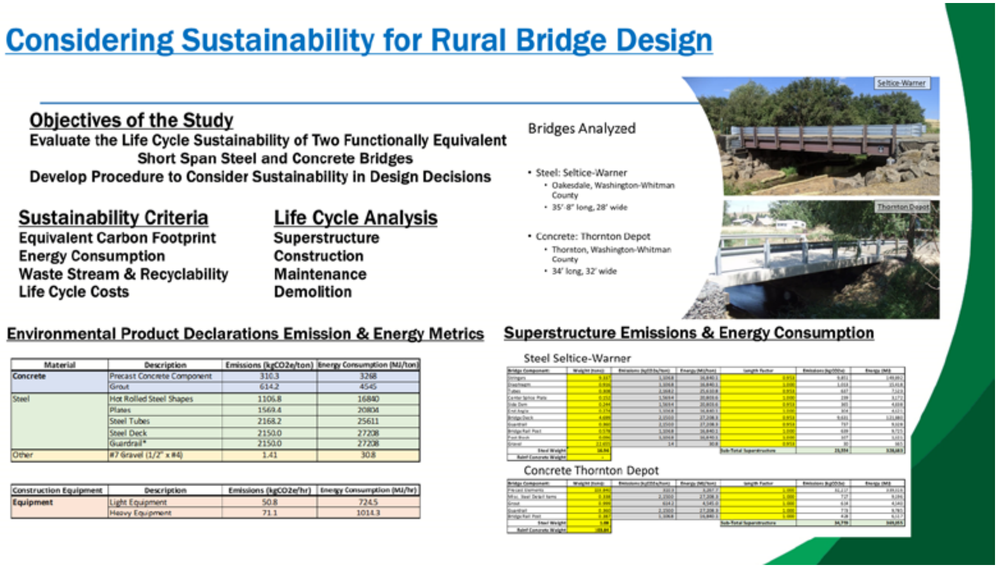
Durable

Speed of Construction – Accelerated Bridge Construction

Cost Effectiveness

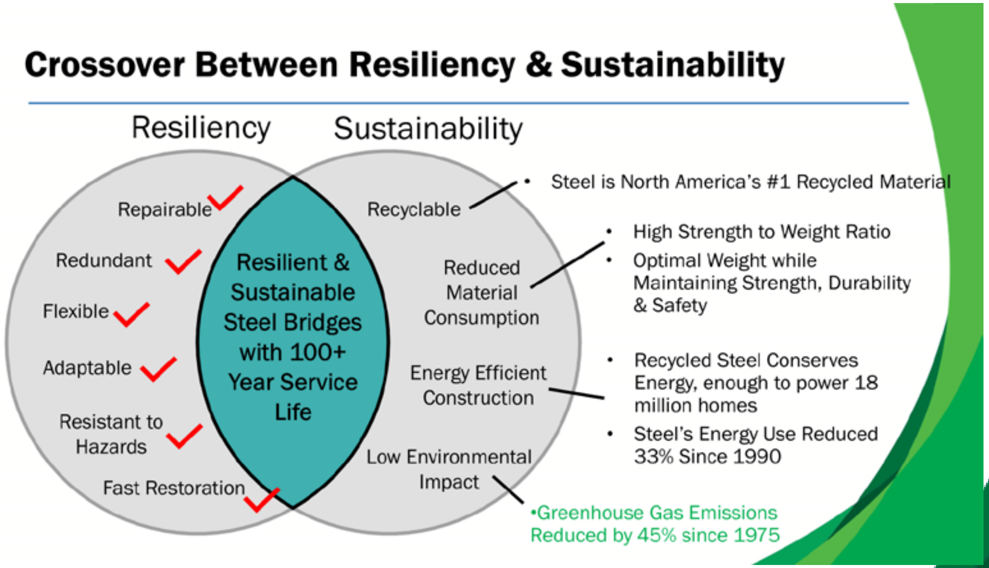
Sustainability

Resiliency



Material	Description	Emissions (kgCO2e/ton)	Energy Consumption (MJ/ton)
Concrete	Precast Concrete Component	310.3	3268
	Grout	614.2	4545
Steel	Hot Rolled Steel Shapes	1106.8	16840
	Plates	1569.4	20804
	Steel Tubes	2168.2	25611
	Steel Deck	2150.0	27208
	Guardrail*	2150.0	27208
Other	#7 Gravel (1/2" x #4)	1.41	30.8

Construction Equipment	Description	Emissions (kgCO2e/hr)	Energy Consumption (MJ/hr)
Equipment	Light Equipment	50.8	724.5
	Heavy Equipment	71.1	1014.3



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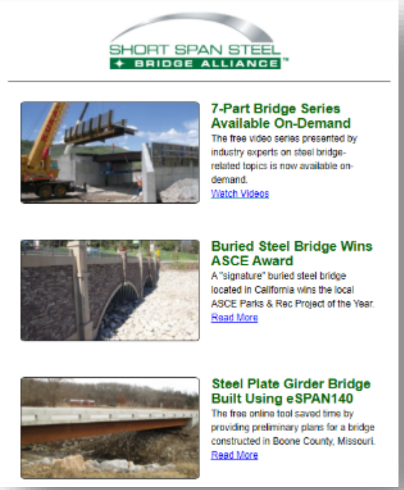
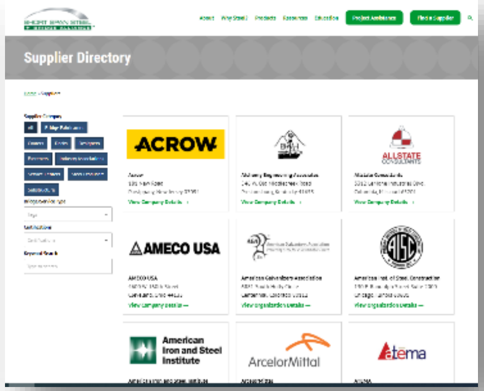
5 Ways to Keep Learning About Steel Bridges

1. Subscribe to the Weekly Newsletter



2. Find a Supplier



3. Design a Bridge in 5-Minutes

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4. Receive Free Project Assistance

5. Schedule a Workshop/Webinar

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Questions? Dan Snyder, Director, SSSBA, dsnyder@steel.org, (301) 367-6179

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