



# Steel Bridges: Beyond the Textbook

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**Webinar 4: Simplifying Short Span Steel  
Bridge Design and Construction, with a  
Contractors Perspective  
June 18, 2026**

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University of Wyoming  
SSSBA, Director of Education

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VP, Beaty Construction



# Short Span Steel Bridge Alliance

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ESTABLISHED  
2007

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**.

# 115 Members



To join, contact Dan Snyder, Director, SSSBA, [dsnyder@steel.org](mailto:dsnyder@steel.org), (301) 367-6179

# SSSBA Supports All Steel Solutions

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## Buried Bridges



## Rolled Beam & Plate Girders



## Press-Brake-Formed Tub Girders



## Truss Bridges



# What Do We Provide?

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- Education
  - Workshops, Webinars, Newsletter
- Technical Resources
  - Standards, best practices, case studies
- Simple Design Tools (eSPAN140, eBEAM140)
- Project Assistance
- Find a Supplier
- Networking / SSSBA Semiannual Meeting



# SSSBA Education – The 5 Cs

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## Cost

Case Studies  
Cost Studies  
Life Cycle Costs  
Economical & Practical Design

## Convenience

eSPAN140, eBEAM140 & ePLATE140  
Standard Designs  
State Standards  
Design Software

## Construction

Accelerated Bridge Construction  
Case Studies / Manufacturer Solutions  
Equipment

## County Built

DIY County Bridges  
Case Studies

## Carbon – CO<sub>2</sub>e

Sustainability of Rural Bridges

# Design of Steel Bridges

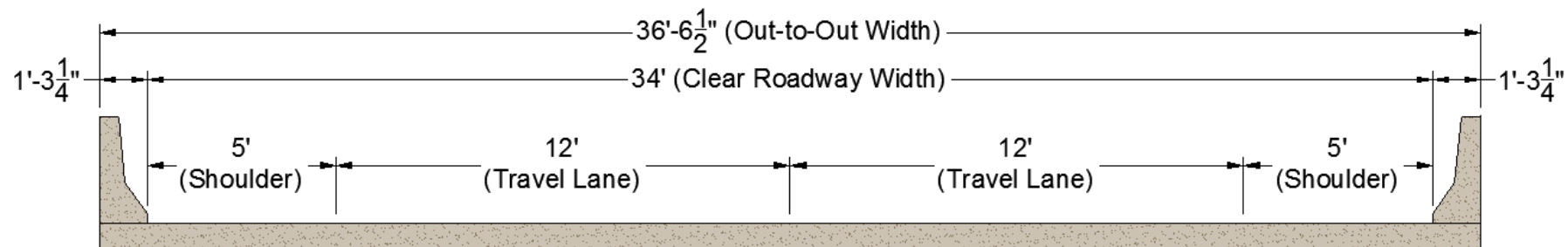
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Design Superstructure for Two-Lane, 80 ft Simple Span Bridge



# 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)



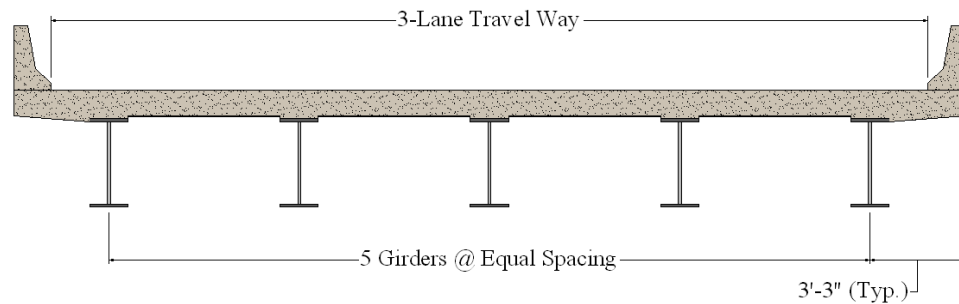
Need an Initial Design for the Bridge SuperStructure

# eSPAN140 - Standard Designs for Short Span Steel Bridges - [www.ShortSpanSteelBridges.org](http://www.ShortSpanSteelBridges.org)

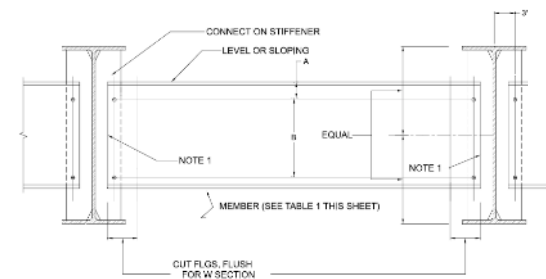
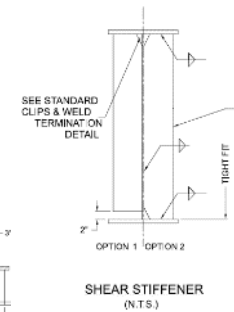
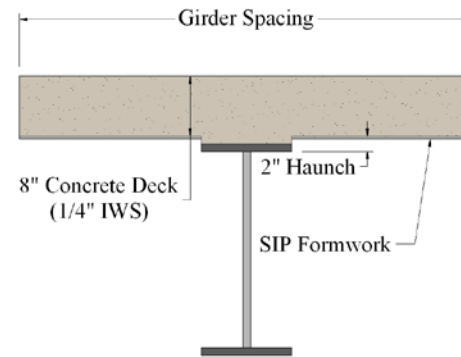
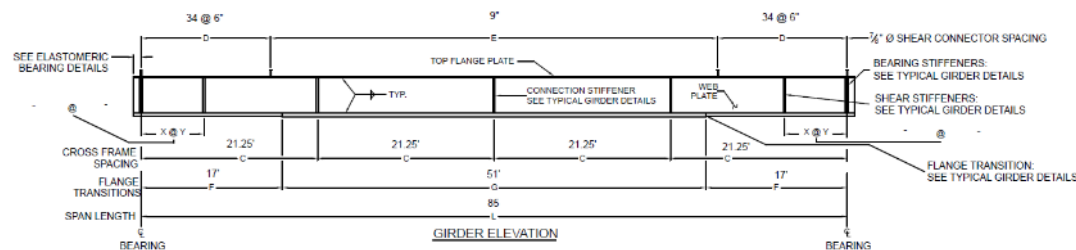
Span lengths 20 ft to 140 ft (in 5 ft increments)

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

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.

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

# eSPAN140 Preliminary Design

Project Name\*  
 Example 80 ft Simple Span Bridge

Project Status\*  
 Informational Only

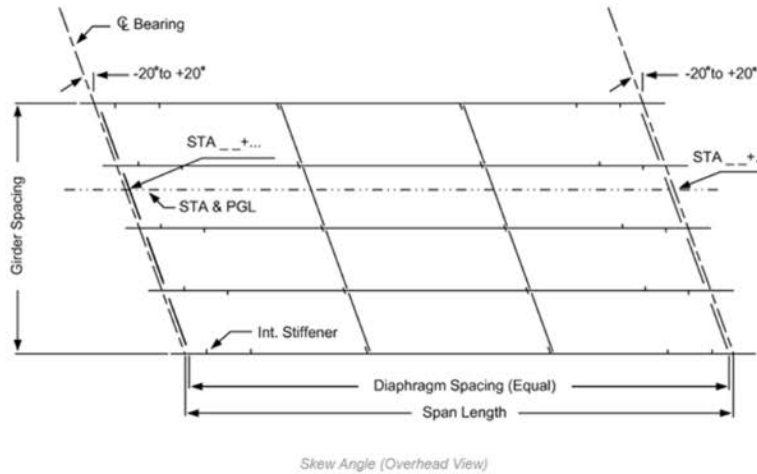
City/County\*  
 Laramie

State/Province\*  
 Wyoming

Roadway Name  
 E 800 South

Bridge Span Length\*  
 80 Feet 0 Inches

[Next >](#) [Return to Projects](#)



# of Striped Traffic Lanes\*  
 2

Roadway Width\*  
 34 Feet 0 Inches

Individual Parapet Width\*  
 1 Foot 3.25 Inches

Individual Deck Overhang Width\*  
 2 Feet 6.25 Inches

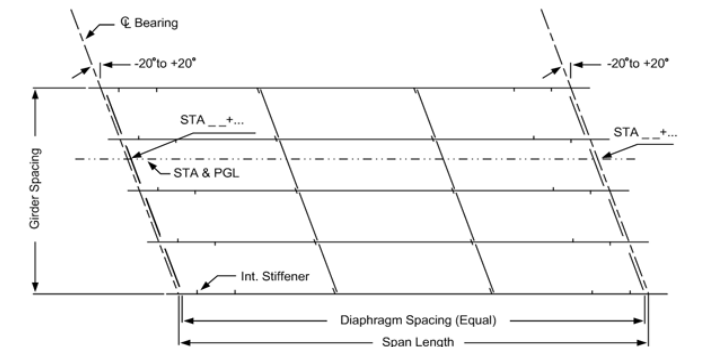
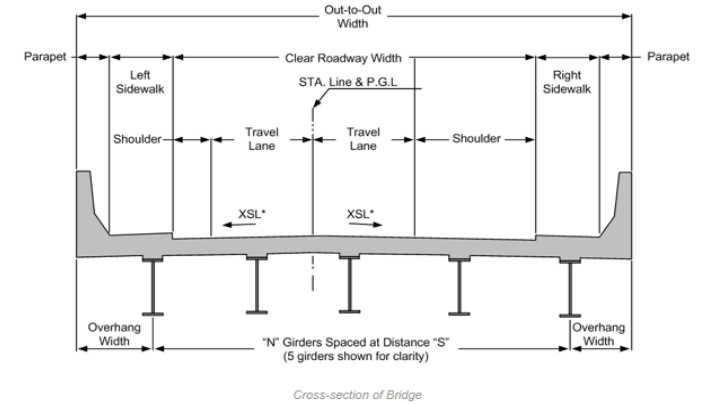
Pedestrian Access?

Skew Angle  
 0 Degrees

Average Daily Traffic  
 Over 2,000

Design Speed  
 46+ mph

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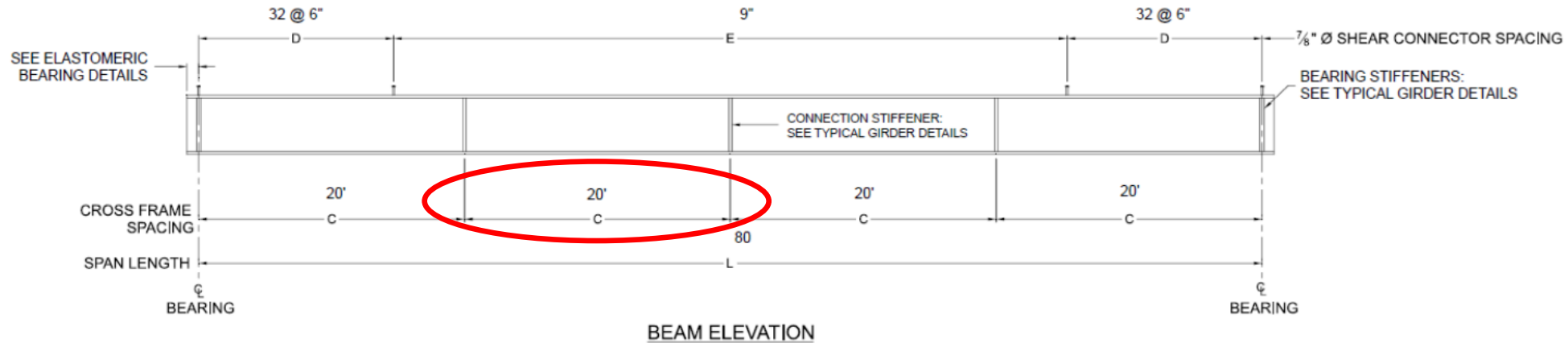


\* Required

# Rolled Beam Recommendation

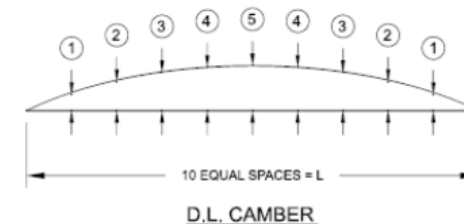
## COMPOSITE ROLLED BEAM WITH PARTIALLY STIFFENED WEB - 4 GIRDERS AT 10' 6" GIRDER SPACING, LIGHTEST WEIGHT

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.



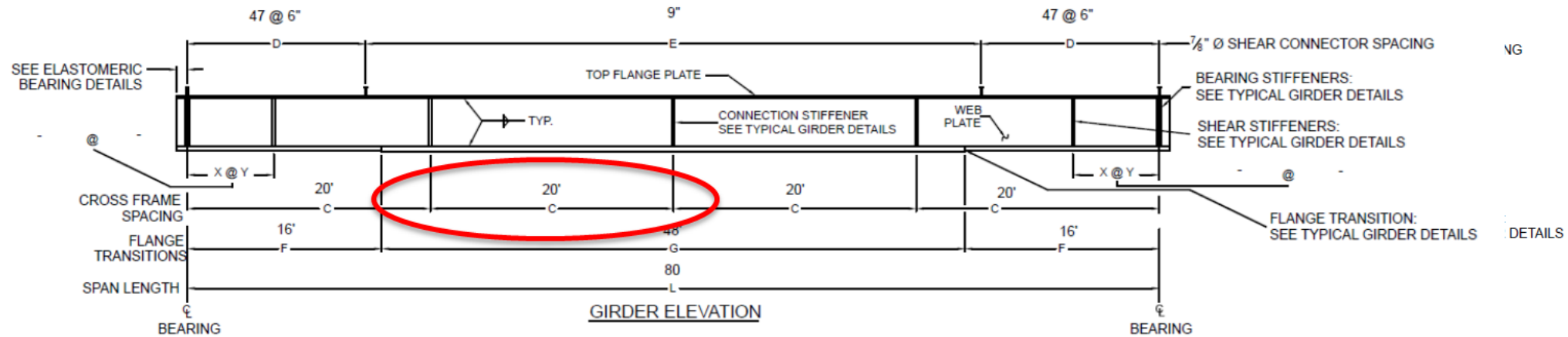
SPAN (L) - ft	ROLLED BEAM	DIAPHRAGM SPACING (C) ft	SHEAR CONNECTOR MAX. SPACING		WEIGHT
			D	E	
80	W36x210	20'	32 @ 6"	9"	16,800 lbs

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"



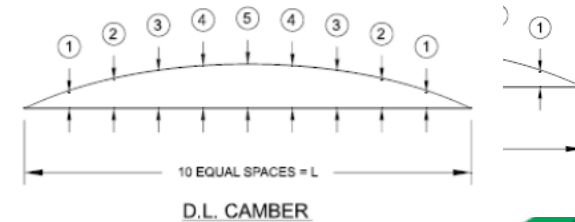
# Plate Girder Recommendation

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

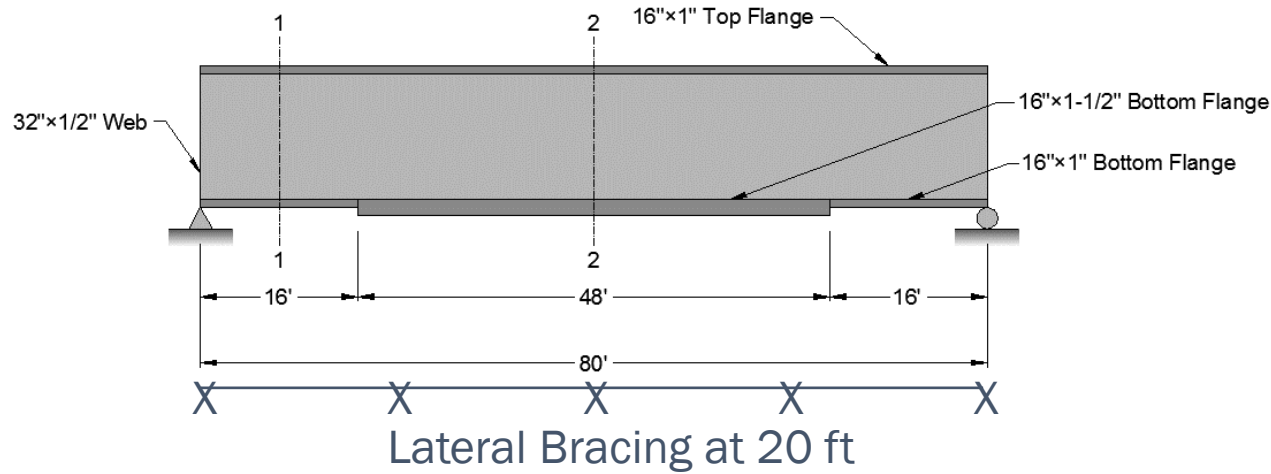
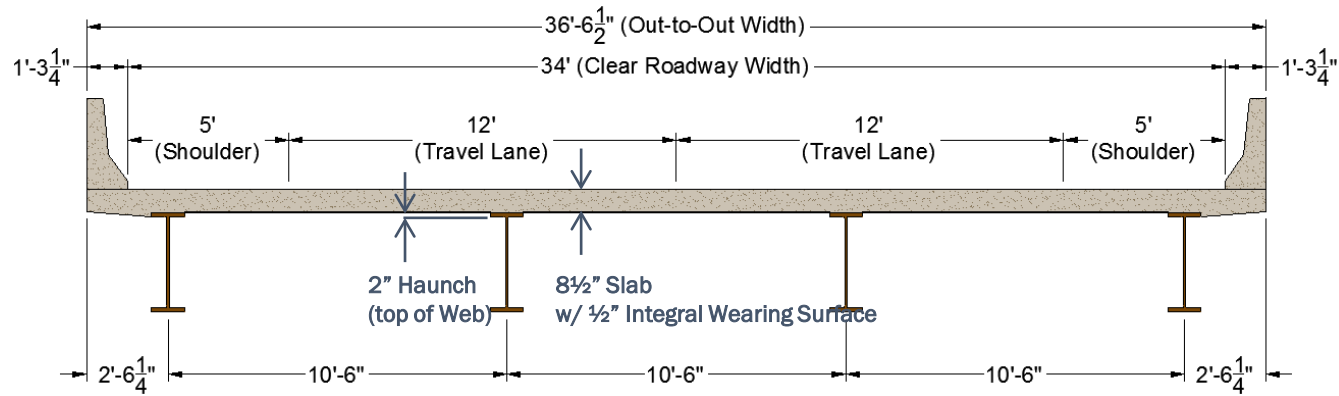


SPAN (L) - ft	PLATE GIRDER SIZE						DIAPHRAGM SPACING (C) - ft	SHEAR STIFFENERS		SHEAR CONNECTOR MAX. SPACING		INDIVIDUAL GIRDER WEIGHT	GIRDER WEIGHT
	TOP FLANGE - in	BOTTOM FLANGE (F)		BOTTOM FLANGE (G)		WEB PLATE - in		X (NO. REQ'd)	Y - ft. (SPACING)	D	E		
		PLATE - in	LENGTH - Ft	PLATE - in	LENGTH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



# Design for Homogeneous Plate Girder Bridge



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



# eSPAN140 Summary

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## Composite Rolled Beam and Plate Girder Designs

1000's of Designs Performed

Has Worked Well

What's Next?

Update to AASHTO 10<sup>th</sup> Edition

Adding NonComposite Bridges

Including Additional Solution Options

Release TBD



Gets You in the BallPark

# **NEW** Short Span Steel Bridge Alliance eBEAM140

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



Excel Based Rolled Beam Design Software  
Version 1.0 - Beta

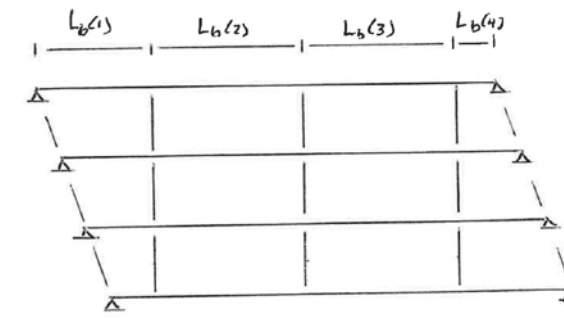
<https://www.shortspansteelbridges.org/ebeam140/>

*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.*

# 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



SERVICE II near Centerline									
DC1 (ft-k)	108.4	5x=209.0	in*3						
DC2 (ft-k)	7.8	5x=209.0	in*3						
DW (ft-k)	35.5	5x=209.0	in*3						
M (ft-k) LRF=1.75	574.5	5x=209.0	in*3						
Shear II Stress	58.5								
Serv II Allow	40.0								
SERVICE II PR 0.961									
Fatigue LDF = 0.653									
Nominal Girder DC1 (ft-k)									
Nominal Girder DC2 (ft-k)									
Nominal Girder DW (ft-k)									
MOMENT LDF = 0.543, 0.556									
Fatigue LDF = 0.653									
Shear LDF = 0.600, 0.600									
LIVE LOAD DEFLECTION									
LL Defl (in)									
Allowable (in)									
DEFLECTION PR 0.861									
FATIGUE CR C at Critical Brace									
Fat Moment (ft-k) LRF = 0.8									
Fat Stress (ksi)									
Fat Allow (ksi)									
FATIGUE PR 0.740									
STRENGTH V/S SHEAR at Support									
DC1 (k)									
DC2 (k)									
DW (k)									
HL93 LL+M (k) LRF = 1.75									
Vu (k)									
Vn (k)									
SHEAR PR 0.270									
Strength Design Uses AASHTO Appendix A6 STRENGTH V/S									
LRF = 1.75									
Mu (ft-k)									
Cb									
Mn (ft-k)									
Perf Ratio									
STRENGTH V/S MAX PR 0.982									
Strength Design Uses AASHTO Appendix A6 CONSTRUCTION									
d<0.075									
Spd<1.15750									
Lf (ft)									
Mconstr (ft-k)									
Mint (ft-k)									
AF									
Aftt (ksi)									
Perf Ratio									
fba+4ftt (ksi)									
Perf Ratio									
fba+4ftt (ksi)									
Perf Ratio									
Fnc (ksi)									
Perf Ratio									
CONSTRUCTION MAX PR 0.472									
DEAD LOAD DEFLECTIONS									
Distance (ft)									
Ia (in^4) = 4470.0									
DC1 (in)									
DC2 (in)									
DW (in)									
Total (in)									
NOMINAL ABUTMENT REACTIONS									
DC1 (k)									
DC2 (k)									
DW (k)									
Single Lane LL+M (k)									
Two Lane LL+M (k)									
Three Lane LL+M (k)									
Four Lane LL+M (k)									
Nominal Moments on Girder									
Length Along Span (ft)									
Moment (ft-k)									
DC1									
DC2									
DW									
User's BM									
Fatigue-M									
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)									
2d (in)									
Singles Pitch (in)									
Doubles Pitch (in)									
Triples Pitch (in)									
Strength Minimum Number of Studs									
Fatigue Singles Estimated Number of Studs									
Fatigue Doubles Estimated Number of Studs									
Fatigue Triples Estimated Number of Studs									
Shear Connector Pitch (in)									
Single Required									
Single Layout									
Double Required									
Double Layout									
Triple Required									
Triple Layout									

# Design Software

## Excel Based Rolled Beam Design Software

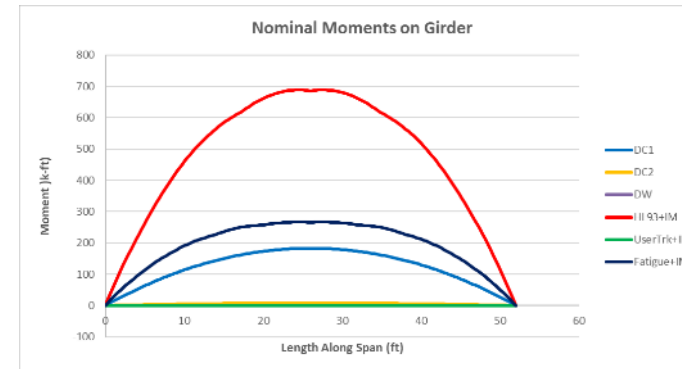
- Allows User to Investigate Alternatives to
  - Diaphragm Spacing
  - Lightest Weight Solution
  - Other Readily Available Sections

ENTER W SECTION FOR MORE INFORMATION						LIST OF ALL W SHAPES RANKED FROM STRENGTH I, SERVICE II & CONSTRUCTION						
						Top 20 That Meet Min Depth, Max Depth & W40 & W44 Limits						
W36X135 NonComposite						Weight (lb/ft) 135						
<b>OVERALL PERFORMANCE FOR W36X135</b>						Shape	Strength I/II	Service II	Construction	Fatigue	Deflection	Overall
Strength I/II	Service II	Construction	Fatigue	Deflection	Overall	W36X135	0.99	0.73	0.16	0.60	0.76	0.99
PR	PR	PR	PR	PR	PR	W33X141	0.92	0.71	0.15	0.58	0.80	0.92
0.993	0.727	0.161	0.599	0.763	0.993	W27X146	0.79	0.77	0.14	0.62	1.05	1.05
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Strength I/II	W30X148	0.95	0.73	0.16	0.58	0.89	0.95
1		1		L/1049		W40X149	0.90	0.62	0.15	0.51	0.61	0.90
<b>PERFORMANCE BY UNBRACED LENGTH FOR W36X135</b>						W36X150	0.81	0.64	0.13	0.52	0.66	0.81
Unbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II	Mn/My	Cb	W33X152	0.81	0.66	0.14	0.53	0.73	0.81
1	26	0 - 26 ft	0.993	0.778	1.255	W36X160	0.73	0.59	0.12	0.48	0.61	0.73
2	26	26 - 52 ft	0.993	0.778	1.256	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

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

Strength Design Uses AASHTO Appendix A6	<b>STRENGTH I/II</b>					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			<b>STRENGTH I/II MAX PR</b>
	2	26	183.1	8.45	0.0	670.5		1412.9	1.26	1423.3	0.993			<b>0.993</b>

Strength Design Uses AASHTO Appendix A6	<b>CONSTRUCTION</b>						<0.60Fy		RpcFy=1.16*50					
		Lb (ft)	Mconstr (ft-k)	Mlat (ft-k)	AF	Affl (ksi)	Perf Ratio	fbu+Affl (ksi)	Perf Ratio	fbu+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		<b>CONSTRUCTION MAX PR</b>
	2	26	228.9	0.0	1.0	0.0	0.00	6.3	0.13	6.3	38.9	0.16		<b>0.161</b>

<b>NOMINAL ABUTMENT REACTIONS</b>			
	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

# eBEAM140 Summary

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## Rolled Shape Bridge Design: Composite & NonComposite

- User Manual & Examples
- Released on [www.ShortSpanSteelBridges.org](http://www.ShortSpanSteelBridges.org) September 2025

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



Optimized Rolled-Shape Design

# SOON Short Span Steel Bridge Alliance ePLATE140

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

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 Short Span Steel Bridge Alliance (SSSBA) program, at the time of preparation. It is believed to reasonably reflect the present state of knowledge and should not be used or relied upon for any specific application without the professional examination and verification of its accuracy, approval, and seal by a licensed engineer, architect or other professional. AISI and SSSBA assume no liability arising from information provided by others or from their use of the information contained in this document, and do not accept any responsibility to issue supplements or corrections in the event of errors being discovered or advances being made in the techniques discussed in the document.*

**SIMILAR**

# ePLATE140 Design Software - 2026

## Excel Based Plate Girder 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						Weight (lb/ft)	LIST OF GIRDERS RANKED FROM STRENGTH I, SERVICE II & CONSTRUCTION														
bfc	tfc	D	tw	bft	tft		Total Wt (tons)	Shape	Strength I/II	Service II	Construction	Fatigue	Deflection	Overall	Total Wt						
OVERALL PERFORMANCE FOR TF:13 x 0.75 Web:38 x 0.5 BF:17 x 0.75						141	22.6								PR	PR	PR	PR	PR	PR	(tons)
bfc>=D/6 OK										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				
bfc/2tfc<=12 OK								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						
D/tw<=150 OK								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						
2Dcp/tw<=lrw OK								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						
lyc/lyt>=0.3 OK								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						
Meets Reqrments for A6?								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						
Yes								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						
Construction Uses A6								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						
PERFORMANCE BY UNBRACED LENGTH FOR TF:13 x 0.75 Web:38 x 0.5 BF:17 x 0.75								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						
Compression Flange Laterally Braced for Final State								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						
Unbraced Length	Unbraced Length (ft)	Lb Range	Strength I/II	Mn/My	Cb			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						
1	20	0 - 20 ft	0.703	1.995	1.509			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						
2	20	20 - 40 ft	0.917	1.995	1.052			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						
3	20	40 - 60 ft	0.917	1.995	1.052			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						
4	20	60 - 80 ft	0.703	1.995	1.509																

# ePLATE140 Plans

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Plate Girder Bridge Design: Composite & NonComposite

AASHTO 10<sup>th</sup> Edition

Develop Users Manual & Examples

Industry Review

Release Sept 2026



Optimized Plate Girder Design

# Example Bridge Designs – SSSBA Plate Girder Study

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## Study: Economical Mid-Range (60 ft – 100 ft) Simple Span Bridges

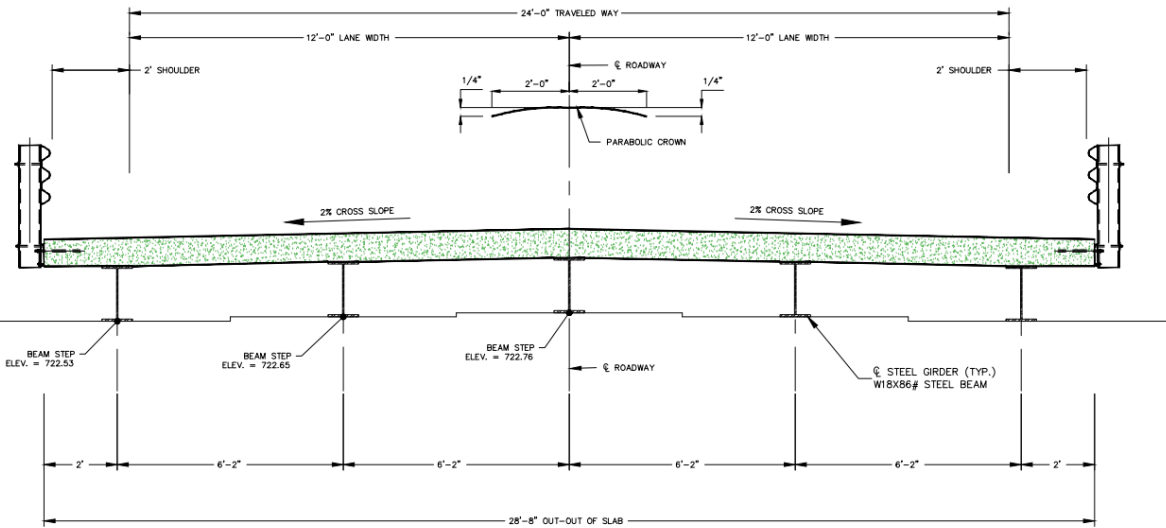
- Two Cross Sections from Actual Bridges
- Three Lengths: 70, 80 & 90 ft
- Optimized Solutions from eBEAM140 and ePLATE140
- Fabricated Costs from DeLong's

The logo for eBEAM140, featuring a grey arch above the text "eBEAM140" in a bold, sans-serif font.



The logo for ePLATE140, featuring a grey arch above the text "ePLATE140" in a bold, sans-serif font.

# 70 ft Simple Span: Lockhart Bridge Section

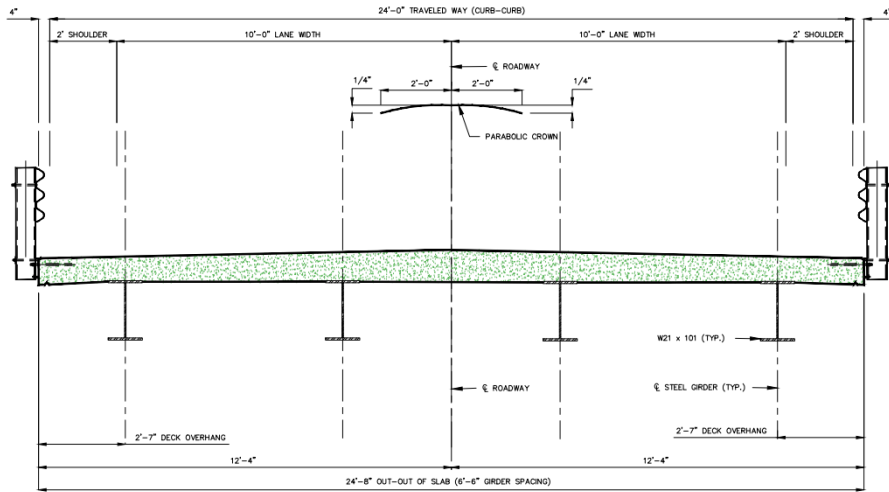


44.8 tons	Yield Strength (ksi)	50	Bridge Width (ft)	28.67	Consider W40 & W44 Beams?	Yes
	Bridge Length (ft)	70	Roadway Width (ft)	28.00	L/D Limited to	30
	Girder Spacing (ft)	6.1667	Shoulders (ft) each side - Double for One Sided	2.00	Minimum Depth Beam (in)	W12
	Number of Girders	5	2 Striped Lanes and 2 Design Lanes		Maximum Depth Beam (in)	W44
Overhang (32.4% of Girder Spacing) (ft)		2	Composite Design	8 in Structural Deck with No SIP Forms		
Barrier Width (ft)		0.3333	AASHTO HL93 Loading and No User Defined Vehicle		Compression Flange Laterally Braced for Final State	
Barrier Load on Girder (lb/ft)		25			Unbraced Length #	Lb
DC Deck Only Loading (psf)		106.25	Strength Design Uses AASHTO Appendix A6		1	23.33
Wearing Surface (psf)		25	Fatigue Design Life (yrs)	75	2	23.33
Additional DC1 Load on Girder (lb/ft)		0	Fatigue ADTT <sub>SL</sub>	200 Fatigue II Controls	3	23.33
Additional DC2 Load on Bridge (lb/ft)		0	Limit States Checked			Cb
			Strength I & II			1.43
AT OVERHANG FOR LATERAL FLANGE BENDING			Service II			
Construction w (lb/ft)	275		Constructability			
Construction p (lb)	3000		Fatigue			
1/2 of Deck Overhang Weight (lb/ft)	106.25		Deflection			
ADDITIONAL VERTICAL BENDING ON GIRDERS						
Exterior - Construction p (lb)	3000					
Exterior - Construction w (lb/ft)	275					
% Misc Stl for Diaphragms, etc	0%					
DEFLECTION LIMIT (x for Deflection Limit in L/x)	800					

- W Shape                      28.0 tons                      W36 x 160
- Plate Girder                      22.0 tons                      TF16x<sup>3</sup>/<sub>4</sub> ; W26x<sup>1</sup>/<sub>2</sub> ; BF16x<sup>3</sup>/<sub>4</sub>

Plate Girder **12000 lbs** less than W36x160

# 80 ft Simple Span: Hendricks Bridge Section



TYPICAL BRIDGE CROSS SECTION

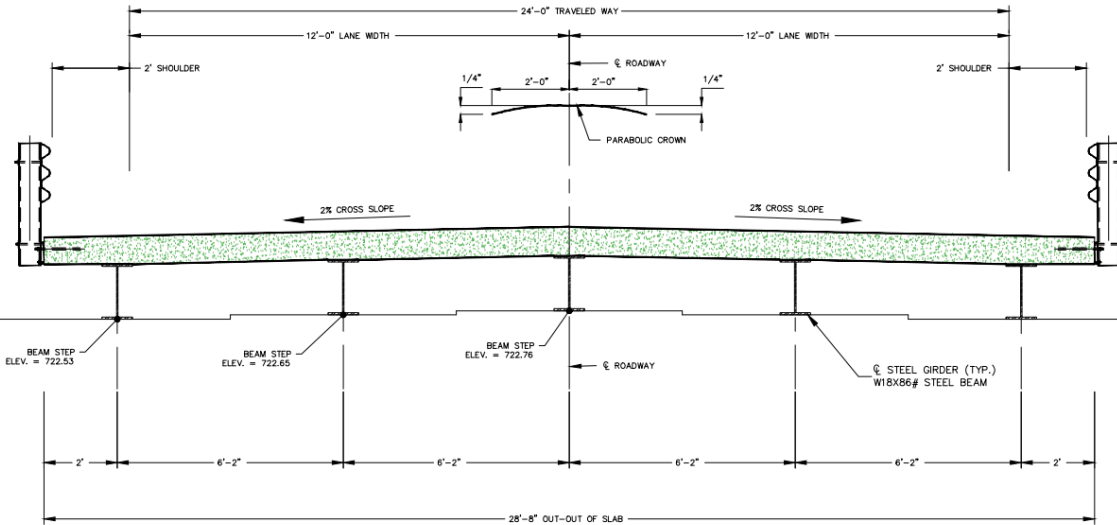
Yield Strength (ksi)	50	Bridge Width (ft)	24.67	Consider W40 & W44 Beams?	Yes
Bridge Length (ft)	80	Roadway Width (ft)	24.00	L/D Limited to	30
Girder Spacing (ft)	6.5	Shoulders (ft) each side - Double for One Sided	0.00	Minimum Depth Beam (in)	W12
Number of Girders	4	2 Striped Lanes and 2 Design Lanes		Maximum Depth Beam (in)	W44
Overhang (39.7% of Girder Spacing) (ft)	2.5833	Composite Design	8 in Structural Deck with No SIP Forms		
Barrier Width (ft)	0.3333	AASHTO HL93 Loading and No User Defined Vehicle		Compression Flange Laterally Braced for Final State	
Barrier Load on Girder (lb/ft)	25			Unbraced Length #	
DC Deck Only Loading (psf)	106.25	Strength Design Uses AASHTO Appendix A6		1	20.00
Wearing Surface (psf)	25	Fatigue Design Life (yrs)	75	2	20.00
Additional DC1 Load on Girder (lb/ft)	0	Fatigue ADTT <sub>SL</sub>	200 Fatigue II Controls	3	20.00
Additional DC2 Load on Bridge (lb/ft)	0			4	20.00
		Limit States Checked			
AT OVERHANG FOR LATERAL FLANGE BENDING		Strength I & II			
Construction w (lb/ft)	275	Service II			
Construction p (lb)	3000	Constructability			
1/2 of Deck Overhang Weight (lb/ft)	137.2378	Fatigue			
ADDITIONAL VERTICAL BENDING ON GIRDERS		Deflection			
Exterior - Construction p (lb)	3000				
Exterior - Construction w (lb/ft)	275				
% Misc Stl for Diaphragms, etc	0%				
DEFLECTION LIMIT (x for Deflection Limit in L/x)	800				7

- W Shape 26.7 tons W40 x 167
- W Shape 27.2 tons W36 x 170
- Plate Girder 21.8 tons TF14x<sup>3</sup>/<sub>4</sub> ; W38x<sup>1</sup>/<sub>2</sub> ; BF14x<sup>3</sup>/<sub>4</sub>

Plate Girder **9800 lbs** less than W40x167

Plate Girder **10800 lbs** less than W36x170

# 90 ft Simple Span: Lockhart Bridge Section



Yield Strength (ksi)	50	Bridge Width (ft)	28.67	Consider W40 & W44 Beams?	Yes
Bridge Length (ft)	90	Roadway Width (ft)	28.00	L/D Limited to	30
Girder Spacing (ft)	6.1667	Shoulders (ft) eachside - Double for One Sided	2.00	Minimum Depth Beam (in)	W12
Number of Girders	5	2 Striped Lanes and 2 Design Lanes		Maximum Depth Beam (in)	W44
Overhang (32.4% of Girder Spacing) (ft)	2	Composite Design	8 in Structural Deck with No SIP Forms		
Barrier Width (ft)	0.3333	AASHTO HL93 Loading and No User Defined Vehicle		Compression Flange Laterally Braced for Final State	
Barrier Load on Girder (lb/ft)	25			Unbraced Length #	Lb Cb
DC Deck Only Loading (psf)	106.25	Strength Design Uses AASHTO Appendix A6		1	22.50 1.51
Wearing Surface (psf)	25	Fatigue Design Life (yrs)	75	2	22.50 1.05
Additional DC1 Load on Girder (lb/ft)	0	Fatigue ADTT <sub>0</sub>	200	3	22.50 1.05
Additional DC2 Load on Bridge (lb/ft)	0	Fatigue II Controls		4	22.50 1.51
<b>AT OVERHANG FOR LATERAL FLANGE BENDING</b>					
Construction w (lb/ft)	275	Limit States Checked			
Construction p (lb)	3000	Strength I & II			
1/2 of Deck Overhang Weight (lb/ft)	106.25	Service II			
<b>ADDITIONAL VERTICAL BENDING ON GIRDERS</b>					
Exterior - Construction p (lb)	3000	Constructability			
Exterior - Construction w (lb/ft)	275	Fatigue			
% Misc Sd for Diaphragms, etc	0%	Deflection			
DEFLECTION LIMIT (x for Deflection Limit in L/x)	800			7	

- W Shape 44.8 tons W40 x 199
- W Shape 47.3 tons W36 x 210
- Plate Girder 32.3 tons TF15x<sup>3</sup>/<sub>4</sub> ; W38x<sup>1</sup>/<sub>2</sub> ; BF16x<sup>3</sup>/<sub>4</sub>

Plate Girder 25000 lbs less than W40x199

Plate Girder 30000 lbs less than W36x210



# Estimated Costs for Fabricated Girders

Although fabricated plate girders require more shop labor (e.g., welding), they often offer (1) weight savings and better fit-up, (2) easier cambering, and (3) more refined detailing, which can offset some of the added fabrication effort.

Description	PG or W	Tonnage	Budgetary Price	% Diff (From Lowest)
70' Lockhart	PG	22.0		-
70' Lockhart	W36	28.0		9.5%
80' Hendricks	PG	21.8		-
80' Hendricks	W40	26.7		10.6%
80' Hendricks	W36	27.2		4.6%
90' Lockhart	PG	32.3		-
90' Lockhart	W40	44.8		25.9%
90' Lockhart	W36	47.3		22.7%

## Two Initial Observations

Plate Girder Less Cost than W Shapes (Fabrication costs offset by weight savings)

Premium on W40 makes W40 Shapes less Economical (Less weight, but more cost than W36)

If W36 Costs \$500k & Concrete Cost is \$450k

Steel Loses with only W Shapes

If PG Costs  $\$500 * (1 - 0.227) = \$390k$

Steel Wins with Plate Girder

# Economical Plate Girders for Mid-Span Bridges (60-100')

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## Expected Outcomes:

- Demonstrate the cost advantages of optimized plate girder designs
- Offer examples that empower fabricators and engineers to propose plate girder options where rolled beams may fall short
- Increase steel's competitiveness in bridge bids
- Add to SSSBA education and marketing program



# Resource Tools for Simple Span Steel Bridge Design

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Preliminary Composite Rolled Shape and Plate Girder



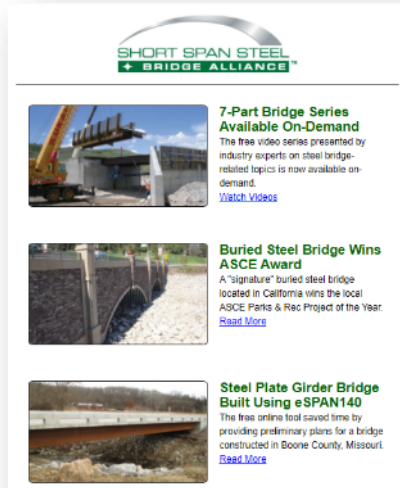
Optimized Composite & NonComposite Rolled Shape



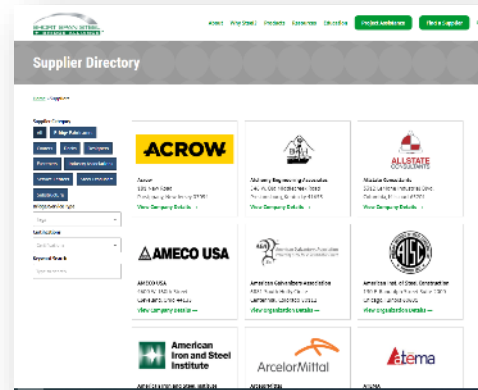
Optimized Composite & NonComposite Plate Girder

# 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



## 4. Receive Free Project Assistance



## 5. Schedule a Workshop/Webinar



[www.ShortSpanSteelBridges.org](http://www.ShortSpanSteelBridges.org)

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



Website: [ShortSpanSteelBridges.org](http://ShortSpanSteelBridges.org)

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