Steel Bridges: Beyond the Textbook

Webinar 3: Next-Gen Steel Bridge Design Approaches – ePLATE140

Sept 10, 2026

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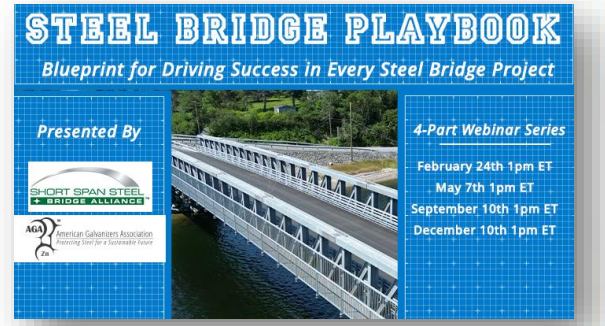
Approved Continuing Education

Steel Bridge Playbook – Quarterly Webinar Series

Webinar #1 – February 24th: Essential Bridge Design Resources Complete (watch online)

Webinar #2 – May 7th: Galvanized Bridge Preservation Tools Complete (watch online)



Webinar #3 – September 10th: Next-Gen Steel Bridge Design Approaches

Webinar #4 – December 10th: Bridge Success Stories & Lessons Learned

This webinar will highlight steel bridge success stories and key lessons learned from real-world projects.

Short Span Steel Bridge Alliance

SHORT SPAN STEEL BRIDGE ALLIANCE™

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**.

Chair: Myrissa Welch, SSAB

115 Members

Producers

Fasteners

Coaters

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SHORT SPAN STEEL BRIDGE ALLIANCE™

American Galvanizers Association

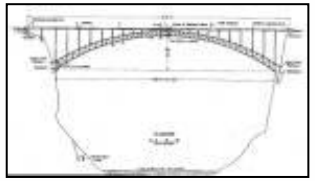
ZINC | international zinc association

American Iron and Steel Institute

NSBA

NCSPA

Trade Organizations



Design Firms

Contractors

NACE International — National Association of County Engineers

Bridge Owners

Universities

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

SSSBA Supports All Steel Solutions

Buried Bridges

Rolled Beam & Plate Girders

Press-Brake-Formed Tub Girders

Truss Bridges

What Do We Provide?

- Education
  - Workshops, Webinars, Newsletter
- Technical Resources
  - Standards, best practices, case studies
- Simple Design Tools (eSPAN140, eBEAM140, ePLATE140)
- Project Assistance
- Find a Supplier
- Networking / SSSBA Semiannual Meeting

Resource Tools for Simple Span Steel Bridge Design

www.ShortSpanSteelBridges.org

eSPAN140™

https://www.espan140.com/

Preliminary Composite Rolled Shape and Plate Girder

eBEAM140

https://www.ebeam140.com/
Version 2 Just Released

Optimized Composite & NonComposite Rolled Shape

ePLATE140

https://www.eplate140.com
Just Released

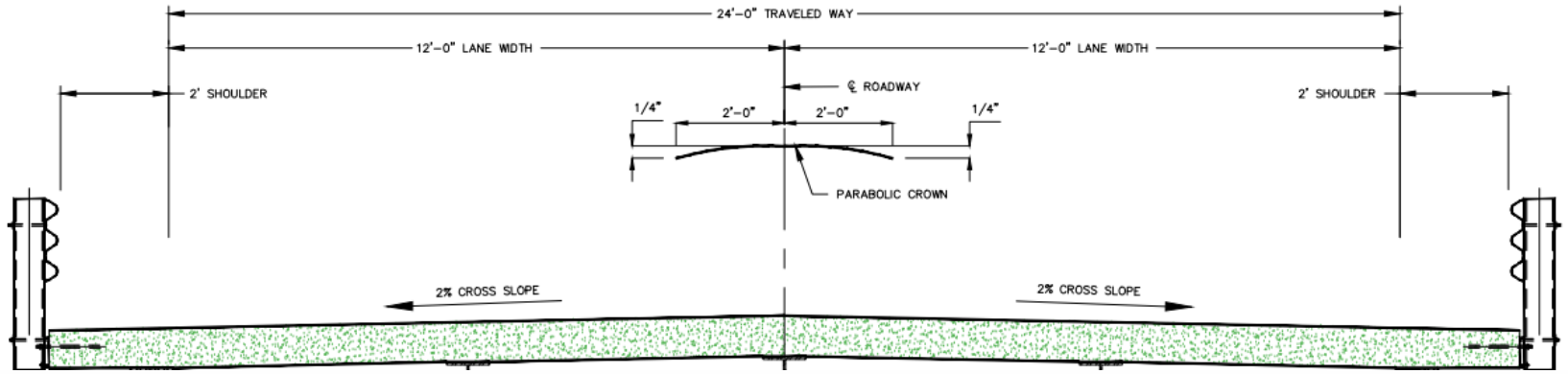
Optimized Composite & NonComposite Plate Girder

Design of Steel Bridges

Design Superstructure for Two-Lane, 90 ft Simple Span Bridge

Bridge Need and Basic Information

- Decided by Owner/Engineer:
  - 90 ft Simple Span Composite – Steel Plate Girders
  - Two 12 ft Travel Lanes, ADT = 5600 one direction
  - 28 ft Roadway Width
  - Barriers



Need a Design for the Bridge SuperStructure

Short Span Steel Bridge Alliance ePLATE140

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

Excel Based Plate Girder Design Software

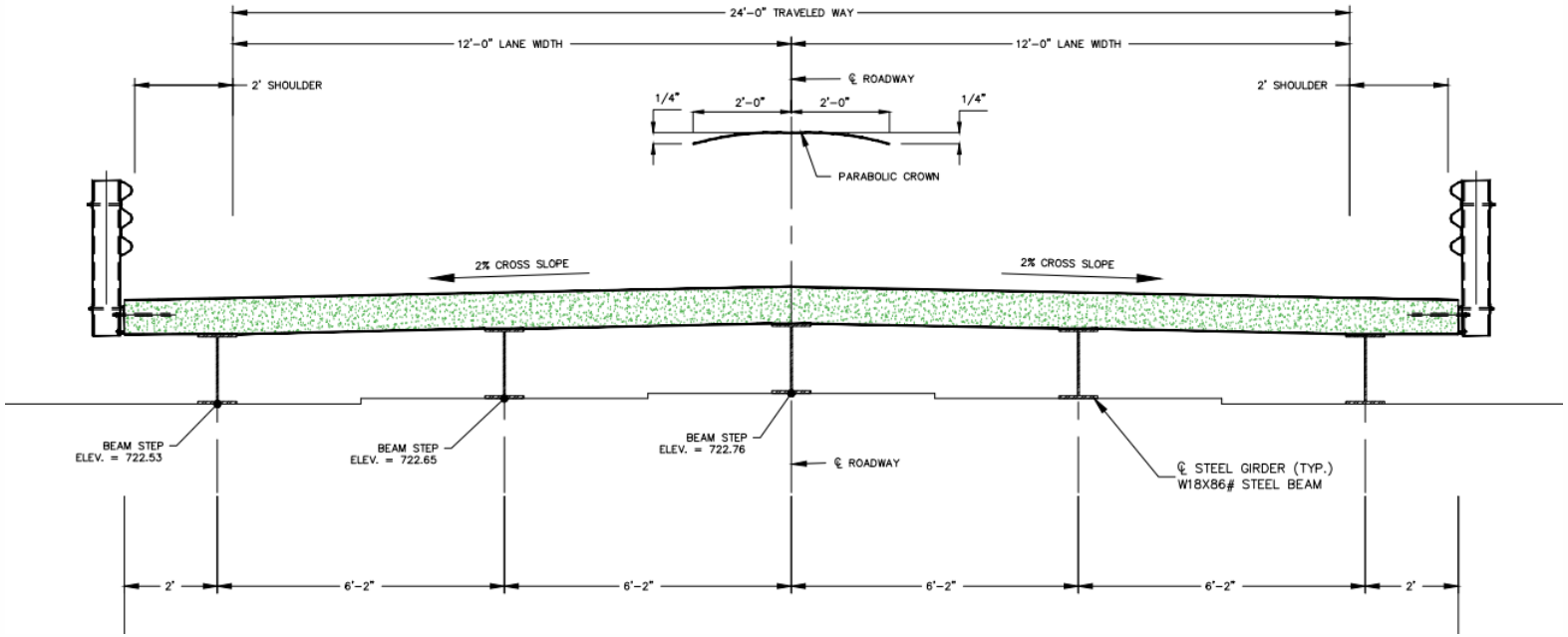
Version 1.0 - Beta

- ***ePLATE140 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.*

Bridge Design Girder Spacing

Bridge Layout

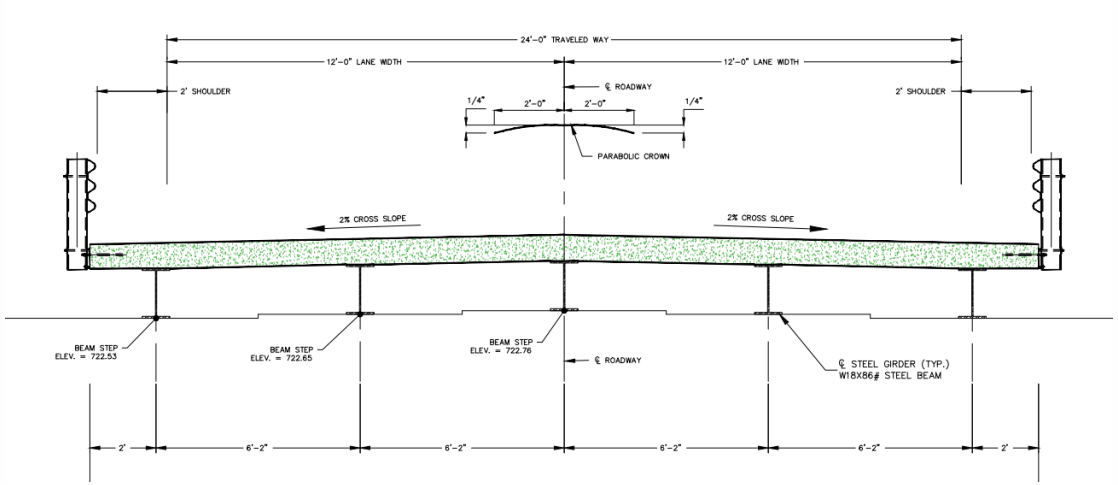
Bridge Length (ft)	90		Type of Bridge	Composite	
Roadway Width (ft)	28				
Number Striped Lanes	2	Bridge Width = Roadway Width + 2 * Barrier Width			
Barrier Width (ft)	0.3333				
Est. Overhang = XX% GS	20%				
Number of Girders	Girder Spacing (ft)	Overhang	Roadway Width	Bridge Width	
4	8.43	1.69	28.00	28.67	
5	6.52	1.30	28.00	28.67	
6	5.31	1.06	28.00	28.67	
7	4.48	0.90	28.00	28.67	
8	3.87	0.77	28.00	28.67	
9	3.41	0.68	28.00	28.67	
10	3.05	0.61	28.00	28.67	
11	2.76	0.55	28.00	28.67	
12	2.51	0.50	28.00	28.67	
13	2.31	0.46	28.00	28.67	
Cross Section Trial					
Number of Girders	Girder Spacing	Calculated Overhang	Overhang	Roadway	Bridge
5	6.167	2.00	2.00	28.00	28.67



Bridge Design Girder Dead & Construction Loading

Composite Bridge Information		Check For LLDF (Warning if Violation)
Deck f'c (psi)	4000	
Structural Deck Thickness (in)	8	
Sacrificial Concrete Deck (in)	0.5	
Haunch from Top of Web (in)	3	
Stay-in-Place (SIP) Forms?	No	
Weight of SIP (psf)	0	
Depth of SIP (in)	0	
Shear Connector Diameter (in)	0.875	
Shear Connector Fu (ksi)	60	
DC1 Deck Only Loading (psf)	106.25	
Fatigue (AASHTO 10th Edition Applied)		
Design Life (yrs)	75	
Average Daily Truck Traffic Single Lane $(ADTT)_{SL}$	200	Fatigue II Controls

	0
Max % of Additional DC1 on Girder	100%
DC2 Barrier Load (lb/ft)	50
Max % on Girder	50%
Add'l DC2 on Bridge Utilities, etc) (lb/ft)	0
Max % Additional DC2 on Girder	100%
Wearing Surface (psf)	25
% Misc Stl for Diaphrams, etc	0%
Construction Loading	
AT END OF OVERHANG FOR LATERAL BENDING	May be 0 for many types of decking
Construction w (lb/ft)	275
Construction p (lb)	3000



Yield Strength (ksi)	50

Diaphragm Bracing Locations in Span (ft)	
Enter Support Bracing at End of Span (ft)	
Distance from End to 1ST Brace (ft) = 0	0
Distance from End to 2nd Brace (ft)	22.5
Distance from End to 3rd Brace (ft)	45
Distance from End to 4th Brace (ft)	67.5
Distance from End to 5th Brace (ft)	90

Bridge Design Girder Webs & Flanges

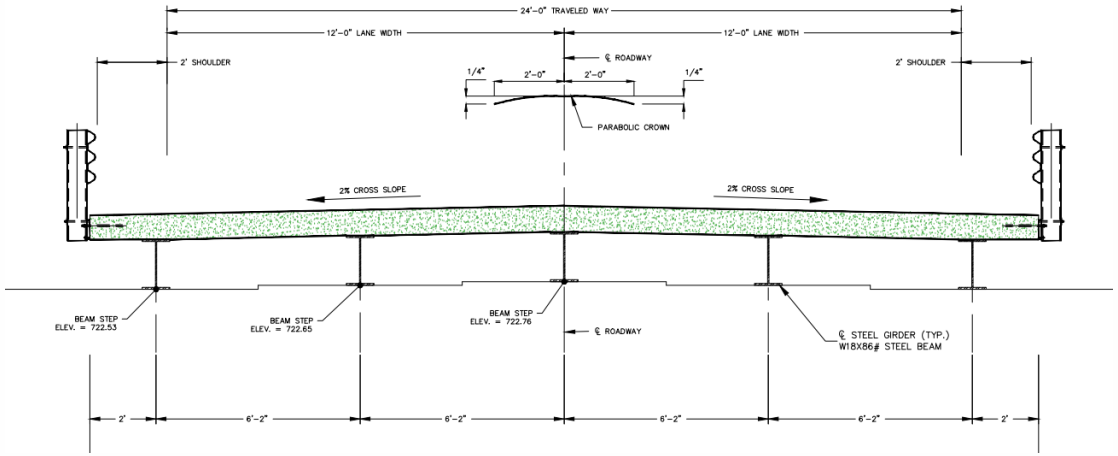
			Target D = 38.5 in
	Target L/D	**28**	**Trial D's for Design**
			D= 36, 38, 40, 42, 44 in
For Diaphragms	Min Depth (in)	12	
For Approach/Clearance	Max Depth (in)	60	L/D =18
	x for Deflection Limit in L/x	800	
	(If Deflections not Considered enter Low Number)		
	Is Compression Flange Fully Braced For Construction?	No	
	Is Compression Flange Fully Braced For Final State?	Yes	

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

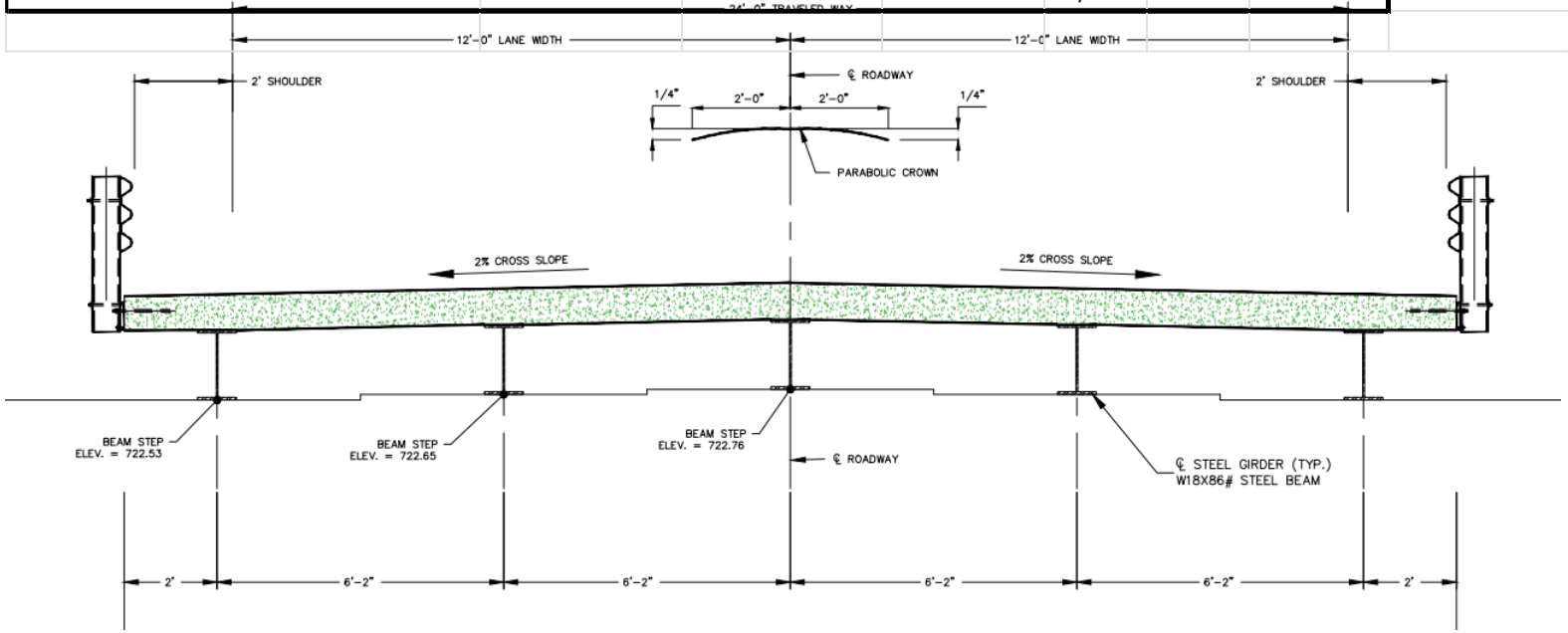


Bridge Design Girder Results

Run Design

Lightest 10 Sections (see to the right for additional Information)

Str I, Serv II, Constr	Fatigue	Deflection	L/D	Defl	Mn/My	Weight (tons)
TF:15 x 0.75 Web:38 x 0.5 BF:16 x 0.75	OK	OK	28.4	L/950	1.77	32.3
TF:15 x 0.75 Web:38 x 0.5 BF:16 x 0.75	OK	OK	28.4	L/950	1.77	32.3
TF:15 x 0.75 Web:40 x 0.5 BF:15 x 0.75	OK	OK	27.0	L/1014	1.74	32.5
TF:16 x 0.75 Web:36 x 0.5 BF:17 x 0.75	OK	OK	30.0	L/886	1.73	32.7
TF:15 x 0.75 Web:38 x 0.5 BF:17 x 0.75	OK	OK	28.4	L/979	1.81	32.9
TF:16 x 0.75 Web:38 x 0.5 BF:16 x 0.75	OK	OK	28.4	L/950	1.70	32.9
TF:14 x 0.75 Web:44 x 0.5 BF:14 x 0.75	OK	OK	24.5	L/1180	1.79	32.9
TF:15 x 0.75 Web:40 x 0.5 BF:16 x 0.75	OK	OK	27.0	L/1046	1.78	33.1
TF:16 x 0.75 Web:36 x 0.5 BF:18 x 0.75	OK	OK	30.0	L/913	1.77	33.3
TF:17 x 0.75 Web:36 x 0.5 BF:17 x 0.75	OK	OK	30.0	L/886	1.66	33.3



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

ENTER SECTION FOR MORE INFORMATION

bfc	tfc	D	tw	bft	tft	Weight (lb/ft)	Total Wt (tons)
15.00	0.750	38.00	0.500	16.00	0.750	144	32.3

bfc>=D/6 OK

D/tw<=150 OK

2Dcp/tw<=lrw OK

Iyc/Iyt>=0.3 OK

OVERALL PERFORMANCE FOR TF:15 x 0.75 Web:38 x 0.5 BF:16 x 0.75

Strength I/II	Service II	Construction	Fatigue	Deflection	Overall
PR	PR	PR	PR	PR	PR
0.921	0.977	0.996	0.756	0.843	0.996
In Lb #	At Centerline	In Lb #	At Critical Brace	At Centerline Equal to	Construction
3		2		L/950	

Meets Reqrments for A6?

Yes

Construction Uses A6

PERFORMANCE BY UNBRACED LENGTH FOR TF:15 x 0.75 Web:38 x 0.5 BF:16 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	22.5	0 - 22.5 ft	0.704	1.774	1.511
2	22.5	22.5 - 45 ft	0.921	1.774	1.053
3	22.5	45 - 67.5 ft	0.921	1.774	1.053
4	22.5	67.5 - 90 ft	0.704	1.774	1.511

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

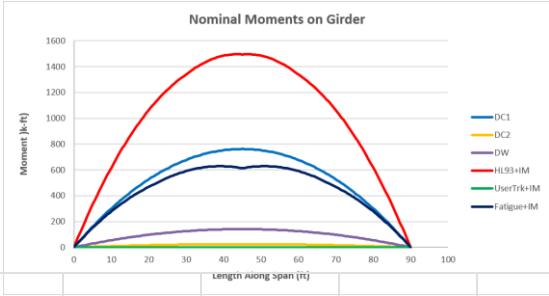
Shape	Strength I/II PR	Service II PR	Construction PR	Fatigue PR	Deflection PR	Overall PR	Total Wt (tons)
TF:15 x 0.75 Web:38 x 0.5 BF:16 x 0.75	0.92	0.98	1.00	0.76	0.84	1.00	32.3
TF:15 x 0.75 Web:38 x 0.5 BF:16 x 0.75	0.92	0.98	1.00	0.76	0.84	1.00	32.3
TF:15 x 0.75 Web:40 x 0.5 BF:15 x 0.75	0.89	0.96	0.93	0.74	0.79	0.96	32.5
TF:16 x 0.75 Web:36 x 0.5 BF:17 x 0.75	0.96	1.00	0.94	0.77	0.90	1.00	32.7
TF:15 x 0.75 Web:38 x 0.5 BF:17 x 0.75	0.90	0.94	0.99	0.73	0.82	0.99	32.9
TF:16 x 0.75 Web:38 x 0.5 BF:16 x 0.75	0.92	0.98	0.88	0.76	0.84	0.98	32.9
TF:14 x 0.75 Web:44 x 0.5 BF:14 x 0.75	0.81	0.90	0.95	0.69	0.68	0.95	32.9
TF:15 x 0.75 Web:40 x 0.5 BF:16 x 0.75	0.86	0.92	0.92	0.71	0.76	0.92	33.1
TF:16 x 0.75 Web:36 x 0.5 BF:18 x 0.75	0.93	0.96	0.94	0.74	0.88	0.96	33.3
TF:17 x 0.75 Web:36 x 0.5 BF:17 x 0.75	0.96	0.99	0.85	0.77	0.90	0.99	33.3
TF:15 x 0.75 Web:42 x 0.5 BF:15 x 0.75	0.84	0.91	0.87	0.70	0.72	0.91	33.3
TF:15 x 0.75 Web:38 x 0.5 BF:18 x 0.75	0.87	0.91	0.99	0.70	0.79	0.99	33.5
TF:16 x 0.75 Web:38 x 0.5 BF:17 x 0.75	0.90	0.94	0.87	0.73	0.82	0.94	33.5
TF:14 x 0.75 Web:44 x 0.5 BF:15 x 0.75	0.79	0.86	0.95	0.67	0.66	0.95	33.5
TF:15 x 0.75 Web:40 x 0.5 BF:17 x 0.75	0.84	0.89	0.92	0.69	0.74	0.92	33.7
TF:16 x 0.75 Web:40 x 0.5 BF:16 x 0.75	0.87	0.92	0.82	0.72	0.76	0.92	33.7
TF:17 x 0.75 Web:36 x 0.5 BF:18 x 0.75	0.93	0.96	0.85	0.74	0.88	0.96	33.9

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

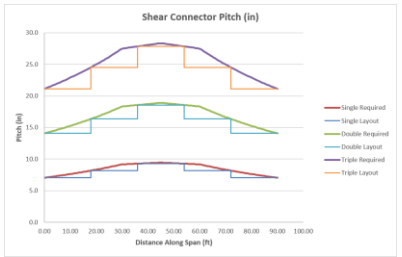
60	**SERVICE II near Centerline**		
	DC1 (ft-k)	762.3	Sx=567.4 in^3
	DC2 (ft-k)	25.3	S3n=738.2 in^3
	DW (ft-k)	141.8	S3n=738.2 in^3
	HL93 LL+IM (ft-k)	1447.6	Sn=819.5 in^3
	Serv II Stress	46.4	
Lane	Serv II Allow	47.5	
	SERVICE II PR	**0.977**	
	LIVE LOAD DEFLECTION		In=28658.8 in^
	LL Defl (in)	1.14	L/950
	Allowable (in)	1.35	=L/800
	DEFLECTION PR	**0.843**	
	FATIGUE Cat C' at Critical Brace		
Fat Moment (ft-k) LLF = 0.8		613.2	Sfat=837.5 in^
	Fat Stress (ksi)	7.03	
	Fat Allow (ksi)	9.30	
	FATIGUE PR	**0.756**	
	STRENGTH I/II SHEAR at Support		
	DC1 (k)	33.9	
	DC2 (k)	1.1	
	DW (k)	6.3	
HL93 LL+IM (k) LLF = 1.75		78.3	
	Vu (k)	190.2	
	Vn (k)	434.3	
Unstiffened	**SHEAR PR**	**0.438**	



STRENGTH I/II		Compression Flange Laterally Braced for Fi			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	22.5	571.8	18.984375	106.3	1117.0		2852.7	1.51	4050.9	0.704		**STRENGTH I/II MAX PR**
2	22.5	762.3	25.3125	141.8	1447.4		3730.2	1.05	4050.9	0.921		**0.921**
3	22.5	762.3	25.3125	141.8	1447.6		3730.5	1.05	4050.9	0.921		
4	22.5	571.8	18.984375	106.3	1116.8		2852.3	1.51	4050.9	0.704		

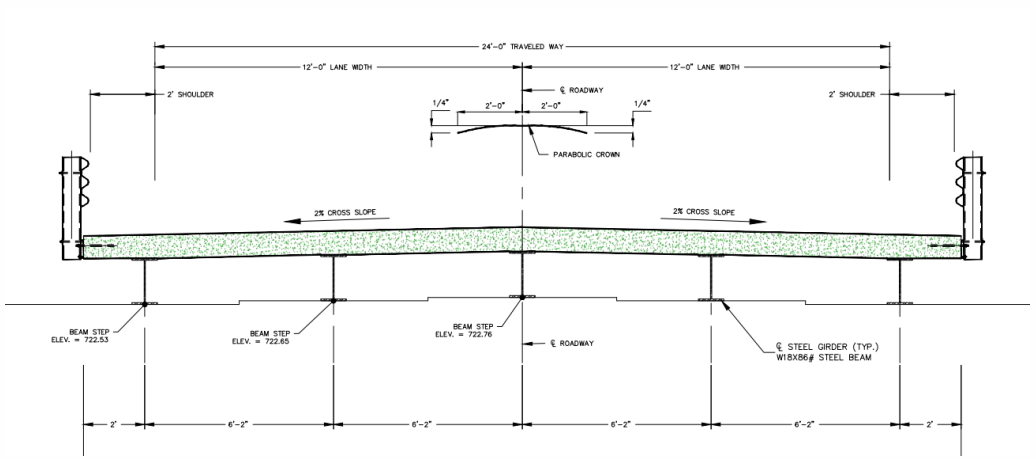
CONSTRUCTION						<0.60Fy		#N/A				
	Lb (ft)	Mconstr (ft-k)	Mlat (ft-k)	AF	Affl (ksi)	Perf Ratio	fbu+Affl (ksi)	Perf Ratio	bu+1/3Affl (ks	Fnc (ksi)	Perf Ratio	
1	22.5	1103.9	22.5	1.18	11.3	0.38	35.5	0.71	28.0	57.6	0.49	**CONSTRUCTION MAX PR**
2	22.5	1471.8	22.5	1.83	17.6	0.59	49.8	1.00	38.1	45.2	0.84	**0.996**
3	22.5	1471.8	22.5	1.83	17.6	0.59	49.8	1.00	38.1	45.2	0.84	
4	22.5	1103.9	22.5	1.18	11.3	0.38	35.5	0.71	28.0	57.6	0.49	

NOMINAL ABUTMENT REACTIONS			
DC1 (k)	137.2	At Centerline	
DC2 (k)	4.5	At Centerline	
DW (k)	31.5	At Centerline	
Single Lane LL+IM (k)	137.6	At 9.00 From Centerline	
Two Lane LL+IM (k)	229.3	At 3.00 From Centerline	



(in) SHEAR STUDE SPACING	Minimum Spacing (in)	3.5			Maxim
	0 - 18.0 ft	18.0 - 36.0 ft	36.0 - 54.0 ft	54.0 - 72.0 ft	72.0 - 90.0 ft
Singles Pitch (in)	7.04	8.18	9.28	8.18	7.04
Doubles Pitch (in)	14.08	16.36	18.56	16.36	14.08
Triples Pitch (in)	21.12	24.54	27.84	24.54	21.12

Design for Homogeneous Plate Girder Bridge

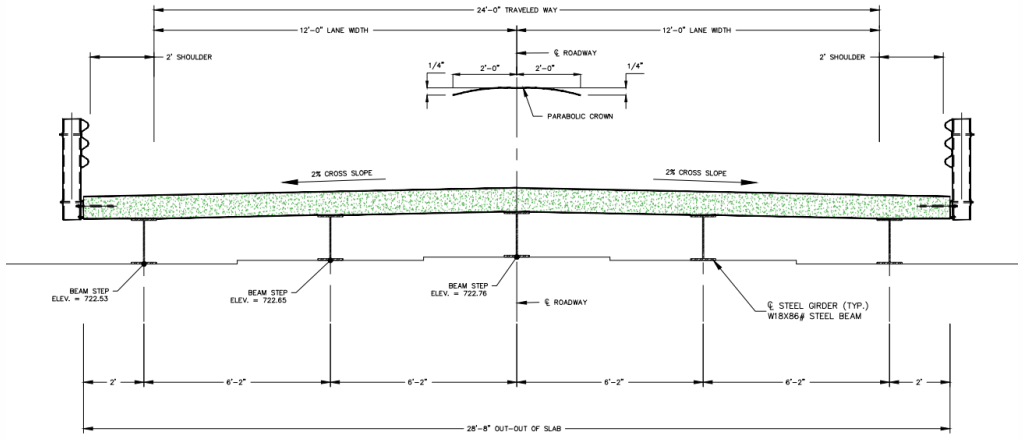


Superstructure Design for Two-Lane, 90 ft Simple Span Bridge

TF:15 x 0.75 Web:38 x 0.5 BF:16 x 0.75

Lateral Bracing at 22.5 ft

Example Bridge Designs – SSSBA Plate Girder Study



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) 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										
Barrier Width (ft)	0.3333		Composite Design	8 in Structural Deck with No SIP Forms							
Barrier Load on Girder (lb/ft)	25										
DC Deck Only Loading (psf)	106.25		AASHTO HL93 Loading and								
Wearing Surface (psf)	25		No User Defined Vehicle				Compression Flange Laterally Braced for Final State				
Additional DC1 Load on Girder (lb/ft)	0							Unbraced			
Additional DC2 Load on Bridge (lb/ft)	0							Length #	Lb	Cb	
			Strength Design Uses AASHTO Appendix A6					1	22.50	1.51	
AT OVERHANG FOR LATERAL FLANGE BENDING								2	22.50	1.05	
Construction w (lb/ft)	275		Fatigue Design Life (yrs)		75			3	22.50	1.05	
Construction p (lb)	3000		Fatigue ADTT$_{SL}$		200	Fatigue II Controls		4	22.50	1.51	
1/2 of Deck Overhang Weight (lb/ft)	106.25										
ADDITIONAL VERTICAL BENDING ON GIRDERS			Limit States Checked								
Exterior - Construction p (lb)	3000		Strength I & II								
Exterior - Construction w (lb/ft)	275		Service II								
			Constructability								
% Misc Stl for Diaphrams, etc	0%		Fatigue								
			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 TF15x¾ ; W38x½ ; BF16x¾

eBEAM140

ePLATE140

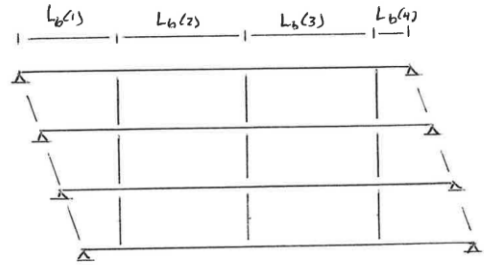
Plate Girder 25000 lbs less than W40x199

Plate Girder 30000 lbs less than W36x210

Versatility of ePLATE140

Excel Based Plate Girder Design Software

- NonComposite & Composite Design
- 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



ePLATE140

Plate Girder Bridge Design: Composite & NonComposite

AASHTO 10th Edition

Users Manual

Release Sept 2026

ePLATE140

Optimized Plate Girder Design

Resource Tools for Simple Span Steel Bridge Design

www.ShortSpanSteelBridges.org

eSPAN140™

https://www.espan140.com/

Preliminary Composite Rolled Shape and Plate Girder

eBEAM140

https://www.ebeam140.com/
Version 2 Just Released

Optimized Composite & NonComposite Rolled Shape

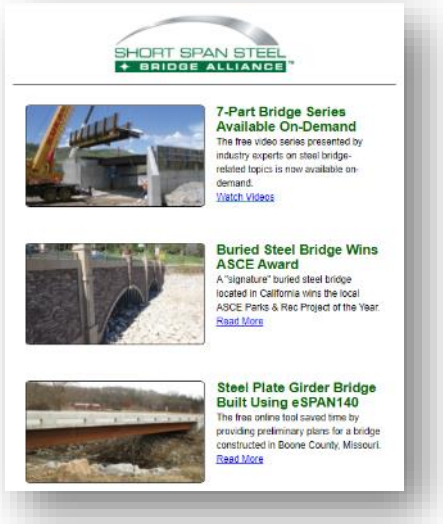
ePLATE140

https://www.eplate140.com
Just Released

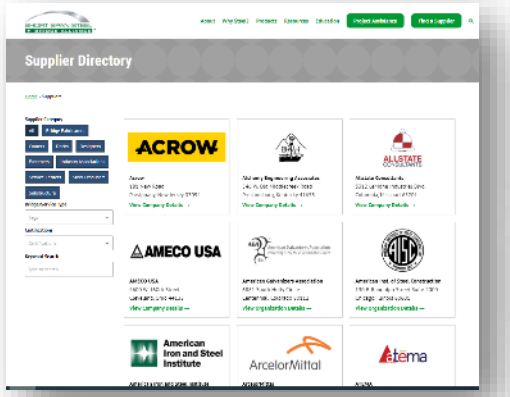
Optimized Composite & NonComposite Plate Girder

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

eSPAN140™

eBEAM140

ePLATE140

4. Receive Free Project Assistance

5. Schedule a Workshop/Webinar

www.ShortSpanSteelBridges.org

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