SHORT SPAN STEEL BRIDGE ALLIANCE™

AGA American Galvanizers Association
Protecting Steel for a Sustainable Future

Building Better Bridges in 2025

AIA Approved Continuing Education

ENGINEERING RCEP REGISTERED CONTINUING EDUCATION PROGRAM

Feb 19, 1 pm ET	Steel vs Concrete Life Cycle Performance and Costs
April 23, 1 pm ET	Unlocking the Potential of Buried Steel Structures
Sept 10, 1 pm ET	**Next-Gen Steel Bridge Design Tools for Smarter Solutions**
Dec 10, 1 pm ET	**Simple for Dead, Continuous for Live Designs for Optimal Performance**

Steel®

www.steel.org

Next-Gen Steel Bridge Design Tools for Smarter Solutions

Building Better Bridges in 2025
Short Span Steel Bridge Alliance
September 10, 2025

Michael Barker, PE
University of Wyoming
Short Span Steel Bridge Alliance

Steel Bridge Design Resources SSSBA/NSBA

Short Span Steel Bridge Alliance eSPAN140

https://www.espan140.com/

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

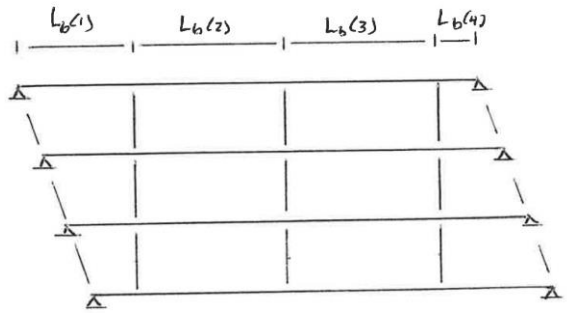
- 52 ft Length
- Two 12 ft Lanes
- 6 Girders at 5’-6” Spacing
- Overhang 1’ – 3”
- Barriers 1’ – 0” (50 lb/ft – 50% on Exterior Girder)
- Roadway Width = 28 ft (4 ft of shoulder)
- Bridge Width 30 ft
- Diaphragm (Centerline) at 26 ft
- Unbraced
- Corrugated Metal Deck & Gravel (80 psf)
- No Additional 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

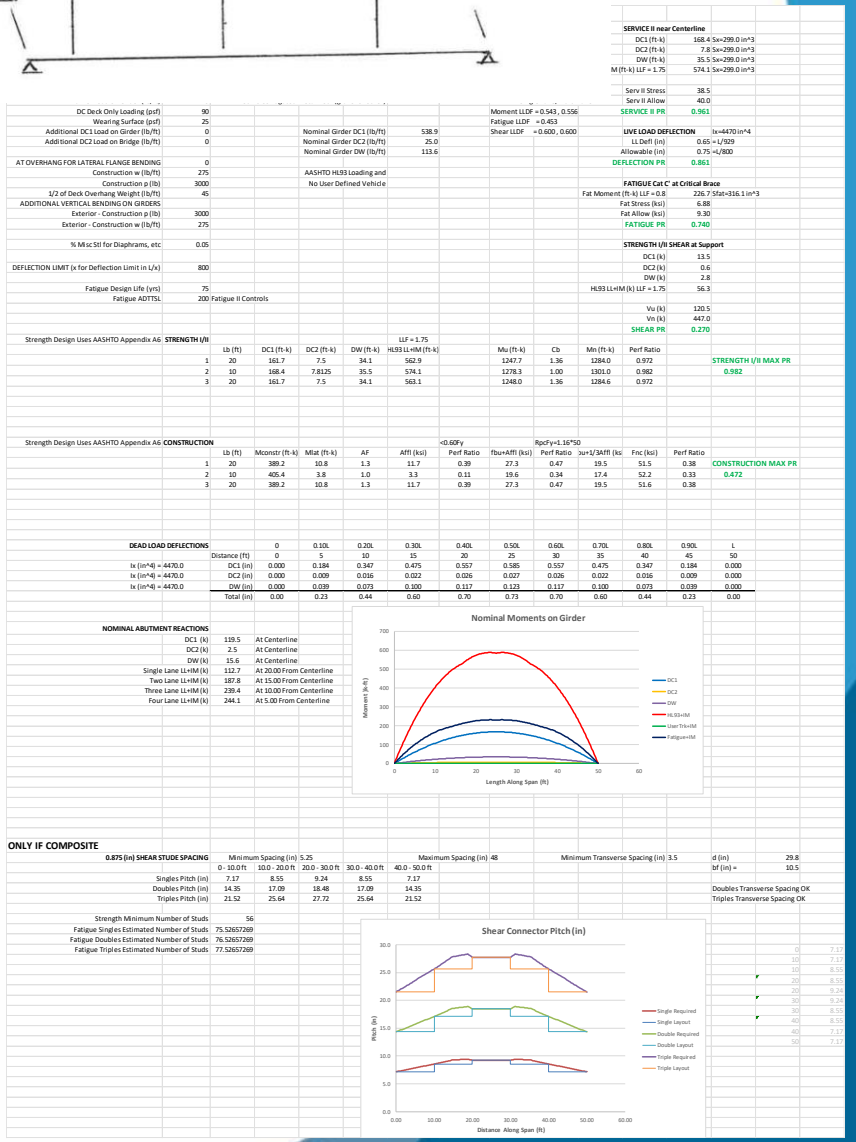
W36x135 Strength I PR = 0.993

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)





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		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		25.0	L/695	1.07	25.3

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

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		

PERFORMANCE BY UNBRACED LENGTH FOR W36X135

			Strength I/II		
Unbraced 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

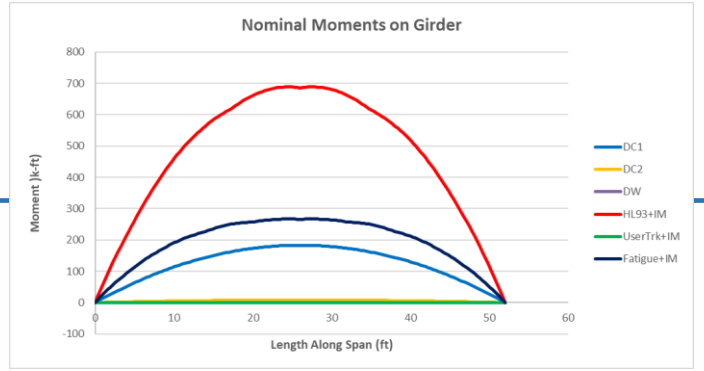
Top 20 That Meet Min Depth, Max Depth & W40 & W44 Limits

Shape	Strength I/II	Service II	Construction	Fatigue	Deflection	Overall
	PR	PR	PR	PR	PR	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

- 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	bu+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	

Continue 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

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		
ERFORMANCE BY UNBRACED LENGTH FOR W36X135						
			Strength I/II			
Unbraced 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)	
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			
ERFORMANCE BY UNBRACED LENGTH FOR W33X118							
			Strength I/II				
Unbraced Length	Unbraced Length (ft)	Lb Range	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
And Deflection = L/793
(W33x130 Meets All)

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			
Unbraced 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			
Unbraced 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
(W33x130 Meets All)

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		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						
			Strength I/II			
Unbraced 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)	
W36X150		NonComposite			150	
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						
			Strength I/II			
Unbraced Length	Unbraced Length (ft)	Lb Range	PR	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 I: LLF = 1.75, No Lane Load, Multi Lane, Unbraced W36x170
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/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

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		
ERFORMANCE BY UNBRACED LENGTH FOR W36X135						
			Strength I/II			
Unbraced Length	Unbraced Length (ft)	Lb Range	PR	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	

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

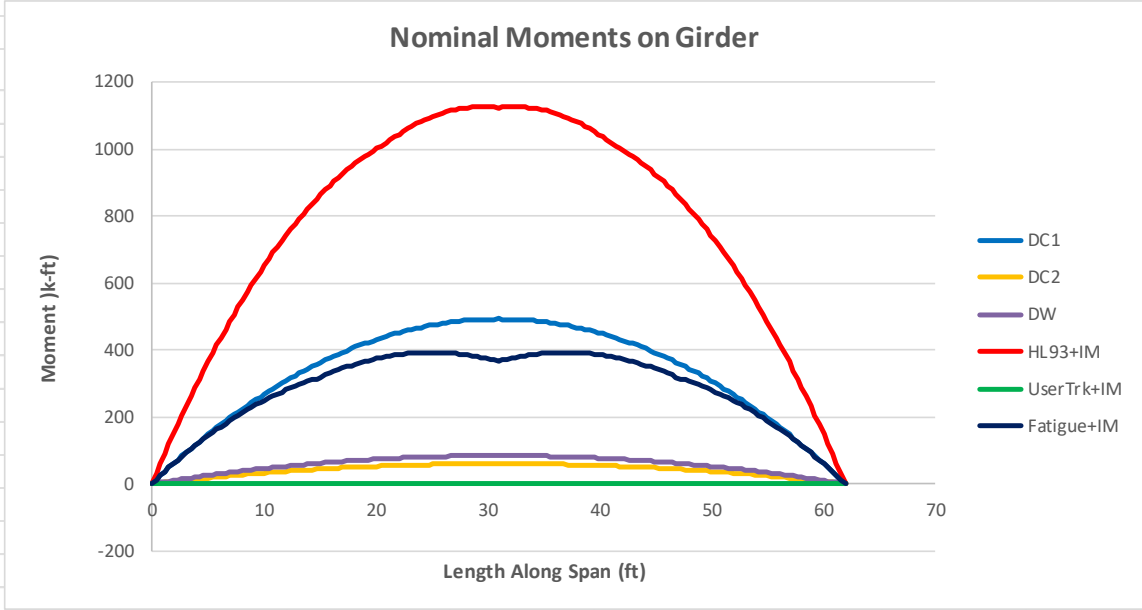
Composite Bridge

	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	bu+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

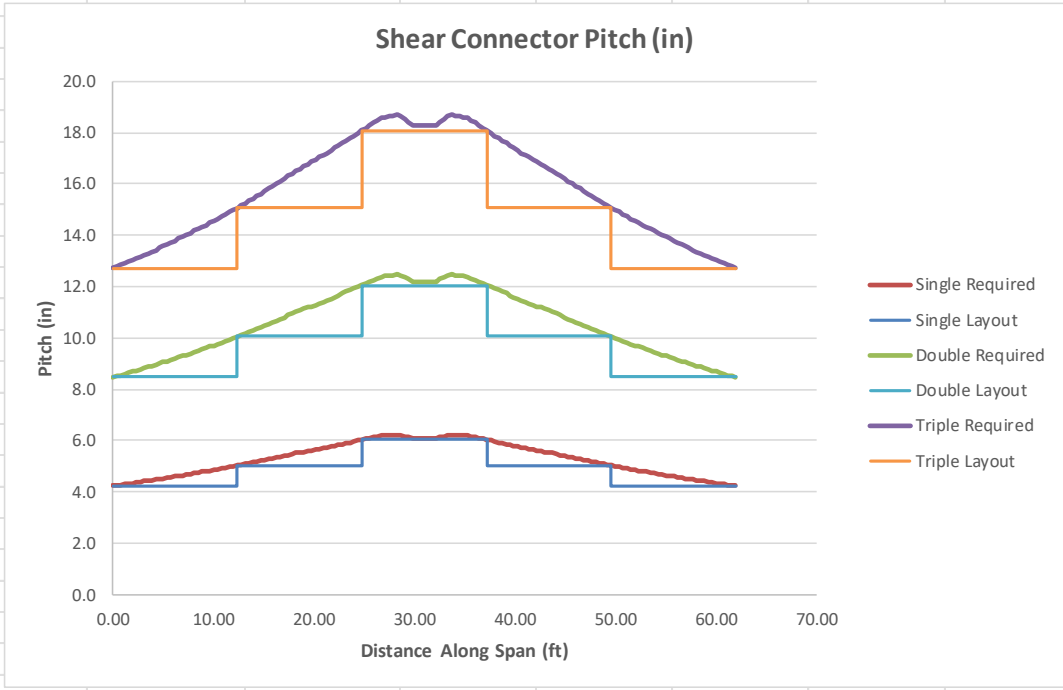


Demonstration: 62 ft Span, 8” Deck w/SIP, 4 Girders @ 9 ft

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 C			
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

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

Composite Bridge: W36 x 135

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

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		
ERFORMANCE BY UNBRACED LENGTH FOR W36X135						
Compression Flange Laterally Braced for Final State			Strength I/II			
Unbraced Length	Unbraced Length (ft)	Lb Range	PR	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	

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
0.822	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		
ERFORMANCE BY UNBRACED LENGTH FOR W36X135						
Compression Flange Laterally Braced for Final State			Strength I/II			
Unbraced Length	Unbraced Length (ft)	Lb Range	PR	Mn/My	Cb	
1	21	0 - 21 ft	0.753	1.883	1.425	
2	20	21 - 41 ft	0.822	1.883	1.009	
3	21	41 - 62 ft	0.753	1.883	1.425	

Strength II: LLF = 1.35, No Lane Load, Single Lane W36x135

Summary

Simple-Span Rolled Shape Bridge Design: Composite & NonComposite

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

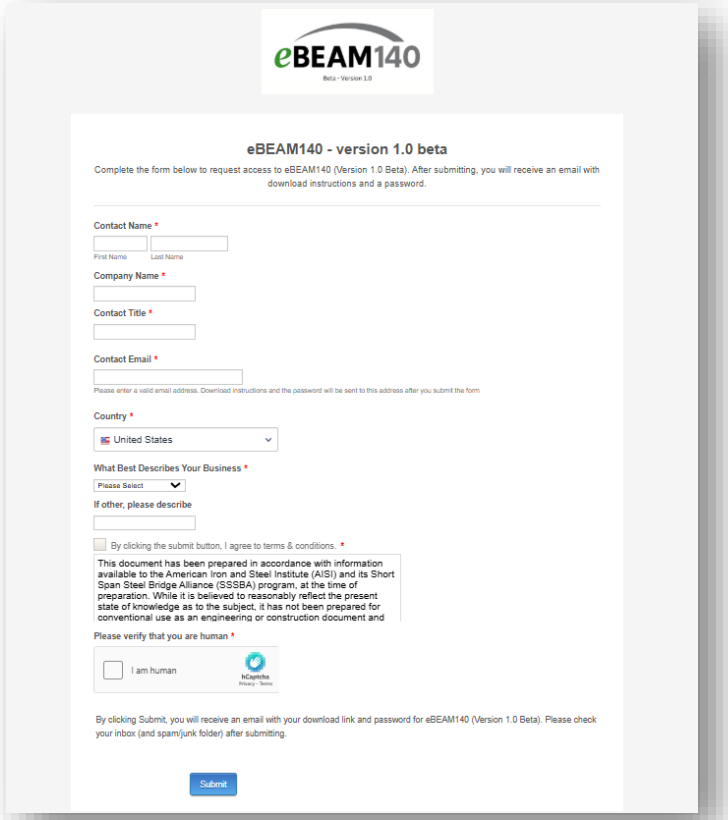
https://www.shortspansteelbridges.org/ebeam140/

Simple-Span Plate Girder Bridge Design in Development

eBEAM140 Download Instructions

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

Complete form:



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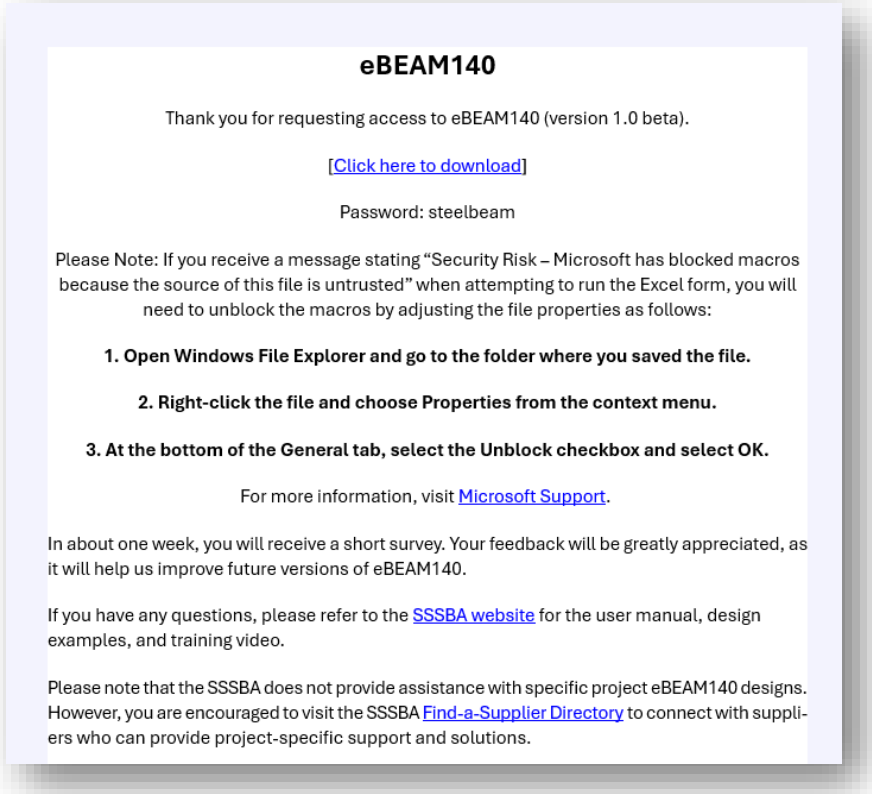

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1. Open Windows File Explorer and go to the folder where you saved the file.

2. Right-click the file and choose Properties from the context menu.

3. At the bottom of the General tab, select the Unblock checkbox and select OK.

For more information, visit Microsoft Support.

In about one week, you will receive a short survey. Your feedback will be greatly appreciated, as it will help us improve future versions of eBEAM140.

If you have any questions, please refer to the SSSBA website for the user manual, design examples, and training video.

Please note that the SSSBA does not provide assistance with specific project eBEAM140 designs. However, you are encouraged to visit the SSSBA Find-a-Supplier Directory to connect with suppliers who can provide project-specific support and solutions.

eBEAM140 Download Instructions

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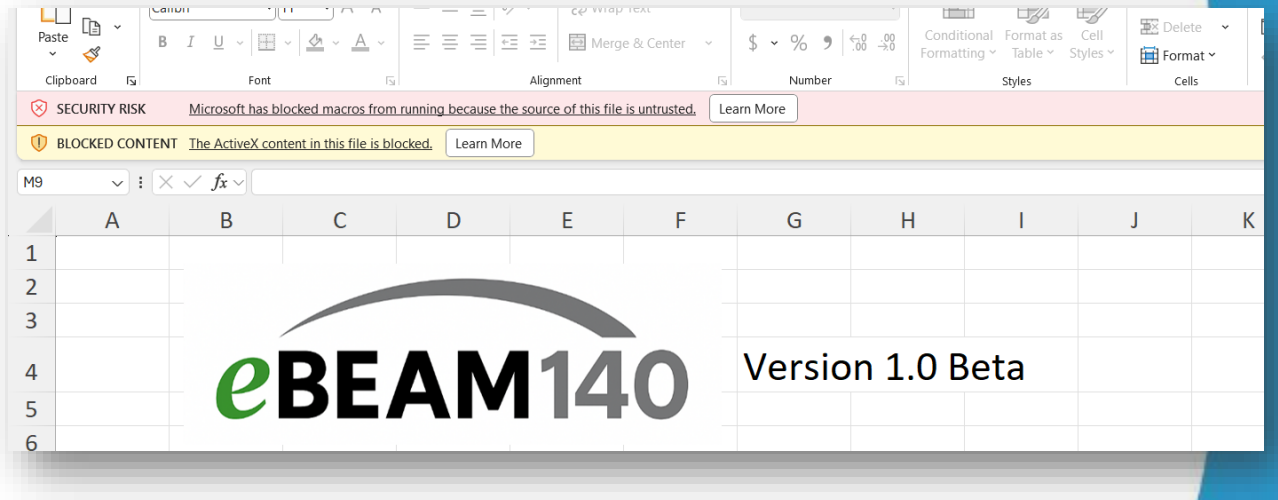
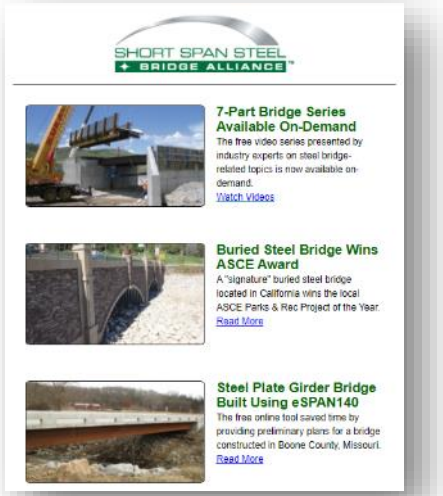


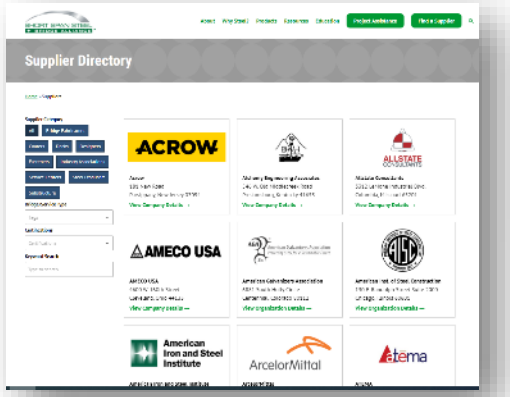
1. Open Windows File Explorer and go to the folder where you saved the file.
2. Right-click the file and choose Properties from the context menu.
3. At the bottom of the General tab, select the Unblock checkbox and select OK.

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

4. Receive Free Project Assistance

5. Schedule a Workshop/Webinar

www.ShortSpanSteelBridges.org

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

Website:ShortSpanSteelBridges.org

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