Steel Bridge Forum

National Steel Bridge Alliance

Bridge Department, South Dakota DOT, Pierre, September 2019

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Anthony (Tony) Peterson, Bridge Steel Specialist
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Overview of Forum

7:45 – 8:45	Welcome and introduction, Steel bridge costs and advantages	Anthony Peterson
8:45 – 9:45	Economical steel bridge design, Skewed bridge considerations	Mike Grubb
9:45 – 10:00	Break	
10:00 – 11:00	Bolted connections, Field splices, Pack rust	Karl Frank
11:00 – 12:00	Steel bridge erection and constructability 1	Genesis Structures
12:00 – 1:15	Lunch (on your own)	
1:15 – 2:15	Steel bridge erection and constructability 2	Genesis Structures
2:15 – 3:15	AASHTO 8th Edition updates (mostly regarding Section 6) and look-ahead to the 9th Edition	Mike Grubb
3:15 – 3:30	Break	
3:30 – 5:00	Virtual fabrication shop tour	Karl Frank & Pat Loftus

Purpose of Forum

- Provide design, fabrication and construction assistance to engineers regarding steel bridges.
- Make it known that NSBA is here to provide assistance and guidance regarding steel bridges.
- AASHTO steel design updates.
- Steel bridge fabrication and constructability insight.

Thanks to South Dakota DOT Bridge Department for providing facility, PDH certificates and coordination.

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$2.2 & $6.5 Million Grants to Help SD/ND Bridges

U.S. Transportation Secretary Elaine L. Chao announced that $225 million will be given to 20 projects in 18 states, according to a news release. The funds were restricted by law to the 25 states with a population density of less than 100 people per square mile.

" The projects funded under the program will serve as models for similar bridge improvement projects throughout the nation."

South Dakota Department of Transportation
West River Counties Bridge Replacement Project
FHWA Competitive Highway Bridge Program Grant Award: $2,247,000

The project replaces four bridges in Butte, Meade and Lawrence Counties. The bridges are on county highways, serving as important connectors for local communities and supporting local and regional economies in South Dakota.

North Dakota Department of Transportation
Bridge Rural Replacement Program
FHWA Competitive Highway Bridge Program Grant Award: $6,511,000

The project replaces 18 bridges in poor condition throughout the state. The improvements support economic vitality by removing load-restricted bridges, allowing for the unimpeded movement of freight and other heavy vehicles.

Antitrust Statement

ANTITRUST AND CONFLICT OF INTEREST REMINDER

Please remember that this meeting may include representatives of companies that compete with one another in the marketplace. Discussions, plans, consensus arrangement, agreements, strategies, etc., may be unlawful, if they relate to any of the following topics:

- Current or future prices or bidding information
- Limits on production or product lines
- Allocating customers or territories
- Individual company marketing strategies, projections, or assessments
- Establishing a practice of dealing with customers or suppliers

Before engaging in any substantive discussions at this meeting, consult the meeting Chair and the organization's Conflict of Interest policy if you or an organization with which you are affiliated:

- Is doing business or contemplating doing business with AISC or any of its affiliated firms; or
- Is involved either as a party or consultant in litigation, arbitration or some other form of dispute resolution, the outcome of which could be affected by the meeting group's action on an issue before it; or
- Are otherwise subject to circumstances that could impair or appear to impair your independent judgment on an issue before the meeting group.

NSBA Organization, Mission & Purpose

The National Steel Bridge Alliance (NSBA), a division of the American Institute of Steel Construction (AISC), is a national, not-for-profit organization dedicated to the advancement of domestically produced steel bridge design and construction.

The **mission** of the NSBA is to establish steel as the preferred material for bridges.

The NSBA functions as the voice of the bridge fabricators and mills while also partnering with the bridge design and construction community.

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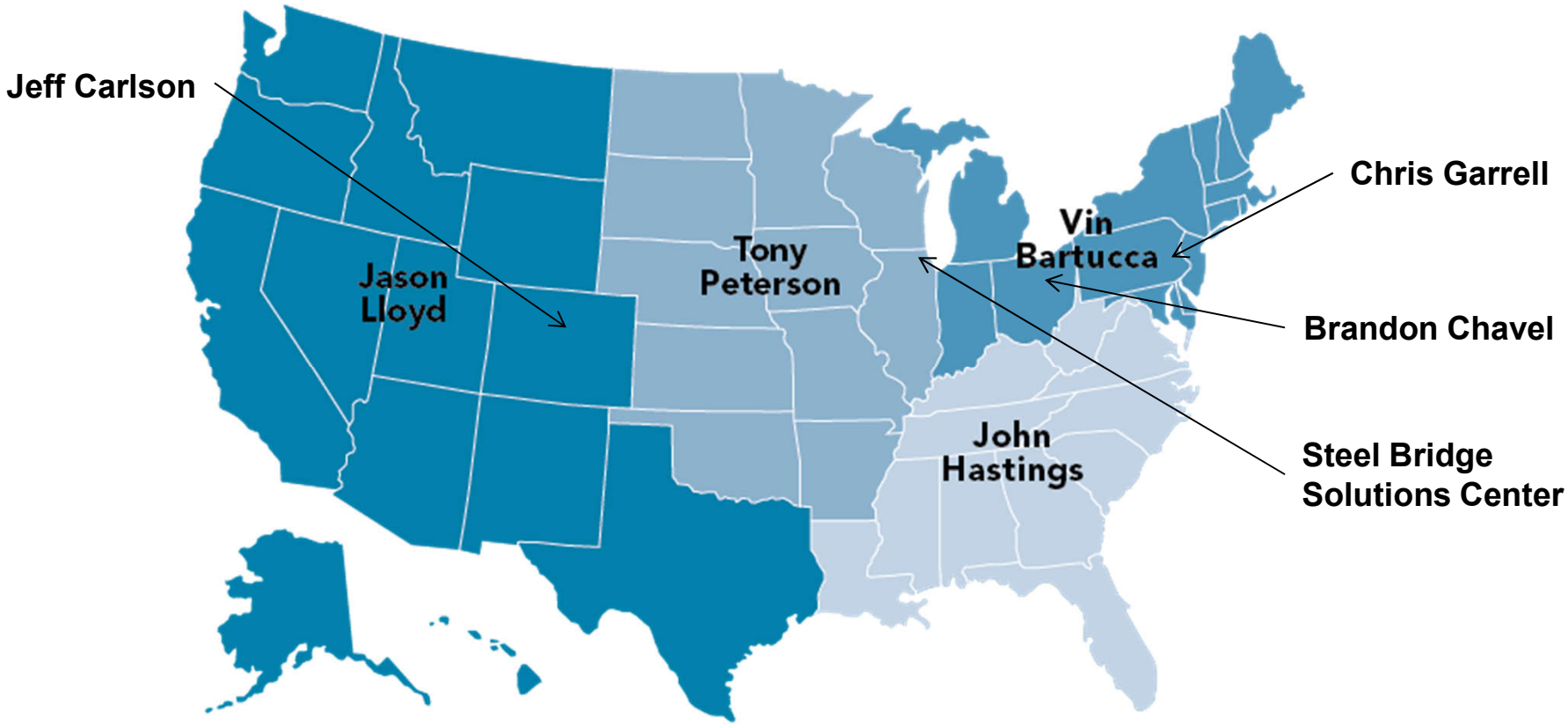
Market Coverage



What We Do & Provide

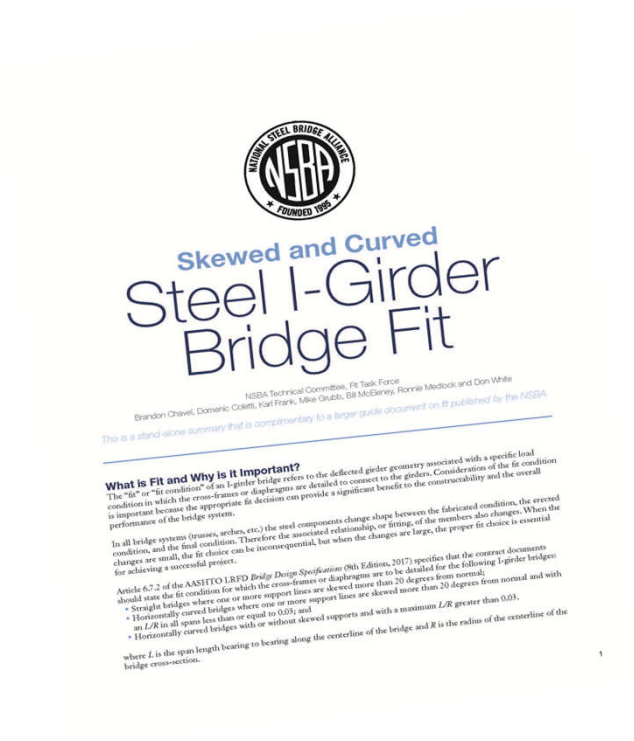
Show Owners and Engineers the Advantages of Steel Bridges.

Assist Owners and Engineers with the Design/Fabrication/Construction of Steel Bridges.

- Bridge Design Software.
- Steel Bridge Design, Fabrication and Construction Support.
- FHWA Steel Bridge Design Handbook.
- AASHTO/NSBA Collaboration.
- Material Availability and Sizing.
- Preliminary Bridge Design.
- Steel Pricing and Trends.

- Bridge Forums.
- AASHTO/NSBA Collaboration Meetings.
- Industry Meetings and Trade Shows.
- Office/Site visits.
- Track Bridge Projects.

Steel Bridge Design Support



Skewed and Curved

Steel I-Girder Bridge Fit

NSBA Technical Committee, Fit Task Force

Brandon Chavel, Domenic Coletti, Karl Frank, Mike Grubb, Bill McEleney, Ronnie Medlock and Don White

This is a stand-alone summary that is complementary to a larger guide document on fit published by the NSBA.

What is Fit and Why is it Important?

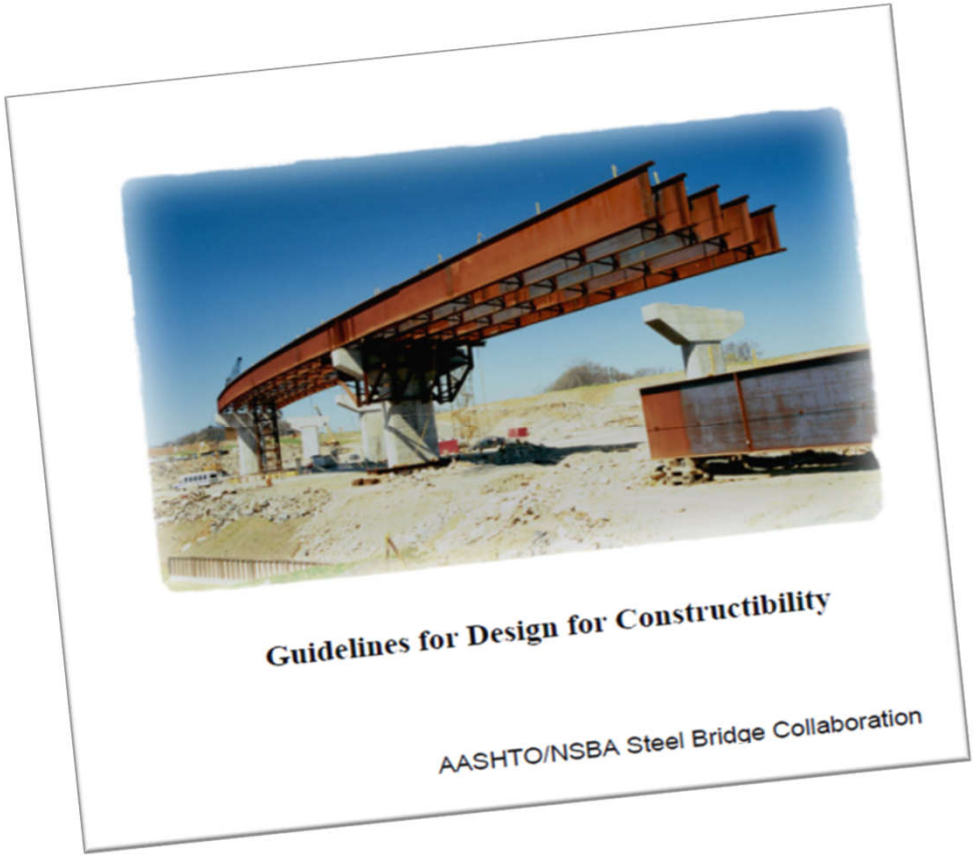
The "fit" or "fit condition" of an I-girder bridge refers to the deflected girder geometry associated with a specific load condition in which the cross-frames or diaphragms are detailed to connect to the girders. Consideration of the fit condition is important because the appropriate fit decision can provide a significant benefit to the constructability and the overall performance of the bridge system.

In all bridge systems (trusses, arches, etc.) the steel components change shape between the fabricated condition, the erected condition, and the final condition. Therefore the associated relationship, or fitting, of the members also changes. When the changes are small, the fit choice can be inconsequential, but when the changes are large, the proper fit choice is essential for achieving a successful project.

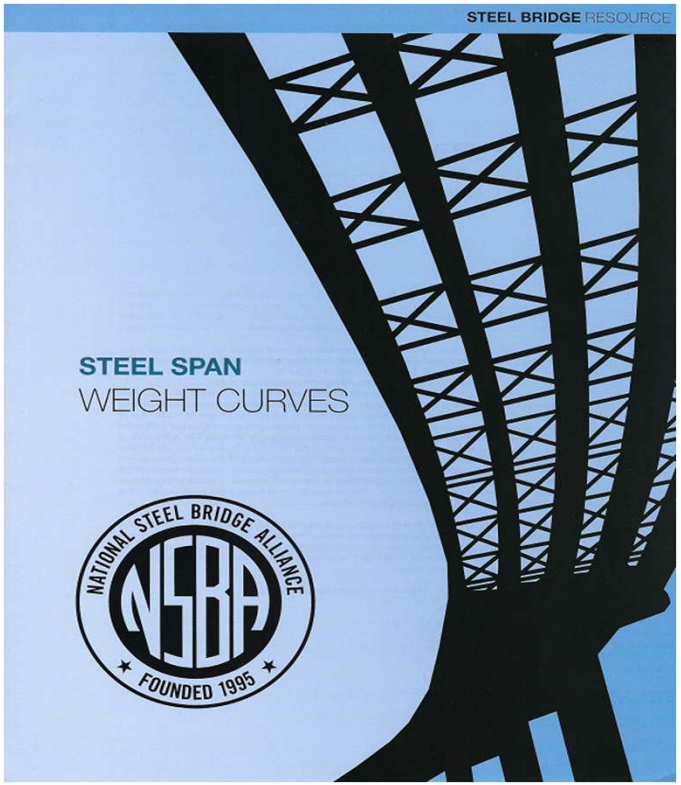
Article 6.7.2 of the AASHTO LRFD *Bridge Design Specifications* (8th Edition, 2017) specifies that the contract documents should state the fit condition for which the cross-frames or diaphragms are to be detailed for the following I-girder bridges:

- Straight bridges where one or more support lines are skewed more than 20 degrees from normal;
- Horizontally curved bridges where one or more support lines are skewed more than 20 degrees from normal and with an L/R in all spans less than or equal to 0.03; and
- Horizontally curved bridges with or without skewed supports and with a maximum L/R greater than 0.03.

where L is the span length bearing to bearing along the centerline of the bridge and R is the radius of the centerline of the bridge cross-section.



Steel Bridge Design Support



Understanding which steel bridge elements are fracture critical members will provide the required protection while saving on in-service inspection.

bridge crossings

ARE YOU SURE THAT'S FRACTURE CRITICAL?

BY ROBERT J. CONNOR, PH.D., KARL FRANK, P.E., PH.D., BILL MCELENEY AND JOHN YADLOSKY, P.E.

ONE OF THE MOST NOTEWORTHY bridge failures in the United States occurred in 1967, when the Point Pleasant Bridge over the Ohio River (also known as the Silver Bridge) collapsed, resulting in 46 deaths.

The collapse was due to brittle fracture of one of the eyebars that formed the suspension system of the bridge. The subsequent failure investigation revealed that the fracture was due to brittle propagation of a tiny crack in the eyebar. Because the fracture toughness of the eyebar was extremely low, a relatively small crack led to a brittle fracture of the eyebar, which in turn led to the collapse of the bridge.

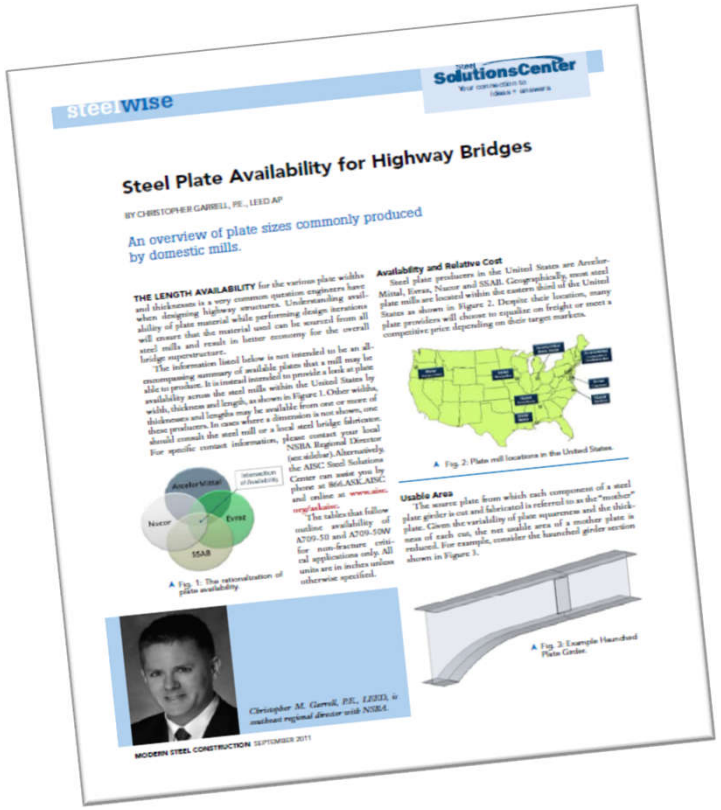
This collapse was the catalyst for many changes in material specifications, design, fabrication and shop inspection of steel bridges. These requirements are codified in the AASHTO *Bridge Design Specifications* and the AASHTO/AWS D1.5 *Bridge Welding Code* (AWS) and are applied to tension members whose fracture could lead to bridge collapse. (Another bridge inci-

Figure 1 – The three "legs" of a total fracture control plan for bridges.

Steel Availability and Pricing

Historic Raw Steel Plate Pricing ($/lb), 2" and Less Delivered to the Fabricator

		A-709-50W			
	Year	January	July	December	
	2003	$0.30		$0.32	
	2004	$0.34		$0.45	
	2005	$0.45		$0.46	
	2006	$0.46		$0.50	
	2007	$0.50		$0.54	
	2008	$0.56	$0.90	$0.53	
	2009	$0.42	$0.31	$0.35	
	2010	$0.42	$0.42	$0.47	
	2011	$0.59	$0.56	$0.53	
	2012	$0.56	$0.50	$0.40	
	2013	$0.44	$0.45	$0.46	
	2014	$0.50	$0.55	$0.51	
	2015	$0.46	$0.00	$0.00	



steelwise

SolutionsCenter

Steel Plate Availability for Highway Bridges

BY CHRISTOPHER GARRELL, PE., LEED AP

An overview of plate sizes commonly produced by domestic mills.

THE LENGTH AVAILABILITY for the various plate widths and thicknesses is a very common question engineers have when designing highway structures. Understanding availability of plate material while performing design iterations will ensure that the material used can be sourced from all steel mills and result in better economy for the overall bridge superstructure.

The information listed below is not intended to be an all-encompassing summary of available plates that a mill may be able to produce. It is instead intended to provide a look at plate availability across the steel mills within the United States by width, thickness and length, as shown in Figure 1. Other widths, thicknesses and lengths may be available from one or more of these producers. In cases where a dimension is not shown, one should consult the steel mill or a local steel bridge fabricator. For specific contact information, please contact your local NSBA Regional Director (see sidebar). Alternatively, the AISC Steel Solutions Center can assist you by phone at 866.ASK.AISC and online at www.aisc.org/askaisc.

The tables that follow outline availability of A709-50 and A709-50W for non-fracture critical applications only. All units are in inches unless otherwise specified.

Availability and Relative Cost

Steel plate producers in the United States are ArcelorMittal, Evraz, Nucor and SSAB. Geographically, most steel plate mills are located within the eastern third of the United States as shown in Figure 2. Despite their locations, many plate providers will choose to equalize on freight or meet a competitive price depending on their target markets.

Fig. 2: Plate mill locations in the United States.

Usable Area

The source plate from which each component of a steel plate girder is cut and fabricated is referred to as the "mother" plate. Given the variability of plate squareness and the thickness of each cut, the net usable area of a mother plate is reduced. For example, consider the haunched girder section shown in Figure 3.

Fig. 3: Example Haunched Plate Girder.

Christopher M. Garrell, P.E., LEED, is southeast regional director with NSBA.

MODERN STEEL CONSTRUCTION SEPTEMBER 2011

Bridge Cost Study

Scope of Study

Conduct a cost analysis of structural steel and concrete bridges that have been built across the nation.

Objectives

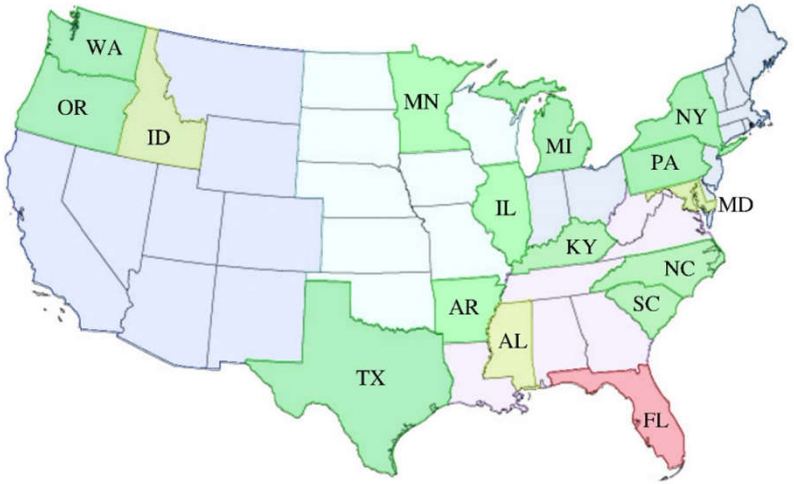
Understand the in-place cost of structural steel versus precast and cast-in-place concrete in the bridge market on a national, regional and state basis.

Investigate the assumption that structural steel bridge “first costs” are more expensive than concrete bridges.

Bridge Cost Study

- Selected 12 total states,
  - Varying levels of concrete and steel utilization.
  - Spread out geographically.
  - Availability of data.
- New and replacement bridges only.
- Projects constructed after 2013.
- Does not include Design-Build, CMGC, etc.

- Span lengths up to 250 feet.
- Bridges let through DOT process only.



Bridge Cost Study - Preliminary Findings

Rolled steel beam and plate girder bridges are cost competitive with concrete superstructure bridges. Many times the steel bridge is likely the low cost option, so it should not be dismissed early on based solely on past bid prices.

Steel bridges are comparatively more expensive than concrete bridges in the southeast region.

Currently overall more concrete bridges being constructed. More states favor concrete than steel for typical bridges.

Steel bridges are typically more complex and longer span.

Need to investigate design-build and CMGC contracts.

Need to investigate railroad bridges.

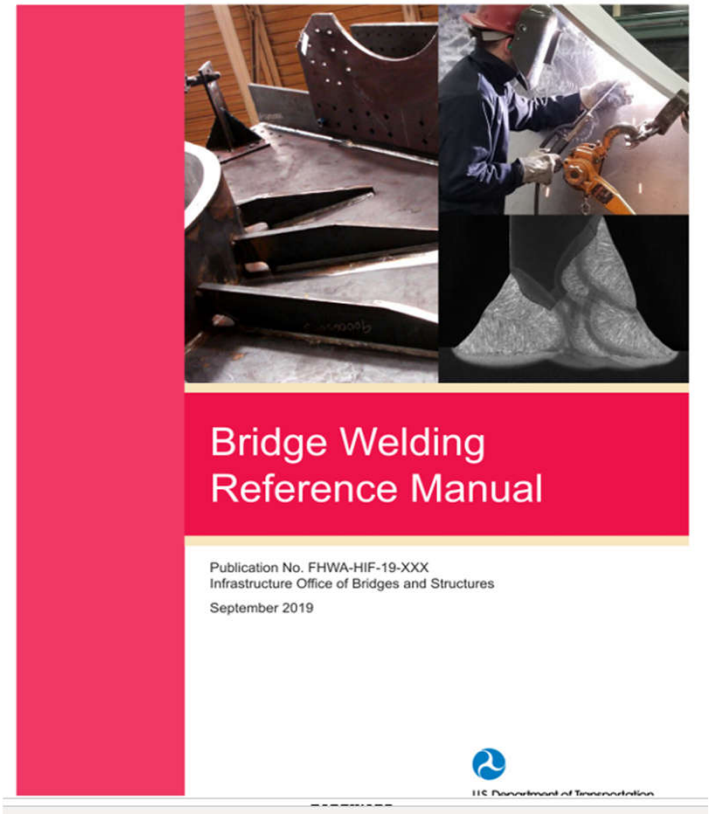
Steel Bridge Advantages

- Inspectability
- Deck Replacement
- Widening & Lengthening
- Reusable & Repurpose
- Strengthening
- Relatively light (improved seismic, less foundation, ABC friendly)
- Reparability
- Damage Repair
- Sustainable & Recyclability
- Proven Material

Steel Bridge Standard Plans

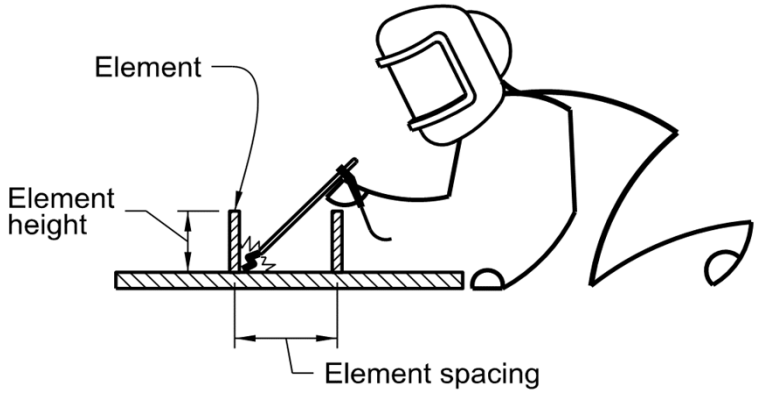
- Needed for “typical” bridges to keep steel rolled beam and plate girder bridges on a level playing field with concrete superstructure bridges.
- Consider developing simple span standards and utilize “link slab” design so they can be used for multiple span bridges (similar to concrete beam standards).
- Ohio is in the process of developing simple span steel bridge standards.
- Pennsylvania DOT is developing short span steel bridge standards, certified.
- Iowa DOT has rolled beam 3-span standards, certified.

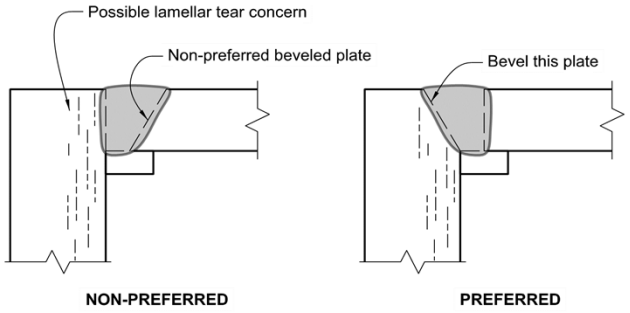
FHWA Bridge Welding Reference Manual



- Designers, Owners, Fabricators.
- Weld types, workmanship, inspection, fracture critical, defects & repairs.
- D1.5 vs. D1.1.
- Steel, aluminum, stainless steel.
- Shop and field welding.
- Reinforcing steel welding.
- Welding coated members.

FHWA Bridge Welding Reference Manual





- Welding access.
- Welding symbols and details.
- Intersecting welds.
- Fracture critical details.
- Maximum angles of fillet welds.

FHWA Bridge Welding Reference Manual

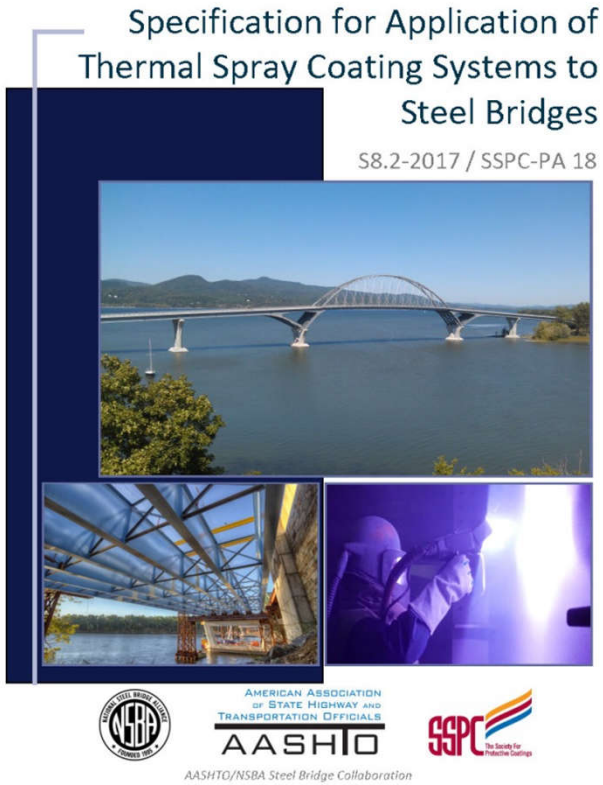
https://www.fhwa.dot.gov/bridge/steel.cfm

- No charge to download documents.

Manuals

Bridge Welding Reference Manual (.pdf) (August, 2019)
Manual for Refined Analysis in Bridge Design and Evaluation (.pdf) (May, 2019)
Design and Evaluation of Steel Bridges for Fatigue and Fracture Reference Manual (.pdf) (December, 2016)
Load and Resistance Factor Design (LRFD) for Highway Bridge Superstructures (.pdf) (July, 2016)
    Design Examples (.pdf, 8 mb)
Steel Bridge Design Handbook (December, 2015)
Engineering for Structural Stability in Bridge Construction (.pdf) (April, 2015)
Contracting and Construction of ABC projects with Prefabricated Bridge Elements and Systems (.pdf) (June, 2013)

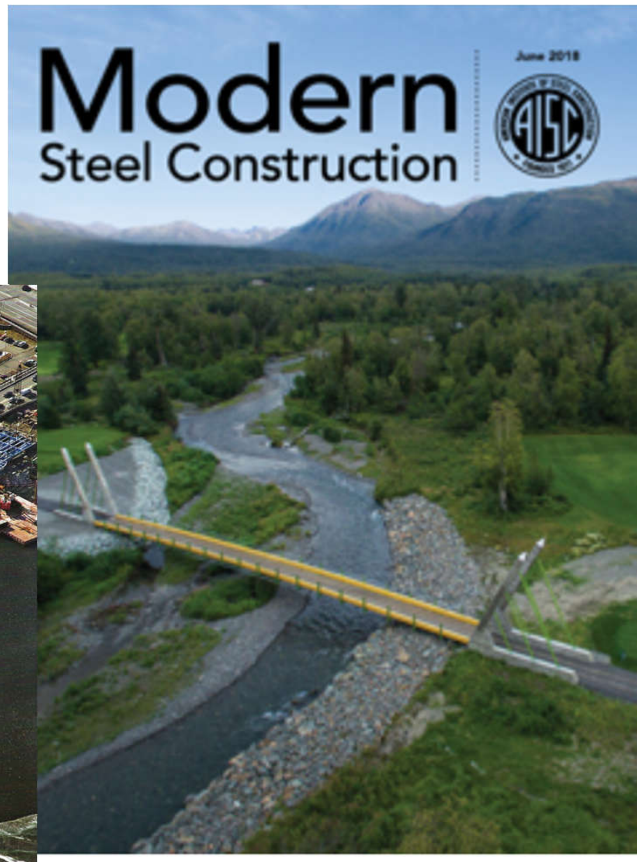
Metallizing

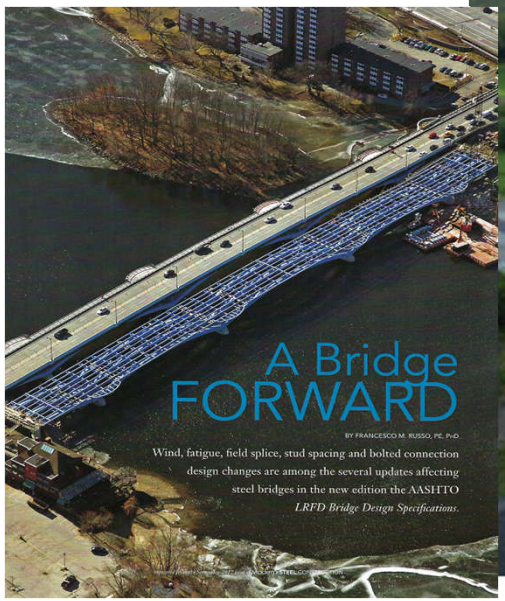


- Being used more frequently in several states.
- Provides corrosion protection similar to hot-dip galvanizing.
- No length limitations.
- Shop or field applied.
- Can be painted over if desired.

Modern Steel Construction

- Have an idea for a great bridge article?
- Submit it to: www.aisc.org/bridgeideas





Circulation = 60,000

68%	Engineers
15%	Architects
8%	Fabricators

AASHTO/NSBA Steel Bridge Collaboration

October 22-24, 2019

Savannah, GA

Task Groups

TG 1 - Detailing
TG 2 - Fabrication Specification
TG 4 - QA/QC
TG 8 - Coatings
TG 10 - Erection
TG 11 - Steel Bridge Design Handbook
TG 12 - Design for Economy and Constructability
TG 13 - Analysis of Steel Bridges
TG 15 - Data Modeling for Interoperability
TG 16 - Orthotropic Deck Panels

AASHTO/NSBA Steel Bridge Collaboration

Guidelines for Design Details (G1.4-2006)

Guidelines for Design for Constructability (G12.1-2003)

Guidelines for Steel Girder Bridge Analysis (G13.1-2014)

Steel Bridge Erection Guide Specification (S10.1-2014)

Steel Bridge Bearing Design and Detailing Guidelines (G9.1-2004)

Steel Bridge Fabrication Guide Specification (S2.1-2008)

Shop Drawing Approval Review/Approval Guidelines (G1.1-2000)

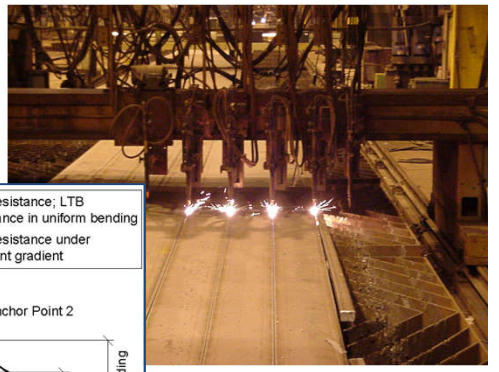
www.steelbridges.org/CollaborationStandards

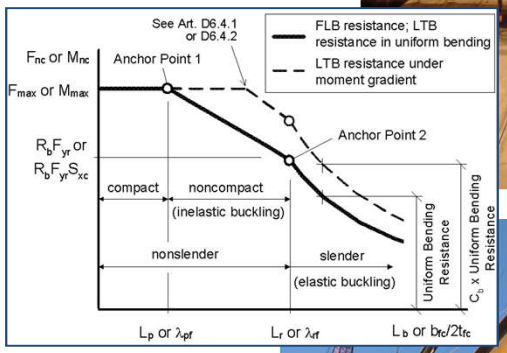

NASCC:
THE STEEL CONFERENCE
ATLANTA
Georgia World Congress Center
April 22–24, 2020
incorporating the
World Steel Bridge Symposium
and the
SSRC Annual Stability Conference
www.aisc.org/nascc

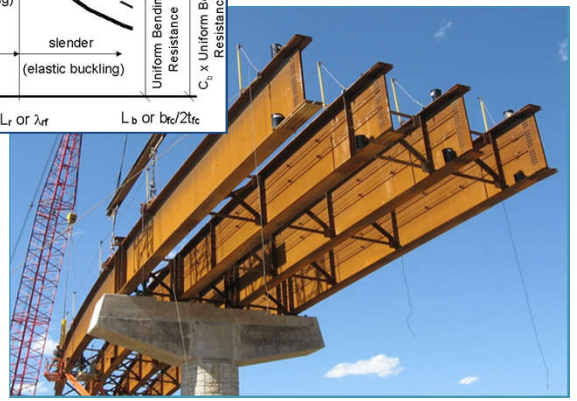
World Steel Bridge Symposium

Steel Bridge Design Workshop at WSBS

- April 21, 2019 – afternoon.
- Agenda
  - Conceptual Layout and Framing.
  - Loads.
  - The Basics of Steel Design.
  - Bolting and Splices.
  - Detailing and Fabrication.
  - Bridge Welding.
  - Modern Corrosion Protection Systems .
- More information coming soon!







Steel Day – September 27, 2019

SSAB Steel Mill Tour
October 2, 2019
Muscatine, IA

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Upcoming Continuing Education Events

Webinars:

September 10, 2019 – A709 Grade 50CR Steel, Applications for Bridges in Corrosive Environment.

Upcoming Webinar schedule;

- December 3, 2019 - FWHA Bridge Welding Reference Manual.
- Early 2020 - Erecting Steel Girders, The 3 C's- Constructability, Cost & Competition.

- Register at www.aisc.org/webinars.

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Bridges to Prosperity – La Marca, Bolivia

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NSBA
FOUNDED 1995

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Bridges to Prosperity – La Marca, Bolivia

360’ Long Completed Bridge.

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Thank You

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