Photo: 2024 Prize Bridge Merit Award, Medium Span - Rt. 34B over Salmon Creek Bridge – Photo Credit: NYSDOT

Jumpstarting Bridge Projects with AISC's Standard Plans and Conceptual Design Tools

Tony Peterson, PE

Senior Bridge Steel Specialist

Jeff Carlson, PE

Senior Director of Bridge Initiatives

American Institute of Steel Construction

Formed in 1921 by steel fabricators

<u>Purpose:</u>

- Uniformity in the fabricating industry
  - Shape data
  - Standard design specification
  - Standard of practice
- Promote structural steel industry

History of AISC

1st AISC *Specification* (1923)

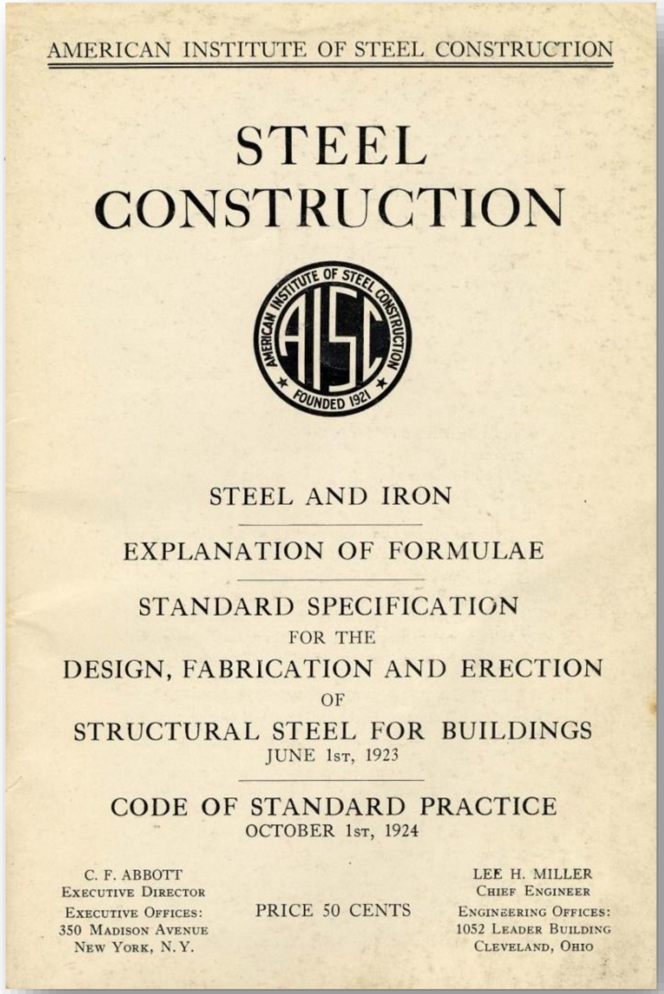
10 pages and $0.50

<u>Objective:</u>

To promote uniform practice

- By 1924, the first AISC *Specification* had been adopted by 25 cities.

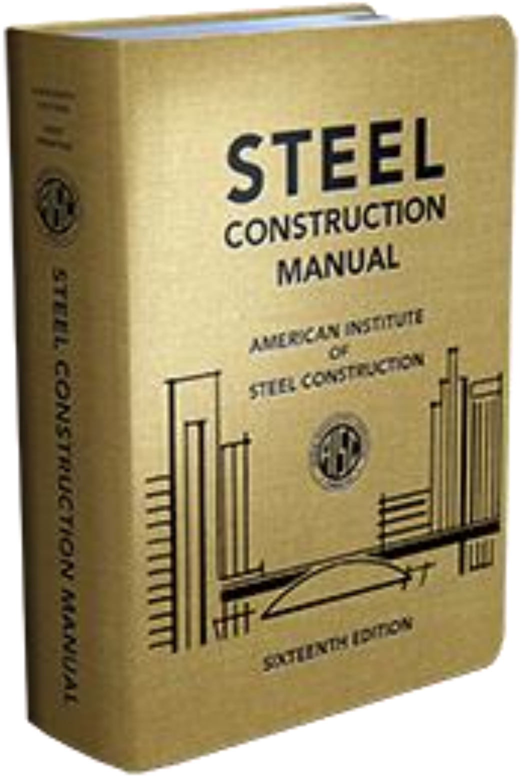
Today:
AISC *Specification* is ~800 pages and is **FREE!**



Current Specification

16th Edition (2023)

No longer $0.50



Who is AISC and what do we do?

- **Certification**
- Membership
- Building initiatives
- Bridge initiatives
- Education
- Research
- **Steel Manual**
- Meetings/Steel Conference
- Communication
- Government relations/sustainability
- Workforce development

Who We Are

National Steel Bridge Alliance, a Division of AISC

- Technical Institute & Trade Association

- Not-for-profit: working for the advancement of steel bridge design and construction

- Services: free resources, forums, AASHTO/NSBA collaboration, preliminary design & evaluation tools, continuing education

NSBA At A Glance

- Link between bridge owners and steel bridge fabricators
- Design resources
- Fabrication resources
- Steel solutions center & project assistance
- Research for new initiatives
- Education for bridge designers and owners
- Communication and messaging
- AASHTO/NSBA Collaboration

What NSBA Can Do For You…

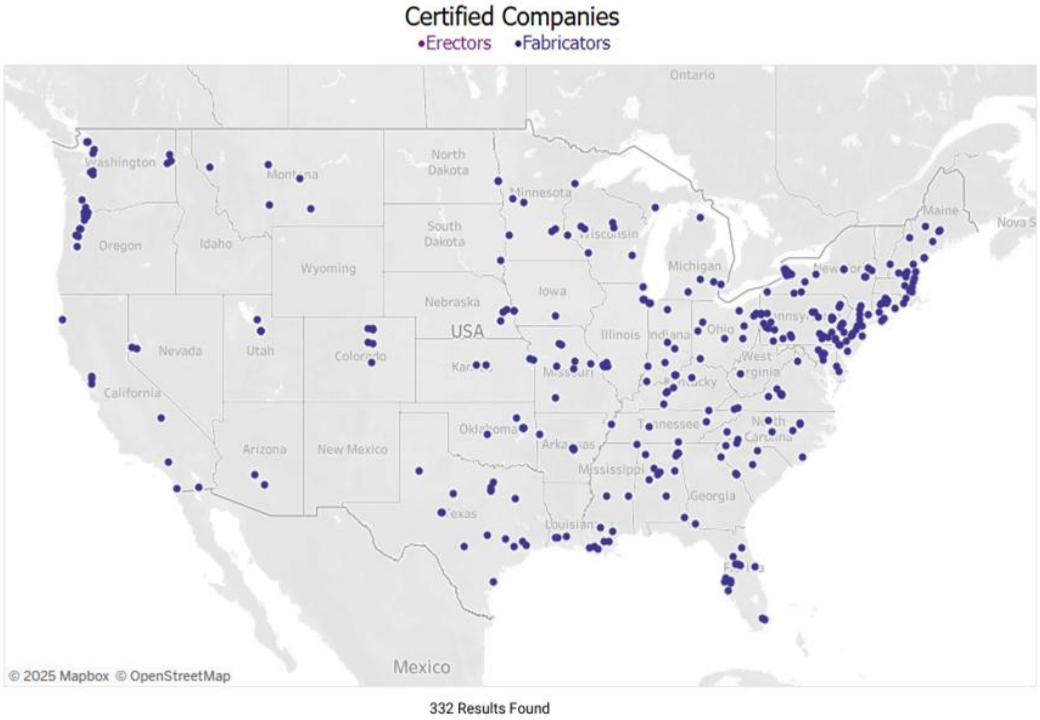
- Steel bridge project assistance
  - Conceptual design
  - Project plan review
  - Connection to steel bridge fabricator
  - Conceptual pricing assistance
  - Design specification review

Why Do We promote Steel?

- There is a time and a place for most bridge types
    - Our 6 primary differentiators:
        - Resilience and longevity
        - Easier inspectability and repairability
        - Accelerated construction schedules
        - Graceful solutions for simple and complex geometries
        - Unmatched span-to-depth ratio
        - A far more sustainable option, with reduced waste and pollution

NATIONAL STEEL BRIDGE ALLIANCE
NSBA
FOUNDED 1995

How to find a steel bridge fabricator



aisc.org/certifiedbridgemembers

STEEL SOLUTIONS CENTER

The Steel Solutions Center is your gateway to nearly 100 years of steel knowledge, and it's just a phone call or email away.

aisc.org/askaisc

solutions@aisc.org

866.ASK.AISC

- answer your technical questions about structural steel design.
- help you understand NSBA's technical publications.
- help you reduce project risk by connecting decision-makers with AISC bridge-member fabricators for price and schedule information.
- provide conceptual solutions for steel girder and beam bridges, including framing plan and girder spacing concepts, preliminary girder sizes, and steel tonnage estimates.

AASHTO/NSBA Steel Bridge Collaboration

Fall 2025 Meeting

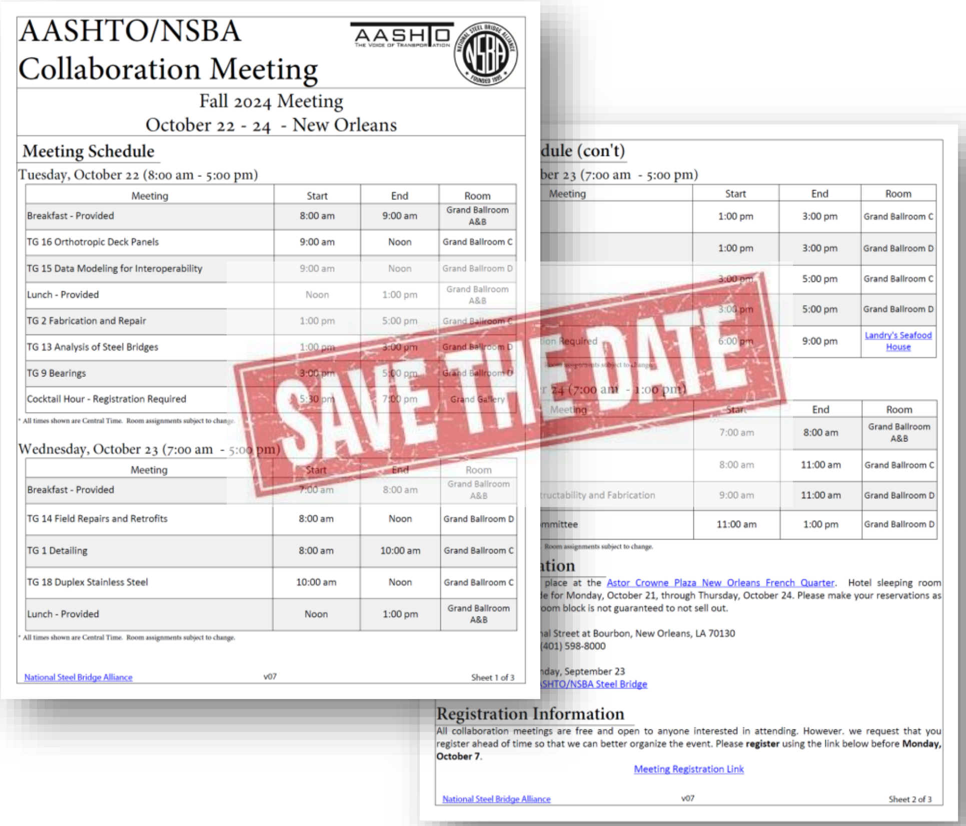
- October 21-23.
- Little Rock, AR

Spring 2026 Meeting

- May 12-14.
- TBD

Fall 2026 Meeting

- October 20-22.
- TBD


AASHTO/NSBA
Collaboration Meeting

Fall 2024 Meeting
October 22 - 24 - New Orleans

Meeting Schedule

Tuesday, October 22 (8:00 am - 5:00 pm)

Meeting	Start	End	Room
Breakfast - Provided	8:00 am	9:00 am	Grand Ballroom A&B
TG 16 Orthotropic Deck Panels	9:00 am	Noon	Grand Ballroom C
TG 15 Data Modeling for Interoperability	9:00 am	Noon	Grand Ballroom D
Lunch - Provided	Noon	1:00 pm	Grand Ballroom A&B
TG 2 Fabrication and Repair	1:00 pm	5:00 pm	Grand Ballroom C
TG 13 Analysis of Steel Bridges	1:00 pm	3:00 pm	Grand Ballroom D
TG 9 Bearings	3:00 pm	5:00 pm	Grand Ballroom D
Cocktail Hour - Registration Required	5:30 pm	7:00 pm	Grand Gallery

* All times shown are Central Time. Room assignments subject to change.

Wednesday, October 23 (7:00 am - 5:00 pm)

Meeting	Start	End	Room
Breakfast - Provided	7:00 am	8:00 am	Grand Ballroom A&B
TG 14 Field Repairs and Retrofits	8:00 am	Noon	Grand Ballroom D
TG 1 Detailing	8:00 am	10:00 am	Grand Ballroom C
TG 18 Duplex Stainless Steel	10:00 am	Noon	Grand Ballroom C
Lunch - Provided	Noon	1:00 pm	Grand Ballroom A&B

* All times shown are Central Time. Room assignments subject to change.

National Steel Bridge Alliance v07 Sheet 1 of 3

SAVE THE DATE

Registration Information

All collaboration meetings are free and open to anyone interested in attending. However, we request that you register ahead of time so that we can better organize the event. Please **register** using the link below before **Monday, October 7**.

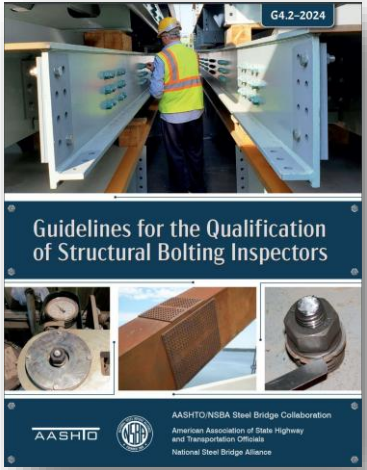
Meeting Registration Link

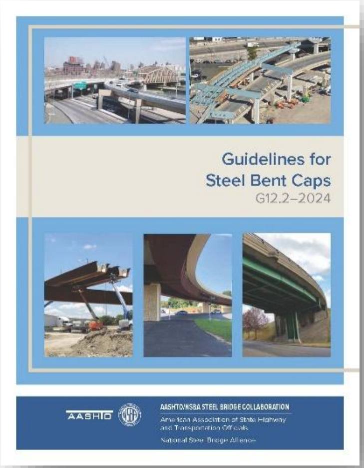
National Steel Bridge Alliance v07 Sheet 2 of 3

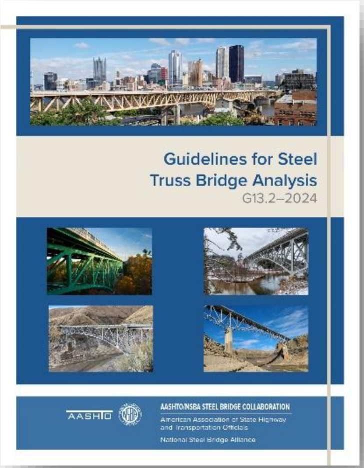
AASHTO/NSBA Collaboration

Updated and New Documents

- G4.2 Guidelines for the Qualification of Structural Bolting Inspectors – Released October 2024.
- G12.2 Guidelines for Steel Bent Caps – May 2025.
- G13.2 Guidelines for the Analysis of Trusses – May 2025.





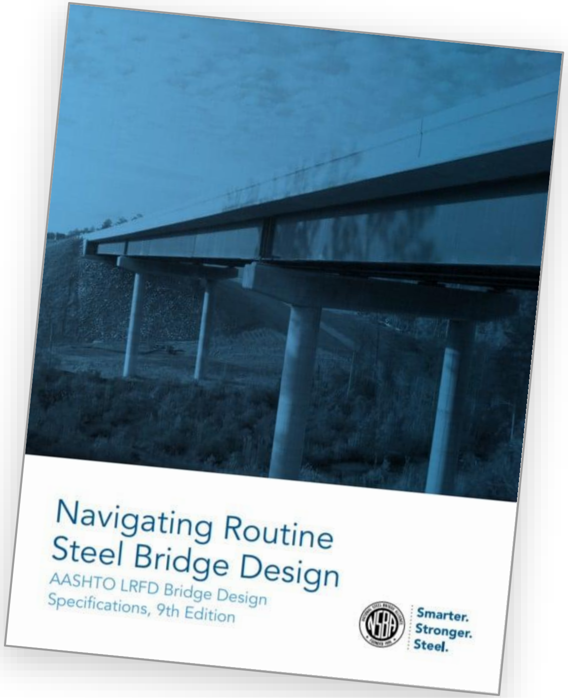


Steel Bridge Resources

NSBA creates technical resources that make it easy for bridge owners to design in steel.

Key Resources For Conceptual Design

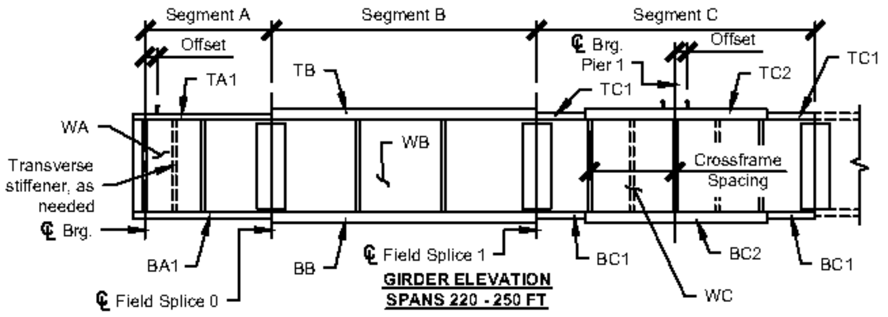
- As a “Cliffs Notes” version of the AASHTO BDS for straight unskewed steel bridges,the NSBA Navigating Routine Steel Bridge Design Guide **makes designing routine steel bridges easier!**



aisc.org/streamlineddesign

Key Resources For Conceptual Design

- New NSBA Standards for 1, 2, 3, & 4 span steel bridges
- **Now available on the NSBA website!**



Key Resources For Conceptual Design

- Short Span Steel Bridge Alliance standards & design aids are useful tools for simply supported steel bridges with spans <140 ft

eSPAN140™

shortspansteelbridges.org/resources/espan140

Ohio Design Data Sheets
shortspansteelbridges.org/ohio

West Virginia Standards
shortspansteelbridges.org/west-virginia-standard-bridge-plans

NSBA Electronic Resource Request

aisc.org/BridgeResources

All of our resources can be found at: www.steelbridges.org


Photo: 2020 Prize Bridge Merit Winner, Major Span – Portageville Bridge Replacement (New York) – Photo Credit: John Kucko

NSBA Continuing Education Efforts

Steel Bridge Forums, Workshops, Webinars, and NASCC/WSBS

Continuing Education

NSBA Steel Bridge Forums – 2025

- North Carolina: February 27, 2025
- Ohio: April 9, 2025
- North & South Dakota: April 23, 2025
- Michigan: October 8, 2025
- California: November 12, 2025
- Others are being planned for 2026

aisc.org/nsba/steel-bridge-forum/

Continuing Education

NSBA Workshops

- Half-day, in-person, technical topic specific
- Examples:
  - Basics of Steel Bridge Design
  - Horizontally Curved Steel Girders
    - Primary Principles
    - Preliminary Design and Analysis
    - Fabrication
    - Methods of Analysis
    - Example Design Computations
    - Construction

Wyoming DOT – Nov 2024

Continuing Education

AISC Webinars

- Upcoming - TBD
- Past

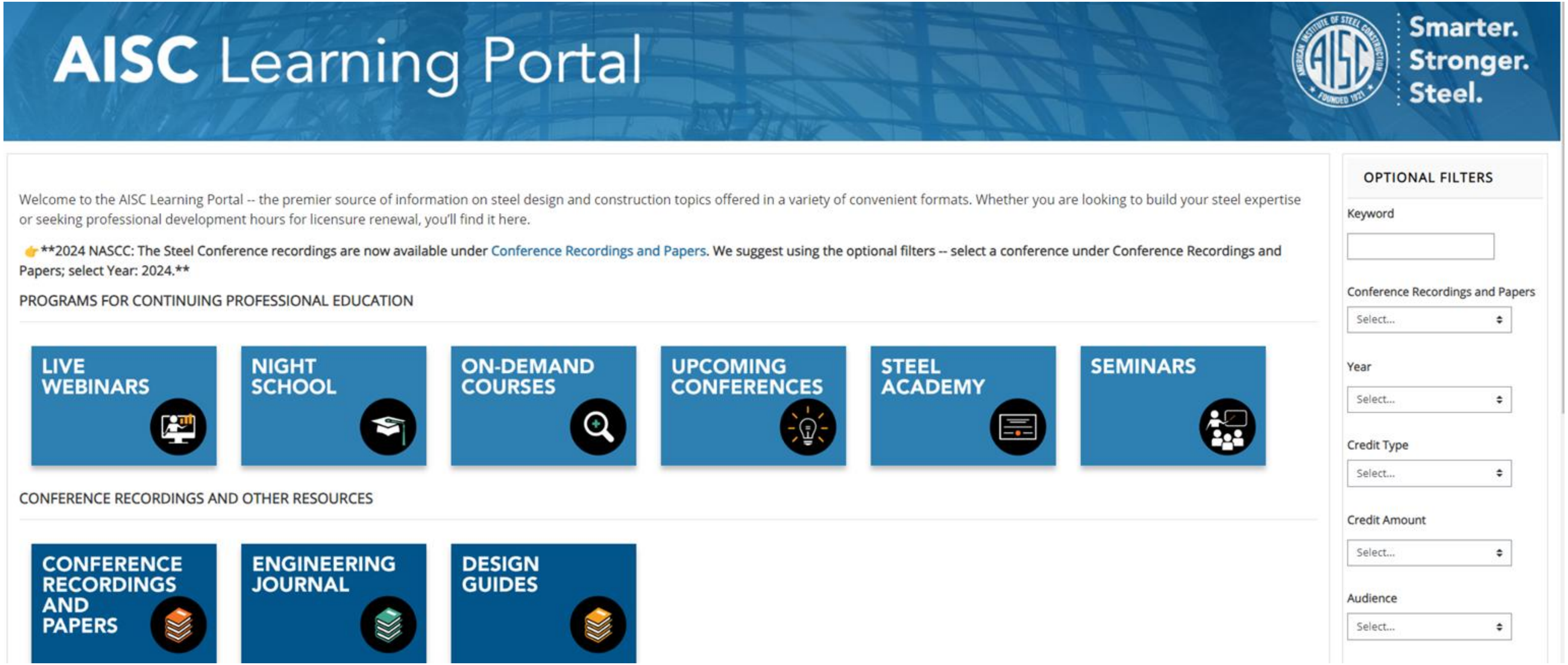
Title: Built-Up Press Brake-Formed Tub Girders
Presenter: Ashley Thrall, PhD, PE
Date: February 4, 2025

Title: What You Need to Know: Steel Design Revisions in the 10th Edition of the AASHTO LRFD Bridge Design Specifications
Presenter(s): Mike Grubb, PE and Brandon Chavel, PhD, PE

Title: Efficient and Integrated Design of Modern Steel Highway Bridges
Presenter: Francesco Russo, PhD, PE

Educational Resources

- AISC Learning Portal - https://learning.aisc.org/



Registration and Travel Stipends for Owner's

NASCC: THE STEEL CONFERENCE

- World Steel Bridge Symposium
- QualityCon
- Architecture in Steel
- SafetyCon
- SEAoK Conference
- SSRC Annual Stability Conference
- NISD Conference on Steel Detailing

Join us for NASCC: The Steel Conference in Louisville, KY at the

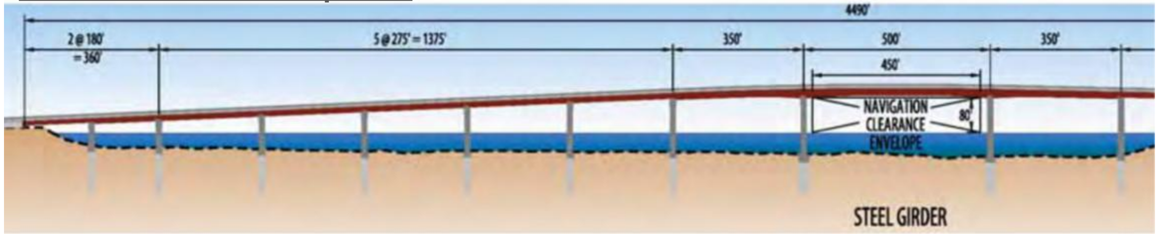
Kentucky International Convention Center April 2-4, 2025.

Registration for NASCC: The Steel Conference 2025 opens Wednesday, January 8th!

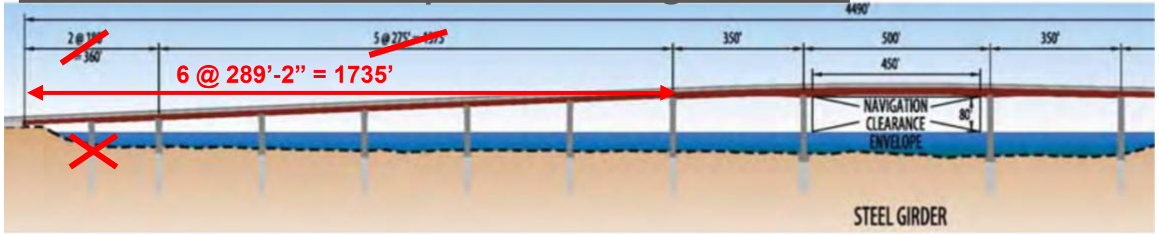
Project Assistance and Conceptual Solutions

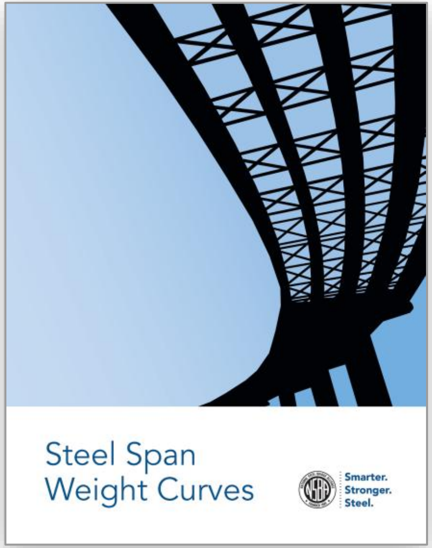
- NSBA can help with project assistance and we (i.e., the fabricator) can help with preliminary cost estimates. Here is one example.

From TS&L Report:



NSBA Revised Span Arrangement:





Project Assistance and Conceptual Solutions

Total Weight

Unit	Steel Weight (psf)	Deck Area (sq. ft.)	Approximate Steel Quantity (tons)
3-Span Main Unit	115	67600	3887
290’ Approach Spans	51	97738	2492
311’ Approach Spans	54	87598	2365
Sub Total	-	252937	8744
		Contingency (5%)	437
		Total	**9182**

Photo: 2020 Prize Bridge Merit Winner, Major Span – Portageville Bridge Replacement (New York) – Photo Credit: John Kucko

Case Studies For NSBA Assistance

Anthony Peterson, PE, ENV SP

- NSBA Senior Steel Bridge Specialist
- Professional Engineer with 30+ years structural engineering experience with bridges of all types
- Envision Sustainability Professional
- Located in Duluth Minnesota

Bridge Project Development

- Conceptual design
- Preliminary design
- Final design
- Construction
- Initial design and construction cost
- Long term costs (inspection, maintenance, repairs)
- Sustainability and resilience
- Assistance from NSBA

Wisconsin Bridge

- Turtle Lake Casino & Campground
- St. Croix Chippewa Tribe
- Steel bridge rehabilitation
- 30’ bridge to campground & amphitheater
- Bridge closed with deck removed and significant deterioration
- Tribe contacted steel fabricator seeking assistance
- I visited site and assisted

Wisconsin Bridge

- Inspected bridge
- Described likely options to tribe that included rehabilitation and replacement
- Provided contacts for engineering and repair services and gave advice on what questions to ask
- Reviewed environmental issues to be aware of
- New steel deck, repaired and painted beams, new railing, abutment repair
- Post repair visit

Alaska Bridge

- Wolf Creek Bridge near Craig
- Craig Tribal Association
- Bridge replacement including a temporary detour bridge.
- 25’ corrugated steel plate arch culvert
- AISC member fabricator provided temporary steel beam bridge and permanent arch culvert
- Natural streambed maintained

Alaska Bridge

- Low maintenance buried steel bridge
- Galvanized steel arch
- Installed with County workforce
- Lightweight
- Quick long-term solution
- Fish and environmentally friendly

Iowa Bridge

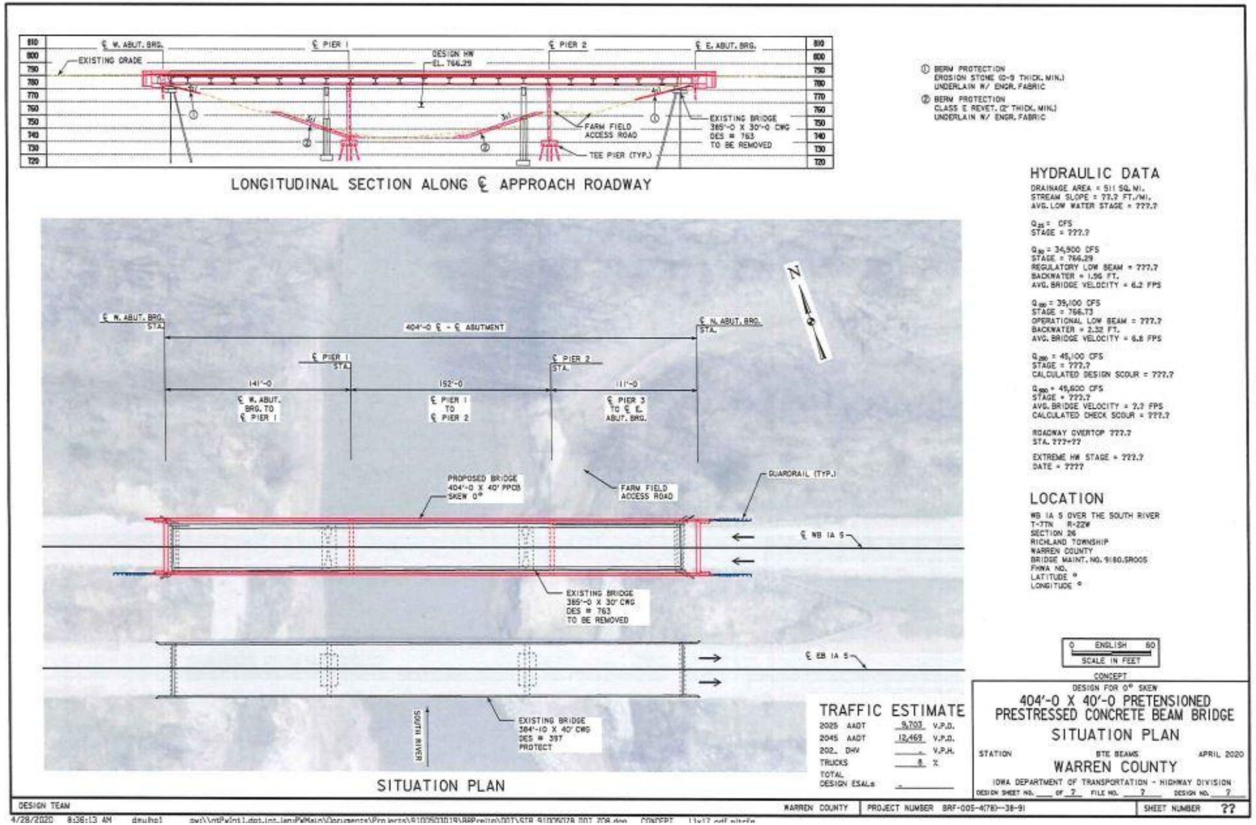
- South River Bridge near Indianola
- Carries northbound lanes of Highway 5
- Owner is Iowa DOT
- Contacted NSBA for assistance during conceptual design stage
- Existing bridge needs replacement and they were interested in alternates
- Low cost and long-term value are key drivers

Iowa Bridge

- Straight channel but bend at bridge
- Mud bottom river that has high scour and erosion potential
- Significant debris carried in river – 500+ square mile drainage area

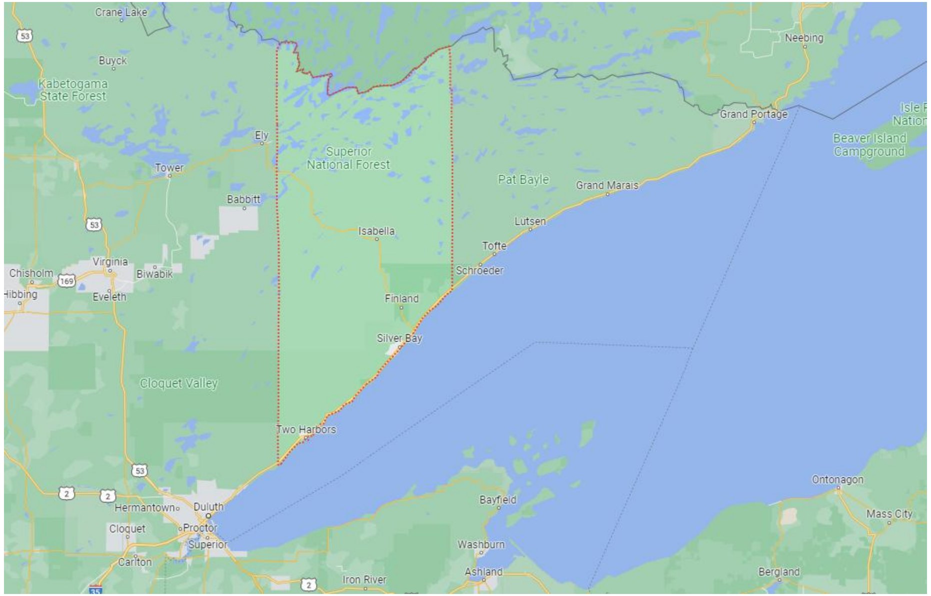
Iowa Bridge

- Steel option verses concrete
- Longer main span
- Piers out of river channel reduce construction and long term costs
- Reduced backwater
- Lower impacts to environment
- Concrete option initially chosen due to slightly lower construction cost
- Steel option ultimately chosen



Minnesota Bridge

- Hockamin Creek Bridge near Finland
- Carries a rural gravel road
- Owned by Lake County
- Existing pipe culverts washed out by flood
- Need replacement structure quickly
- County interested in more resistant structure to floods and more fish-friendly



Minnesota Bridge

- Corrugated steel pipe arch buried structure
- 31’ span with 12’ rise
- Matches creek width nicely and provides natural bottom for fish
- Maintains existing road profile
- Galvanized steel

Minnesota Bridge

- Constructed with County workforce
- Less costly than concrete arch alternative due to constructability
- Low maintenance compared to beam bridge
- Sustainable resilient steel
- Performed excellent during major flood event

Minnesota Bridge

DULUTH News Tribune

Unlock digital at duluthnewstribune.com/activate — Saturday, July 13, 2024 — $3.00

Climate-resilient culverts survive flood

BY JIMMY LOVRIEN
Duluth News Tribune

FINLAND, Minn. — It wasn't all that uncommon for Hockamin Creek to overwhelm the Heffelfinger Road crossing, damaging the road and cutting off residents who live down the road.

The two culverts under the gravel road in Crystal Bay Township, a 200-square-mile township of 600 people just west of Finland, were undersized and perched above or near the waterline. Erosion issues surrounded the culverts.

The culverts also prevented brook trout from passing through the creek, a tributary to the Baptism River, which travels through Tettegouche State Park before emptying into Lake Superior.

So state and local officials designed a replacement culvert that considered both brook trout habitat and 100-year-rain fall events. Completed in fall 2022, the culvert is more of a bridge than a traditional culvert — it has an open bottom and a wide span.

And it's working.

As heavy rain on June 18 washed out dozens of Northland roads and culverts, the Finland area saw some of the heaviest rain totals of between 5 and 6 inches of rain within 24 hours.

Even so, the new culvert "performed wonderfully," said Tara Solem, district manager of the Lake County Soil and Water Conservation District.

"I'm really impressed at how well they work," said Douglas "Pudge" Perfetto, Crystal Bay's road supervisor. "It saved us a lot of misery."

With climate change already increasing precipitation and extreme

FLOOD on A8

Contributed / Jeff Jasperson, Minnesota Pollution Control Agency

Hockamin Creek flows through a new culvert on Heffelfinger Road in Crystal Bay township just west of Finland, Minn. The culvert, completed in 2022, is designed to help brook trout reach cold water and is built to withstand 100-year rainfall events.

Minnesota & Wisconsin Tribal Infrastructure

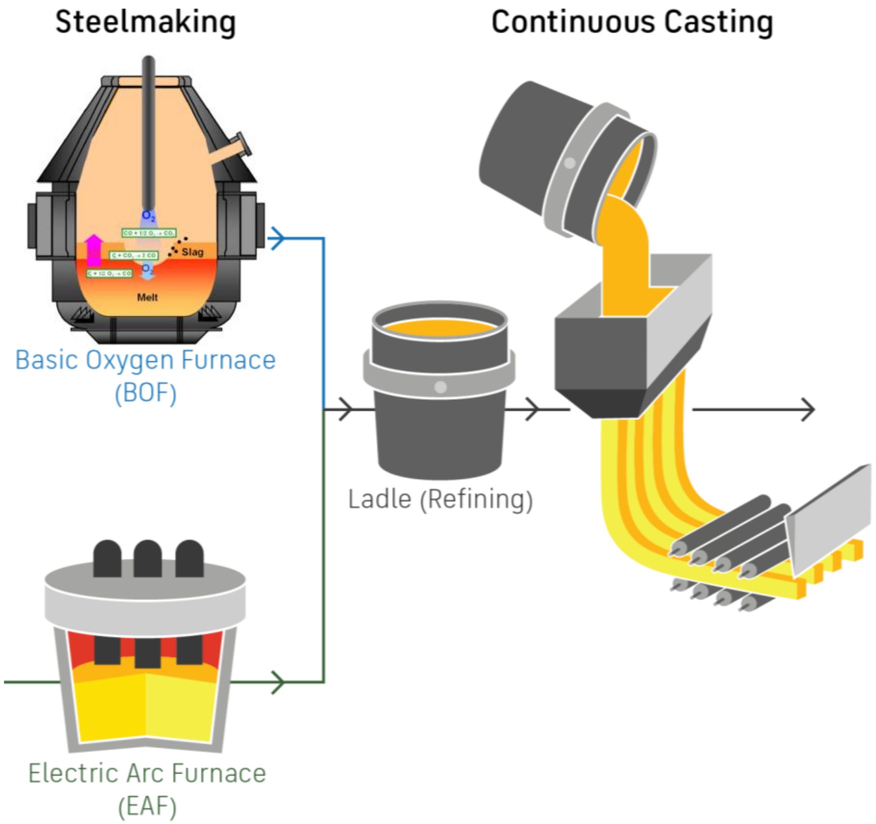
Ojibwe Tribal Land

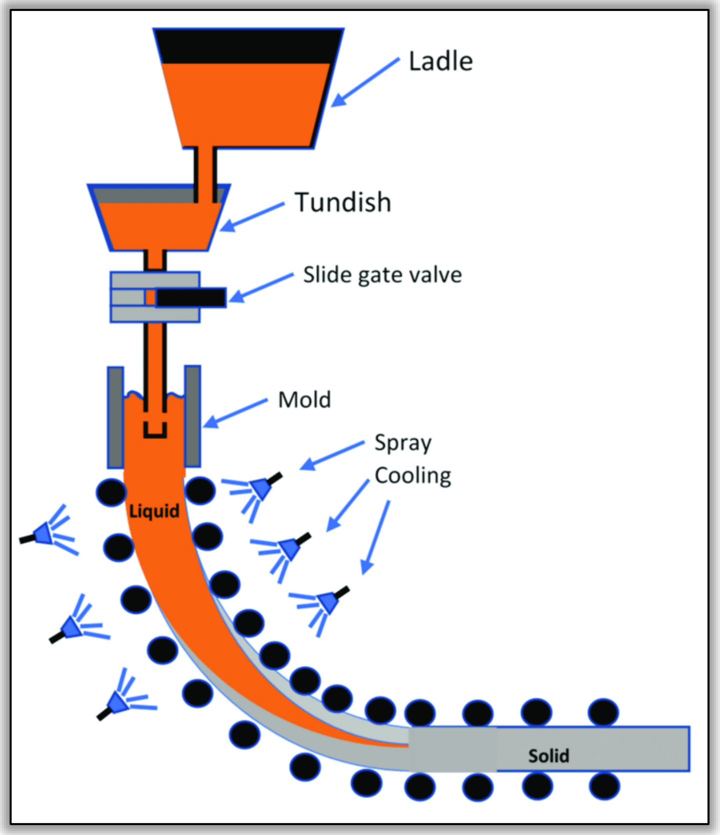
- Bad River and Lac Coutre Oreilles tribes in NW Wisconsin
- Large land areas with extensive road systems and river crossings
- Environmentally sensitive areas with potential impacts from surrounding municipalities and utilities
- Adequately maintaining bridges/culverts to provide for vehicles and wildlife is important
- NSBA is here to assist – Visit our booth
- **Anthony Peterson, peterson@aisc.org**

Photo: 2020 Prize Bridge Merit Winner, Major Span – Portageville Bridge Replacement (New York) – Photo Credit: John Kucko

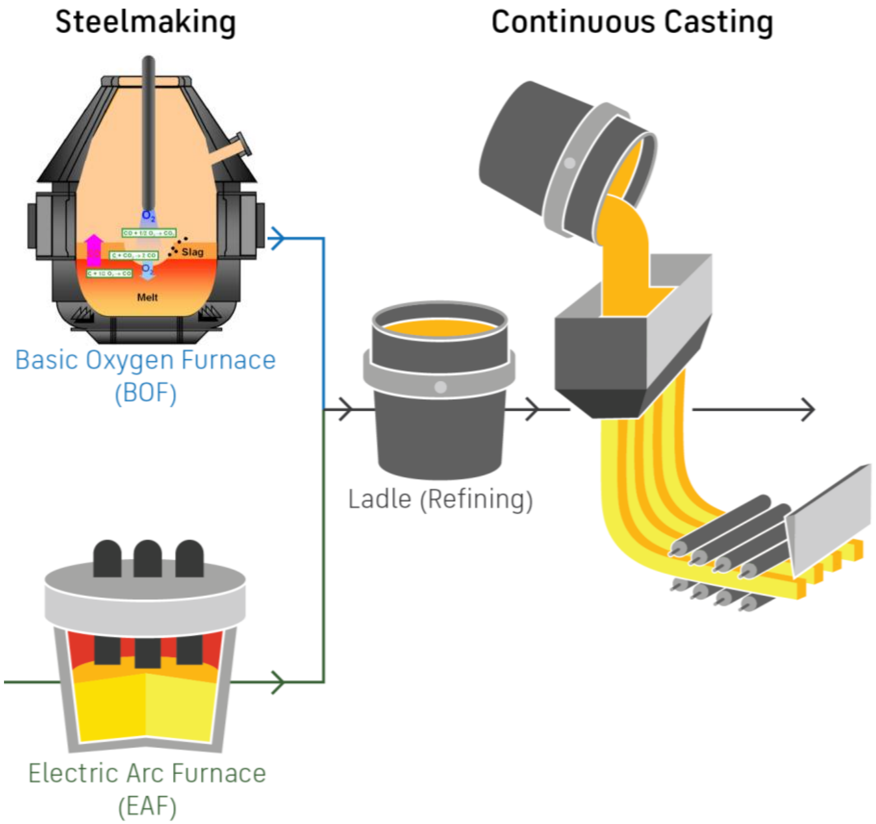
Basics of Steel Bridge Fabrication

Steel Mill: Melt Shop

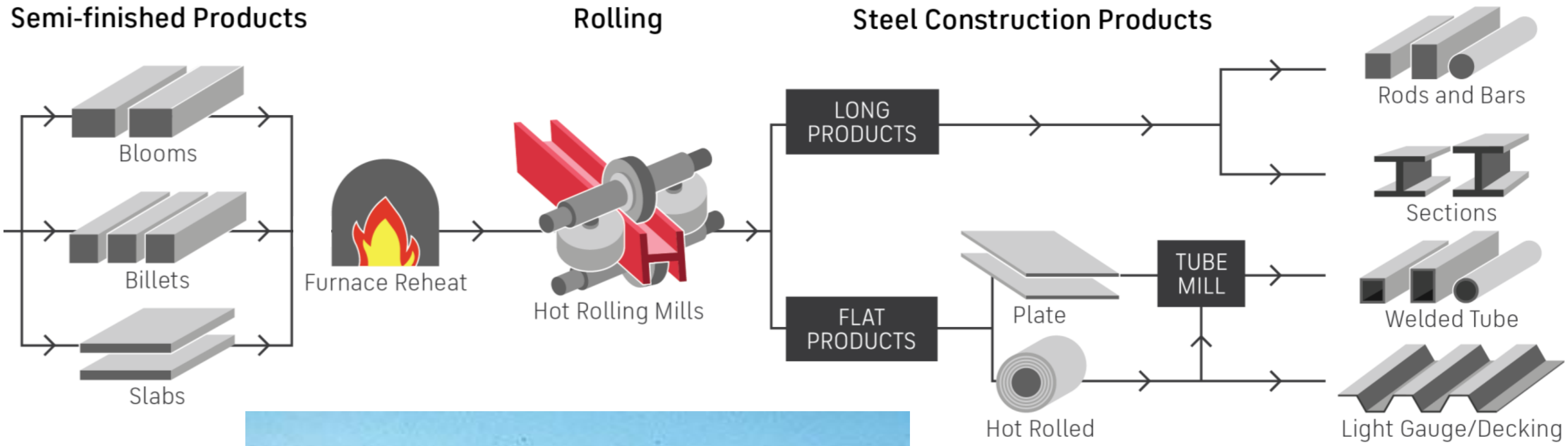




Steel Mill: Melt Shop



Steel Mill: Rolling Mill



Rolled Beam vs. Welded Plate Girder

- **Rolled Beams**
  - Generally, for shorter spans
  - Dependent on mill rolling schedules
  - Stocked at Service Centers

- **Welded Plate Girder**
  - Usually for longer spans
  - Flanges and web welded together
  - Made from flat plate material

Fabrication – Common Practices

- Raw Material

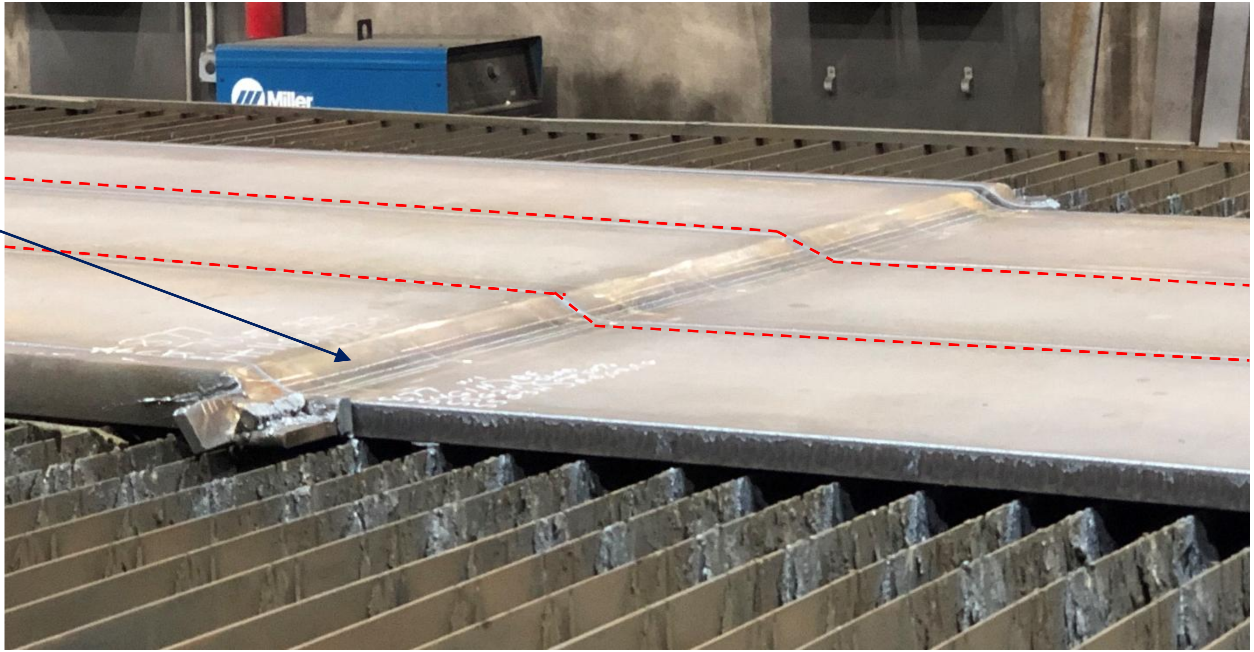
Fabrication – Common Practices

- First Steps
  - Shop Splice Flange Plates, Web Plates
    - Full Penetration Welds for splicing plates
    - Nesting of Flange Plates
  - Trim Mill Edges of the wider plates
  - Cut Flange Plates to Width from Wider plate

Fabrication – Common Practices

- Flanges
  - Example: Three flanges cut from two large plates welded together

Welded Shop Splice, thicker plate to thinner plate

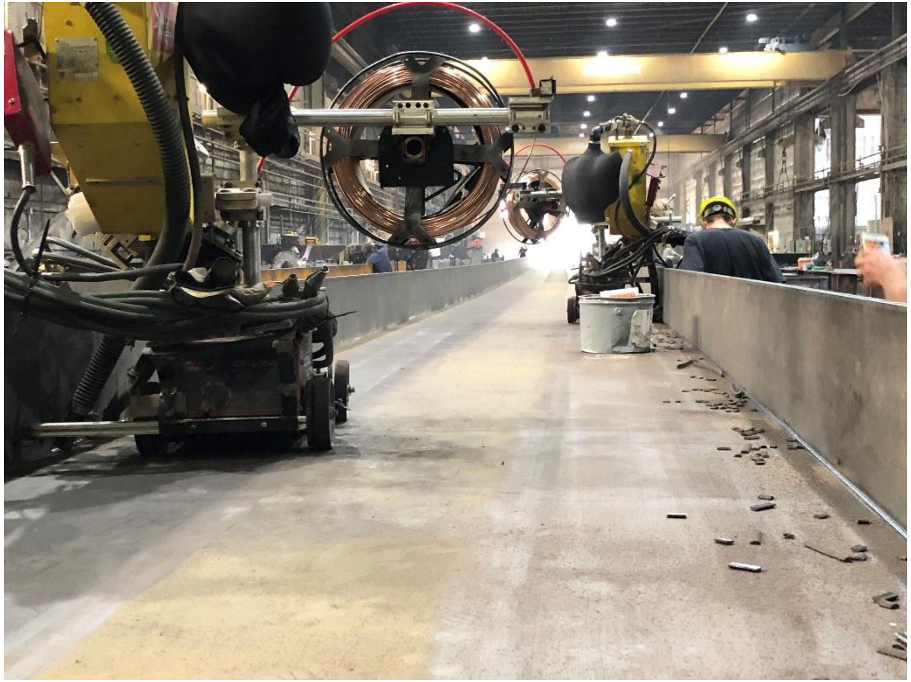


Fabrication – Common Practices

- Assemble plates to form girder

Fabrication – Common Practices

- Weld flanges to the web



Fabrication – Common Practices

- Weld flange plates to web plate
  - Completed flange to web weld

Fabrication – Common Practices

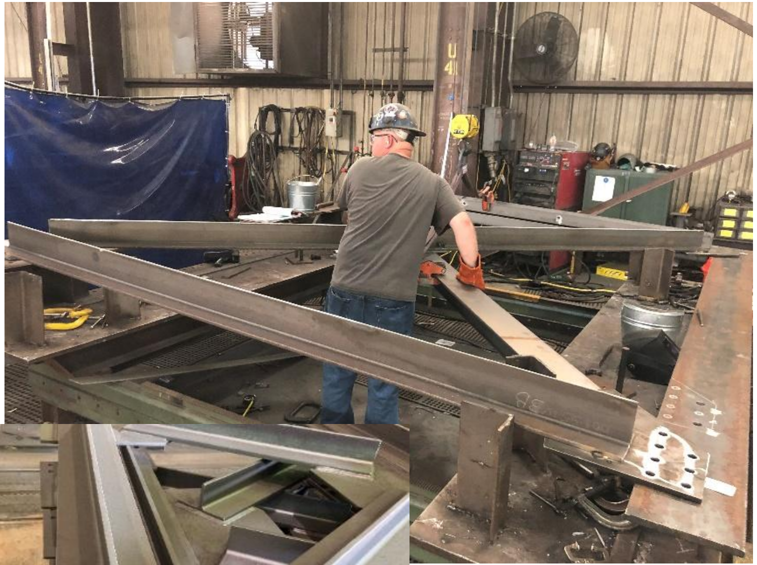
- Fit up & weld stiffeners

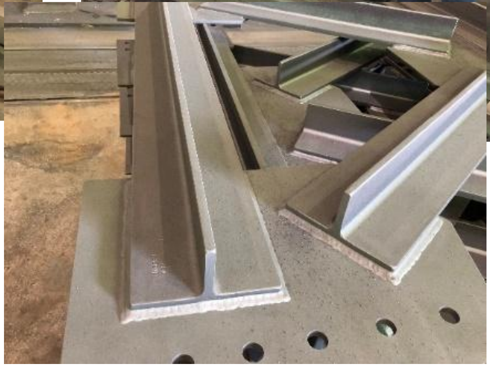
Fabrication – Common Practices

- Field splice plates

Fabrication – Common Practices

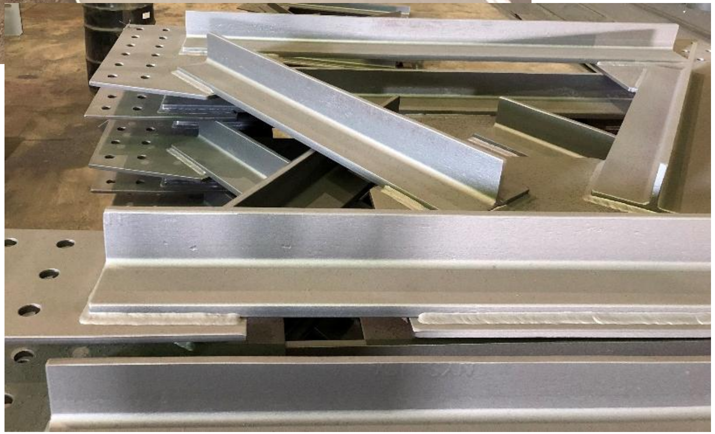
- Cross-frames





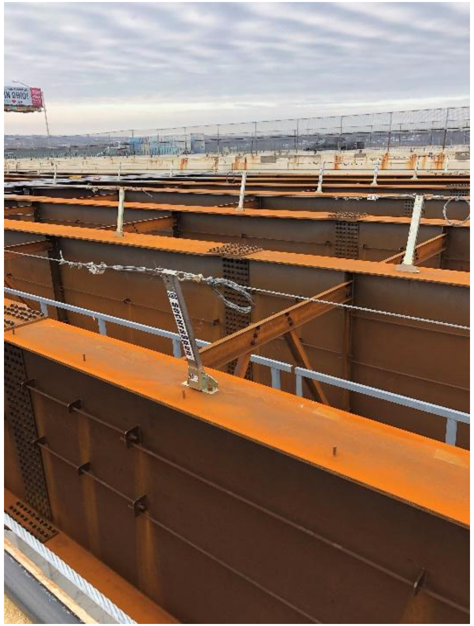
Fabrication – Common Practices

- Blast Cleaning

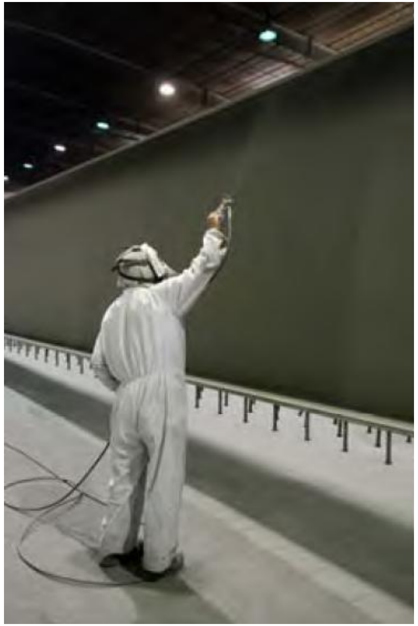


Fabrication – Common Practices

- Most efficient solution
  - Uncoated Weathering Steel



- Alternative - Painting
  - Typically, 2 or 3 coats



Uncoated Weathering Steel Bridge in Arizona

Pinto Creek Bridge

Fabrication

- **Questions**

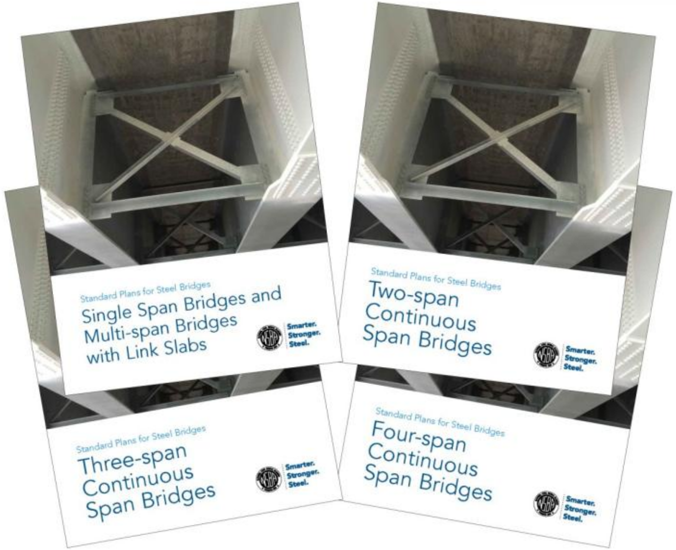
Photo: 2020 Prize Bridge Merit Winner, Major Span – Portageville Bridge Replacement (New York) – Photo Credit: John Kucko

AISC/NSBA’s Standard Plans

General Information

- **Need:**
  - Designers routinely face repetitive design decisions regarding material thickness and sizes for the routine steel I-girder bridges
  - Variety in typical steel bridge design
  - Need for Speed Project

- **Purpose:**
  - Provide optimized designs for 1, 2, 3, and 4 span plate girder bridges.
  - Ensure cost-efficient and reflect standard plate sizes available from domestic mills.

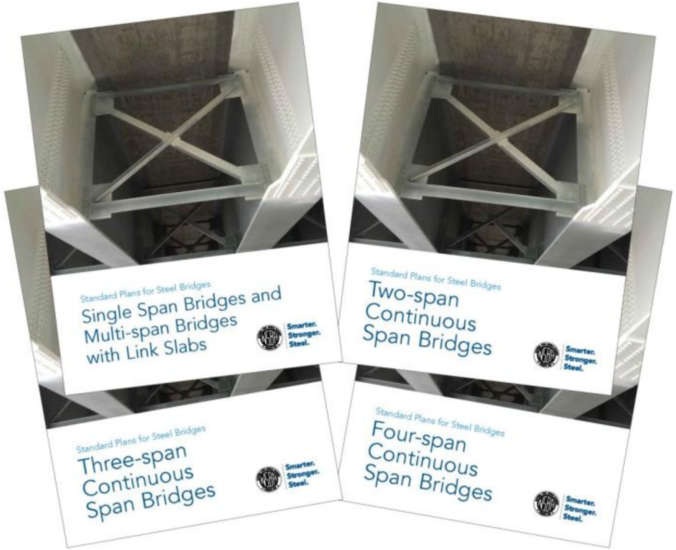


aisc.org/standard-bridge-plans

General Information

- **Result:**
  - Nearly 300 full bridge designs
    - Spans range from 80ft to 300ft
    - Girder spacings = 8ft, 10ft, 12ft, 14ft

  - Girders
  - Stiffeners
  - Shear Studs
  - Field Splices
  - Bearing Reactions
  - Camber
  - Cross-frames & Diaphragms
  - Deck Pour Sequence Considerations
  - and much, much more…….



aisc.org/standard-bridge-plans

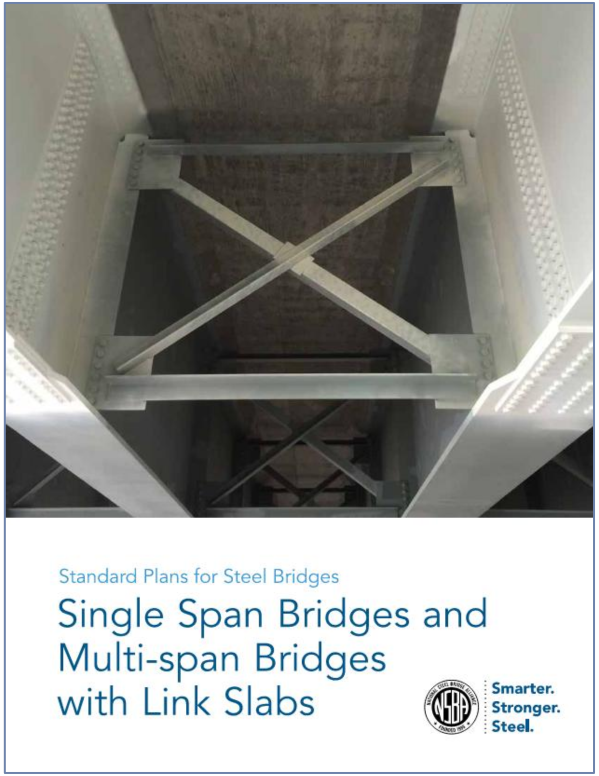
Standard Plans for Steel Bridges

What is in there???

- **Single Span Bridges:**
  - 80 ft to 140 ft spans
  - 150 ft to 210 ft spans
  - 220 ft to 300 ft spans

  - Cross-frame & Diaphragm Details
  - Lateral Bracing Details
  - Bolted Field Splices
  - Deck Details
  - Link Slab Details

  - 39 sheets



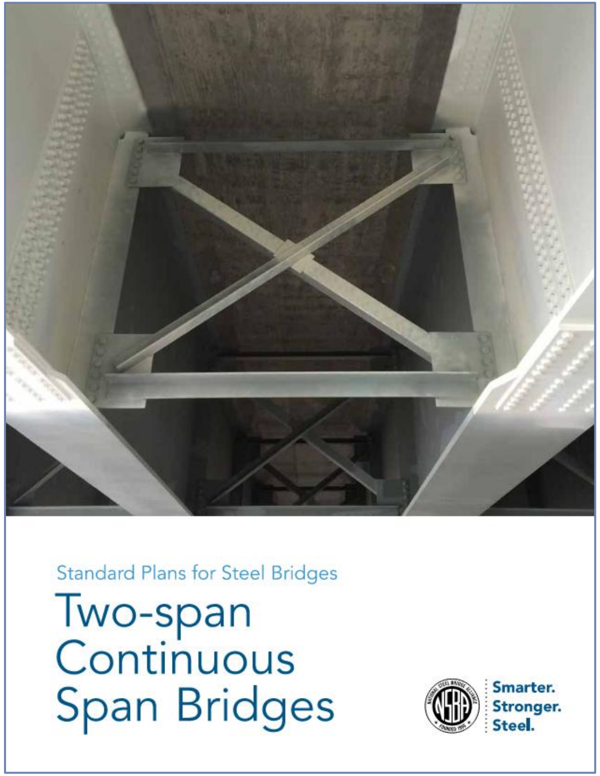
Standard Plans for Steel Bridges

What is in there???

- **2-Span Continuous Bridges:**
  - Equal Spans
  - 100 ft to 250 ft spans

  - Deck Pouring Sequence
  - Cross-frame & Diaphragm Details
  - Lateral Bracing Details
  - Bolted Field Splices
  - Deck Details

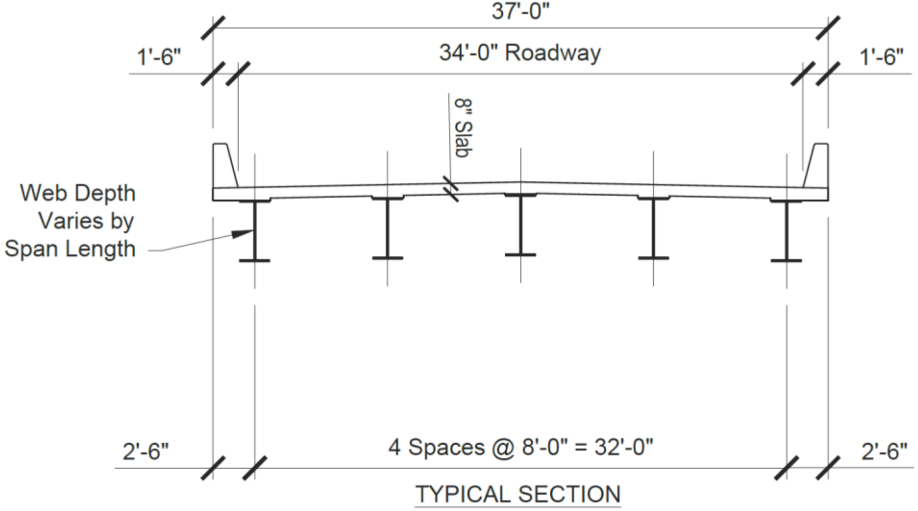
  - 28 sheets



Typical Cross-sections

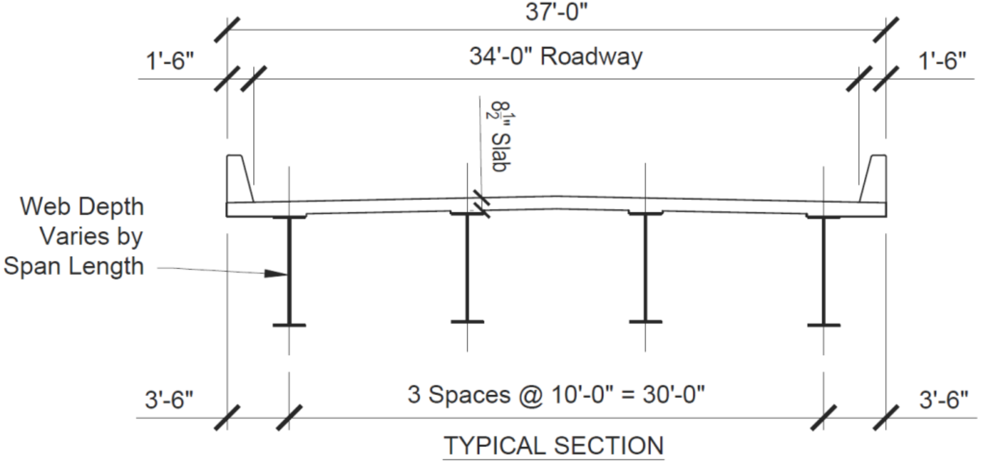
Girder Spacing and Overhangs

8 ft Girder Spacing



Overhang = 0.31S

10 ft Girder Spacing

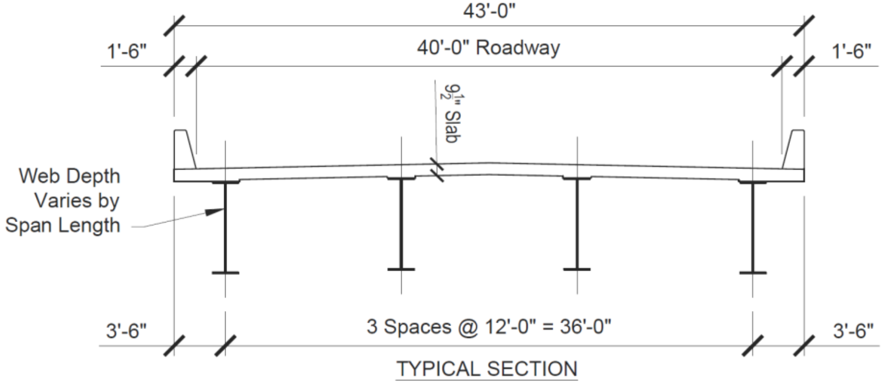


Overhang = 0.35S

Typical Cross-sections

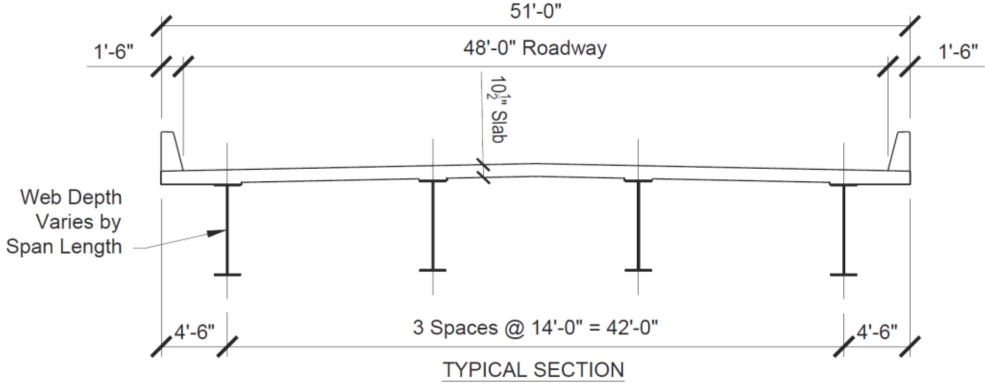
Girder Spacing and Overhangs

12 ft Girder Spacing



Overhang = 0.29S

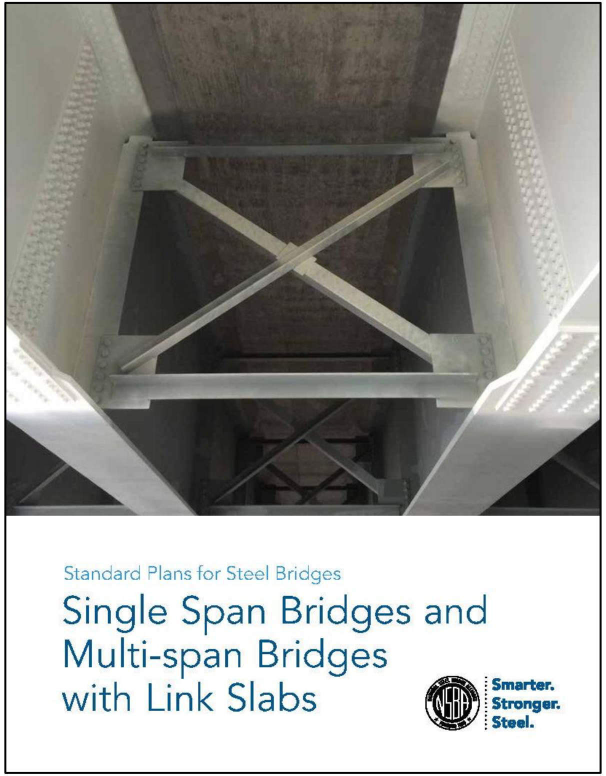
14 ft Girder Spacing

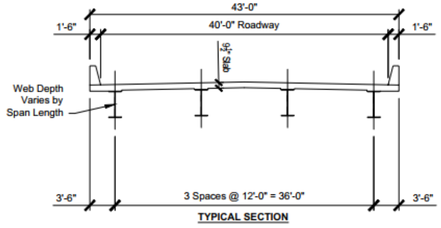


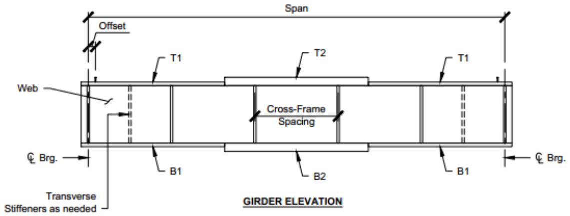
Overhang = 0.32S

Walk-thru of the Standard Plans

1-Span, 12 ft Girder Spacing







Span, ft.	Web (in. x in. x ft.)	T1 (in. x in. x ft.)	T2 (in. x in. x ft.)	B1 (in. x in. x ft.)	B2 (in. x in. x ft.)
80	36 x 0.5 x 80	---	15 x 1.25 x 80	---	15 x 1.5 x 80
90	38 x 0.5 x 90	---	16 x 1.25 x 90	---	16 x 1.75 x 90
100	45 x 0.5 x 100	18 x 1 x 35	18 x 1.5 x 30	18 x 1 x 24	18 x 1.5 x 52
110	47 x 0.5 x 110	18 x 1 x 40	18 x 1.5 x 30	18 x 1 x 20	18 x 1.75 x 70
120	50 x 0.5 x 120	18 x 1 x 25	18 x 1.5 x 70	18 x 1 x 20	18 x 2 x 80
130	52 x 0.5 x 130	19 x 1 x 30	19 x 1.5 x 70	20 x 1 x 22	20 x 2 x 86
140	56 x 0.5 x 140	20 x 1 x 30	20 x 1.5 x 80	22 x 1 x 25	22 x 2 x 90

Note: All plates are A709 Gr 50W

TRANSVERSE AND BEARING STIFFENERS					
Span, ft.	Transverse Stiffener Size and Location			Bearing Stiffeners	
	Width in.	Thickness in.	Location, ft.	Width in.	Thickness in.
80	---	---	---	6.75	0.625
90	---	---	---	7.25	0.75
100	4.5	0.5	5.5, 94.5	8.25	0.75
110	4.5	0.5	5.75, 17.5, 92.5, 104.25	8.25	0.75
120	4.5	0.5	6.25, 18.75, 101.25, 113.75	8.25	0.75
130	5	0.5	6.25, 19.25, 32.25, 97.75, 110.75, 123.75	8.75	0.875
140	6	0.5	5.75, 19.75, 33.75, 47.75, 92.25, 106.25, 120.25, 134.25	9.25	0.875

GIRDER WEIGHT	
Span ft.	Girder weight tons
80	8.06
90	10.26
100	11.21
110	13.20
120	15.98
130	18.43
140	21.40

Note: Girder weight is total weight of web and flanges only, measured between CL brg at each end. Does not include girder extension at end bearings, stiffeners, shear studs, splices, bracing, or any other allowances.

CROSS-FRAME SPACING		
Span, ft.	Spacing, ft.	Type
80	20	Diaphragm
90	22.5	Diaphragm
100	25	Diaphragm
110	22	Diaphragm
120	24	Diaphragm
130	26	Diaphragm
140	28	K-Frame

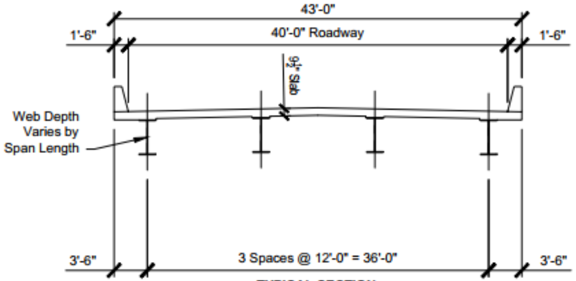
DEAD AND LIVE LOAD REACTIONS				
Span, ft.	DC kips	DW kips	Truck kips	Lane kips
80	82	10	99	30
90	93	11	100	34
100	103	12	101	37
110	114	13	102	41
120	126	14	103	45
130	138	16	103	48
140	150	17	103	52

Note: Truck and lane reactions include distribution factors, skew correction, and impact on the truck loading.

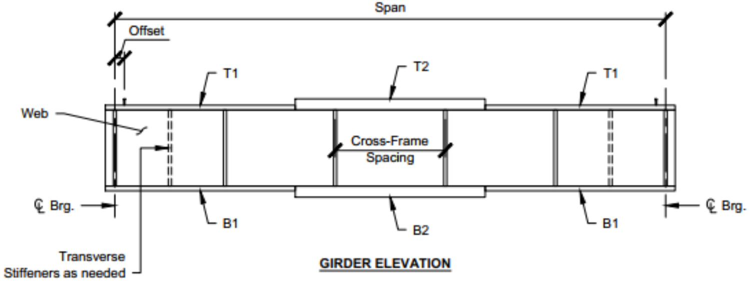
SINGLE SPAN 80-140 FT
12 FT SPACING

Issued January 2025
Revision 0

Sheet 9 of 38



TYPICAL SECTION



GIRDER ELEVATION

Span, ft.	Web (in. x in. x ft.)	T1 (in. x in. x ft.)	T2 (in. x in. x ft.)	B1 (in. x in. x ft.)	B2 (in. x in. x ft.)
80	36 x 0.5 x 80	---	15 x 1.25 x 80	---	15 x 1.5 x 80
90	38 x 0.5 x 90	---	16 x 1.25 x 90	---	16 x 1.75 x 90
100	45 x 0.5 x 100	18 x 1 x 35	18 x 1.5 x 30	18 x 1 x 24	18 x 1.5 x 52
110	47 x 0.5 x 110	18 x 1 x 40	18 x 1.5 x 30	18 x 1 x 20	18 x 1.75 x 70
120	50 x 0.5 x 120	18 x 1 x 25	18 x 1.5 x 70	18 x 1 x 20	18 x 2 x 80
130	52 x 0.5 x 130	19 x 1 x 30	19 x 1.5 x 70	20 x 1 x 22	20 x 2 x 86
140	56 x 0.5 x 140	20 x 1 x 30	20 x 1.5 x 80	22 x 1 x 25	22 x 2 x 90

Note: All plates are A709 Gr 50W

TRANSVERSE AND BEARING STIFFENERS					
Span, ft.	Transverse Stiffener Size and Location			Bearing Stiffeners	
	Width in.	Thickness in.	Location, ft.	Width in.	Thickness in.
80	---	---	---	6.75	0.625
90	---	---	---	7.25	0.75
100	4.5	0.5	5.5, 94.5	8.25	0.75
110	4.5	0.5	5.75, 17.5, 92.5, 104.25	8.25	0.75
120	4.5	0.5	6.25, 18.75, 101.25, 113.75	8.25	0.75
130	5	0.5	6.25, 19.25, 32.25, 97.75, 110.75, 123.75	8.75	0.875
140	6	0.5	5.75, 19.75, 33.75, 47.75, 92.25, 106.25, 120.25, 134.25	9.25	0.875

GIRDER WEIGHT	
Span ft.	Girder weight tons
80	8.06
90	10.26
100	11.21
110	13.20
120	15.98
130	18.43
140	21.40

Note: Girder weight is total weight of web and flanges only, measured between CL brg at each end. Does not include girder extension at end bearings, stiffeners, shear studs, splices, bracing, or any other allowances.

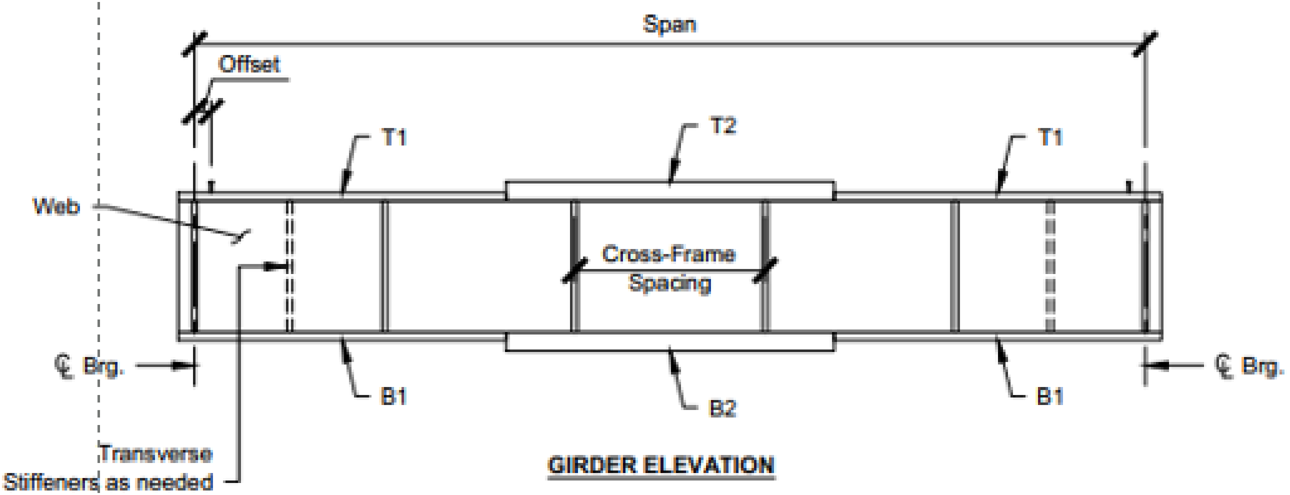
CROSS-FRAME SPACING		
Span, ft.	Spacing, ft.	Type
80	20	Diaphragm
90	22.5	Diaphragm
100	25	Diaphragm
110	22	Diaphragm
120	24	Diaphragm
130	26	Diaphragm
140	28	K-Frame

DEAD AND LIVE LOAD REACTIONS				
Span, ft.	DC kips	DW kips	Truck kips	Lane kips
80	82	10	99	30
90	93	11	100	34
100	103	12	101	37
110	114	13	102	41
120	126	14	103	45
130	138	16	103	48
140	150	17	103	52

Note: Truck and lane reactions include distribution factors, skew correction, and impact on the truck loading.

SINGLE SPAN 80-140 FT
12 FT SPACING

Issued January 2025
Revision 0



GIRDER ELEVATION

Span, ft.	Web (in. x in. x ft.)	T1 (in. x in. x ft.)	T2 (in. x in. x ft.)	B1 (in. x in. x ft.)	B2 (in. x in. x ft.)
80	36 x 0.5 x 80	---	15 x 1.25 x 80	---	15 x 1.5 x 80
90	38 x 0.5 x 90	---	16 x 1.25 x 90	---	16 x 1.75 x 90
100	45 x 0.5 x 100	18 x 1 x 35	18 x 1.5 x 30	18 x 1 x 24	18 x 1.5 x 52
110	47 x 0.5 x 110	18 x 1 x 40	18 x 1.5 x 30	18 x 1 x 20	18 x 1.75 x 70
120	50 x 0.5 x 120	18 x 1 x 25	18 x 1.5 x 70	18 x 1 x 20	18 x 2 x 80
130	52 x 0.5 x 130	19 x 1 x 30	19 x 1.5 x 70	20 x 1 x 22	20 x 2 x 86
140	56 x 0.5 x 140	20 x 1 x 30	20 x 1.5 x 80	22 x 1 x 25	22 x 2 x 90

Span, ft.
80
90
100
110
120
130
140

Note: All

Span, ft.	Width in.
80	---
90	---
100	4.5
110	4.5
120	4.5
130	5
140	6

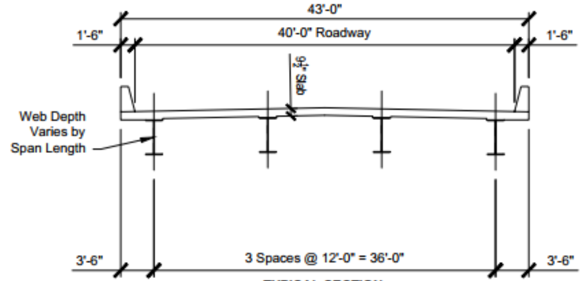
DW kips	Truck kips	Lane kips
10	99	30
11	100	34
12	101	37
13	102	41
14	103	45
16	103	48
17	103	52

e reactions include distribution
tion, and impact on the truck

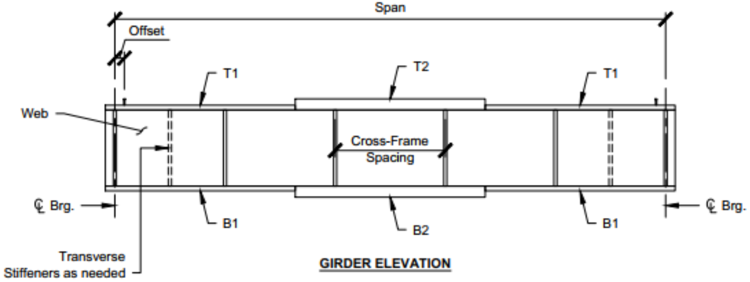
E SPAN 80-140 FT
2 FT SPACING

uary 2025

Sheet 9 of 38



TYPICAL SECTION



GIRDER ELEVATION

Span, ft.	Web (in. x in. x ft.)	T1 (in. x in. x ft.)	T2 (in. x in. x ft.)	B1 (in. x in. x ft.)	B2 (in. x in. x ft.)
80	36 x 0.5 x 80	---	15 x 1.25 x 80	---	15 x 1.5 x 80
90	38 x 0.5 x 90	---	16 x 1.25 x 90	---	16 x 1.75 x 90
100	45 x 0.5 x 100	18 x 1 x 35	18 x 1.5 x 30	18 x 1 x 24	18 x 1.5 x 52
110	47 x 0.5 x 110	18 x 1 x 40	18 x 1.5 x 30	18 x 1 x 20	18 x 1.75 x 70
120	50 x 0.5 x 120	18 x 1 x 25	18 x 1.5 x 70	18 x 1 x 20	18 x 2 x 80
130	52 x 0.5 x 130	19 x 1 x 30	19 x 1.5 x 70	20 x 1 x 22	20 x 2 x 86
140	56 x 0.5 x 140	20 x 1 x 30	20 x 1.5 x 80	22 x 1 x 25	22 x 2 x 90

Note: All plates are A709 Gr 50W

Support Reactions

TRANSVERSE AND BEARING STIFFENERS

Span, ft.	Transverse Stiffener Size and Location			Bearing Stiffeners	
	Width in.	Thickness in.	Location, ft.	Width in.	Thickness in.
80	---	---	---	6.75	0.625
90	---	---	---	7.25	0.75
100	4.5	0.5	5.5, 94.5	8.25	0.75
110	4.5	0.5	5.75, 17.5, 92.5, 104.25	8.25	0.75
120	4.5	0.5	6.25, 18.75, 101.25, 113.75	8.25	0.75
130	5	0.5	6.25, 19.25, 32.25, 97.75, 110.75, 123.75	8.75	0.875
140	6	0.5	5.75, 19.75, 33.75, 47.75, 92.25, 106.25, 120.25, 134.25	9.25	0.875

GIRDER WEIGHT

Span ft.	Girder weight tons
80	8.06
90	10.26
100	11.21
110	13.20
120	15.98
130	18.43
140	21.40

Note: Girder weight is total weight of web and flanges only, measured between CL brg at each end. Does not include girder extension at end bearings, stiffeners, shear studs, splices, bracing, or any other allowances.

CROSS-FRAME SPACING

Span, ft.	Spacing, ft.	Type
80	20	Diaphragm
90	22.5	Diaphragm
100	25	Diaphragm
110	22	Diaphragm
120	24	Diaphragm
130	26	Diaphragm
140	28	K-Frame

DEAD AND LIVE LOAD REACTIONS

Span, ft.	DC kips	DW kips	Truck kips	Lane kips
80	82	10	99	30
90	93	11	100	34
100	103	12	101	37
110	114	13	102	41
120	126	14	103	45
130	138	16	103	48
140	150	17	103	52

Note: Truck and lane reactions include distribution factors, skew correction, and impact on the truck loading.

Stiffeners

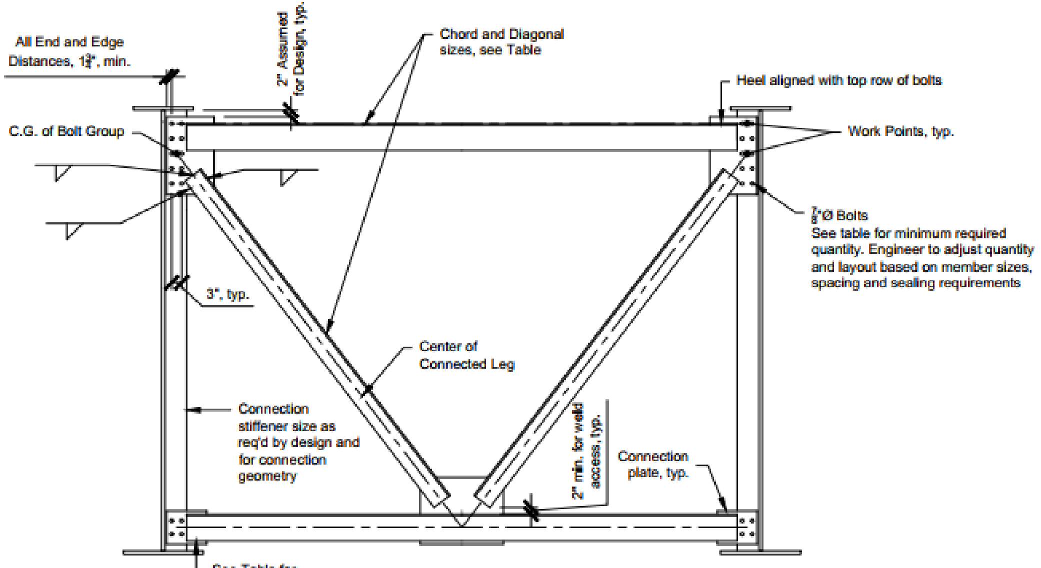
Girder Weight

Cross Frame Spacing

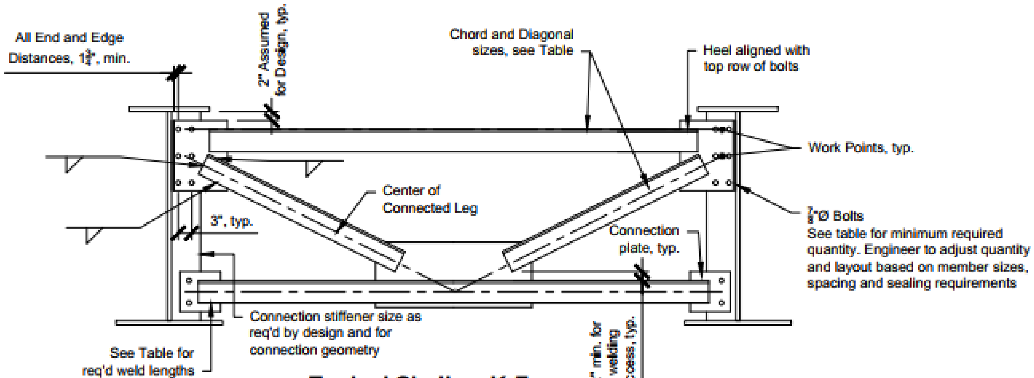
SINGLE SPAN 80-140 FT
12 FT SPACING

Issued January 2025
Revision 0

Sheet 9 of 38



Typical Deep K-Frame



Typical Shallow K-Frame

CROSS-FRAME MEMBER SIZES				
Beam Spacing, ft.	Span, ft.	Type	Chord	Diagonal
8	100-180	K-Frame	L5X5X3/8	L5X5X3/8
	190-300	X-Frame	L5X5X3/8	L6x6x3/8
10	120-220	K-Frame	L5X5X1/2	L5X5X1/2
	230-260	X-Frame	L5X5X1/2	L6X6X3/8
	260-300	X-Frame	L5X5X1/2	L8X6X1/2
12	140-250	K-Frame	L6X6X3/8	L5X5X5/8
	260-300	X-Frame	L6X6X3/8	L8X8X1/2
14	160-210	K-Frame	L8X6X1/2	L6X6X3/8
	220-260	K-Frame	L8X6X1/2	L6X6X1/2
	270-290	K-Frame	L8X6X1/2	L6X6X5/8
	300	K-Frame	L8X6X1/2	L6X6X3/4

CROSS-FRAME WELD DETAILS		
Angle Size	Toe Length	Heel Length
L5x5x3/8	2 in. min. See notes regarding toe weld length	4 in.
L5x5x1/2		4.5 in.
L5x5x5/8		4.5 in.
L6x6x3/8		4 in.
L6x6x1/2		5.5
L6x6x5/8		6 in.
L6x6x3/4		7 in.
L8x6x1/2		5.5 in.
L8x8x1/2		6.5 in.

CROSS-FRAME BOLTED CONNECTION DETAILS					
Beam Spacing, ft.	Type	Top Connection		Bottom Connection	
		Total Num Bolts	Vertical Spacing	Total Num Bolts	Vertical Spacing
8	K-Frame	6	6 in.	2	3 in.
	X-Frame	6	6 in.	6	6 in.
10	K-Frame	6	6 in.	2	3 in.
	X-Frame	8	4 in.	8	4 in.
12	K-Frame	6	6 in.	2	3 in.
	X-Frame	8	4 in.	8	4 in.
14	K-Frame	10	4.5 in.	4	3 in.

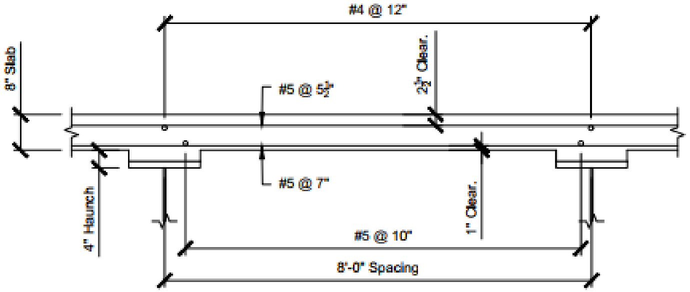
Notes:

1. For general notes, see **Cross-Frame & Diaphragm Details 1**.

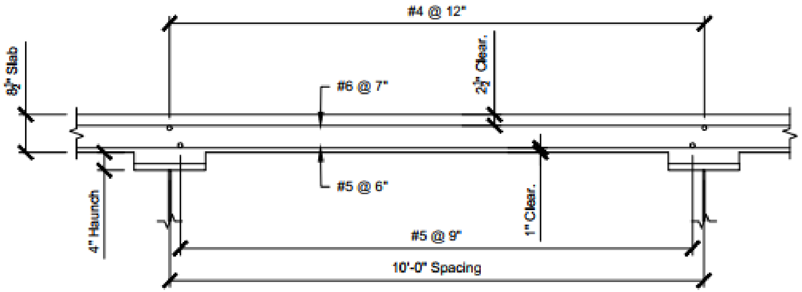
CROSS-FRAME & DIAPHRAGM DETAILS 2

Issued January 2025
Revision 0

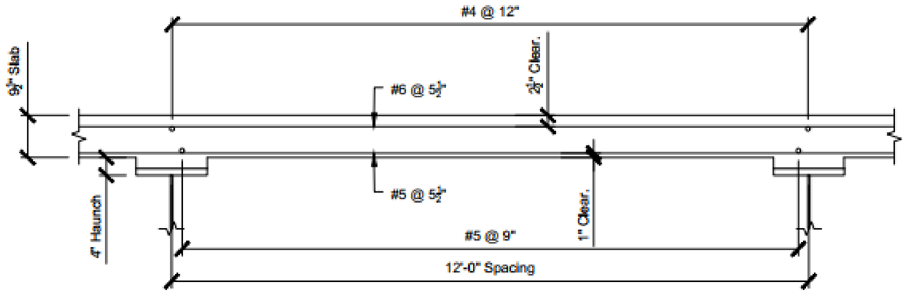
Sheet 30 of 38



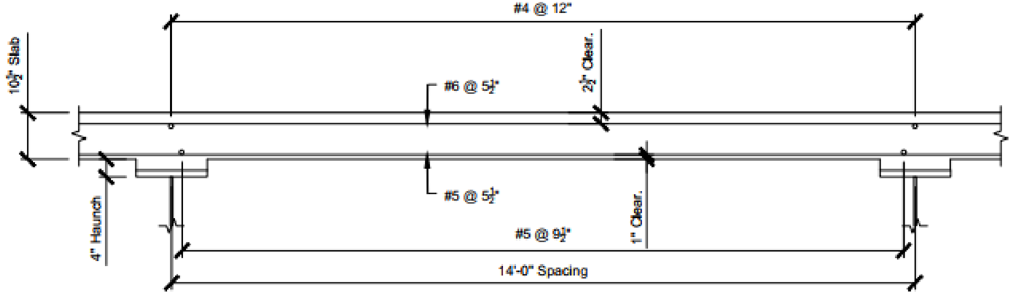
8 FT SPACING



10 FT SPACING



12 FT SPACING



14 FT SPACING

DECK DESIGN NOTES

1. Deck details are representative of slab designs for the beam spacings used in these plans.
2. The gross thickness shown is used for weight calculations. Structural capacity assumes a 1/2 in. loss in deck thickness due to wear.
3. The details on this sheet are for positive moment regions of the span and represent an acceptable transverse and longitudinal reinforcing steel design complying with AASHTO LRFD 9.7.3.
4. The slab thickness, cover, bar sizes and spacing are based on decks designed using the AASHTO equivalent strip method.

DECK DETAILS

Simple Spans and Positive Moment Region of Continuous Spans

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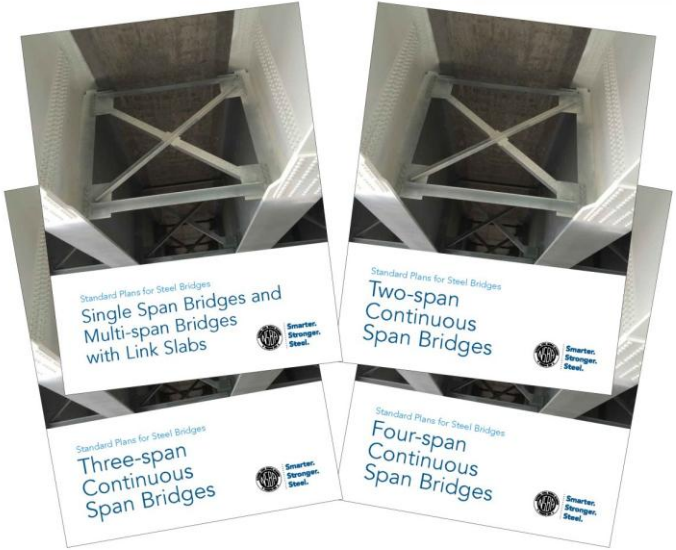
Revision 0

Standard Plans for Straight I-Girder Bridges

What is next…..

- Examples demonstrating use when spans and/or spacing do not exactly match:
  1. Three-Span Bridge Matching a Standard Design
  2. Three-Span Bridge with a Thicker Slab
  3. Three-Span Bridge with a Non-Standard Beam Spacing and Matching Span Lengths
  4. Three-Span Bridge with Matching Beam Spacing but Non-Standard Span Lengths
  5. Three-Span Bridge with Unique Beam Spacing, Overhangs, and Span Lengths
  6. Three-Span Bridge with Unique Beam Spacing, Overhangs, and Span Lengths with a Skew Index > 0.3
  7. Preliminary Curved Girder Bridge
- SIMON files to be packaged with SIMON

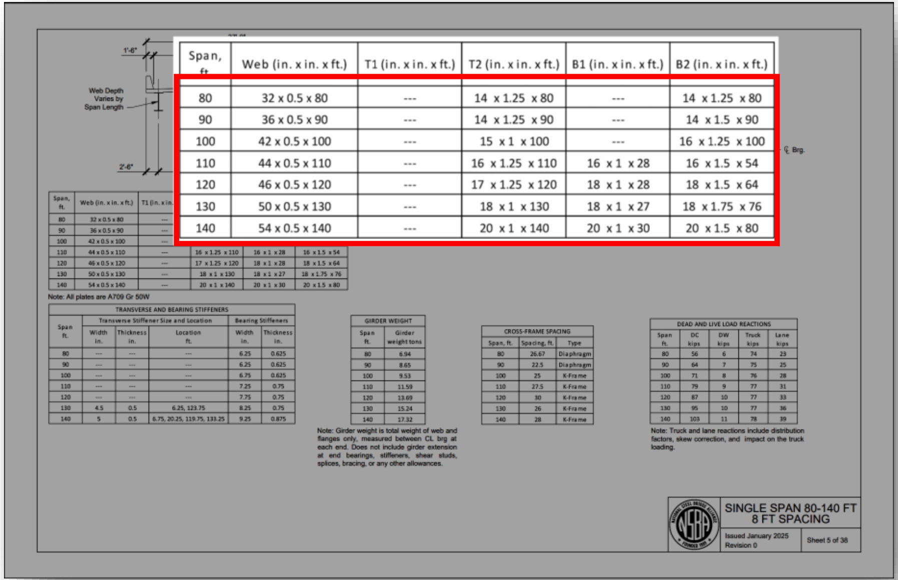


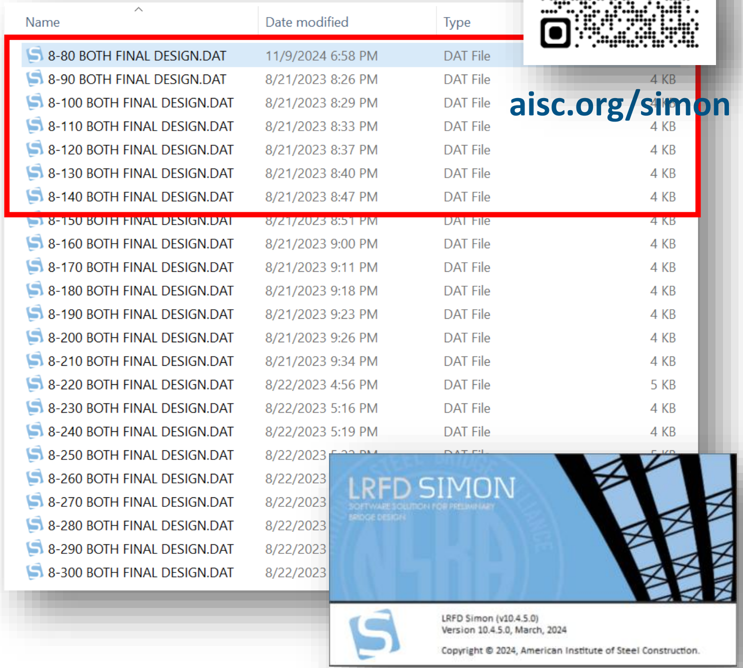
aisc.org/standard-bridge-plans

Standard Plans for Straight I-Girder Bridges

What is next……

- LRFD Simon – Design Files





aisc.org/simon

Photo: Eads Bridge Over the Mississippi River, St. Louis, Missouri

Conceptual Design Kickstarter

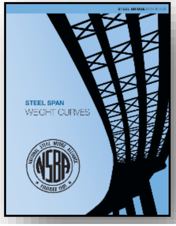
Photo: 2020 Prize Bridge Merit Winner, Major Span – Portageville Bridge Replacement (New York) – Photo Credit: John Kucko

NSBA Resources for Conceptual Design

Overview of the Tools

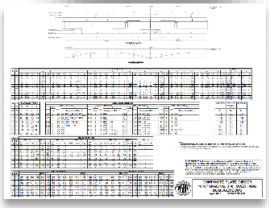
Span Weight Curves

- Quickest, superstructure weight



Span Standards

- Quick, superstructure weight + plates sizes (1, 2, 3, & 4 span configurations)



LRFD Simon

- Line girder analysis software, any span config, design & analysis, web optimization

NSBA Steel Span Weight Curves

- Derived from 800 economical solutions
- Quickly determine relative costs
- Various girder spacings, span lengths, and number of spans
    - Horizontally curved & straight bridges
    - Single span or multi-span
    - 7’ to over 11’ spacing
    - 50’ to 450’ main span
- Download for free @ aisc.org/spanweightcurves

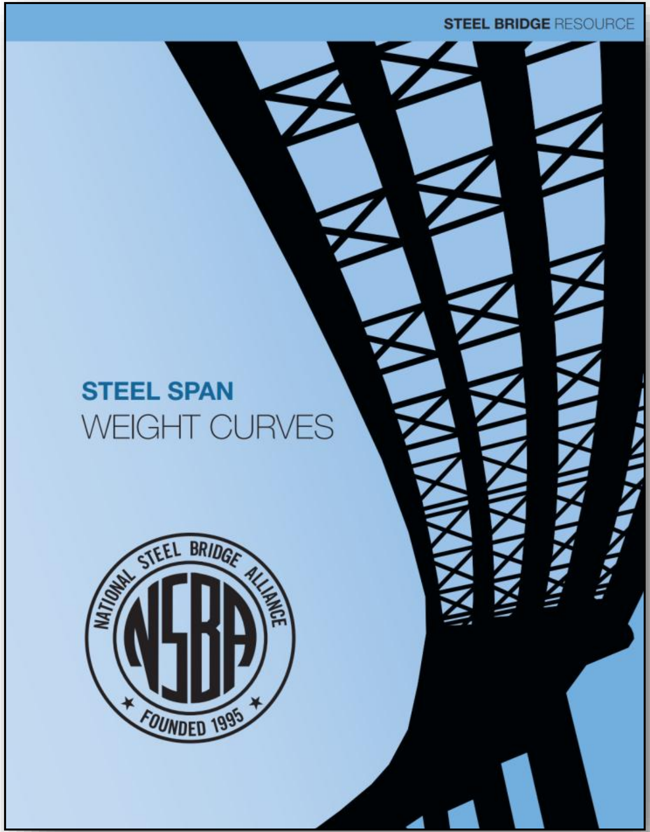
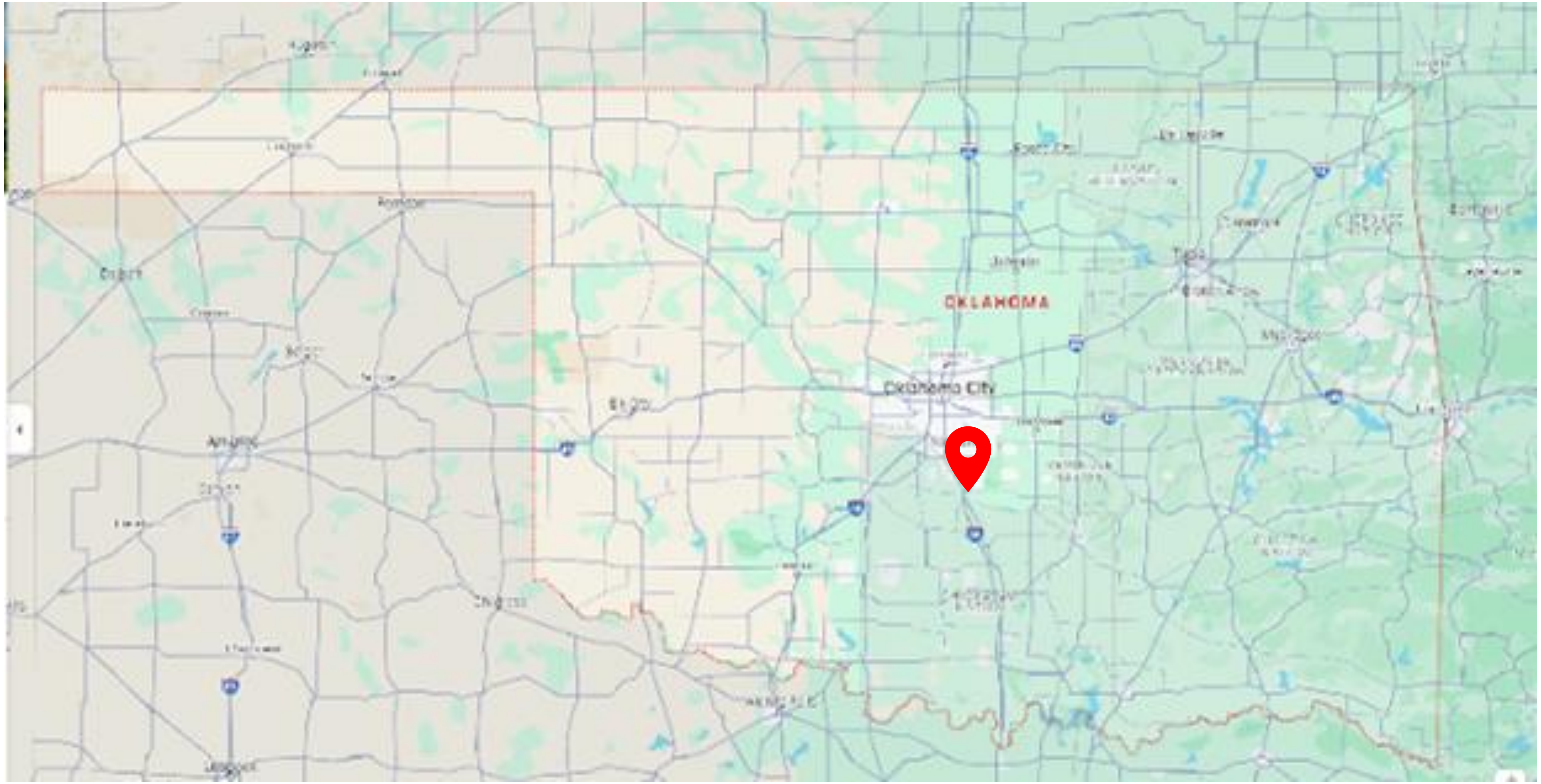


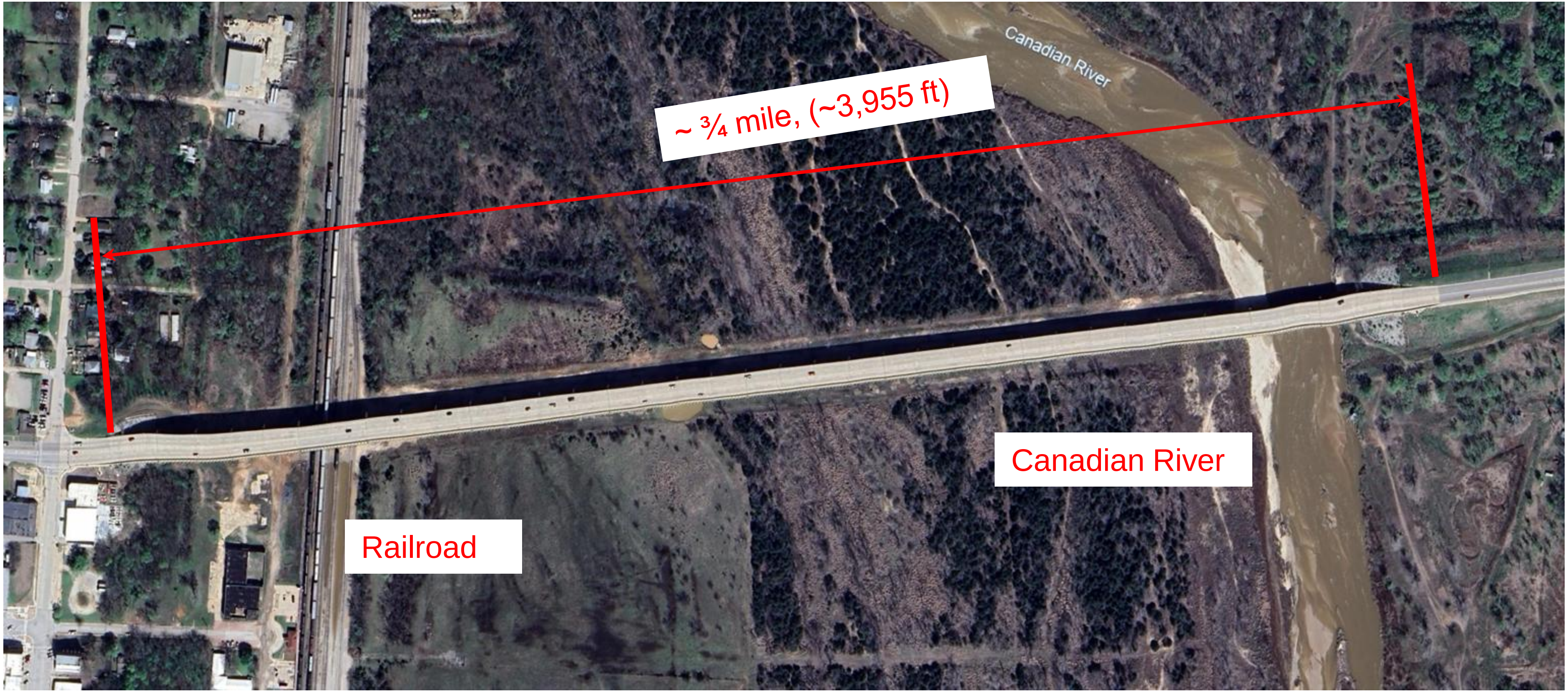
Photo: 2020 Prize Bridge National Winner, Major Span – Gov Cuomo/Tappen Zee (New York) – Photo Credit: New York State Thruway Authority

US-77 Over The Canadian River

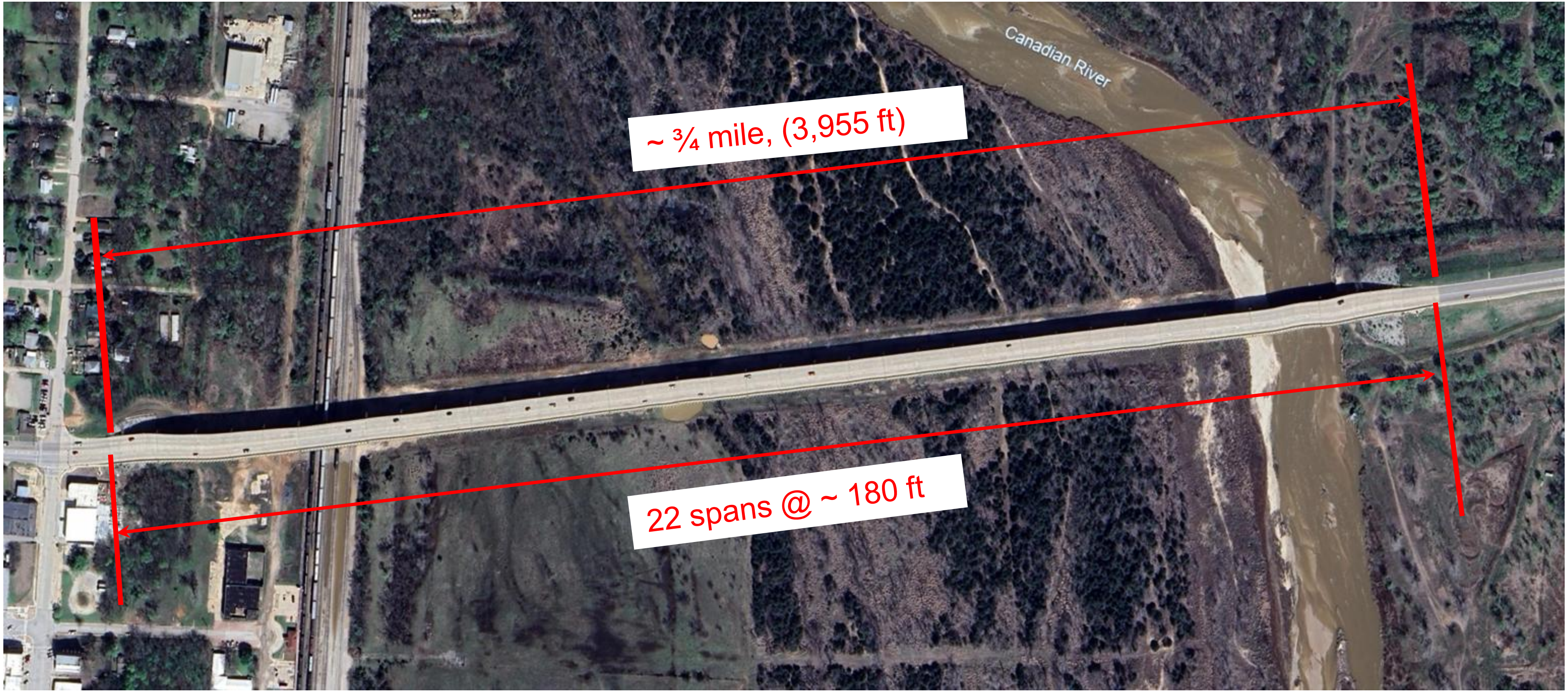
US-77 Over The Canadian River



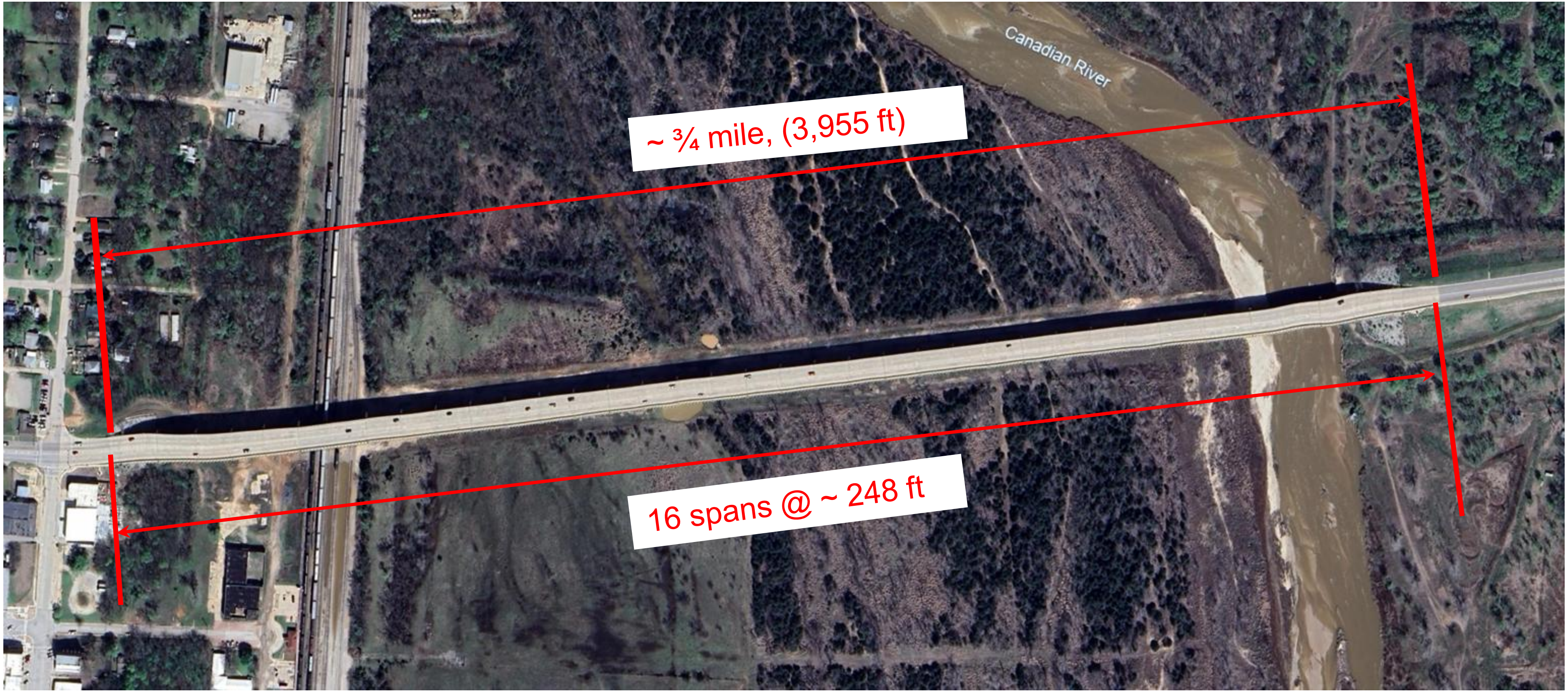
US-77 Over The Canadian River



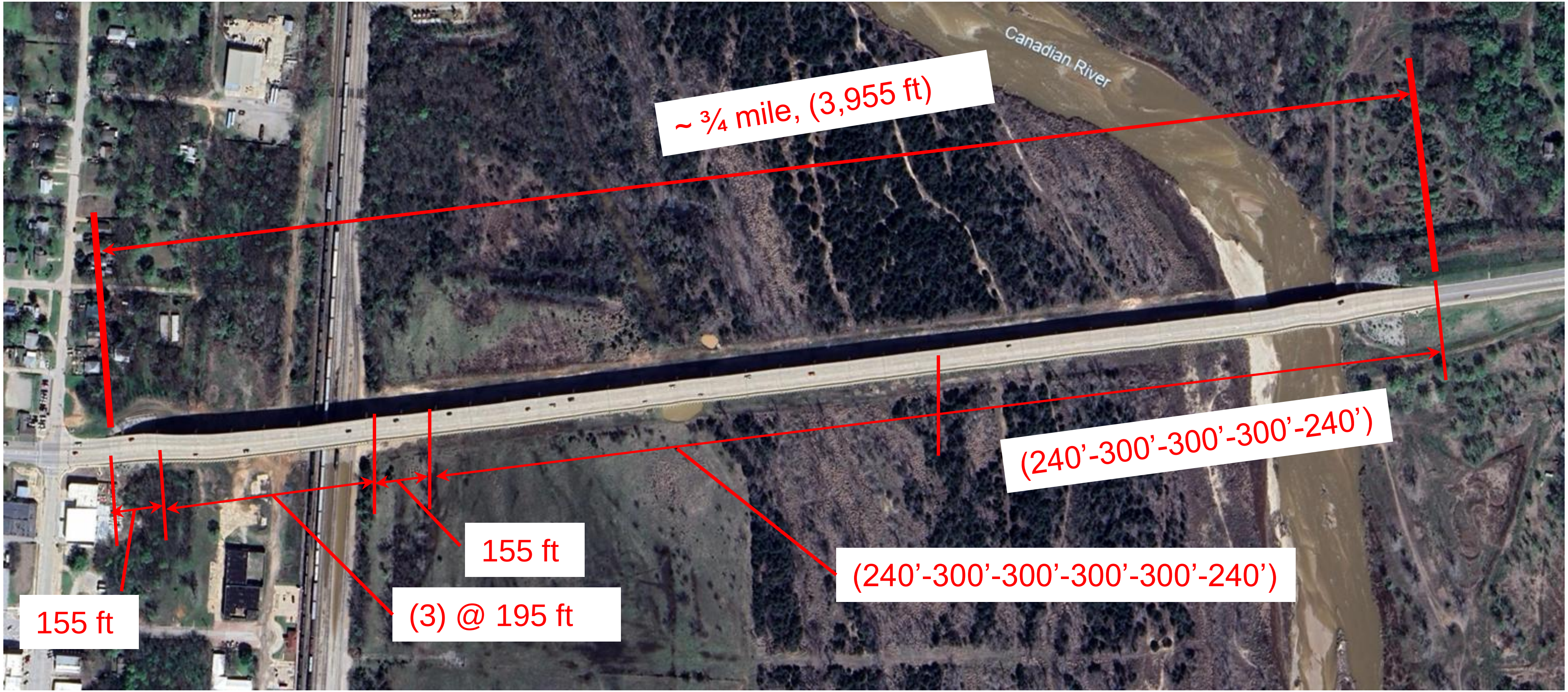
US-77 Over The Canadian River – Option #1



US-77 Over The Canadian River – Option #2



US-77 Over The Canadian River – Option #3



Summary Of Existing Bridge

James Nance Memorial Bridge

- Total length = 3,955 ft
- Width = 70 ft
- 4 total lanes
- Obstacles:
  - Main river channel
  - Railroad

New Bridge Options

- Total length = 3,955 ft
- 6 total lanes
- Width = 96 ft
  - 6 – 12 ft lanes, 8 ft shoulders on both sides, 4 ft total barrier width, 4 ft median width
- Overhang = 3.5 ft
- Deck area = 3,955 ft x 96 ft = 380,000 ft^2

Girder Spacing Options

- Eight girder lines (7 spaces): ~12’ - 8”
- Nine girder lines (8 spaces): ~11’ – 2”

New Bridge Options

1.) Equal Spans – Simply Supported

- Span length = (22) - 180 ft
- Use as a baseline as likely not realistic due to pier locations
- Eight girder lines (7 spaces): ~12’ - 8”
- Deep girders, but consistent fabrication and erection

2.) Equal Spans – Continuous – Longer Span Lengths

- Spans length = 248 ft
- Eight girder lines (7 spaces): ~12’ - 8”
- Fewer piers, but end spans not balanced
- Pier locations may not work with site obstacles

New Bridge Options

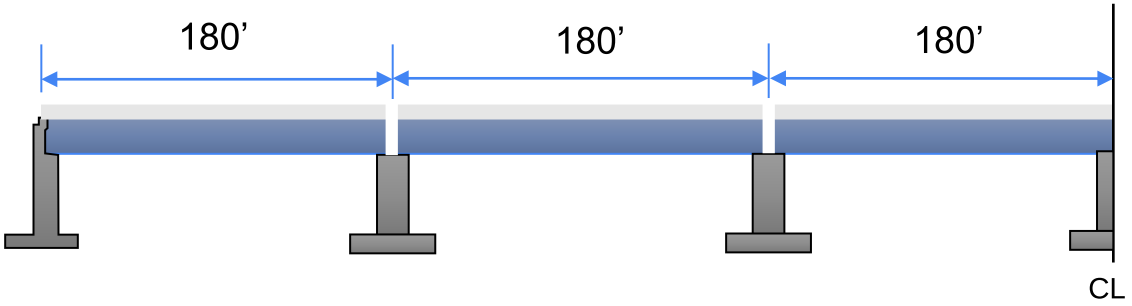
3.) Continuous & Longer Spans, Logical Pier Locations

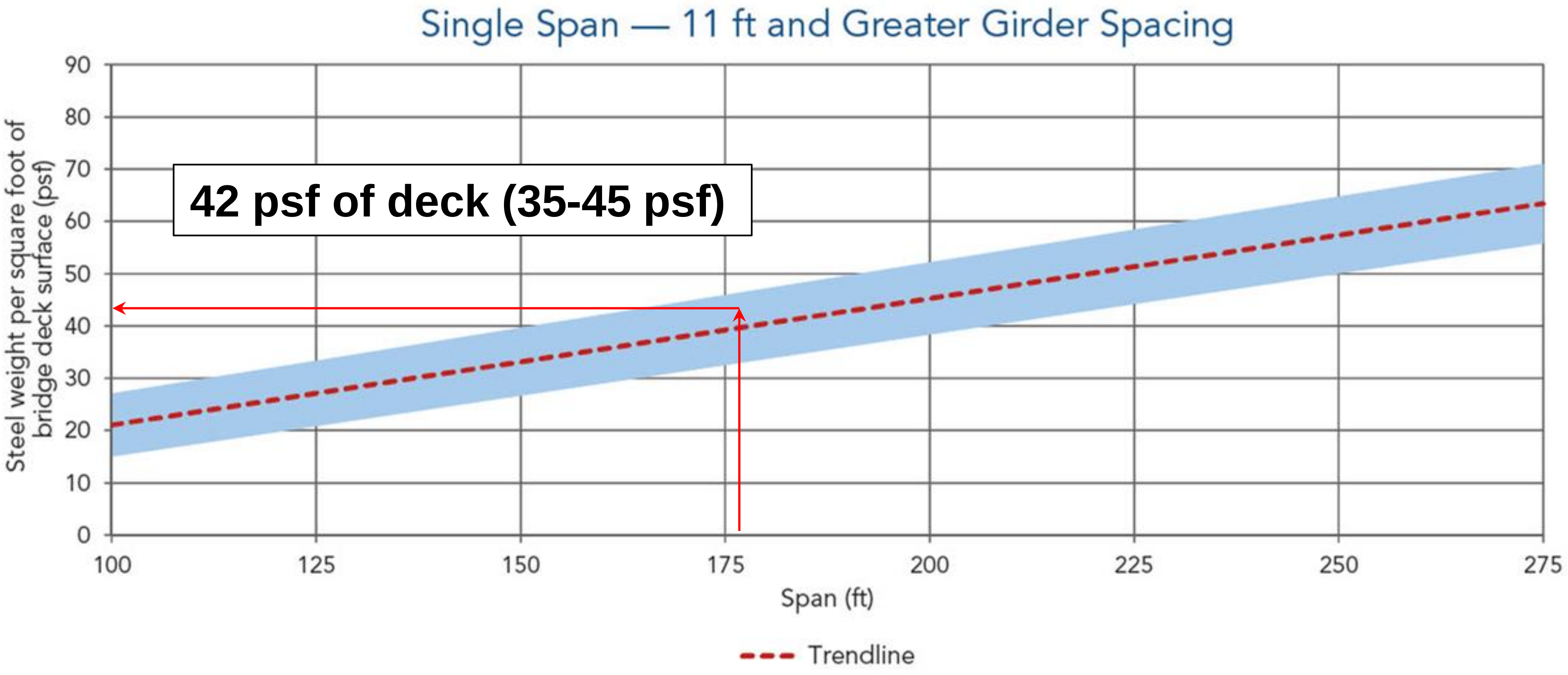
- Spans length = varies over obstacles
- Efficient span arrangement (balanced spans)
- Eight girder lines (7 spaces): ~12’ - 8”
- Efficient design and fabrication
- Pier locations accommodate site obstacles

Option #1

1.) 22 Spans – Simply Supported

- Eight girder lines (7 spaces): ~12’ - 8”
- Equal span lengths of ~180 ft
- 21 piers




Single Span — 11 ft and Greater Girder Spacing
42 psf of deck (35-45 psf)
Steel weight per square foot of bridge deck surface (psf)
0
10
20
30
40
50
60
70
80
90
100
125
150
175
200
225
250
275
Span (ft)
Trendline

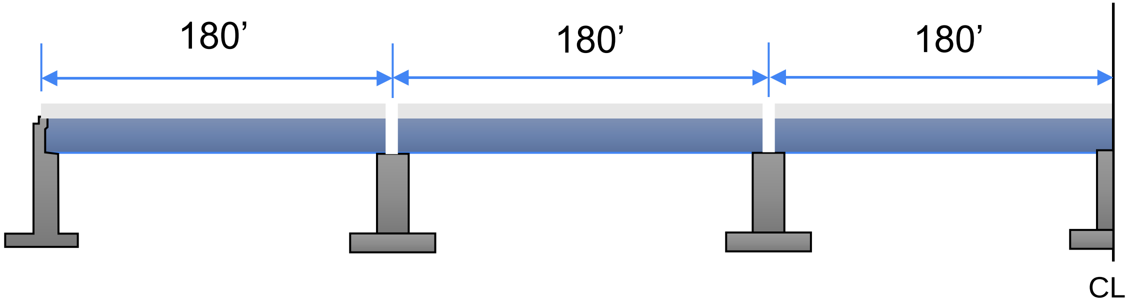
Option #1 - Results

1.) 22 Spans – Simply Supported

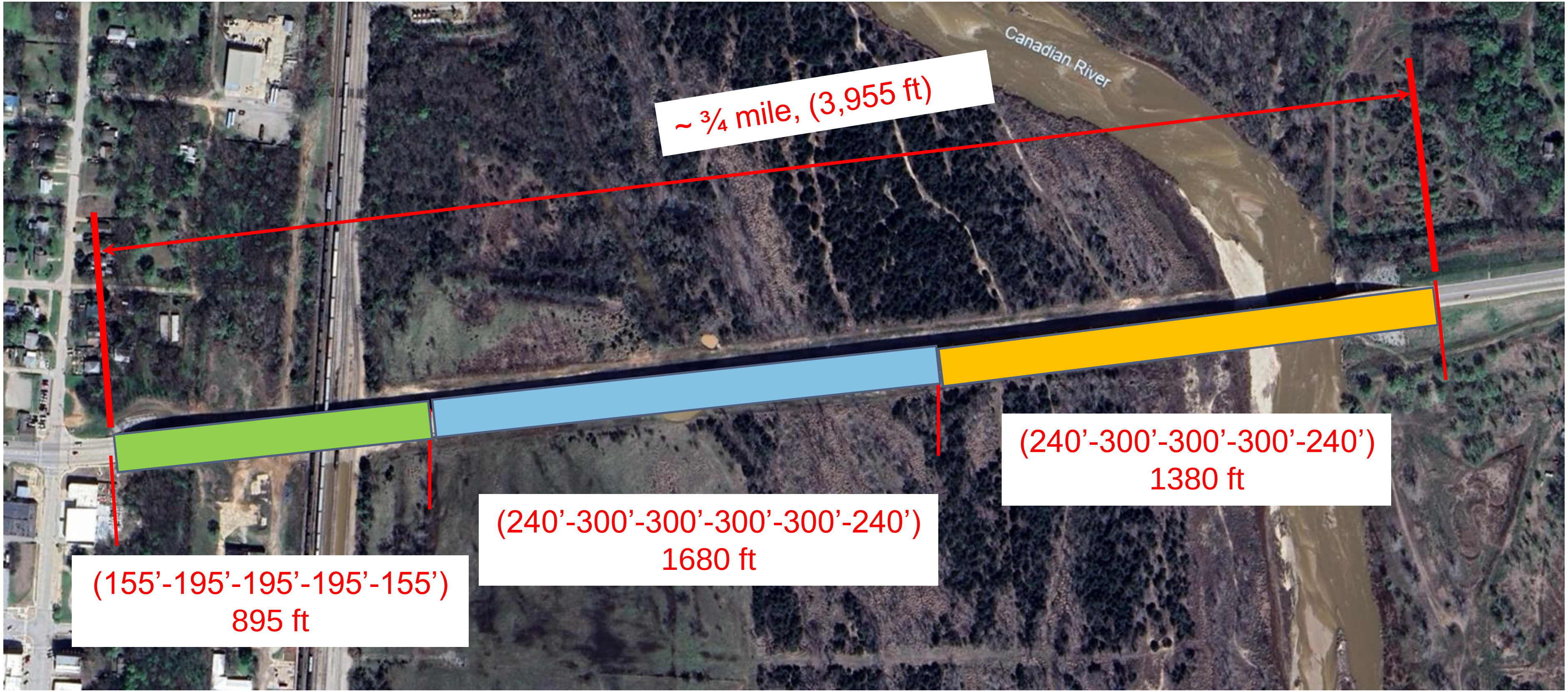
- Estimated weight per area = 42 psf
- Total estimated superstructure weight = (380,000 ft^2 x 42 psf)/2,000 lb/ton = 7,980 tons
- Estimated direct unit cost for fabrication and erection = \$1.92/lb

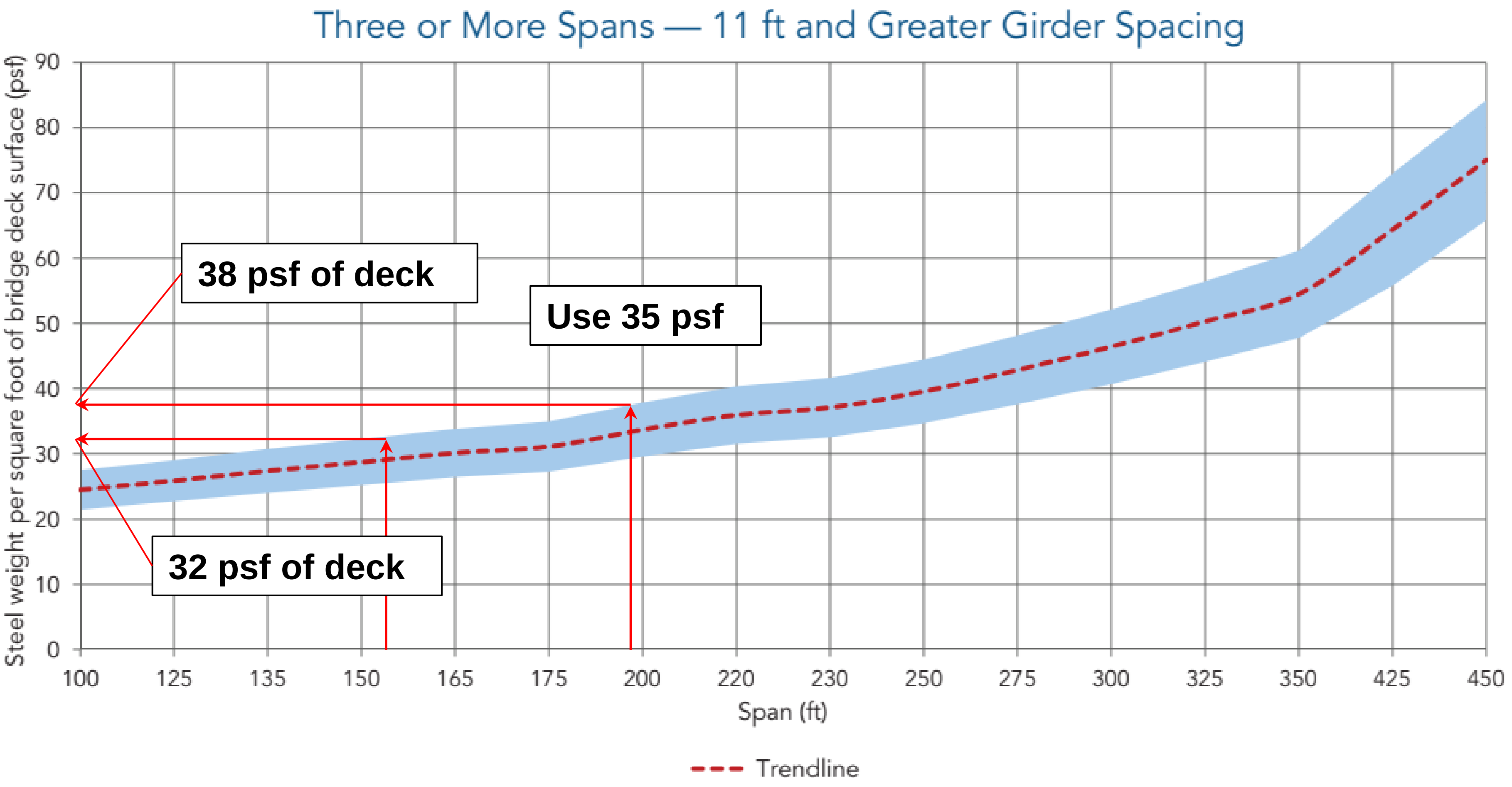
More on this later

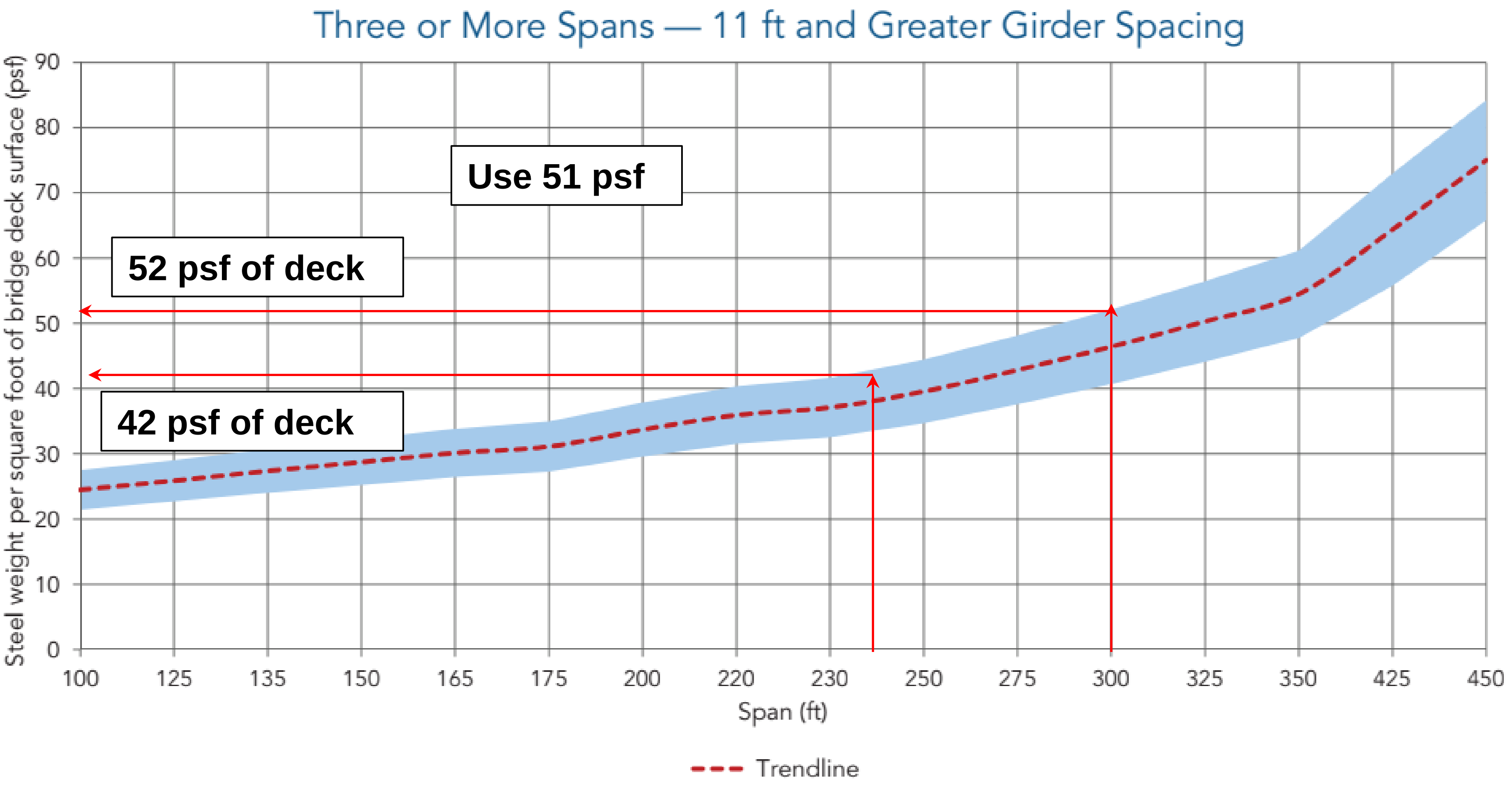
- Total estimated superstructure cost = \$30.6M



Option #3 - Three “Bridges” – Continuous – Various Span Lengths



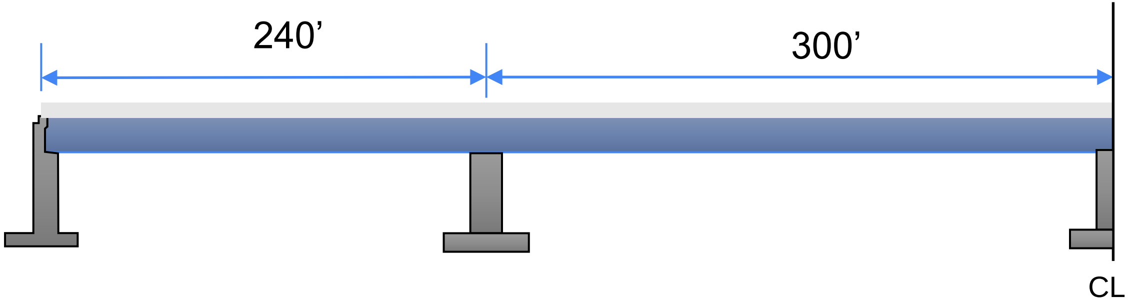

Three or More Spans — 11 ft and Greater Girder Spacing
Steel weight per square foot of bridge deck surface (psf)
90
80
70
60
50
40
30
20
10
0
100
125
135
150
165
175
200
220
230
250
275
300
325
350
425
450
Span (ft)
38 psf of deck
Use 35 psf
32 psf of deck
Trendline


Three or More Spans — 11 ft and Greater Girder Spacing
Use 51 psf
52 psf of deck
42 psf of deck
Steel weight per square foot of bridge deck surface (psf)
90
80
70
60
50
40
30
20
10
0
100
125
135
150
165
175
200
220
230
250
275
300
325
350
425
450
Span (ft)
Trendline

Option #3 - Results

3.) Three Spans – Continuous

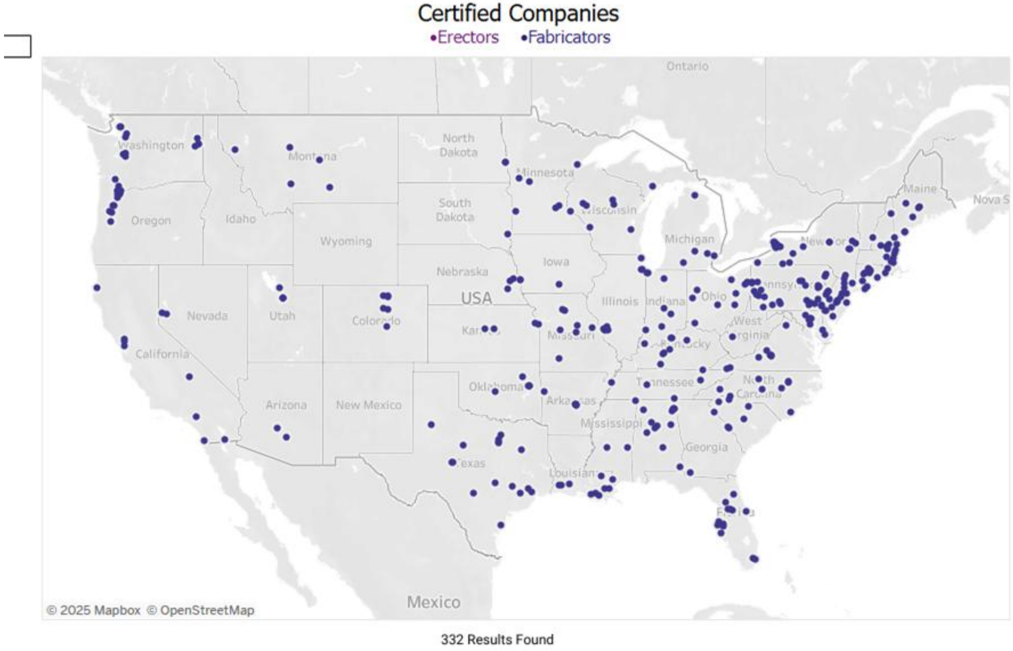
- Estimated weight per area = Use 51 psf & 35 psf
- 15 piers, balanced span arrangement
- Total estimated superstructure weight = [((96ft x 895ft)*35psf) + ((96ft x(1680+1380))*51 psf)]/2,000 lb/ton = **8,995 tons**
    - Bridge unit over river channel: ((96 ft x 1380 ft)*51 psf] / 2,000 = <u>3,380 tons</u>
- Estimated direct unit cost for fabrication and erection = $2.02/lb
- Total estimated superstructure cost = $36.3M



Summary Of Weight/Span Curve Options

	Option #1	Option #2	Option #3
Average unit weight (psf)	42	44	35 & 51
Total superstructure weight (tons)	7,980	8,360	8,995
Estimated cost per pound	$1.92	$2.08	$2.02
Estimated superstructure direct cost ($)	30.6M	34.8M	36.3M
# of girder lines	8	8	8
# of piers	21	15	15
Span arrangement	NA	Unbalanced	Balanced
Pier locations	Not realistic with obstacles	Not realistic with obstacles	Realistic with obstacles

Where To Get Pricing Information



aisc.org/certifiedbridgemembers

Photo: 2020 Prize Bridge National Winner, Major Span – Gov Cuomo/Tappen Zee (New York) – Photo Credit: New York State Thruway Authority

Option #3 (River Bridge) – Weight to Span Charts vs 4-Span Standards

Option #3 (River Bridge) – NSBA Bridge Standards

	Weight/Span Charts	4 Span Standards
Average unit weight (psf)	51	?
Total superstructure weight (tons)	3,380	?

New NSBA Standards

Standard Designs for Straight I-Girder Bridges – New

- **Purpose:**
  - Provide optimized designs for 1, 2, 3, and 4 span plate girder bridges.
  - Ensure cost-efficient and reflect standard plate sizes available from domestic mills.
  - Nearly 300 bridge designs
    - Spans range from 80ft to 300ft
    - Girder spacings = 8ft, 10ft, 12ft, 14ft
  - Next items:
    - Examples demonstrating use when spans and/or spacing do not exactly match.
    - SIMON files to be packaged with SIMON

aisc.org/standard-bridge-plans

Option #3 – NSBA Bridge Standards

AISC STANDARD PLANS FOR
STEEL BRIDGES

FOUR-SPAN CONTINUOUS SPAN BRIDGES

Design Specification: AASHTO LRFD 10th Edition
Release Date: January 2025

Smarter.
Stronger.
Steel.

Option #3 (River Bridge) – NSBA Bridge Standards

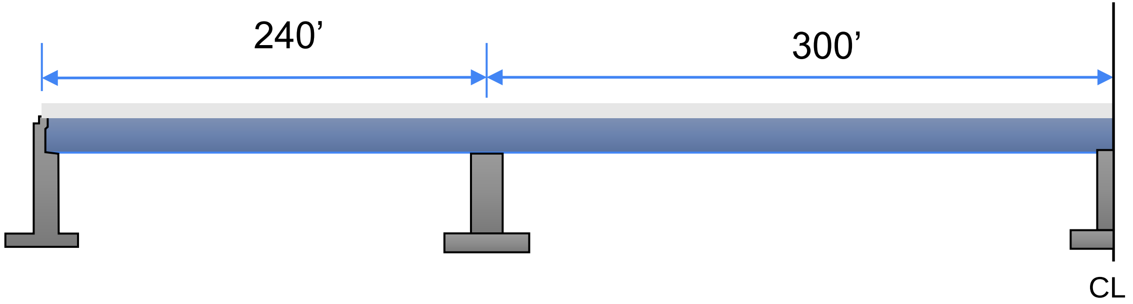
	Weight/Span Charts	4 Span Standards
Average unit weight (psf)	51	50
Total superstructure weight (tons)	3,380	3,296

Photo: 2020 Prize Bridge National Winner, Major Span – Gov Cuomo/Tappen Zee (New York) – Photo Credit: New York State Thruway Authority

Option #3 (River Bridge) – Weight to Span Charts vs Simon

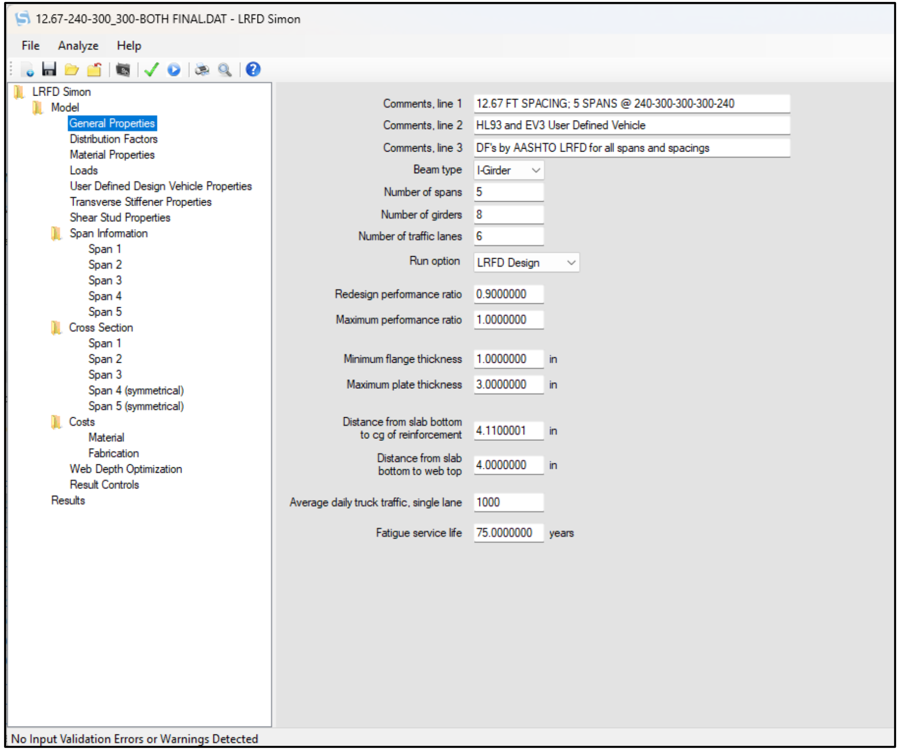
Option #3 – LRFD Simon

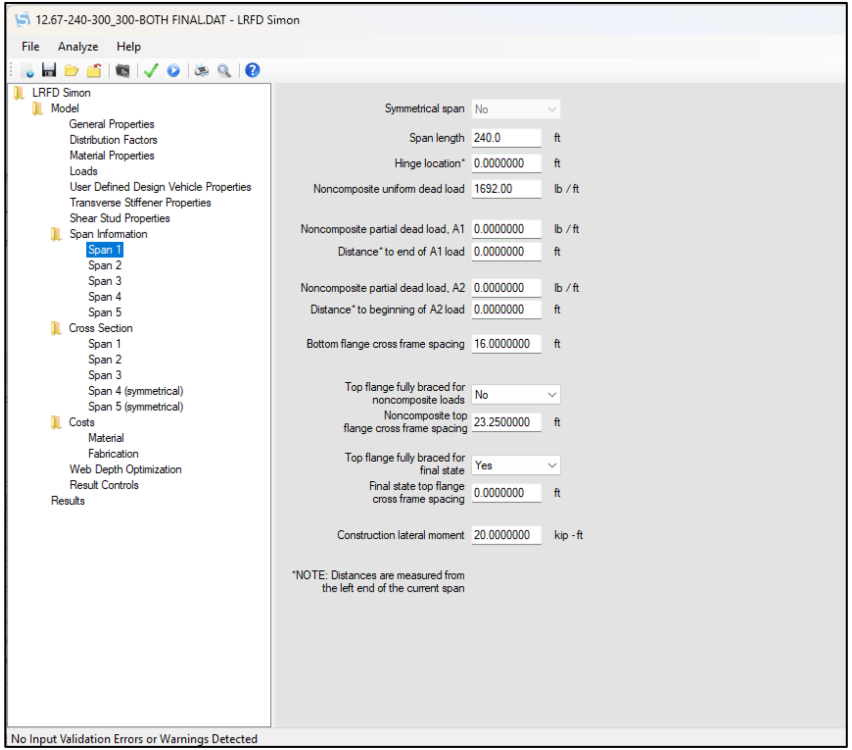
	Weight/Span Charts	4 Span Standards	Simon
Average unit weight (psf)	51	50	?
Total superstructure weight (tons)	3,380	3,296	?



Option #3 – LRFD Simon

Simon Inputs





Option #3 – LRFD Simon

Simon Results

12.67-240-300_300-BOTH FINAL.DAT - LRFD Simon

File Analyze Help

- LRFD Simon
  - Model
    - General Properties
    - Distribution Factors
    - Material Properties
    - Loads
    - User Defined Design Vehicle Properties
    - Transverse Stiffener Properties
    - Shear Stud Properties
    - Span Information
      - Span 1
      - Span 2
      - Span 3
      - Span 4
      - Span 5
    - Cross Section
      - Span 1
      - Span 2
      - Span 3
      - Span 4 (symmetrical)
      - Span 5 (symmetrical)
    - Costs
      - Material
      - Fabrication
    - Web Depth Optimization
    - Result Controls
  - Results

LRFD Simon

Version 10.4.5.0 **2025-02-18 11:26**

Vehicle library: C:\Projects\OK conceptual example - US77_CandanianRiver\NSBA_UserVehicle_Data
Program library: NSBA_simon_library_data.txt
Agency library: NSBA_library_data.txt

Job Name: AISC / NSBA STANDARD STEEL BRIDGE DESIGNS
Project Name:
Description:

12.67 FT SPACING; 5 SPANS @ 240-300-300-300-240
HL93 and EV3 User Defined Vehicle
DF's by AASHTO LRFD for all spans and spacings

National Steel Bridge Alliance
American Institute of Steel Construction
130 East Randolph Street
Suite 2000
Chicago, IL 60601

For assistance contact: The National Steel Bridge Alliance: nsbaresources@aisc.org

12.67-240-300_300-BOTH FINAL.DAT - LRFD Simon

File Analyze Help

SPAN 1

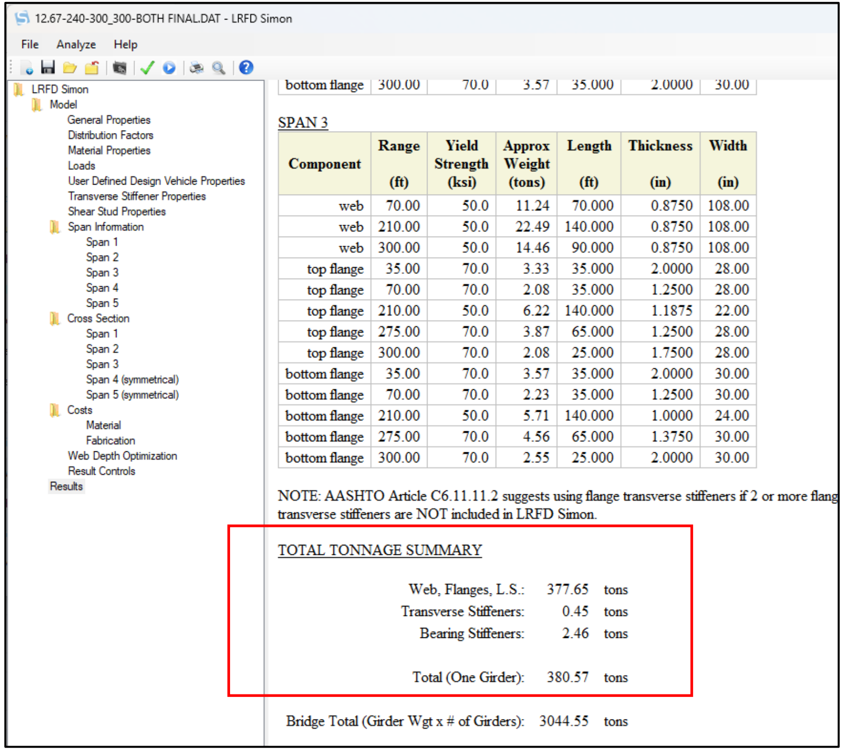
Component	Range (ft)	Yield Strength (ksi)	Approx Weight (tons)	Length (ft)	Thickness (in)	Width (in)
web	54.00	50.0	8.67	54.000	0.8750	108.00
web	189.00	50.0	21.69	135.000	0.8750	108.00
web	240.00	50.0	8.19	51.000	0.8750	108.00
top flange	54.00	50.0	2.20	54.000	1.0000	24.00
top flange	189.00	50.0	5.51	135.000	1.0000	24.00
top flange	211.00	70.0	1.31	22.000	1.2500	28.00
top flange	240.00	70.0	2.42	29.000	1.7500	28.00
bottom flange	54.00	50.0	2.20	54.000	1.0000	24.00
bottom flange	189.00	50.0	6.88	135.000	1.2500	24.00
bottom flange	211.00	70.0	1.40	22.000	1.2500	30.00
bottom flange	240.00	70.0	2.96	29.000	2.0000	30.00

SPAN 2

Component	Range (ft)	Yield Strength (ksi)	Approx Weight (tons)	Length (ft)	Thickness (in)	Width (in)
web	90.00	50.0	14.46	90.000	0.8750	108.00
web	230.00	50.0	22.49	140.000	0.8750	108.00
web	300.00	50.0	11.24	70.000	0.8750	108.00
top flange	25.00	70.0	2.08	25.000	1.7500	28.00
top flange	90.00	70.0	3.87	65.000	1.2500	28.00
top flange	230.00	50.0	5.24	140.000	1.0000	22.00
top flange	265.00	70.0	2.08	35.000	1.2500	28.00
top flange	300.00	70.0	3.33	35.000	2.0000	28.00
bottom flange	25.00	70.0	2.55	25.000	2.0000	30.00
bottom flange	90.00	70.0	4.35	65.000	1.3125	30.00
bottom flange	230.00	50.0	5.71	140.000	1.0000	24.00
bottom flange	265.00	70.0	2.23	35.000	1.2500	30.00
bottom flange	300.00	70.0	3.57	35.000	2.0000	30.00

Option #3 – LRFD Simon

Simon Results



bottom flange	300.00	70.0	3.57	35.000	2.0000	30.00

SPAN 3

Component	Range (ft)	Yield Strength (ksi)	Approx Weight (tons)	Length (ft)	Thickness (in)	Width (in)
web	70.00	50.0	11.24	70.000	0.8750	108.00
web	210.00	50.0	22.49	140.000	0.8750	108.00
web	300.00	50.0	14.46	90.000	0.8750	108.00
top flange	35.00	70.0	3.33	35.000	2.0000	28.00
top flange	70.00	70.0	2.08	35.000	1.2500	28.00
top flange	210.00	50.0	6.22	140.000	1.1875	22.00
top flange	275.00	70.0	3.87	65.000	1.2500	28.00
top flange	300.00	70.0	2.08	25.000	1.7500	28.00
bottom flange	35.00	70.0	3.57	35.000	2.0000	30.00
bottom flange	70.00	70.0	2.23	35.000	1.2500	30.00
bottom flange	210.00	50.0	5.71	140.000	1.0000	24.00
bottom flange	275.00	70.0	4.56	65.000	1.3750	30.00
bottom flange	300.00	70.0	2.55	25.000	2.0000	30.00

NOTE: AASHTO Article C6.11.11.2 suggests using flange transverse stiffeners if 2 or more flang
transverse stiffeners are NOT included in LRFD Simon.

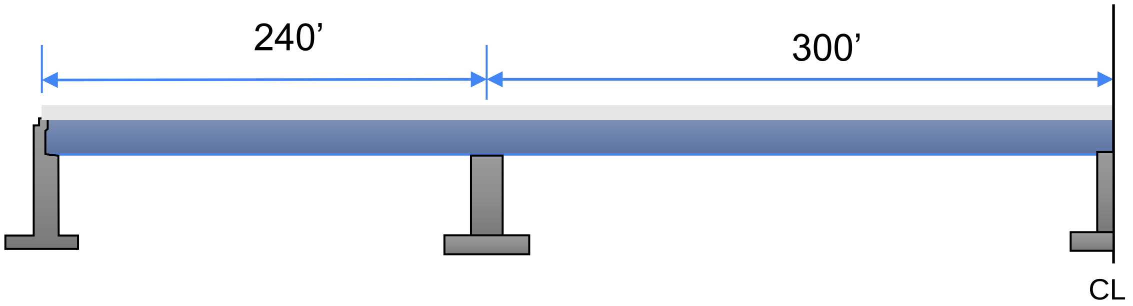
TOTAL TONNAGE SUMMARY

Web, Flanges, L.S.:	377.65	tons
Transverse Stiffeners:	0.45	tons
Bearing Stiffeners:	2.46	tons
Total (One Girder):	380.57	tons

Bridge Total (Girder Wgt x # of Girders): 3044.55 tons

Option #3 – LRFD Simon

	Weight/Span Charts	4 Span Standards	Simon
Average unit weight (psf)	51	50	49
Total superstructure weight (tons)	3,380	3,296	3,248



Summary of the Tools

Span Weight Curves

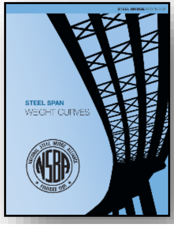
- Quickest, superstructure weight for conceptual design

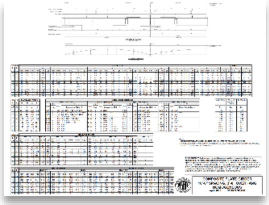
Span Standards

- Quick, superstructure weight + plates sizes (1, 2, 3, & 4 span configurations)

LRFD Simon

- Line girder analysis software, any span config, design & analysis, web optimization





Where To Get NSBA Tools & Resources

Span to Weight Curves

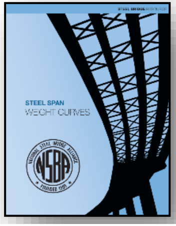
- aisc.org/spanweightcurves

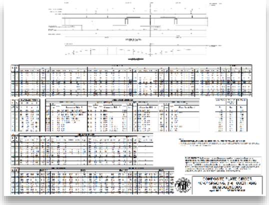
Span Standards

- aisc.org/standard-bridge-plans

LRFD Simon

- aisc.org/simon





Uncoated Weathering Steel Bridge in Arizona

Pinto Creek Bridge

Jeff Carlson, PE

Senior Director of Bridge Initiatives

720-440-3011 |carlson@steelbridges.org

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