



# **Bridges of Franklin County: The Missouri Version**

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**Steel In Action: Featuring Innovative, Resilient and  
Cost-Effective Case Study Projects**

July 8, 2025

**Michael G. Barker, PE**  
University of Wyoming &  
SSSBA, Director of Education

**Gary Wisch, PE**  
DeLong's. Inc



# Problem Statement

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Over the Years, Preconception that Concrete is Always Less Expensive Than Steel for Simple Span Bridges

## COST ESTIMATE GUIDE FOR RURAL PRELIMINARY DESIGN

(These cost figures were last updated in 2017)

- Many Times Steel is Not Even Considered
- Owners Paying More Than They Could for Bridges
- Unwarranted Lack of Competition Not Good

Bridge Structures	Cost per Sq. foot
Prestressed Concrete	\$95
Steel Girder	\$120

Assumes Concrete is 20% less Expensive  $1 - (95/120)$  or  
Steel is 26% more Expensive  $(120/95) - 1$

Missouri, like Many States, Assumed Concrete Less Expensive than Steel for Short Span Bridges

# MoDOT Bridge Construction

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Between January 2009 to May 2018:

10 yrs

How Many Typical Concrete Bridges Did MoDOT Build?

**378**

- Prestressed NU
- PC I Beam
- PC Box
- PC Bulb T, Dbl T & Slab

How Many Typical Steel Bridges?

**16**

15 Plate and 1 Wideflange, Excludes:

- Major River Crossings
- Tight Horizontal Curves
- Widening
- And Special Configurations

**4% Typical Steel Bridges**

# Steel & Concrete Bridge Costs in Missouri

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In 2018, DeLong's, the SSSBA and MoDOT worked together to study steel and concrete costs for typical bridges. Two workshops delivered in Missouri:

- Learn & Earn Workshop, Kansas City, May 2018
- Learn & Earn Workshop, St. Louis, November 2018
- Presented to MoDOT, Consultants & Contractors



**Results Showed Steel & Concrete Bridges are Competitive for Short Spans**

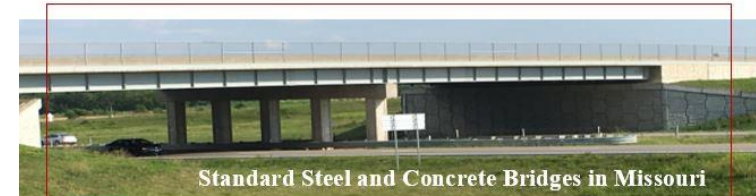
# Problem Solution

Over the Years, Preconception that Concrete is Always Less Expensive Than Steel for Simple Span Bridges



**MoDOT Removed Cost Guidance December 2018 And Competed Steel Bridges**

**Other States Have Similar Policies**



Standard Steel and Concrete Bridges in Missouri

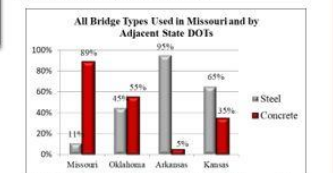
- Background**
- For most of the last two decades the belief around the bridge industry in the U.S. was that concrete girder bridges were cheaper to construct than equivalent steel girder bridges. This belief was common for spans less than 120 feet.
  - This myth was perpetuated because steel was often used on more complex, expensive bridges, and those complex bridges increased the initial average cost per square foot of steel bridges.
  - Given budget constraints, MoDOT decided whether to construct a steel or concrete bridge based only on initial cost.
  - Since May of 2017, DeLong's, Inc. representatives have worked closely with MoDOT to review historical cost data regarding the initial cost of comparable structures, standard steel and concrete bridges.
  - Research showed the initial average cost per square foot of standard steel and concrete bridges was comparable.

**Recent Actions**  
Based on the actual cost data, in December 2017, MoDOT updated the MoDOT Engineering Policy Guide to specify steel and concrete bridges as the same initial cost.

Bridge Structures	Cost per Sq. Foot
Typical Girder	\$60
Temporary Bridge (State furnished)	\$140
Temporary Bridge (Contractor furnished)	\$200 - \$250
Major Lake Crossing	\$250 - \$450
Major River Crossing	\$250 - \$450

From January 2018 through June 2018, MoDOT has let 2 standard steel bridges totaling \$663,000 and 61 standard concrete bridges totaling \$50,250,000.

- Bridge Types Used in Adjacent States & Missouri Cities and Counties**
- Some surrounding states use significantly more steel for bridges than Missouri.
  - Missouri cities and counties have built 59 standard steel bridges compared to MoDOT's two standard steel bridges from January 2014 through June 2018.



**Total Standard Steel and Concrete Bridges let by MoDOT between January 2014 and June 2018:**

	Total Spent	Total Number	Percentage	Average Cost Per Sq. Ft.
Steel	\$663,389	2	1%	\$90
Concrete	\$166,965,592	237	99%	\$102

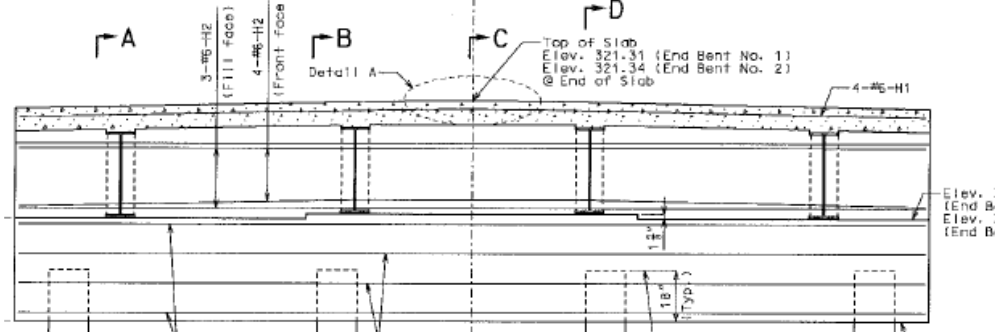
- Other Advantages of Steel in Addition to Initial Cost**
- Adaptability and Repairability** – Steel bridges can easily be widened, lengthened, strengthened, re-decked, and modified to accommodate future needs, and sections can be repaired quickly and easily.
  - Renewability** – Steel is the most recycled material on earth. Recycled content of structural steel is over 90%.
  - Efficiency** – Steel's span-to-depth ratio is more efficient than concrete's, reducing fill dirt required at approaches.
  - Constructability** – Steel girders are lighter than concrete girders for the same span, which enables the use of smaller capacity cranes.
  - Reusability** – Old beams/girders can be used for new bridges, as falsework support by contractors, or recycled.

# So What Happened When Competing Short Span Steel Bridges?

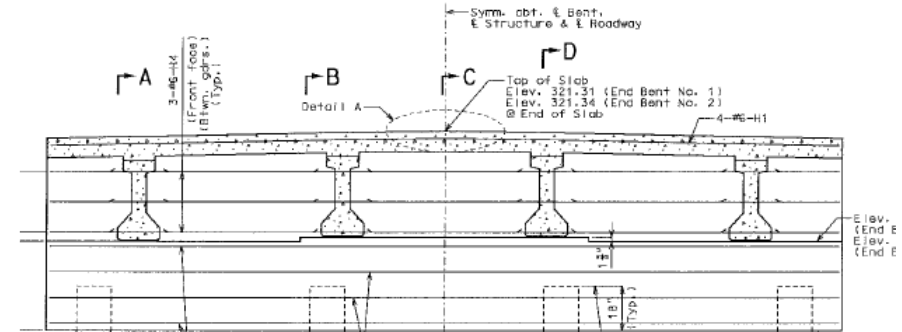
Scott County, MO, 45 ft Simple Span, 26 ft-8 in Width, Built 2019

Increase Length for Hydraulic Opening; Increase Width for Lanes

Composite Rolled W Shapes



Prestressed I Beams



8 Bids from General Contractors  
4 for Steel  
4 for Concrete

Low Bid Steel - **Galvanized Beams**

Closest Concrete Bid 19% Higher

**Difference of \$290,000**



# Another Example – Large Design-Build Bridge Bundling Project



Fixing Access to Rural Missouri (FARM) Bridge Program: 31 Bridges, \$26 mil

Bids & Award

Best Value for a Fixed Budget

Category	Available Points	Team 1	Team 2	Team 3
		Primarily Concrete	Primarily Concrete	Primarily Steel
Bridge Bundling Part 1	40	39.7	38.3	40
Bridge Bundling Part 2 (Bonus)	15	1.5	0	1.5
Quality & Longevity	30	18.7	20	21.7
Completion & Maintenance of Traffic	15	5.8	11.8	8.9
<b>TOTAL SCORE</b>	<b>100</b>	<b>65.7</b>	<b>70.1</b>	<b>72.1</b>

## Design-Build Team





## How Did Steel Win the Bid? – for the 25 multi-span bridges

- Bridge Bundling (40 pts + 1.5 pts bonus) highest score — Economy of Steel Bridges
  - 31 bridges replaced
  - Innovative Simple for Dead Load, Continuous for Live Load (SDCL) designs
- Quality & Longevity (21.7 pts) highest score — Performance of Steel Bridges
  - Galvanized beams – 100 yr expectation in rural setting
  - Full-depth CIP deck
- Completion & Maintenance of Traffic (8.9 pts) 2<sup>nd</sup> highest — Equipment & Ease of Construction
  - Ease and pace of construction
  - Weight of bridge and lighter equipment



# Now for the Bridges of Franklin County

## 5 Bridges in Franklin County to be Replaced (2023 – 2025)

Bridge	Hendrix Road	Little Indian Creek	Huff Road	Little Boone Creek	Lockhart Road
Type of Bridge	Steel	Steel	Steel	Concrete	Steel
Low Bid	\$549,202	\$494,630	\$638,787	\$651,130	\$564,806
Lowest Other Material	\$748,163	\$518,490	\$685,604	\$722,735	\$577,939
% Higher Other Material	36.2%	<b>Saved \$23,860</b>	<b>Saved \$46,817</b>	11.0%	2.3%
Number of Bids	3	6	7	6	4
Order of Bids	Steel	Steel	Steel	Concrete	Steel
	Concrete	Concrete	Steel	Concrete	Steel
	Steel	Concrete	Concrete	Steel	Concrete
	<b>Saved \$198,961</b>	Steel	Steel	<b>Saved \$13,133</b>	Steel
		Concrete	Concrete	Steel	
		Concrete	Concrete	Steel	
			Concrete		

Delongs Fabricated

**Steel Saved \$282,771**

Delongs Fabricated

# Hendrix Road Bridge

45 ft Span; 24 ft Roadway Width

Four W21x101 Girders @ 6 ft – 6 in

Weathering Steel

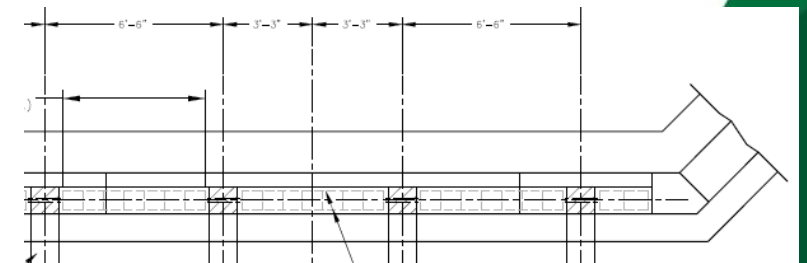
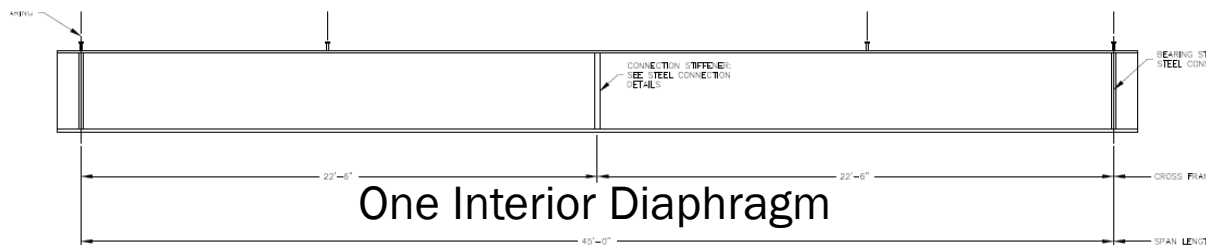
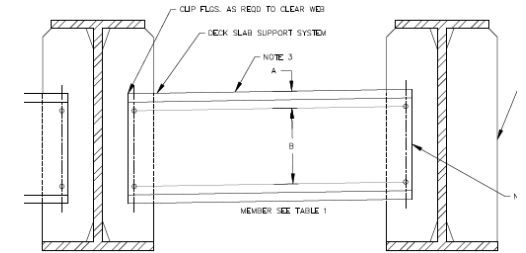
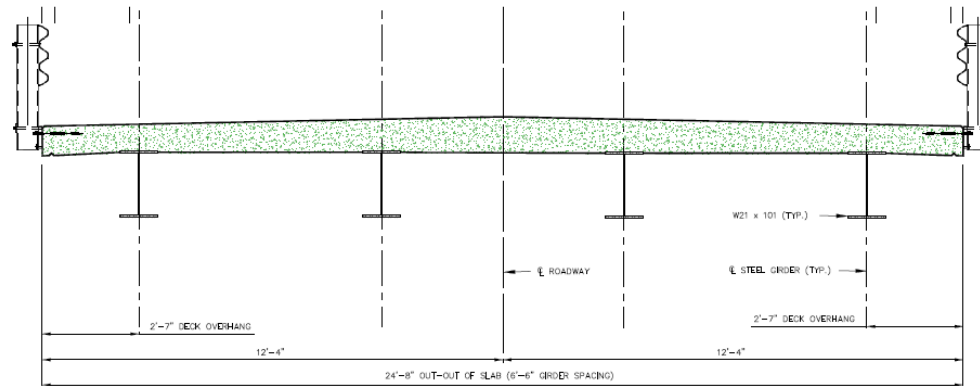
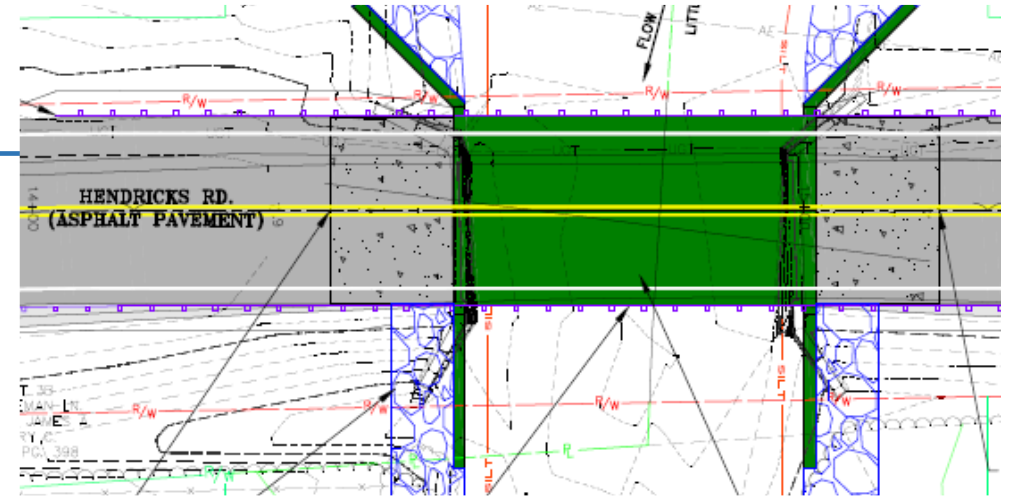
No Skew

Integral Abutment

Channel Diaphragms

SIP Form Deck

Simple Bridge Railing



# Hendrix Road Bridge



# Hendrix Road Bridge

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# Lockhart Road Bridge

41ft – 6 in Span; 28 ft Roadway Width

Five W18x86 Girders @ 6 ft – 2 in

Weathering Steel

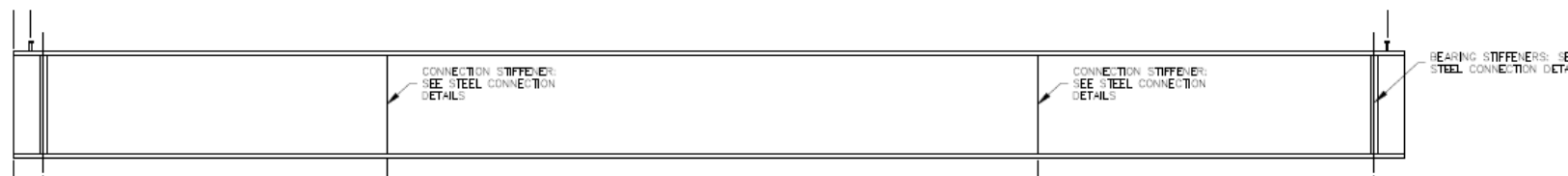
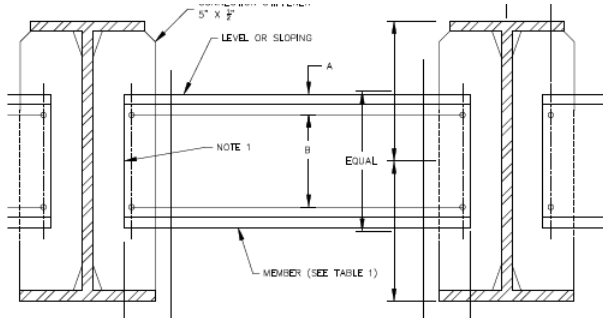
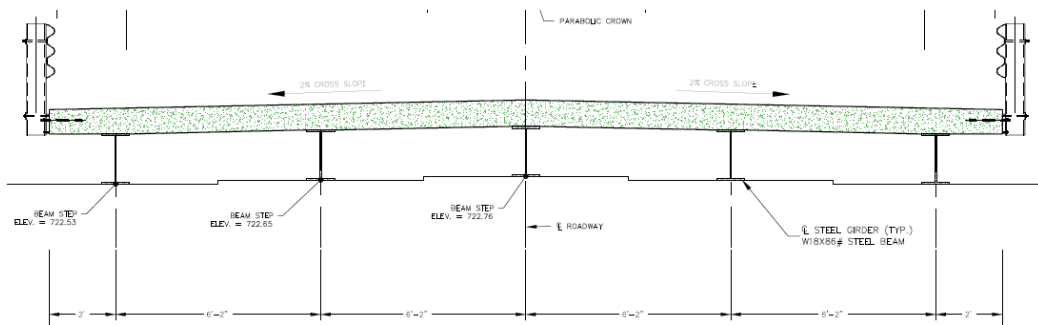
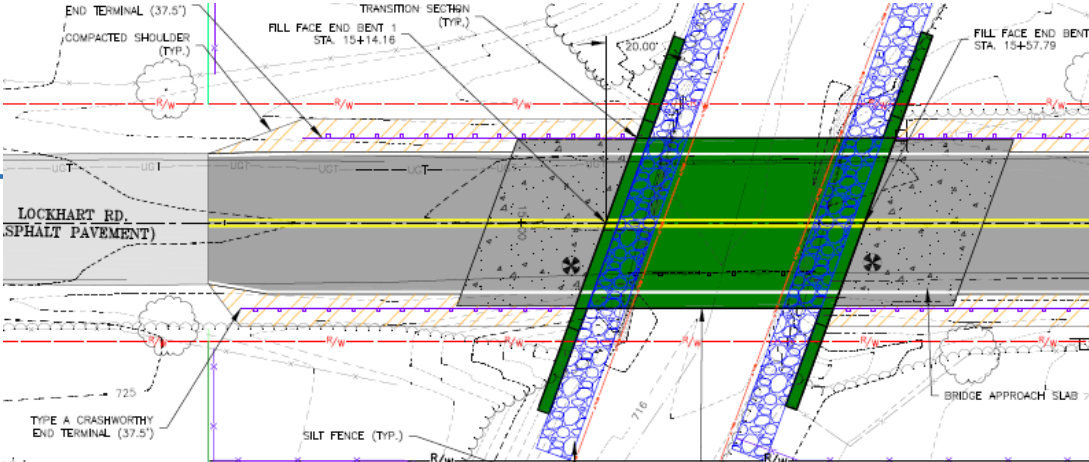
20° Skew

Integral Abutment

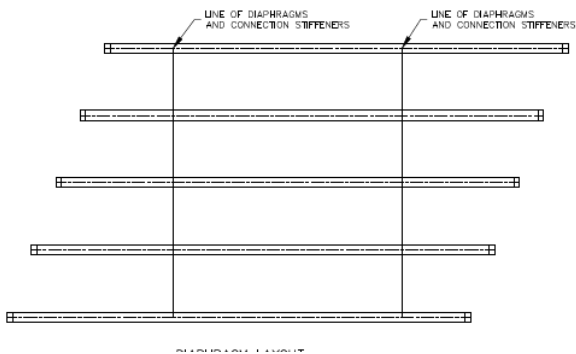
Normal Diaphragms

Solid Deck

Simple Bridge Railing



Two Interior Diaphragms - Staggered



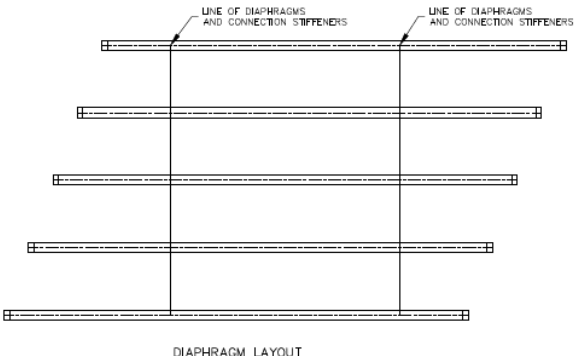
Variable Unbraced Lengths

# Lockhart Road Bridge

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# Lockhart Road Bridge



# Performance of Today's Short Span Steel Bridges

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## Cost Effective

- Simple & Practical Details
- Lighter Equipment
- Smaller Abutments



## Speed of Construction

- Accelerated Bridge Construction
- Modular Construction

## Longevity - 100+ yrs

- Durable Materials
- Corrosion Protection Systems
- Integral Abutments & Jointless Decks



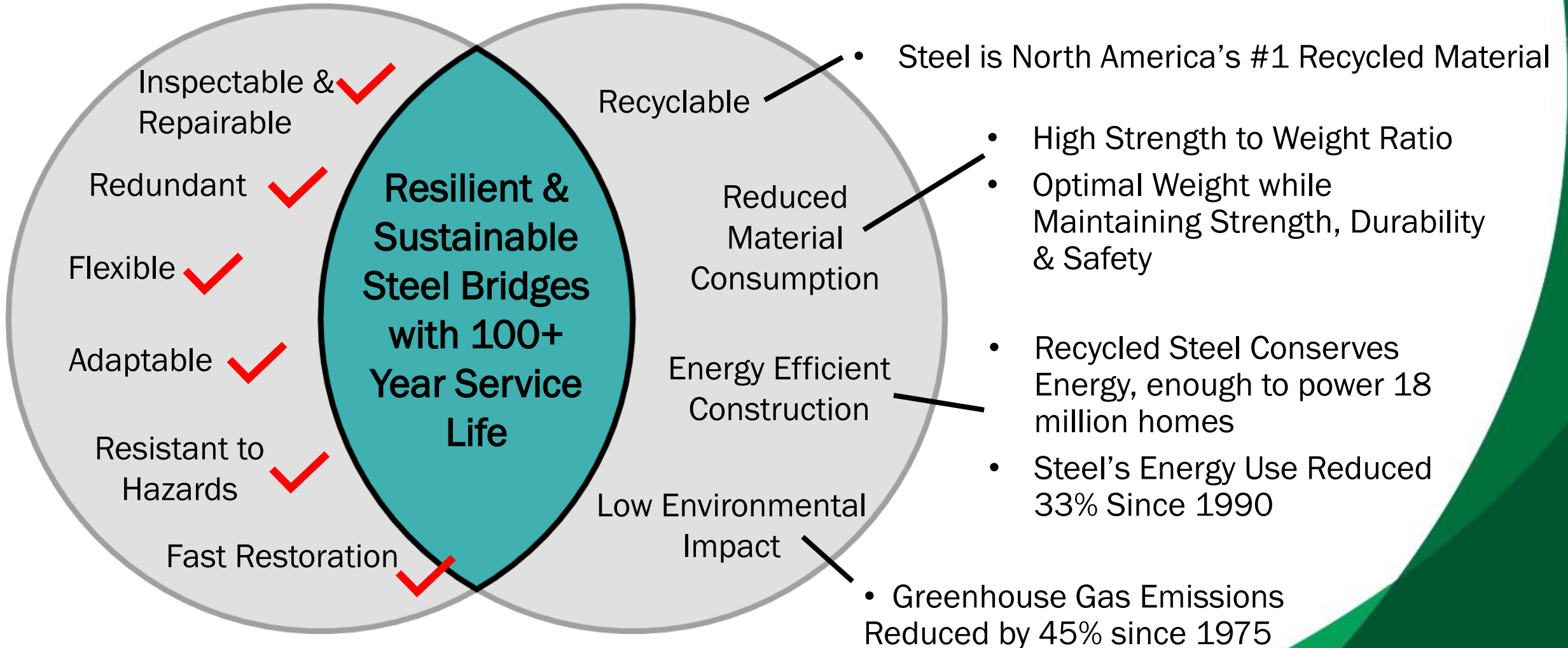
## Resilient & Sustainable

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

# Resiliency & Sustainability

## Resiliency

## Sustainability



# Summary & Conclusions

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Competition Between Steel & Concrete is Healthy For:

- Costs
- Quality of Bridges
- Industry Responsiveness
- Industry Capabilities

Steel and Concrete are Competitive on First Costs & Life Cycle Costs

Steel or Concrete May Be the Lowest Cost for a Particular Project

**Owners, Designers & Contractors Should Consider Both Concrete & Steel for Bridge Projects**

# Recent MoDOT Bridge Construction

Between ~~January 2009 to May 2018~~ 2021 to 2025:

~~10 yrs~~

vs

5 yrs

How Many Typical Concrete Bridges Did MoDOT Build?

~~230~~ 378

- 39%

- Prestressed NU
- PC I Beam
- PC Box
- PC Bulb T, Dbl T & Slab

Does Not Include

Bridge Bundling Bridges

- 25 Steel: FARM
- 24 Steel: NW MO
- 12 Steel: SW MO
- 4 Steel: Kaysinger Basin

How Many Typical Steel Bridges?

24 ~~16~~

+ 50%

~~15~~ 8 Plate and ~~1~~ 16 Wideflange, Excludes:

- Major River Crossings
- Tight Horizontal Curves
- Widening
- And Special Configurations

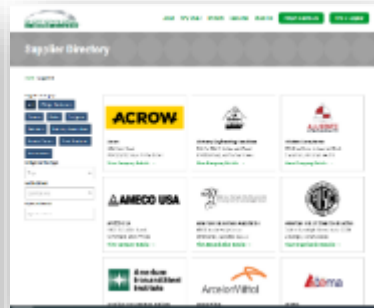
~~4~~ 10% Typical Steel Bridges – AND Competition Saving Missouri Money!

# 5 Ways to Keep Learning About Steel Bridges

1. Subscribe to the Weekly Newsletter



2. Find a Supplier



3. Design a Bridge in 5-Minutes



4. Receive Free Project Assistance



5. Schedule a Workshop/Webinar



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

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



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

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