



Photo: 2020 Prize Bridge National Winner – Manning Crevice (Idaho) — Photo Credit: Ken Saindon

Competitive Short-Span Steel Bridges

John Hastings, PE

Bridge Steel Specialist, Southeast



**Smarter.
Stronger.
Steel.**

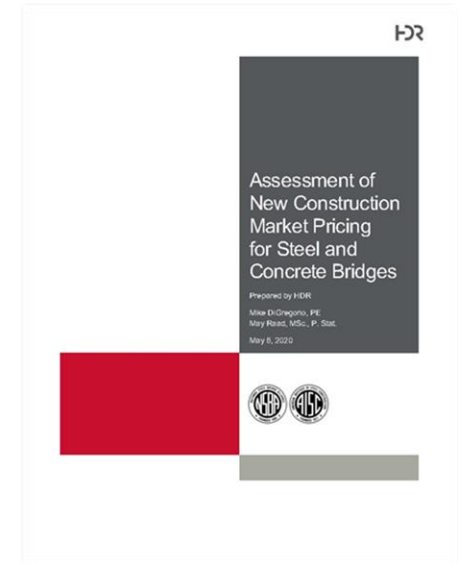
Competitive Short-Span Steel Bridges

Assessment of New Construction Market Pricing for Steel and Concrete Bridges

- Comprehensive national study of bridge cost
- Prepared by HDR
 - Michael DiGregorio, PE, MBA Professional Associate
- Conclusions
 - Steel bridges are cost-competitive
 - Rolled steel bridges are most cost-competitive
 - States exhibit a bias toward bridge types (steel vs concrete)

“These conclusions come as a surprise to the authors, who assumed that concrete bridge would be more cost-competitive than steel bridges.”

Michael DiGregorio



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Project Objectives

- Determine the in-place cost of structural steel and precast concrete bridges
- Break these cost down
- Compare similar structures
- Compare national and regional cost

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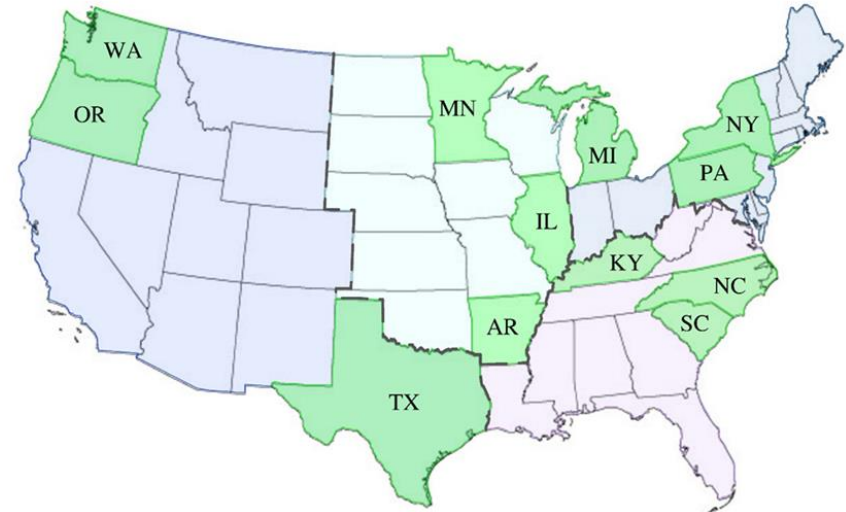
Project Scope of Work

- Structural Steel and Concrete bridges
- New and replacement structures for vehicular traffic
- Typical girder/beam/slab type bridges (i.e. no truss, arch, cable stay, suspension, etc.)
- Bridge let by State Department of Transportation agencies
- Projects constructed between 2011 and 2019
- Design-Bid-Build delivery approach

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Project Approach

- Selected 12 states
- Gathered information
 - Reviewed bridge plans
 - Reviewed Historic bid tabs



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Project Approach

Region	State	Steel								Concrete								Total
		11	14	15	16	17	18	19	Tot	11	14	15	16	17	18	19	Tot	
West	Oregon		2	1		1			4		6	7	8	2			23	27
	Texas				1	3	1	1	6						63	29	92	98
	Washington	2							2	1	9	8	10	4	3	5	40	42
Central	Arkansas				38	9	6		53									53
	Illinois						23	8	31						29	4	33	64
	Minnesota					2			2					42	8		50	52
Southeast	Kentucky				1	2			3				1	11	21	14	47	50
	North Carolina					12	5		17					25	29		54	71
	South Carolina						1	1	2		6	13	3	9	6	4	41	43
Northeast	Michigan			3	2	3	4	3	15			3	21	9	16	7	56	71
	New York				16	14	8		38				1	5	2		8	46
	Pennsylvania					6	1		7				30	27	33		90	97
Total		2	2	4	58	52	49	13	180	1	21	31	74	134	210	63	534	714

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Project Approach Comparable Cost

- Typical items included:
 - Mobilization
 - Structural Excavation
 - Foundations
 - Beams
 - Superstructure/Deck

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Project Approach Comparable Cost

- Typical items not included:
 - Overlay
 - Bridge rail
 - Approach Slab
 - Aesthetics

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Project Approach Cost Adjustments

- Escalation
 - Necessary to escalate project cost from past years to consistent base year for comparison (Q2 2019)
- Location Adjustment
 - Necessary to adjust project costs from state specific to national average for comparison

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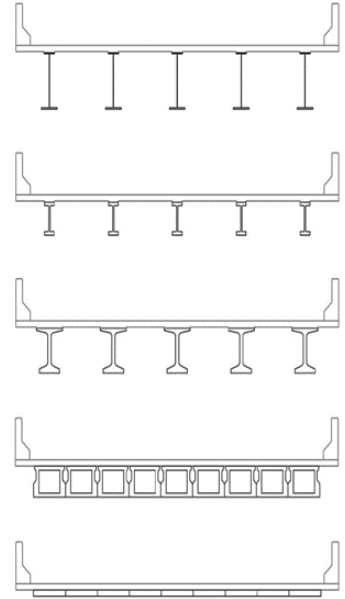
Establish Key Parameters

- Bridge Type
- Span Length Classification
- Skew Angle and Horizontal Curvature
- Phasing
- Coatings
- Grade of material

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Establish Key Parameters

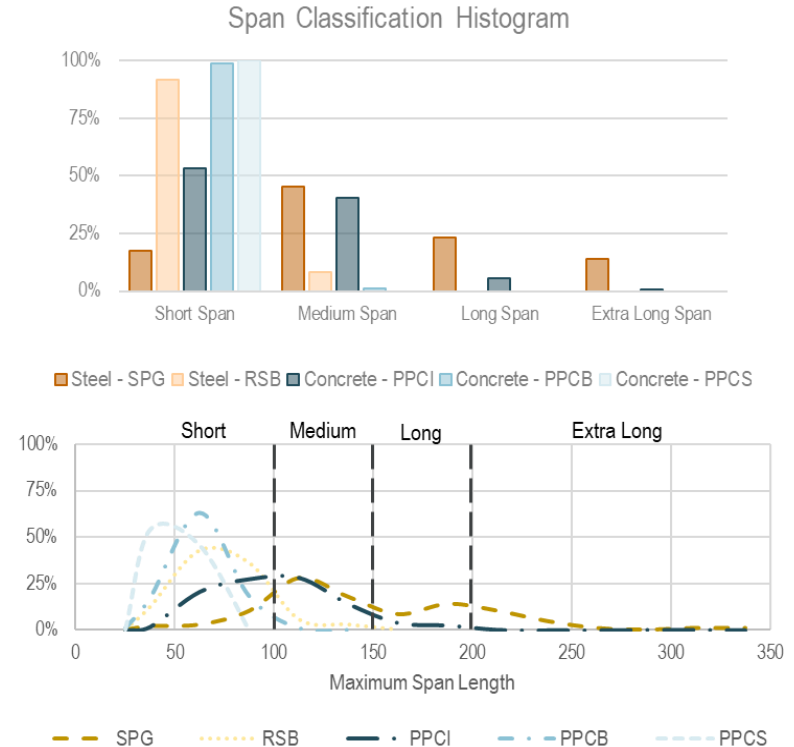
- Bridge Type and Subtype
 - Structural Steel
 - Steel plate girder (SPG)
 - Rolled steel beam (RSB)
 - Concrete
 - Precast, prestressed concrete I-beam (PPCI)
 - Precast, prestressed concrete box beam (PPCB)
 - Precast, prestressed concrete slab beams (PPCS)



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Establish Key Parameters

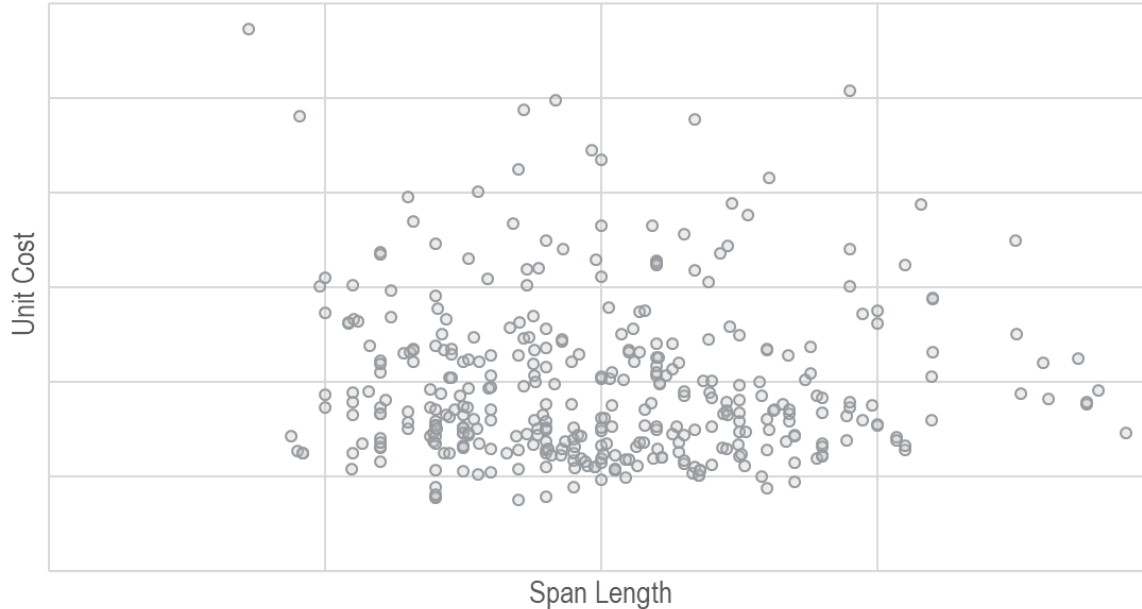
- Span Length Classification
 - Captured the length of each span for every bridge
 - Developed a histogram of maximum span length
 - Span ranges from span distribution
 - <100'
 - 100' to 150'
 - 150' to 200'
 - > 200'



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How to Report Costs

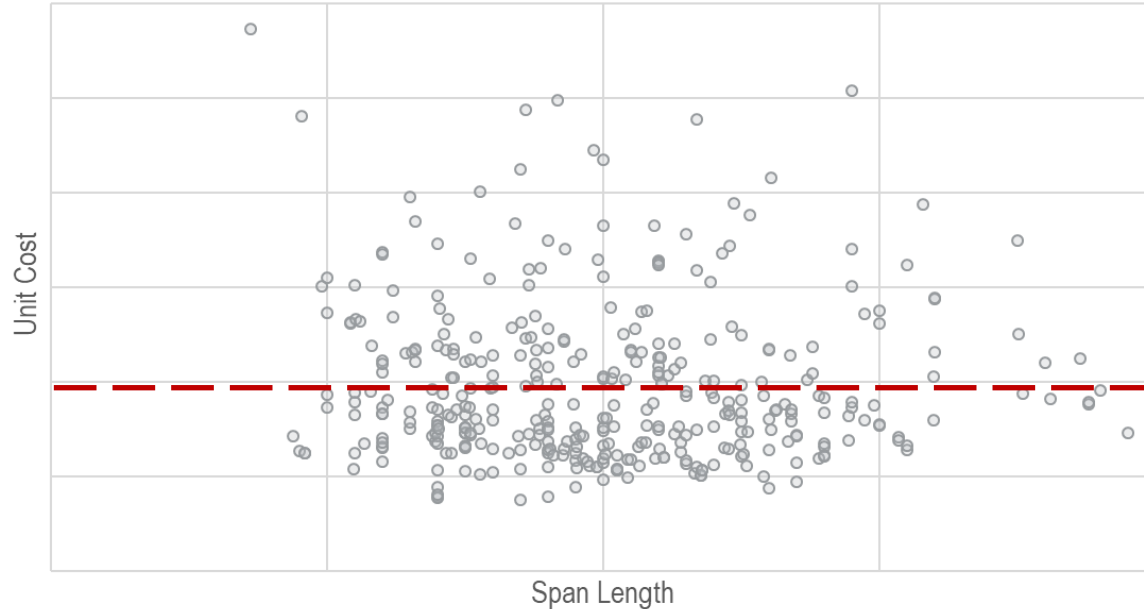
- Unit Price Data Set



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How to Report Costs

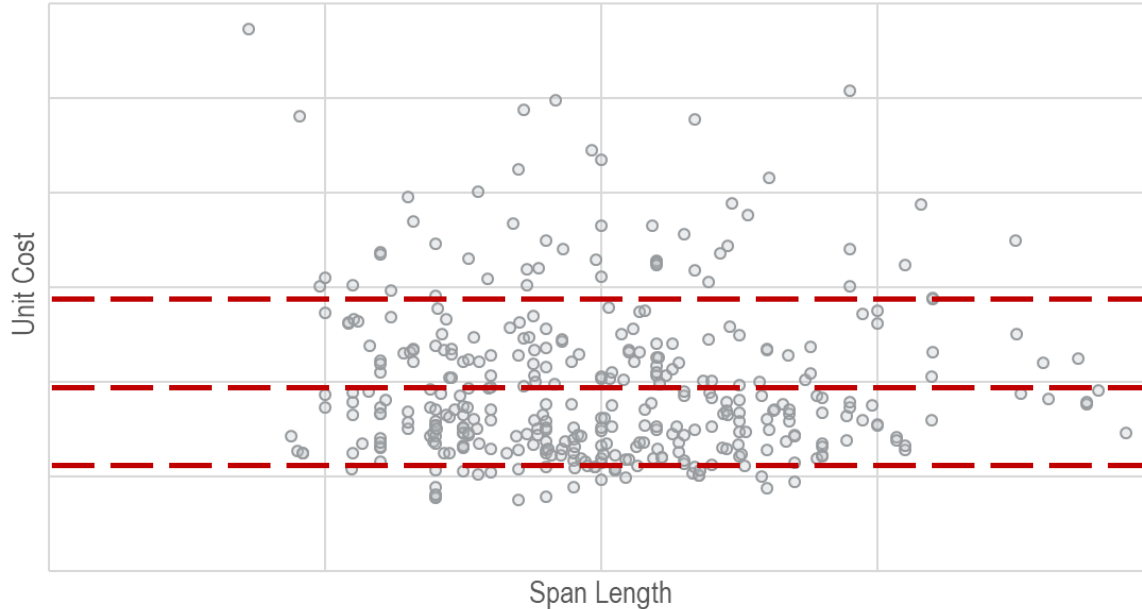
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How to Report Costs

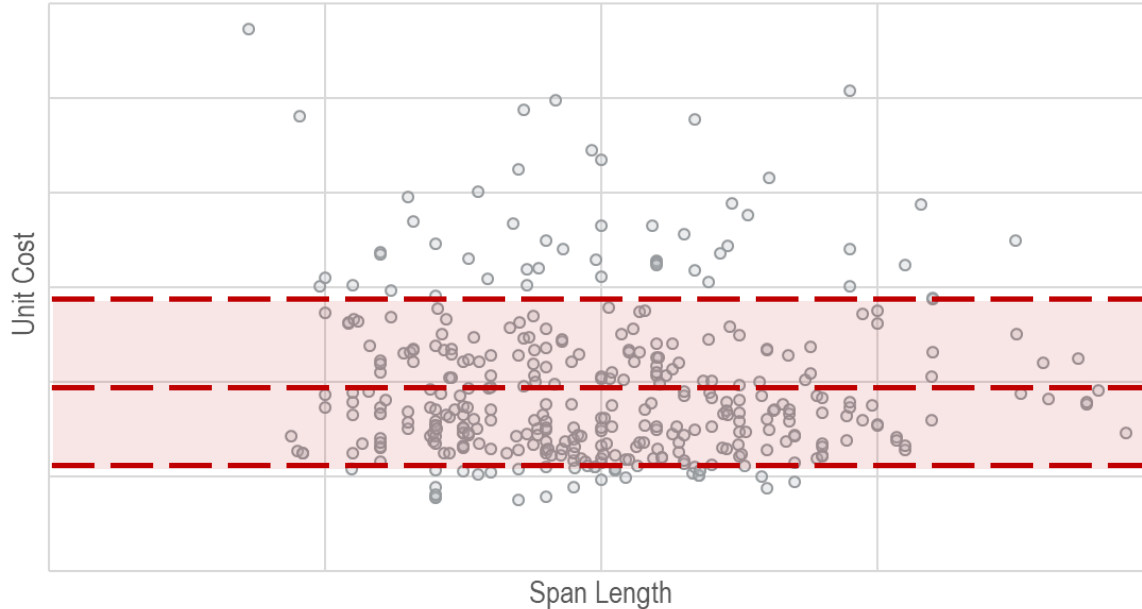
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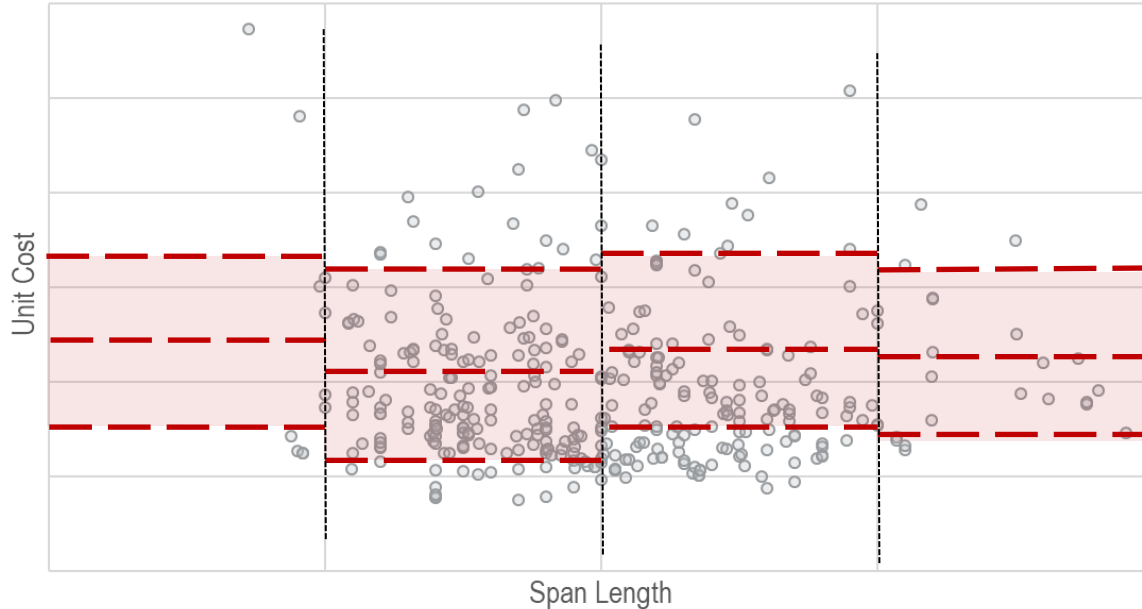
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How to Report Costs

- Unit Price Data Set



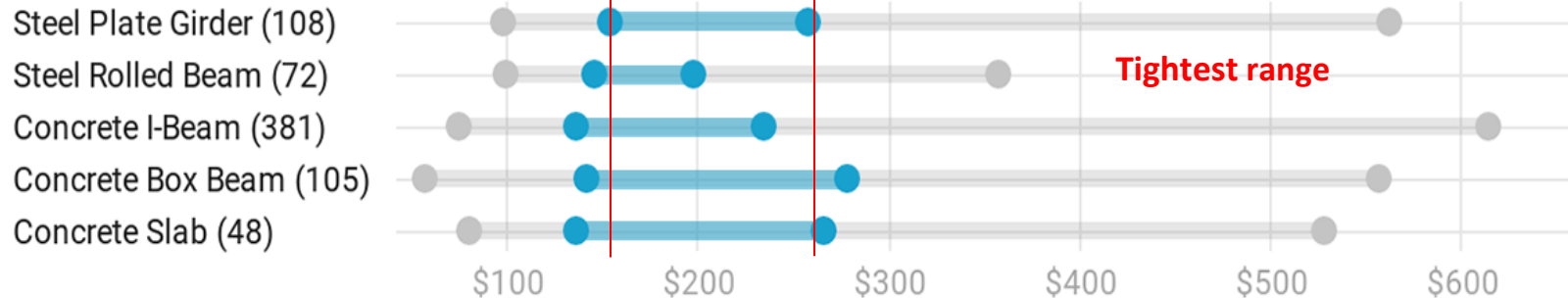
Competitive Short-Span Steel Bridges

National Bridge Cost by Beam Subtype (\$/SF)

(#) indicates number of bridges for each beam type

● Minimum ● 25th Percentile ● 75th Percentile ● Maximum

All Spans



Lots of overlap in 50th percentiles

Tightest range

- Cost in \$/ SF for different beam types, and gray bars show overall range of bridge costs for each beam type
- Blue shaded portion highlights 50th percentile range of bridge costs
- Significant overlap with all concrete beam types

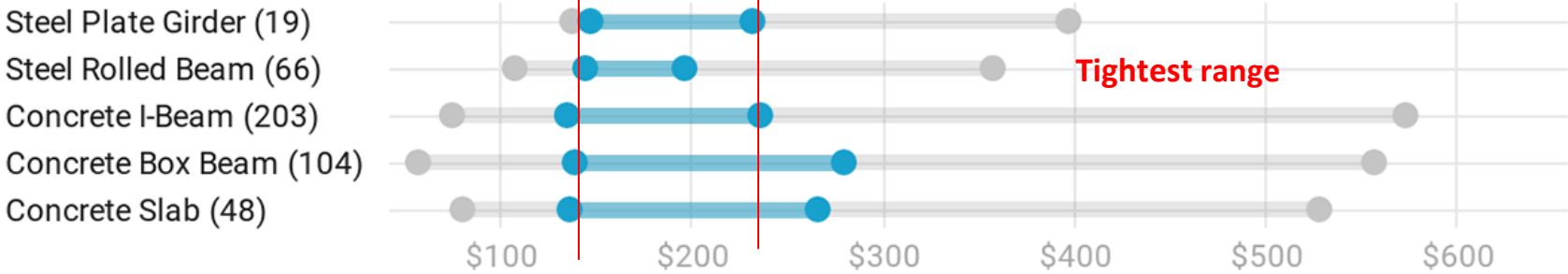
Competitive Short-Span Steel Bridges

National Bridge Cost by Beam Subtype (\$/SF)

(#) indicates number of bridges for each beam type

● Minimum ● 25th Percentile ● 75th Percentile ● Maximum

Less Than 100 ft.



Lots of overlap in 50th percentiles

Tightest range

- Steel plate girders and rolled beams are competitive with concrete

Competitive Short-Span Steel Bridges

National Bridge Cost by Beam Subtype (\$/SF)

(#) indicates number of bridges for each beam type

● Minimum ● 25th Percentile ● 75th Percentile ● Maximum

100 - 150 ft.

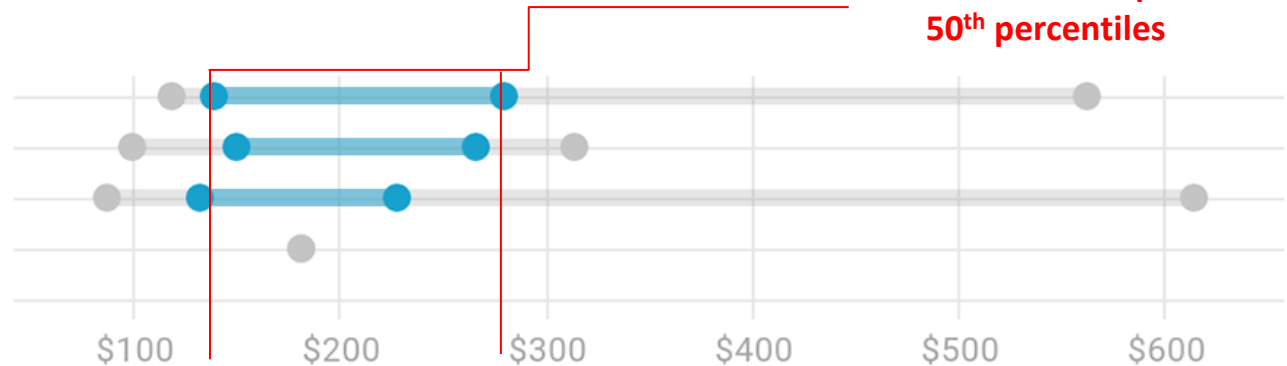
Steel Plate Girder (49)

Steel Rolled Beam (6)

Concrete I-Beam (154)

Concrete Box Beam (1)

Concrete Slab



Lots of overlap in
50th percentiles

- Significant overlap between all types suggests all beam types are competitive within this span range
- Rolled steel beams aren't as economical above 100'

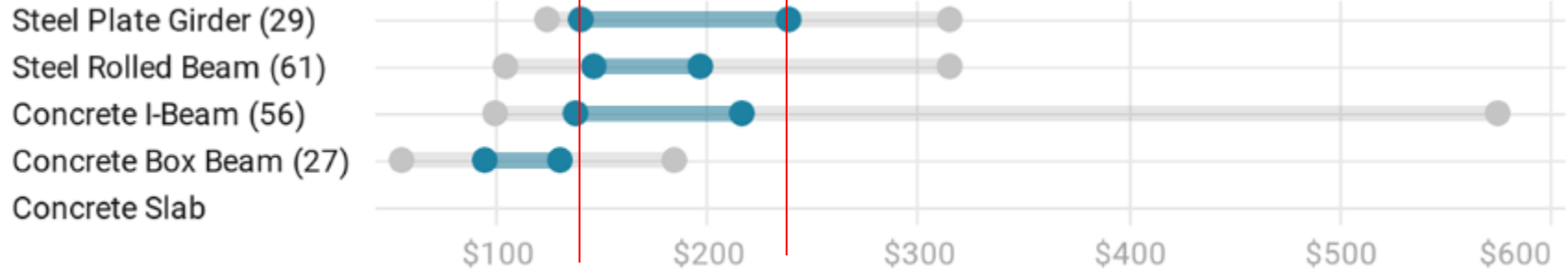
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Bridge Cost by Beam Subtype - Central Region (\$/SF)

(#) indicates number of bridges for each beam type

● Minimum ● 25th Percentile ● Average ● 75th Percentile ● Maximum

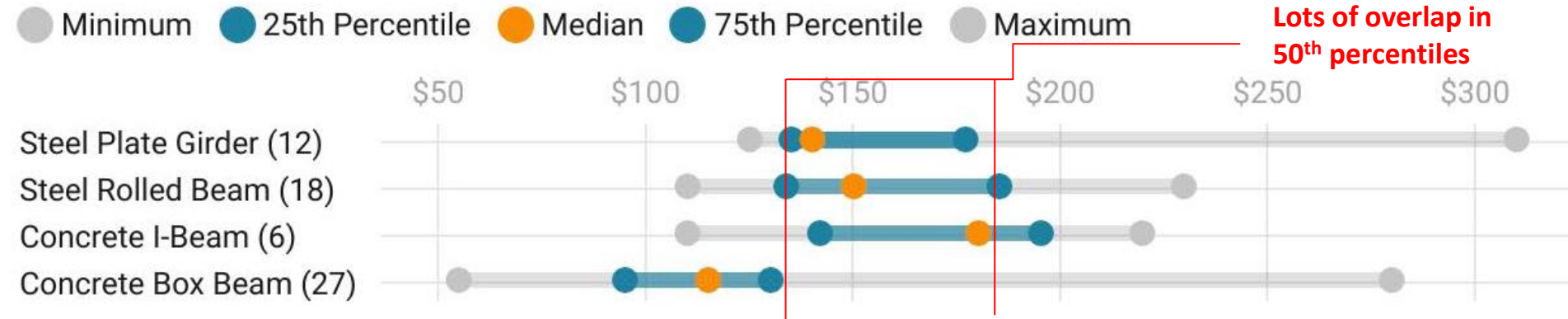
All Spans



- Significant overlap between all types suggests all beam types are competitive within this span range
- Rolled steel beams are the most predictable

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Bridge Cost By Beam Subtype - Illinois < 150'



- The Median for Steel Girders and Rolled Beams is lower than Concrete I-Beams
- Concrete Box Beams in this state typically only have an asphalt overlay which skews their results, and they are typically on low volume secondary roads.

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More Information

Bridge Steel Specialists

Western Market

open

Central Market

Tony Peterson

Southeast Market

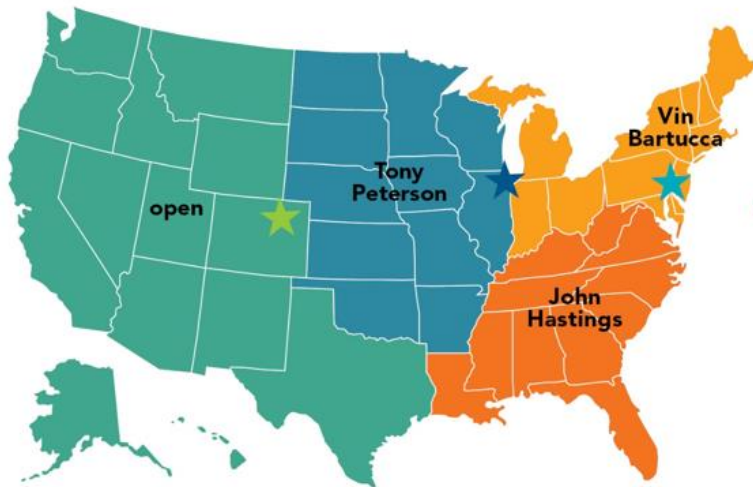
John Hastings

Northeast Market

Vin Bartucca

Steel Solutions Center

Devin Altman ★



Leadership Team

Senior Director of
Market Development

Jeff Carlson ★

Chief Bridge Engineer

Chris Garrell ★

www.aisc.org/nsba/



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Considerations for Steel Girder Efficiency

- Utilize balance spans when possible
 - Continuous span standards available at <https://www.aisc.org/nsba/design-resources/>
- Eliminate or reduce the number of piers to optimize span arrangements
 - Span-to-Weight Curves available at <https://www.aisc.org/nsba/design-resources/>
- Utilize wider girder spacings to reduce fabrication and erection cost.
- Balance loads in interior and exterior girders
- Optimize web depth (Simon has a feature for this, eSPAN 140)
- Simplify details

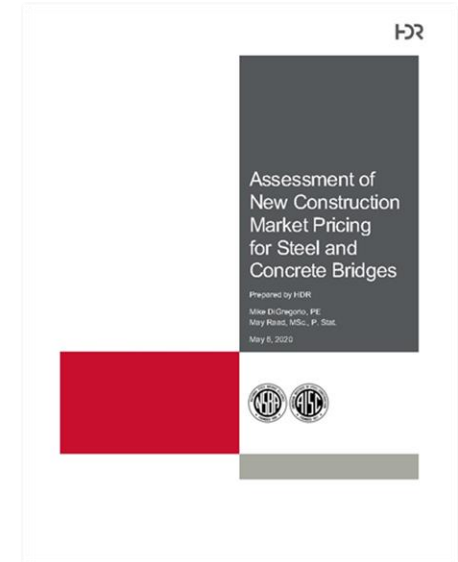
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Conclusions

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John Hastings, P.E.
615.490.6519
hastings@aisc.org



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