Notice:

Steel Bridge Selection and Design

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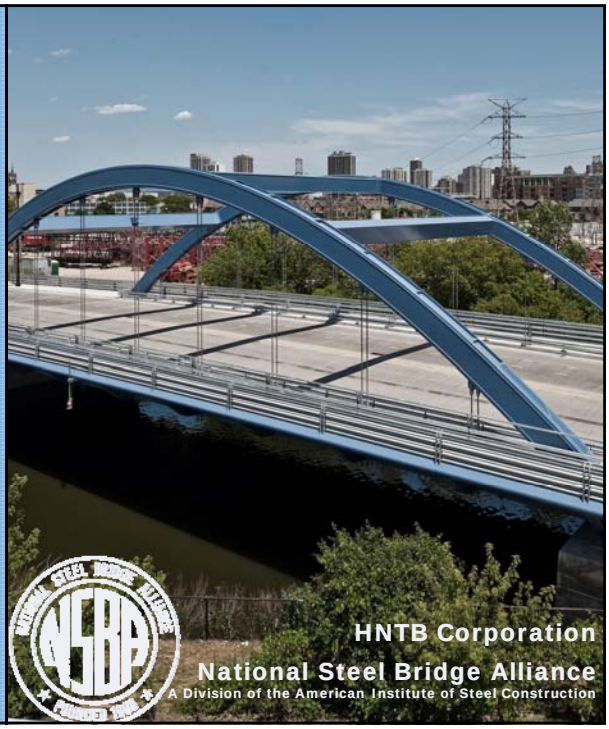
HNTB



Steel Bridge Design References

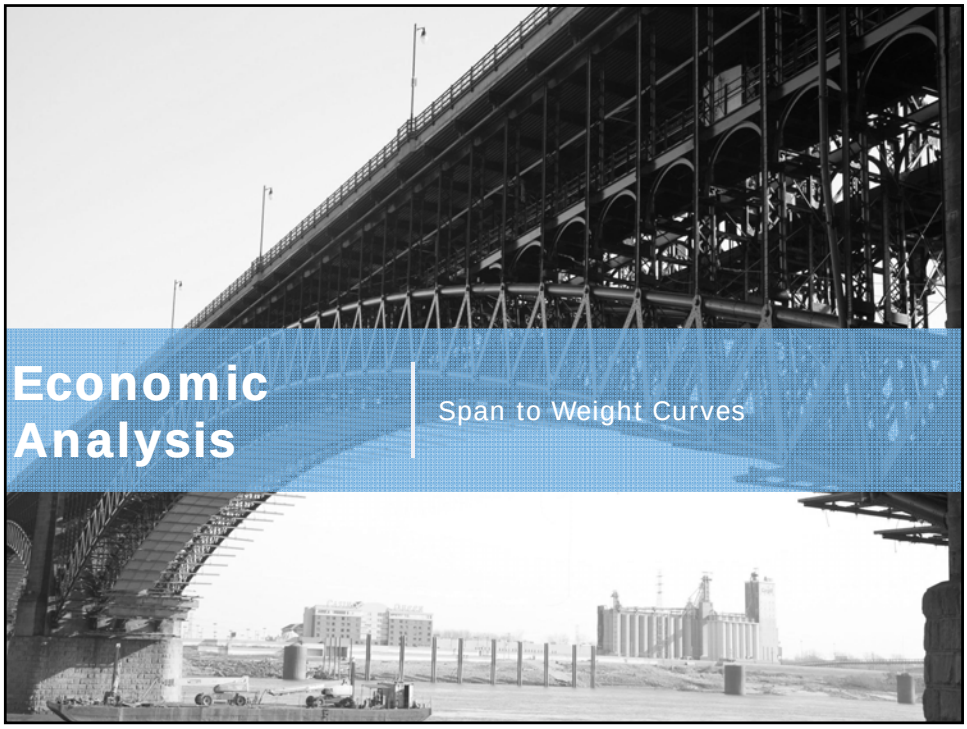
- Basic Design Resources

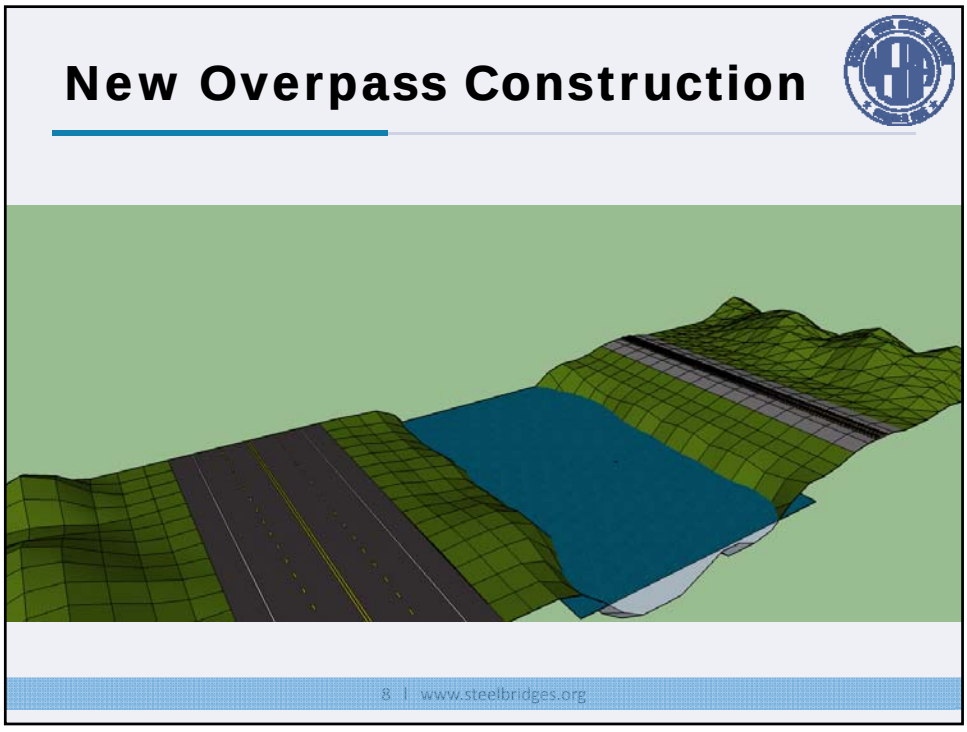
Steel Bridge Design References

- Cutting Edge Resources

Steel Bridge Design References

- NHI 5 day seminar on Steel Bridges
- 2016 Course title: *LRFD and Analysis of Curved Steel Highway Bridges*


Economic Analysis
Span to Weight Curves


New Overpass Construction
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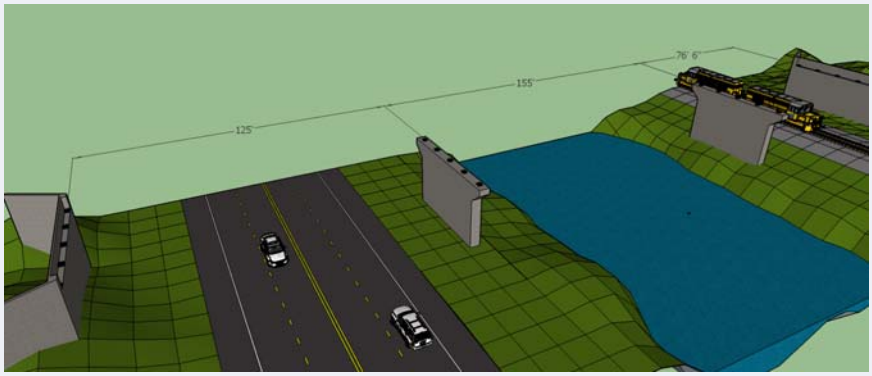
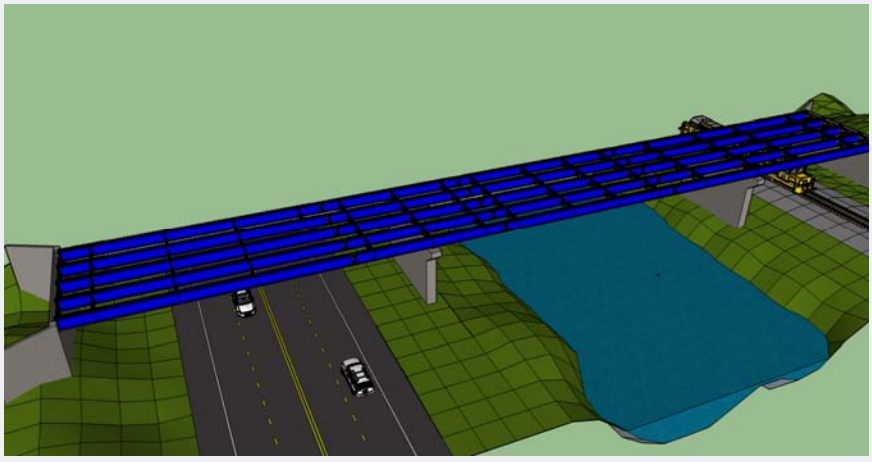
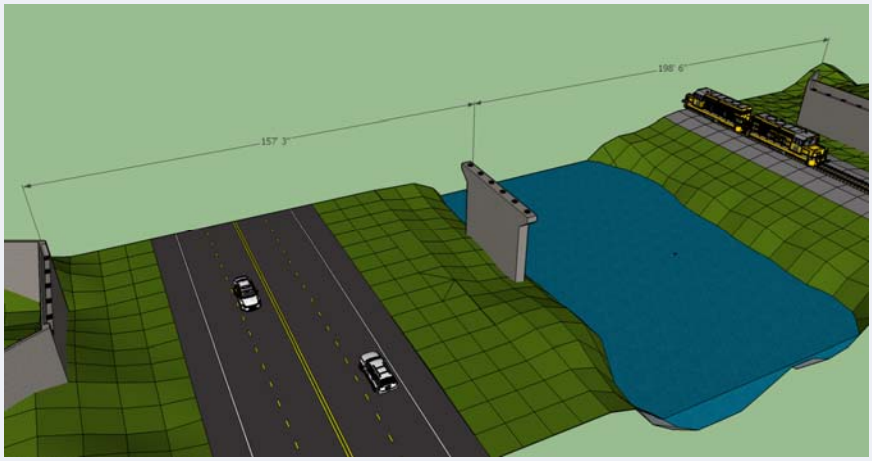
Substructure Layout



Substructure Layout



Substructure Layout



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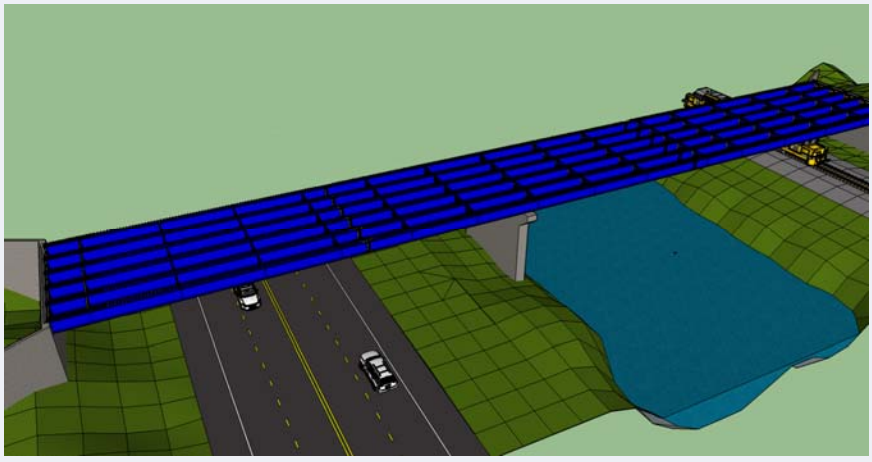

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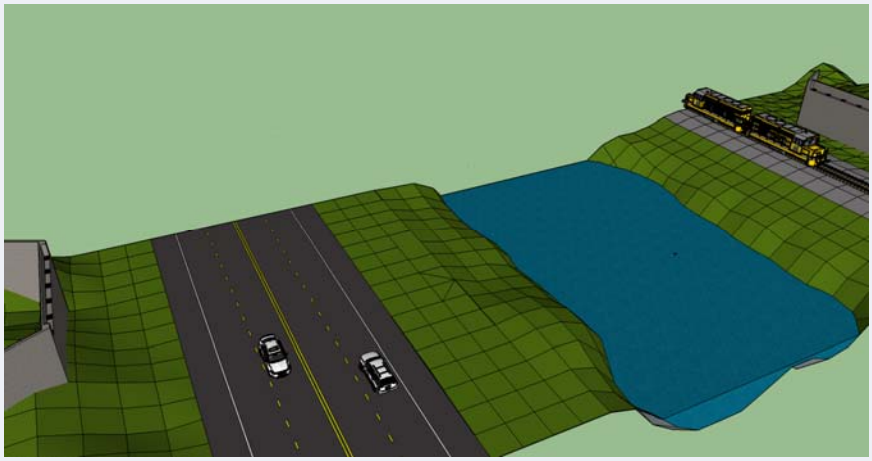
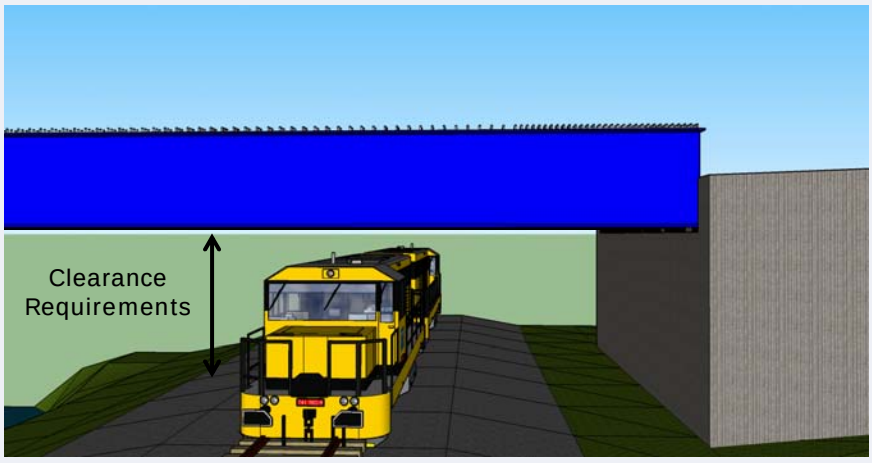
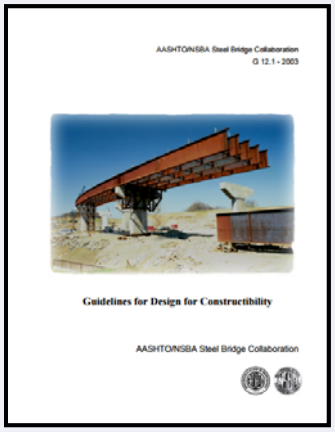


Substructure Layout

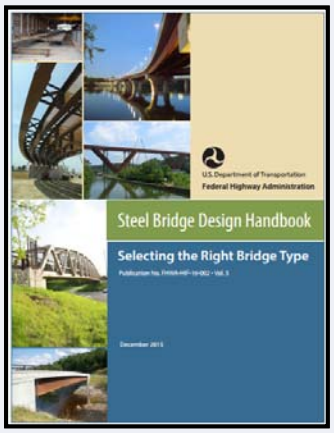


Selecting Bridge Type

AASHTO/NSBA Collaboration
G12.1-2003: *Guidelines for Design for Constructibility*



Steel Bridge Design Handbook: Selecting the Right Bridge Type



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Rolled Beam vs. Plate Girder

- Rolled Beam? Welded Plate Girder?.....It Depends!
- 80 feet is where a plate girder becomes more advantageous from a pounds per foot perspective.

	Bridge Span Length (ft)							
Solution Type	0	20	40	60	80	100	120	>140
Rolled Beam								
Homogeneous Plate Girder								

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Rolled Beams

Benefits

- Simplified Design.
- Simplified Fabrication.
- Great for limited depth requirements: (33” to 36” most economical).

Limitations

- 40” depth beams become less economical.
- Must heat curve
  - Significant dead load camber will make heat curving difficult.
  - Minimum 1200 ft radius for horizontal curvature.
- Depends on rolling schedule.
- Lengths available up to 120’.

Plate Girders

Benefits

- Will fit the project constraints.
- No availability issues with regards to typical plate sizes.
- Can cut girder to fit camber and horizontal curvature requirements.

Limitations

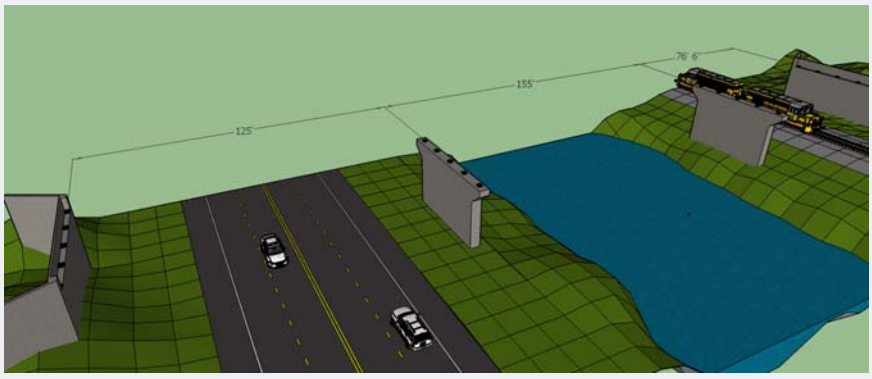
- More involved design.

Rolled Beam vs. Plate Girder

- AASHTO/NSBA Collaboration document *G12.1-2003* recommends note allowing substitution of plate girder for rolled beam
- Nevada DOT provides language in their *Standard Spec.*

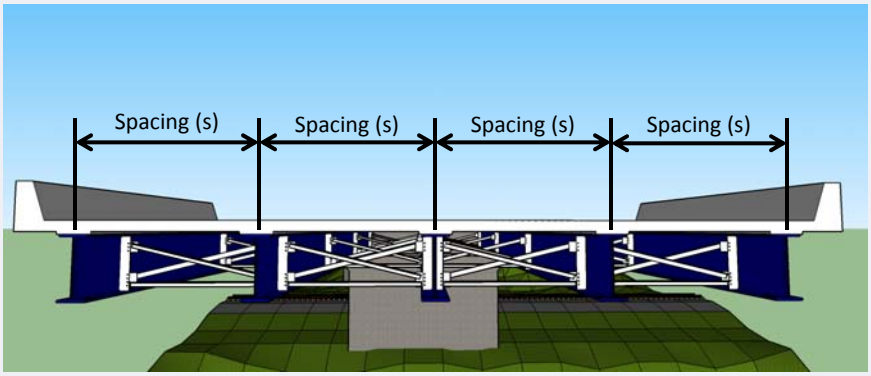
> Welded sections may be substituted for the rolled shapes, provided that the shapes and sections to be substituted comply with the following provisions:
>
> (a) Provide depth, width, and average thicknesses at least equal to those for the shape or section shown on the plans.
>
> (b) Weld flanges to web with continuous fillet welds on each side of web, according to Subsection 506.03.16.
>
> (c) Do not reduce the strength classification of the material.

Substructure Layout



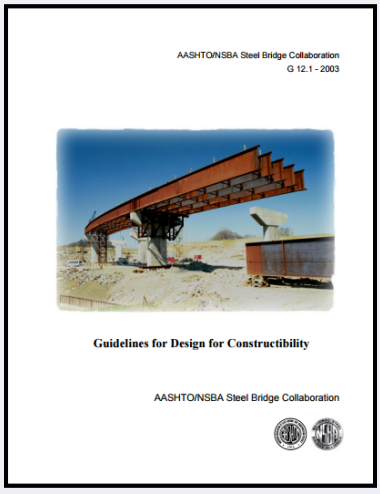
Girder Spacing

- Objective: Balance What's Practical with What's Economical



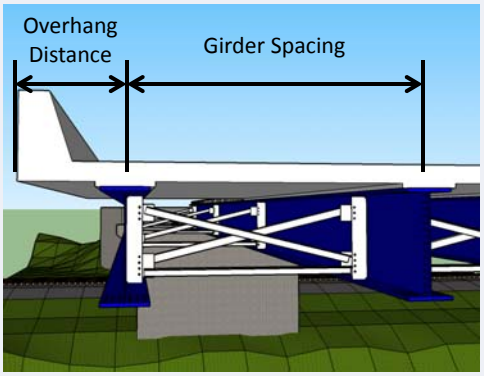
Steel Bridge Design Resource

- AASHTO-NSBA Collaboration G12.1-2003
  - Section 1.2: Girder Spacing
    - Up to 140' spans: 10' to 11' girder spacings.
    - Over 140' spans: Greater than 11' girder spacings
  - Vertical clearance and owner preferences could be limitations.



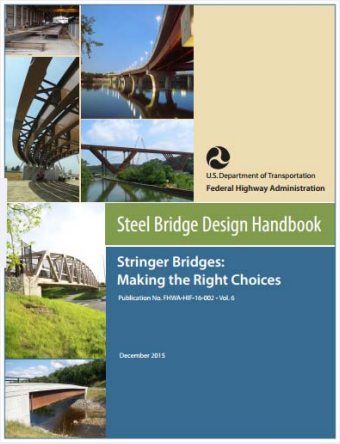
Deck Overhang

- Objective: Balance girder moments so exterior and interior girders have same plate sizes.



Steel Bridge Design Resource

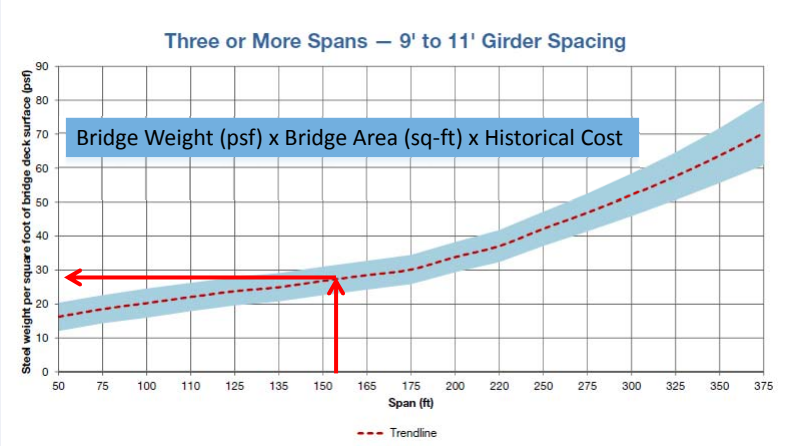
- *Handbook* Vol 6.
  - Section 3.0: Basic Framing Development
    - Deck overhangs to be 30% to 32% of girder spacing.



Steel Bridge Design Resources

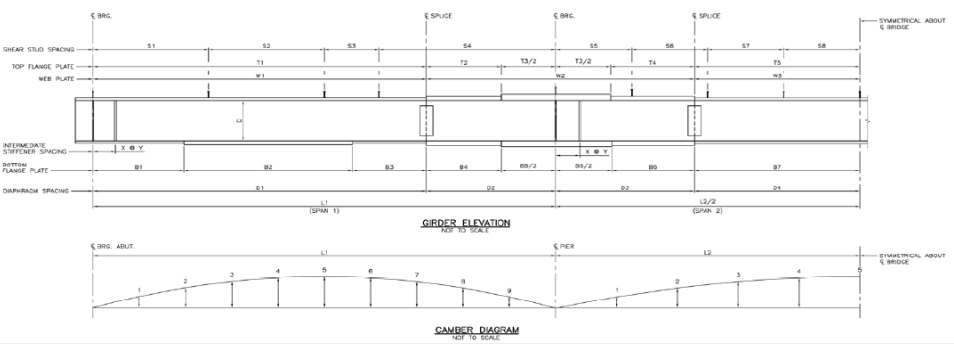
- Span to Weight Charts
  - Used during preliminary design phase.
  - Evaluation alternative structures.
  - Quickly determine relative costs.

Span - Steel Weight Curves

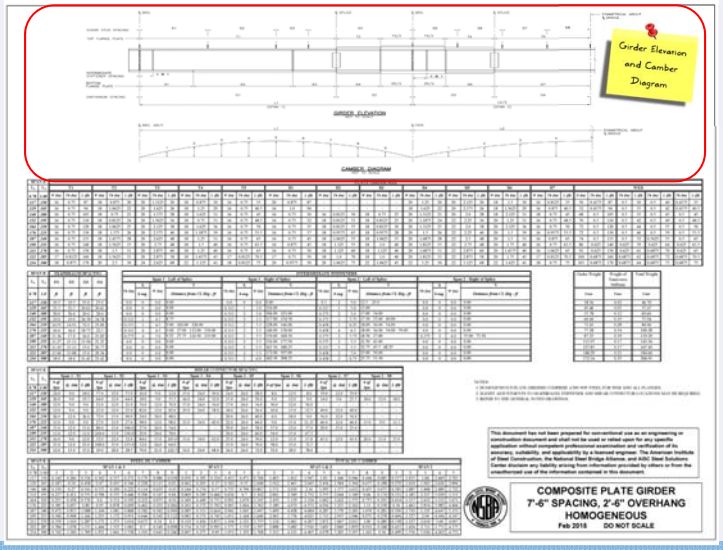


Steel Bridge Design Resources

- Continuous Span Standards
  - Provides preliminary solutions.



Conceptual Solution – Girder Elevation



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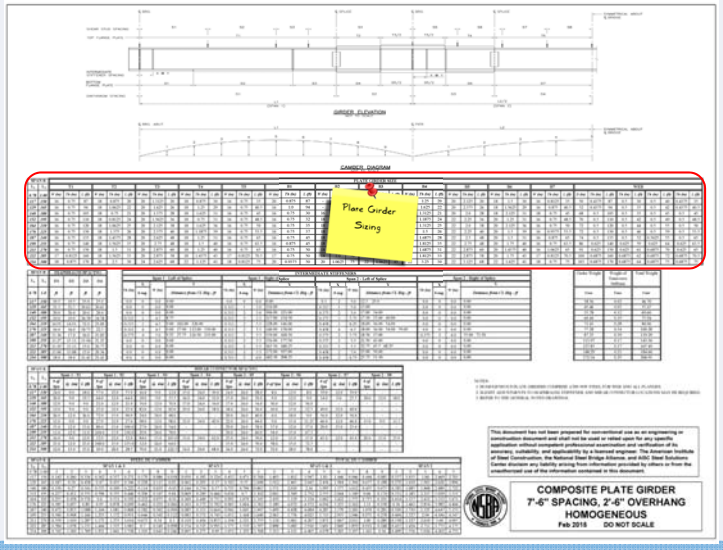
Conceptual Solution - Girder Sizing



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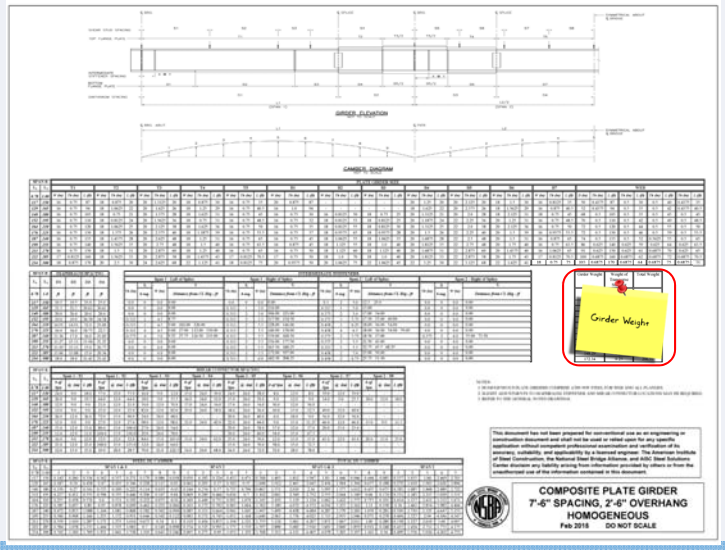
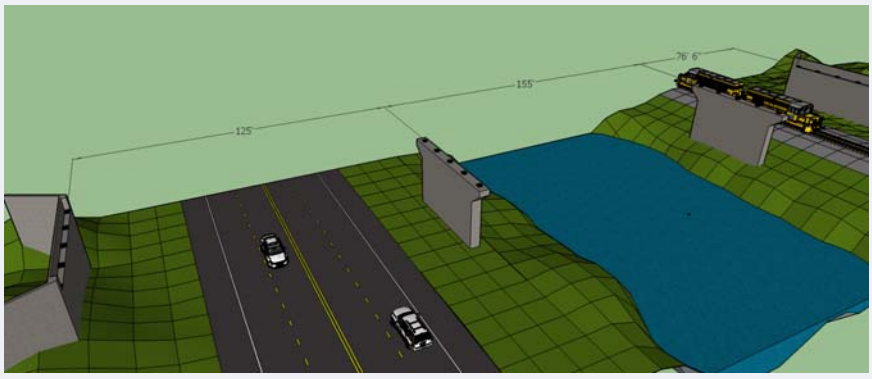
Conceptual Solution - Weight

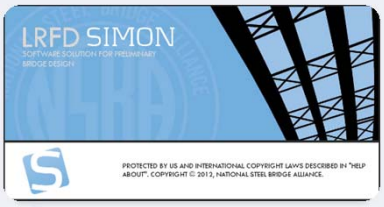


Substructure Layout

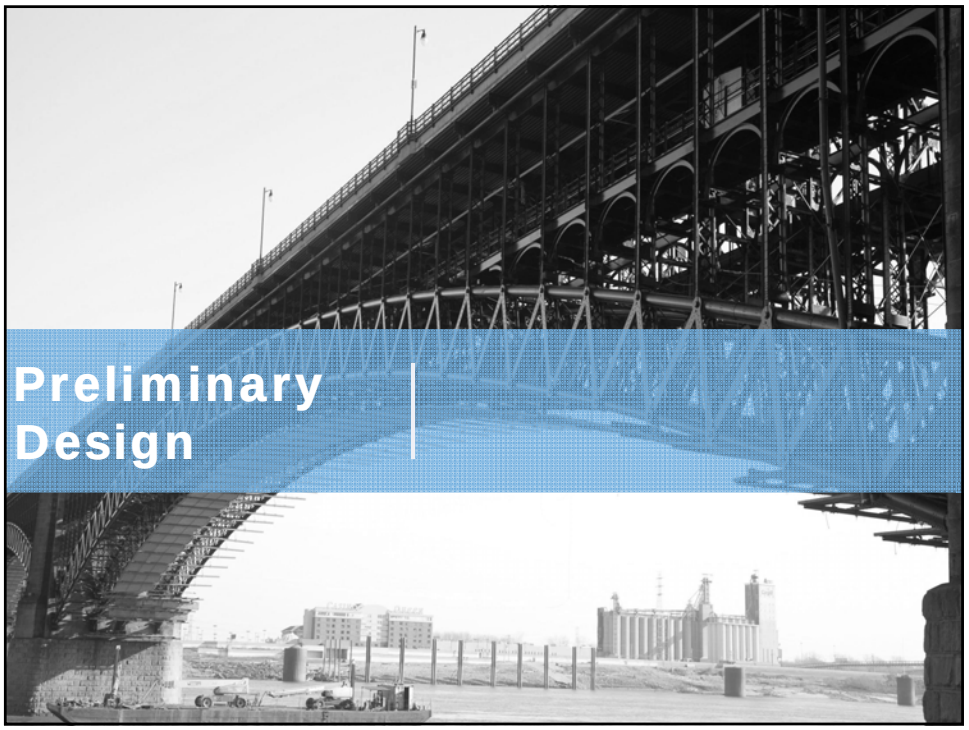


Conceptual Solutions

- Input files allow you to develop a solution that fits your project constraints.



www.steelbridges.org/SoftwareRegistration



Material Availability

- Ensure the output of plate sizes are readily available.
- Consult 2011 MSC Article – *Steel Plate Availability for Highway Bridges*

	Plate Width								
	72	78	84	90	96	102	108	114	120
⅛	972	972	972	972	972	972	972	972	750
⅙	972	972	972	972	972	972	972	972	750
⁹⁄₁₆	972	972	972	972	972	972	972	972	972
⅝	972	972	972	972	972	972	972	972	972
¾	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030
⅞	1,030	1,030	1,030	1,030	1,030	1,030	1,007	954	907
1	1,030	1,030	1,030	1,030	992	933	882	835	793
1¼	1,030	1,030	907	846	793	747	705	668	635
1⅜	1,030	1,030	756	705	661	622	588	557	529
1½	1,030	1,030	648	604	567	533	504	477	453
2	937	937	567	529	496	467	441	418	397
2¼	833	833	504	470	441	415	392	371	353
2⅜	749	749	453	423	397	373	353	334	317
2½	681	681	412	385	361	339	321	304	288
3	624	624	378	353	331	311	294	278	264

Table 4 Composite plate chart: Maximum length (in inches) for given plate thickness and width.

NSBA's Regional Resources
The National Steel Bridge Alliance's Regional Directors are the primary liaisons between NSBA and the bridge design and construction community. They assist fabricators, designers, and owners in making the best bridge design selections possible. In addition, NSBA regional directors provide steel superstructure technical assistance and technical reviews at various stages of drawing completion. To contact your NSBA regional director, please see the list to the right.

NSBA Managing Director
William F. McElwey, Cranston, R.I.
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Regional Director
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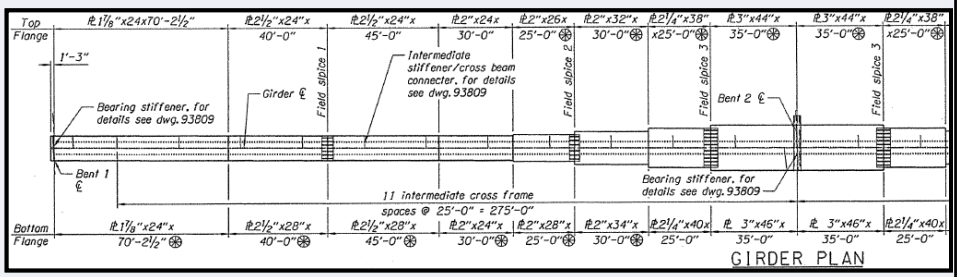
Regional Director
Jeff Carlson, P.E., Denver, Co.
carlson@steelbridges.org

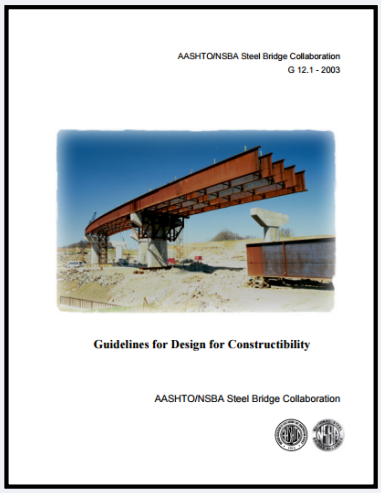
Plate Transitions

- Write down all plate sizes from analysis. If more than 5 plates sizes are listed, consider combining sizes.



Steel Bridge Resource

- AASHTO-NSBA Collaboration G12.1-2003
  - Section 1.5: Flange Sizing
    - Limit the number of plate sizes.
    - TexasDOT estimates an 800 to 1000 lbs plate savings to justify shop splice.



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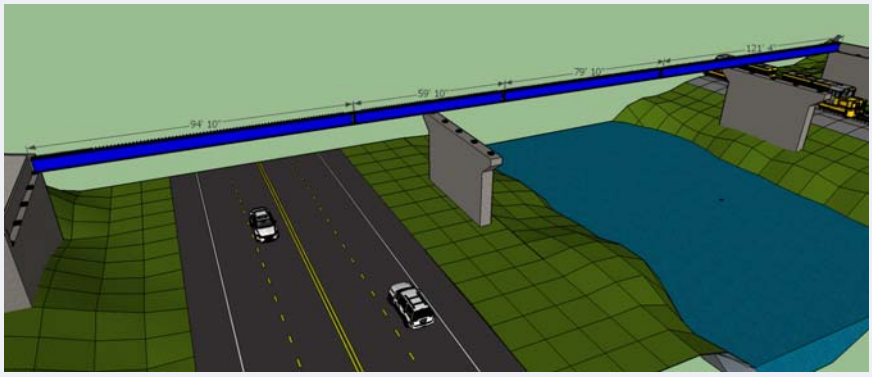
Field Sections

- Objective: Balance what can be fabricated practically with what can be shipped.



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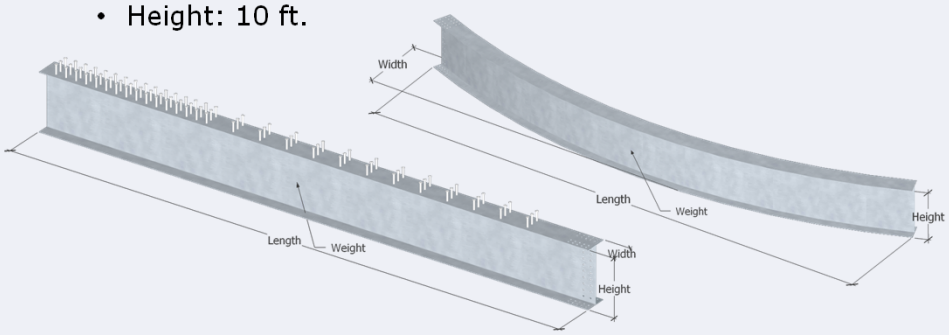
Steel Bridge Resource

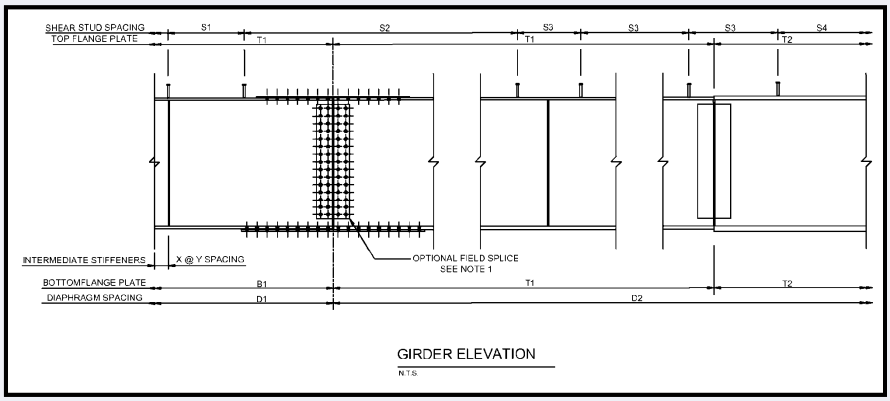
Field Section Bounding Box

- Length: 175 ft. Possible, 80 ft. Comfortable.
- Weight: 100 Tons Maximum, 40 Tons No Permit.
- Width: 16 ft. Maximum.
- Height: 10 ft.



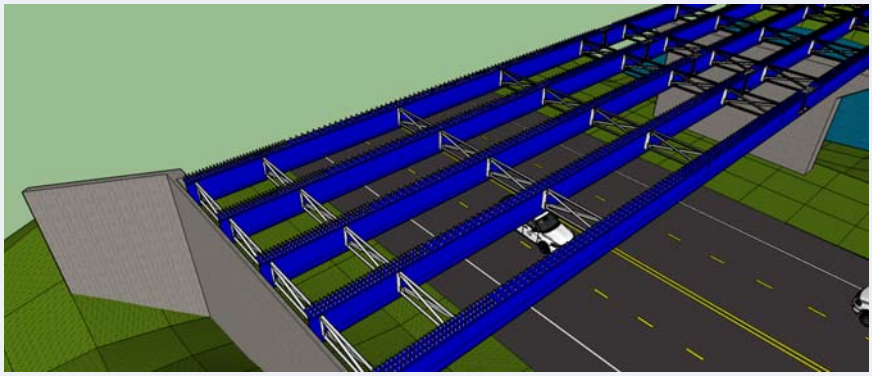
Field Splices

- Listing field splices as optional gives the fabricator the opportunity to ship larger field sections.



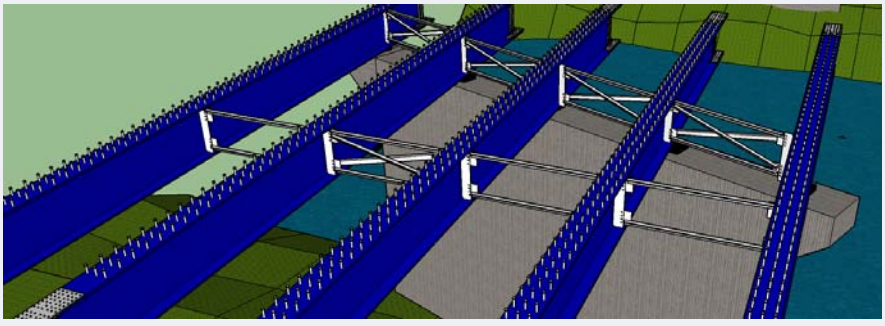
Crossframe Layout

- Continuous Bracing



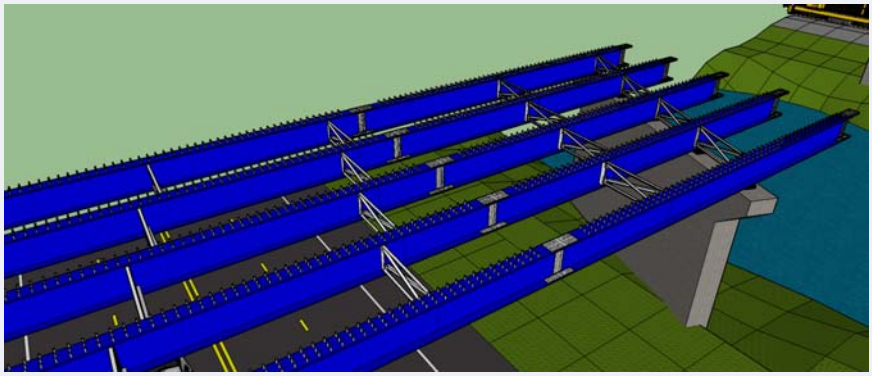
Crossframe Layout

- Lean on Bracing

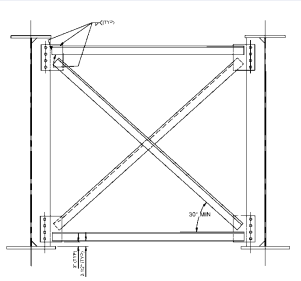


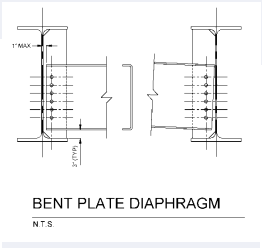
Crossframe Layout

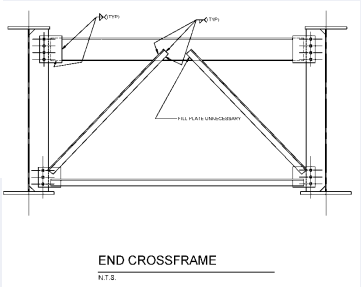
- Discontinuous Bracing



Crossframe Types

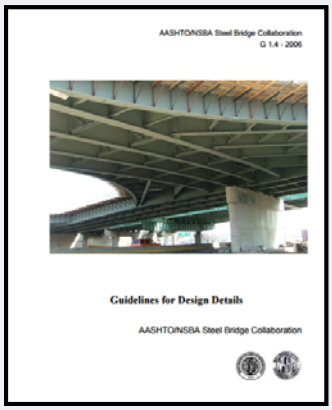




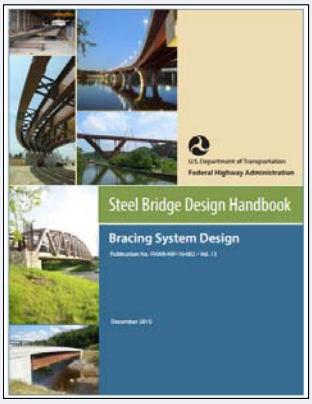


Steel Bridge Resource

AASHTO NSBA Collaboration G1.4-2006: *Guidelines for Design Details*



Steel Bridge Design Handbook: Bracing System Design



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