Steel Bridge Resources

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*
Substructure Layout

Substructure Layout
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Clearance Requirements

Substructure Layout
Selecting Bridge Type

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

Steel Bridge Design Handbook: Selecting the Right Bridge Type

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.

<table>
<thead>
<tr>
<th>Bridge Span Length (ft)</th>
<th>0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
<th>120</th>
<th>&gt;140</th>
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<tr>
<td>Solution Type</td>
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<tr>
<td>Rolled Beam</td>
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<td>Homogeneous Plate Girder</td>
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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 608.03.16.

(c) Do not reduce the strength classification of the material.

Substructure Layout
Girder Spacing

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

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- 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.

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  - 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

Bridge Weight (psf) x Bridge Area (sq-ft) x Historical Cost
Steel Bridge Design Resources

- Continuous Span Standards
  - Provides preliminary solutions.
Conceptual Solution – Girder Elevation

Conceptual Solution - Girder Sizing
Conceptual Solution - Weight

Substructure Layout
Conceptual Solutions

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

[Image: NSBA SPLICING SOFTWARE AND LRFD SIMON SOFTWARE]

www.steelbridges.org/SoftwareRegistration

Preliminary Design
Material Availability

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

Plate Transitions

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

Field Sections

- Objective: Balance what can be fabricated practically with what can be shipped.
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Field Section Bounding Box
- Weight: 100 Tons Maximum, 40 Tons No Permit.
- 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

- Intermediate Crossframe
- End Crossframe
- Bent Plate Diaphragm
Steel Bridge Resource

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

Steel Bridge Design Handbook: Bracing System Design

Steel Bridge Selection and Design Design - Part 1