Memorial Bridge Replacement

June 23rd, 2014       Columbus, OH
Design Build – Goals for Best Value

- Enhance Safety
- Enhance Service Life
- Reduce Cost and Schedule
  - Avoid In-Water Work
  - Fabrication
  - Erection
  - Float-In Construction
Concept Design – Visually Similar

- Tower Height / Truss Depth / Span Drive Machinery
Constant Depth Trusses with Identical Geometry
General Arrangement
Single Barge Float-Out / Float-In
On-Barge Truss Erection
Sheave Design Optimization – Design for Erection
Trunnion Sheave
Mechanical Systems - Counterweight Boxes
Mechanical Systems - Machinery Layout
Mechanical Systems - Machinery Layout
Machinery Layout – Use of Barge Overhang
Float in Construction – Lift Span
Gusset Plate Elimination

- Use of Rolled Sections for Diagonals / Lateral Bracing
Global Buckling Analyses
Why Focus on Gusset Plates?

- Bridge Safety & Redundancy
Why Focus on Gusset Plates?

- I-35 Collapse
Why Focus on Gusset Plates

NCHRP 12-84 - Full Scale Testing
Why Focus on Gusset Plates?
Gusset Plates – Achilles Heal to Existing Bridge
Truss Connection Inspectability
Intermediate Floorbeams & Vessel Impact
Deck and Floorbeam Arrangement

LIFT SPAN - PARTIAL DECK PLAN - 1

NOTES:
1. FOR DECK JOINT DETAILS SEE SHEET NO. 85-2.
Fabrication
Section Proportioning for Optimal Behavior
Cold Bending for Candy Canes

Stress vs. Strain diagram showing:
- Increase in yield stress due to strain aging
- Strain hardening
- Unload after cold bending
- Reload after 1 hour
- Increase in ultimate strength from strain aging

Cold bending changes steel material properties

Cold Bending
Design Development – Full 3D FEM

- Lift span
Gusset-less Truss Design

- Section Proportioning
  - Thick Webs
  - Asymmetry
  - Large Bend Radii
Gussetless Truss Design - Fatigue Behavior

Maximum 1.73112E3 at node 1553 of element 4654
Minimum -7.1503E3 at node 1094 of element 1089
Splice Type Connections

- Double Shear for all Main Member Connections
Counterweight Rope Connectivity

- Cable Anchorage
Counterweight Rope Connections
Lift Span Connection Points

- Cable Anchorage

Loadcase: 1:Counterweight
Results file: load_lineas_06.mys
Entity: Stress (bottom) - Thick Shell
Component: Sabs

-50.0
-44.7366
-39.4737
-34.2105
-28.9474
-23.6842
-18.4211
-13.1579
-7.89474
-2.63158
2.63158
7.89474
13.1579
18.4211
23.6842
28.9474
34.2105
39.4737
44.7366
50.0

Maximum 53.362 at node 7541
Minimum -53.0237 at node 5912
Speed of Truss Erection
Float-in Construction
Flanking Span Deck – Tower Truss Interface
Truss Design / Fabrication / Erection
Span Lifted and Out of Harms Way
Construction – AWC, Structural, Genesis, Local Trades
Portsmouth Memorial Bridge