Laboratory and Field Evaluation of the 24th Street Bridge

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24th Street Bridge Background

- Council Bluffs, Iowa
- Over Interstate 80/29
- Constructed in two phases
- Opened in Spring of 2009
Objectives

- Document the effectiveness of innovative construction techniques
  - Laboratory component
    » Answer design and construction questions
  - Field component
    » Evaluation during and after construction
Bridge Description

- Two spans
- 353.5 ft long
- 6 lanes plus sidewalks (99 ft wide)
- Precast deck panels (post tensioned)
- Composite steel girders
Bridge Plan/ Girder Layout

Cross Frame Spacing

11 Spans @ 9'-0" = 99'-0"
3'-6"
5'-6"

Bridges Girders (Typ.)

Cross Frame (Typ.)

Driving Direction

South Abutment

N

Pier

North Abutment

24th Street
Precast Panel
Bridge Plan/ Panel Layout

South Abutment

North Abutment

2'-9" 3'-3"

Phase I Construction

Phase II Construction

Closure Pour

Deck Panel (Typ.)

Shear Stud Pocket (Typ.)

24th Street

1'-0" Closure Pour

1'-6"

Closure Pour

10'-0" (Typ.)
Bridge / Panel Layout
Laboratory Testing

- Stud pocket bend test
  - Confined space in pocket
  - Able to conduct bend test on all studs
Laboratory Testing

- Grout flowability
  - Sufficient grout flow from stud pockets to haunch
Laboratory Testing

- Duct splicing performance
  - 1 in. x 3 in. duct splice checked for grout tightness
  - Waterproof duct tape
    » Simple
    » Works
Laboratory Testing

- Panel transverse joint shear
- Surface treatments
  - Control (no roughing)
  - Diamond plate forms
  - Chemical etching
  - Sandblasting (best performance: 578 psi)
Field Testing

- Corrosion Monitoring
  - 6 pre-stress strands
  - 6 sacrificial post-tensioning strands

- No corrosion taking place as of June
Field Testing

- Handling Performance
Field Testing

- Panel Joint Pressure
  - Monitored during post-tension
Field Testing

- Live load testing
  - Gauges located on north span
    » Deflection, Strain, & Acceleration
Field Testing

- Live load testing
  - 6 transverse load positions
  - Tandem axle dump truck
Field Testing

- Live load testing
  - Deflection @ midspan of north span
    - Truck on south span: max 0.15 in.
    - Truck on north span: min -0.31 in.
Field Testing

- Live load testing
  - Strain
Field Testing

- Live load testing
  - Strain

<table>
<thead>
<tr>
<th>Gauge Location</th>
<th>Bottom Flange</th>
<th>Top Flange</th>
<th>Bottom of Slab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abutment</td>
<td>-4 to +14</td>
<td>-5 to +6</td>
<td>NS</td>
</tr>
<tr>
<td>Pier</td>
<td>-16 to +3</td>
<td>-1 to +5</td>
<td>NS</td>
</tr>
<tr>
<td>Mid-span</td>
<td>-22 to +66</td>
<td>-5 to +5</td>
<td>-2 to +6</td>
</tr>
</tbody>
</table>
Conclusion & Recommendations

- Laboratory Testing
  - Stud pockets
    » Installation
    » Bend test
  - Grout can sufficiently flow from stud pocket into haunch
  - Waterproof duct tape is sufficient for sealing duct splices
  - Sandblasting surface of joint provide highest shear resistance
Conclusion & Recommendations

- Field Testing
  - No corrosion indicated
  - Minimal pressure at mid-span joint during post-tensioning
  - Deflections were less than L/6770
  - Max and minimum strain occurred at bottom flange mid-span
    » Max tension 66με
    » Max compression 22με
24th Street Bridge

• Questions??