UTILIZING “BRIDGE DESIGN” FOR SHORED CONSTRUCTION AND ACCELERATED BRIDGE CONSTRUCTION IN NEW YORK STATE

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NEW YORK STATE DEPARTMENT OF TRANSPORTATION
Main Office Structures
Agenda

- What is Shored Construction?
- Designing with BrD for Shored Construction
- Case Studies
  - I81 over Preble Road
  - I190 over Buffalo Avenue
What is Shored Construction?

Non-Composite Section

Composite Section
Areas of Concern with Shored Construction

- Ability to Replace the Deck in the Future
- Required Camber for Shored Construction (Cast the barrier as shored or unshored?)
- “Previous” Lack of Software for Shored Construction
Utilizing BrD for Shored Construction

BrD Version 6.5 and Previous Versions

• The Girder and Deck loads are hard coded into the program as a DC1/Non-Composite Loads

• To “fake” the program into having the girder as a DC2 load, you need to unload the girder weight as a DC1/Non-composite and then reload it as a DC2/Composite load

• Sounds simple enough, but becomes a bookkeeping problem.
For un-shored construction design, the load cases are as follows:

<table>
<thead>
<tr>
<th>Load Case Name</th>
<th>Description</th>
<th>Stage</th>
<th>Type</th>
<th>Time* (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC1</td>
<td>DC acting on non-composite section</td>
<td>Non-composite (Stage 1)</td>
<td>D,DC</td>
<td></td>
</tr>
<tr>
<td>DC2</td>
<td>DC acting on long-term composite section</td>
<td>Composite (long term) (Stage 2)</td>
<td>D,DC</td>
<td></td>
</tr>
<tr>
<td>DW</td>
<td>DW acting on long-term composite section</td>
<td>Composite (long term) (Stage 2)</td>
<td>D,DW</td>
<td></td>
</tr>
<tr>
<td>SIP Forms</td>
<td>Weight due to stay-in-place forms</td>
<td>Non-composite (Stage 1)</td>
<td>D,DC</td>
<td></td>
</tr>
<tr>
<td>DIAPH</td>
<td>DC acting on noncomposite</td>
<td>Non-composite (Stage 1)</td>
<td>D,DC</td>
<td></td>
</tr>
</tbody>
</table>
For shored construction design, the load cases are as follows:

<table>
<thead>
<tr>
<th>Load Case Name</th>
<th>Description</th>
<th>Stage</th>
<th>Type(s)</th>
<th>Time* (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Slope Barrier</td>
<td>Fascia Barrier, Single Slope</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>Barrier load on fascia units</td>
<td>Barrier load differential on fascia unit girders</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>non-comp girder load</td>
<td>non-comp girder load</td>
<td>Non-composite (Stage 1)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>non-comp slab load</td>
<td>non-comp slab load</td>
<td>Non-composite (Stage 1)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>non-comp diaphragm loads</td>
<td>non-comp diaphragm loads</td>
<td>Non-composite (Stage 1)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>non-comp haunch load</td>
<td>non-comp haunch load</td>
<td>Non-composite (Stage 1)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>comp diaphragm loads</td>
<td>comp diaphragm loads</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>DC1</td>
<td>DC acting on non-composite section</td>
<td>Non-composite (Stage 1)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>DC2</td>
<td>DC acting on long-term composite section</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>Int barrier load differentials</td>
<td>Barrier load differentials, interior unit girders</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>Comp deck slab loads</td>
<td>Comp deck slab loads</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>comp haunch loads</td>
<td>comp haunch loads</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>comp girder load</td>
<td>girder self weight comp</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DC</td>
<td></td>
</tr>
<tr>
<td>fws</td>
<td>future wearing surface</td>
<td>Composite (long term) (Stage 2)</td>
<td>D, DW</td>
<td></td>
</tr>
</tbody>
</table>
Girder and Deck loads need to be

Unloaded as non-composite

Reloaded as composite
BrD Version 6.6

- The Girder and Deck loads can be defined as either Composite or Non-Composite Loads

- "Faking" the program is no longer necessary

- Bookkeeping returns to normal
For un-shored construction design, the default is “Engine Assigned”

For shored construction design, The user can set the self load to DC2
Utilizing BrD for Shored Construction

BrD Version 6.6 – Under Typical Section

For un-shored construction design, the default is “Engine Assigned”

For shored construction design, the user can set the deck load to DC2
Case Study: I81 over Preble Road

Bridge Location - South of Syracuse on Interstate 81
Existing Bridge Information

- Two Bridges – I81 NB and I81 SB
- Built in 1966 (46 year old in 2012)
- Three Simple Spans: 39’ – 46’ – 39’
- Bridge Width – 35’-4”
Project Overview

April 27th, 2012 - NB Bridge was hit by Tractor Trailer with Over Height Backhoe
April 28th, 2012 – Support Columns Installed

Repair is deemed temporary – Bridge needs to be replaced.
New Bridge Information

- NB Bridge utilized a crossover for MPT – 10 day closure
- SB Bridge utilized staged construction – 14 day closure
- Span Length – 75’
- Bridge Width – 43’

Designer: NYSDOT - Office of Structures
Contractor: Slate Hill Constructors, Warners, NY
Fabricator: Fort Miller of Schuylerville, NY
Project Cost $7.775 M (Two Bridges)
Vertical Staging

• Construct Abutments Underneath Existing Bridge (Bridge is still open to traffic.)

• Soil Nail Wall is Utilized for Excavation Support

• Allows for a Short Closure Window on the Interstate
Soil Nail Wall
Footing Pour
Vertical Stage Complete
Modular Deck Beams

PROPOSED BRIDGE SECTION
Precast Semi-Integral Abutments

• Eliminates Joints at Abutments
• Reduces Construction Time with Precast Backwall
• Easier Shipping and Handling with use of Horizontal UHPC Joints in the Precast Backwall
Semi-Integral Abutment – As Fabricated
Semi-Integral Abutment – As Fabricated

~21 ft

7 in
Fabrication
Superstructure Construction
Construction
Construction
Construction
Construction
Construction
Construction
Construction
Construction
Construction
Construction
Finished Bridge
Case Study: I-190 over Buffalo Ave. (Niagara Falls, NY on Interstate 190)
I-190 over Buffalo Ave – Niagara Falls, NY

• Vertical Staging Utilized

• Semi-Integral Abutment Utilized to Accelerate Construction Schedule

• **3 Day Closure (midnight Thursday to midnight on Sunday)**

• Accelerated Concrete used for Closure Pours instead of UHPC

• Modular Deck Beam Constructed in a Yard one mile from Bridge Location Instead of Fabrication Plant.
I-190 over Buffalo Ave

Vertical Staging
I 190 over Buffalo Ave
Fabrication at Yard 1 Mile from Bridge
Video
THANK YOU QUESTIONS?

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