Efficient Integration of Accelerated Bridge Construction

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Presenters

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Presentation Outline

- Hartford Bridge Replacement Project Planning
- Pre-Construction Planning: Construction Manager/General Contractor (CM/GC) + Accelerated Bridge Construction (ABC)
- Project Plans & Special Provisions
- Project Outreach
- ABC
  - Pre-Closure
  - Closure
- Keys to Success
- Questions
Hartford Project Planning
Project Background

- Hartford project programmed in 2012
- Both structures on I-91 had suspended span steel connections and were fracture critical
Project Scope

- Project scope called for complete bridge replacement
  - Wider bridges for maintenance
  - Future project on Route 5 to add a sidewalk and bike lanes
- Site constraints were steering us toward ABC
- Slide-in bridge construction (SIBC) seemed feasible for this location
- Sought input from FHWA and lead adopter states
FHWA had just published the Slide-In Bridge Construction Implementation Guide – Planning and Executing Projects with the Lateral Slide Method

- Table 1.1 Common Applications of SIBC
### Common Applications of SIBC

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
<th>Reason</th>
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<tr>
<td>More traffic over the bridge</td>
<td>SIBC typically has greater benefits for bridges where the roadway over the bridge has a lower annual average daily traffic (AADT) than the roadway under the bridge.</td>
<td>If traffic volume on the bridge is a significant issue, SIBC reduces the mobility impacts and user costs. However, for traffic under the bridge, SIBC still requires closures for beam and deck placement on the new bridge, and closure during the existing bridge demolition, new bridge slide, and for post-slide demolition removal and cleanup.</td>
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<td>High user cost location</td>
<td>SIBC is generally applicable when user costs are a major consideration.</td>
<td>With fewer detours and work-zone traffic delays, SIBC results in lower user costs than traditional construction.</td>
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<td>Elevated safety concerns</td>
<td>SIBC is generally applicable for bridges with extended duration impacts, complex traffic shifts, or other safety concerns.</td>
<td>SIBC increases safety by constructing the superstructure away from traffic, not reducing lane widths, and avoiding merges and potentially confusing lane configurations.</td>
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<td>Long detour or no available detour</td>
<td>SIBC is generally applicable for bridge replacements that require a long detour or where no detour route is available due to geography or construction on adjacent routes.</td>
<td>SIBC significantly reduces the duration that a detour is required for the traveling public. If a short-term bridge closure can be sustained without the need for a detour, then SIBC provides a viable solution when no detour is available.</td>
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<td>Temporary bridge avoidance</td>
<td>SIBC is generally applicable when a temporary bridge is either unfeasible or cost-prohibitive.</td>
<td>SIBC allows for a short closure period and avoids the need for a temporary bridge to maintain traffic during construction.</td>
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<td>No phased construction</td>
<td>SIBC is generally applicable for bridge replacements where phased construction is not permitted or not desired.</td>
<td>If phased construction is not an option due to structure type, constructability issues, or schedule, SIBC provides a viable solution.</td>
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<td>Limited on-site construction time</td>
<td>SIBC is generally applicable when the on-site time during construction is limited.</td>
<td>SIBC generally reduces the construction duration when compared to phased construction. This streamlined construction timeframe provides an effective solution to sensitive environments, work required in railroad ROWs, and highly populated commerce, residential, or recreation areas.</td>
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- High traffic on bridge
- High user costs (Rte. 5 and I-91)
- Replacement bridge shorter than existing if complete reconstruction
- Geometric constraints/safety
  - No room for crossovers or temporary bridge
Project Constraints

I-89/I-91 INTERCHANGE

PROJECT LOCATION

DIFFERENT ELEVATION AND LIMITED SPACE

BRIDGE

STEEP GRADES
SHARP CURVES
LEDGE
OUTCROPS
Traffic Volumes

- High traffic volumes over and under the bridge
Concerns with SIBC

- Lack of design experience with SIBC
- Lack of local contractor experience with SIBC
- Opted to pursue innovative alternative project delivery method - CM/GC
ABC Planning with CM/GC
Implementing ABC via CM/GC

- Innovative contracting method supported by FHWA

- VTrans selected PCL Civil Constructors, Inc.
  - Experienced CM/GC firm
  - Experienced with bridge slides (SIBC)

- CM/GC process involves an Independent Cost Estimator (ICE)
Project Goals

- No full closure of US-5
- Only two weekend closures of I-91
- Maintain pedestrian traffic
- One construction season
- High public satisfaction
Construct new substructure under existing
3-D Modeling from PCL

Construct new superstructure adjacent
3-D Modeling from PCL

Slide over and through new
Closure planning

3-D Modeling from PCL
3-D Modeling from PCL

Lateral slide during closure
Benefits of Pairing CM/GC & ABC

- SIBC experience
- Partnering design and constructability
- Mitigate risk
- Accelerated project schedule
- Accelerated closure schedule
- Owner/Contractor invested in each other’s success
Project Plans & Specifications
Project Plans

Foundation

- Conceptual foundation plan - MSE walls with a shallow foundation
- Contractor recommended micropiles due to space constraints for wall reinforcing strips
- VTrans and PCL worked together to design and detail appropriate size based on machinery necessary to install under existing bridges
Project Plans

Bridge Deck

- Contractor requested SIP precast deck forming panels
- VTrans incorporated them into the plans and worked out details with PCL
Project Special Provisions

- Temporary support and horizontal slide
  - Developed as performance specification
  - Placed all responsibility on contractor
  - Nothing specifically shown in plans
  - Sought input from states with SIBC experience to develop specification

- High early strength concrete
  - Original plan was to slide approach slabs
  - Contractor requested placing approach slabs after the slide but within the closure period
  - Performance based specification requiring 4000 psi before loading
Project Outreach
Public Outreach

- Hired public outreach coordinator
  - Early collaboration with stakeholders and public officials
  - Developed a project website with project fact sheets
  - Developed a list of interested parties
  - Coordinated with local newspaper at the onset of the project
Project Fact Sheet

Step 1: Construct superstructure next to existing bridges
Step 2: Detour traffic and demolish the existing bridge
Step 3: Slide the new superstructure into place and reopen the bridge

BETTER ROUTE FOR BIKES & PEDESTRIANS

Besides building new highway bridges, VTrans is working with the Town of Hartford to improve the roadway environment for bicyclists and pedestrians along US Route 5. The span of the interstate bridges will be designed to accommodate a future 5’ sidewalk and 5’ grass buffer along US Route 5.

During construction there will be some changes to the I-91 southbound onramp that may become a permanent fixture. Potential bicycle and pedestrian improvements are still being reviewed.

DETOUR ROUTE

Road closures and detours for this project will be limited to two weekends. The detour routes are still under investigation and not yet finalized.
Construction Outreach

IT’S MOVING DAY!

The weekend of Aug 28-31, the Vermont Agency of Transportation (VTrans) will install a new I-91 Northbound replacement bridge at Exit 11, over US Route 5 in White River Junction.

Can the public watch the bridge slide?

Yes on Saturday, August 29, but...that weekend traffic on Route 5 will be very heavy because the northbound I-91 will experience a closure from 6 p.m. Friday, August 28 – 6 a.m. Monday, August 31. Traffic will be re-routed at Exit 11 from the Northbound Off Ramp, across Route 5 back onto the Northbound On Ramp. For safety reasons it will be important to limit pedestrians in construction area so VTrans requests people to meet at its DISTRICT OFFICE located near the construction site, 221 Beswick Drive, White River Junction. From there the public will be shuttled by van to a viewing area just north of the bridge between 12 noon and 6 p.m.

How will the slide happen? Hydraulic jacks will move the bridge 18 inches at a time, with 10-15 minute intervals between each slide. The total distance the bridge will move will be about 50 feet.
Public Outreach

Public outreach with the Contractor

• Contractor attended the first public meeting and presented the project with VTrans
• Contractor added credibility to construction approach and maintenance of traffic
• Continued public outreach into construction
• Concluded with a public satisfaction survey
How satisfied were you with how the project was delivered?
ABC methods required closing each direction of I-91 at exit 11 for one weekend but shortened the length of the project (one year rather than two years). What do you think about the method VTrans used to construct this project?

Survey Results
Survey Results

How satisfied were you with the timing of the two weekend bridge closures (Aug. 28-31 and Sept. 18-21)?

- Very satisfied
- Somewhat satisfied
- No opinion
- Somewhat dissatisfied
- Very dissatisfied
Accelerated Bridge Construction (ABC)
Footing on Bedrock
Abutment Construction
Abutment Construction
Abutment Construction
Temporary Supports

- Shoring Towers
- New Superstructure
- Pour Beam
- Slide Support Beam
- Slide Support Beam
Structural Steel
Pre-stressed Concrete Deck Panels
Deck Pours
Approach Slabs
Bridge Closures
August 28-31 (NB)
September 19-22 (SB)
Demolition
Demolition
Demolition
Horizontal Slide

Northbound Slide System (Bridge Pushed)
Horizontal Slide

Southbound Slide System (Bridge pulled)
Approach Slabs
Keys to Success

- CM/GC is a great tool for trying new innovations, such as SIBC
- Deliberate selection of project personnel
- Procure the ICE early
- Communicate expectations internally (Contractor & State)
- Communicate what to expect externally (Public)
- Assemble strong team of subs
More Keys to Success

- Continuity of Owner & Contractor PMs
- Project Team committed to aggressive schedules
- Accelerated Bridge Construction (ABC) Professional Engineer responsible for demolition sequencing and stability onsite during demolition
- Accelerated Bridge Construction (ABC) Professional Engineer responsible for bridge slide design and performance onsite for inspections, trial slide, and closure slides
Time Lapse Video
Questions?

TOGETHER WE BUILD SUCCESS.