



Efficient Integration of Accelerated Bridge Construction

January 26, 2016



**Accelerated
Bridge
Program**
VTRANS

Presenters



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Transportation

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

An aerial photograph of a highway interchange in Hartford, showing a multi-level interchange under construction. The main highway runs diagonally from the top left to the bottom right. A bridge structure is being built over a road that crosses the highway. There are construction materials, cranes, and workers visible on the bridge. The surrounding area includes green spaces, trees, and some buildings. The text "Hartford Project Planning" is overlaid in large white font in the center of the image.

Hartford Project Planning

Project Background

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

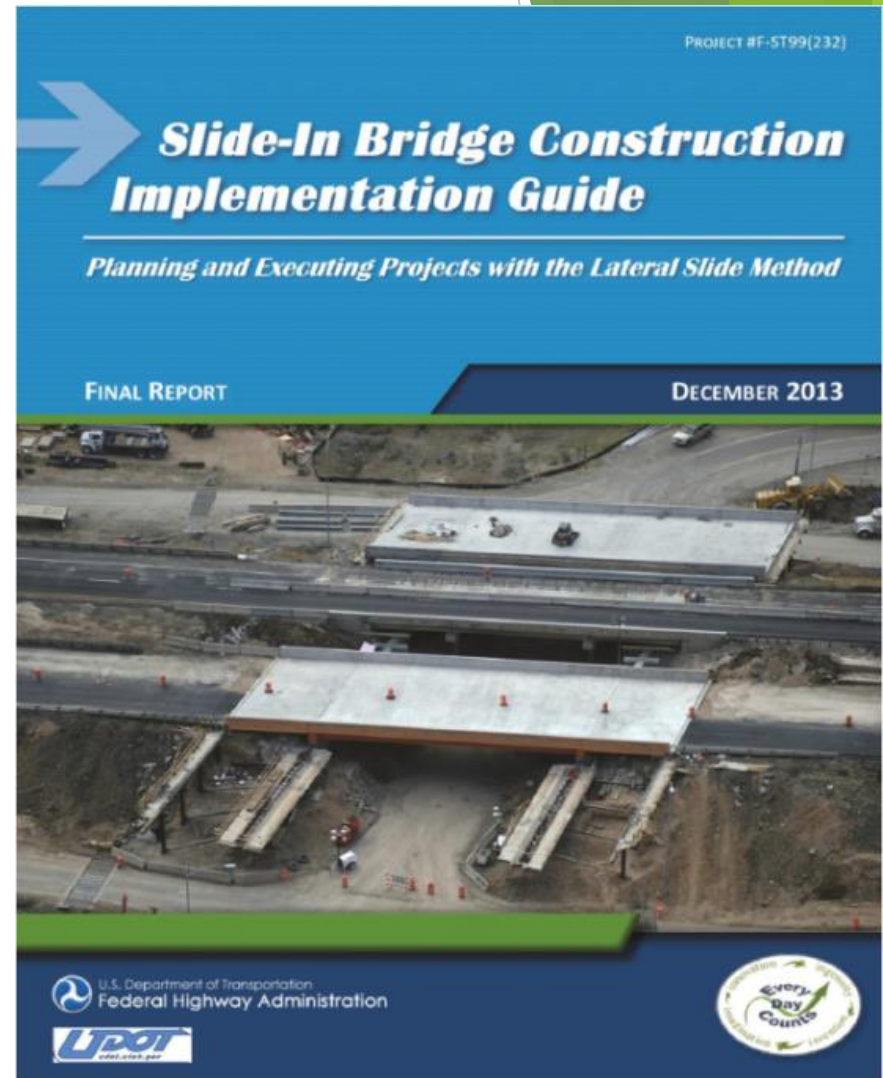


Project Scope

- ▶ 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

Resources and Guidance

- ▶ 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



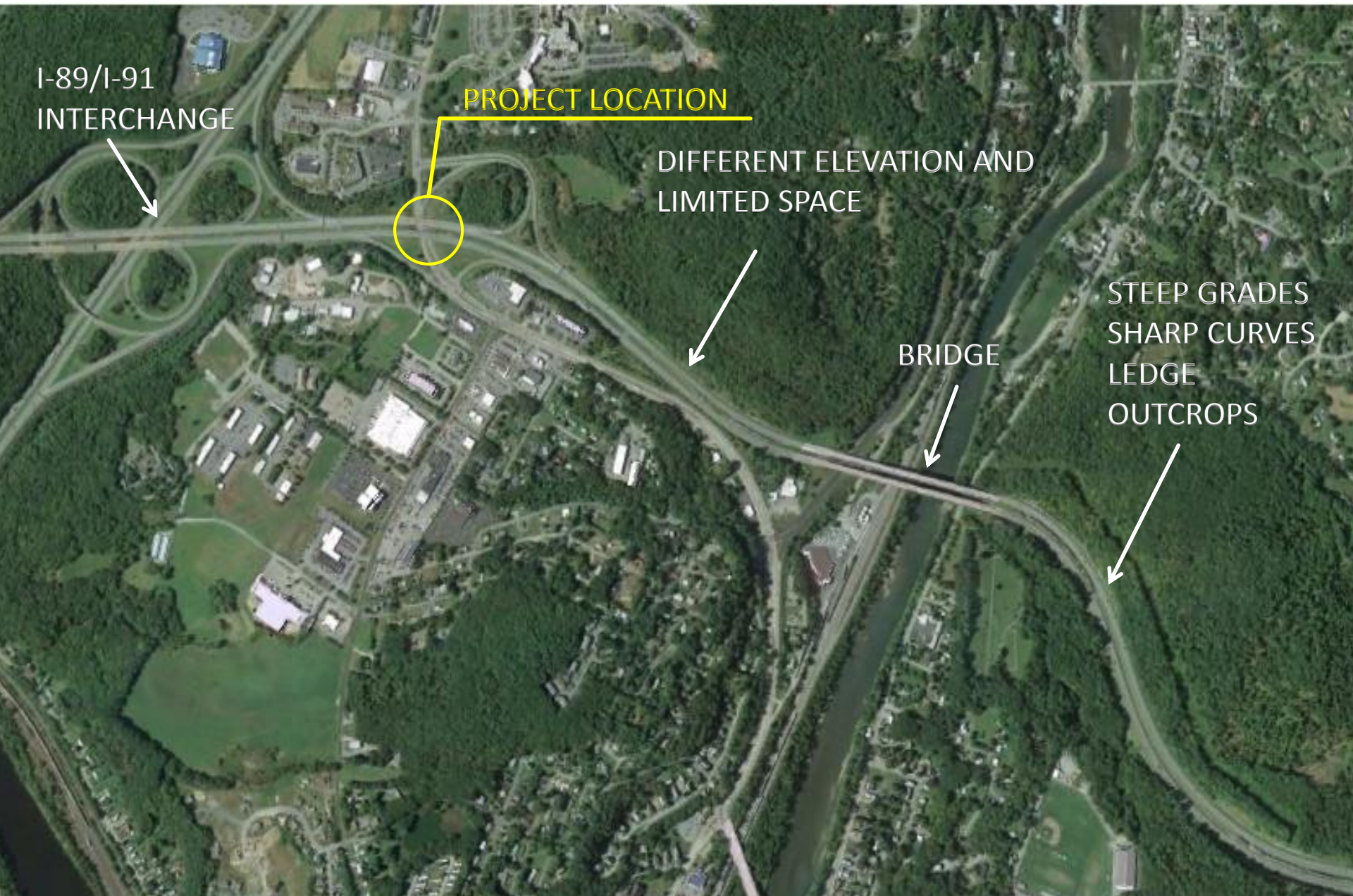
Common Applications of SIBC

| Application | Description | Reason |
|--|--|--|
| More traffic over the bridge than under the bridge | 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. | 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. |
| High user cost location | SIBC is generally applicable when user costs are a major consideration. | With fewer detours and work-zone traffic delays, SIBC results in lower user costs than traditional construction. |
| Elevated safety concerns | SIBC is generally applicable for bridges with extended duration impacts, complex traffic shifts, or other safety concerns. | SIBC increases safety by constructing the superstructure away from traffic, not reducing lane widths, and avoiding merges and potentially confusing lane configurations. |
| Long detour or no available detour | 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. | 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. |
| Temporary bridge avoidance | SIBC is generally applicable when a temporary bridge is either unfeasible or cost-prohibitive. | SIBC allows for a short closure period and avoids the need for a temporary bridge to maintain traffic during construction. |
| No phased construction | SIBC is generally applicable for bridge replacements where phased construction is not permitted or not desired. | If phased construction is not an option due to structure type, constructability issues, or schedule, SIBC provides a viable solution. |
| Limited on-site construction time | SIBC is generally applicable when the on-site time during construction is limited. | 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. |

| Application | Description | Reason |
|---|--|---|
| Narrow bridge | SIBC is generally applicable for bridges with a limited width. | A narrow bridge may make traffic control during phased construction unfeasible or unsafe. SIBC precludes the need for extended periods of traffic control on the bridge. |
| Railroad bridge | SIBC is generally applicable for bridges that carry railroad traffic. | Closure of a railroad bridge stops all related train traffic until the bridge is reopened, which greatly affects the transport of both people and products. SIBC reduces the duration of the bridge closure for railroad bridges. |
| Replacement bridge shorter than existing | SIBC is generally applicable for replacement bridges that are shorter than the existing. | SIBC facilitates the construction of new substructures under the existing bridge while it remains in service to minimize closure time. |
| Site conditions and geometric constraints | SIBC is generally applicable for bridges with site conditions or geometric constraints that preclude traffic shifts. | SIBC does not require traffic shifts. Therefore, it is a favorable alternative for bridges with site constraints that preclude traffic shifts. |

- ▶ 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

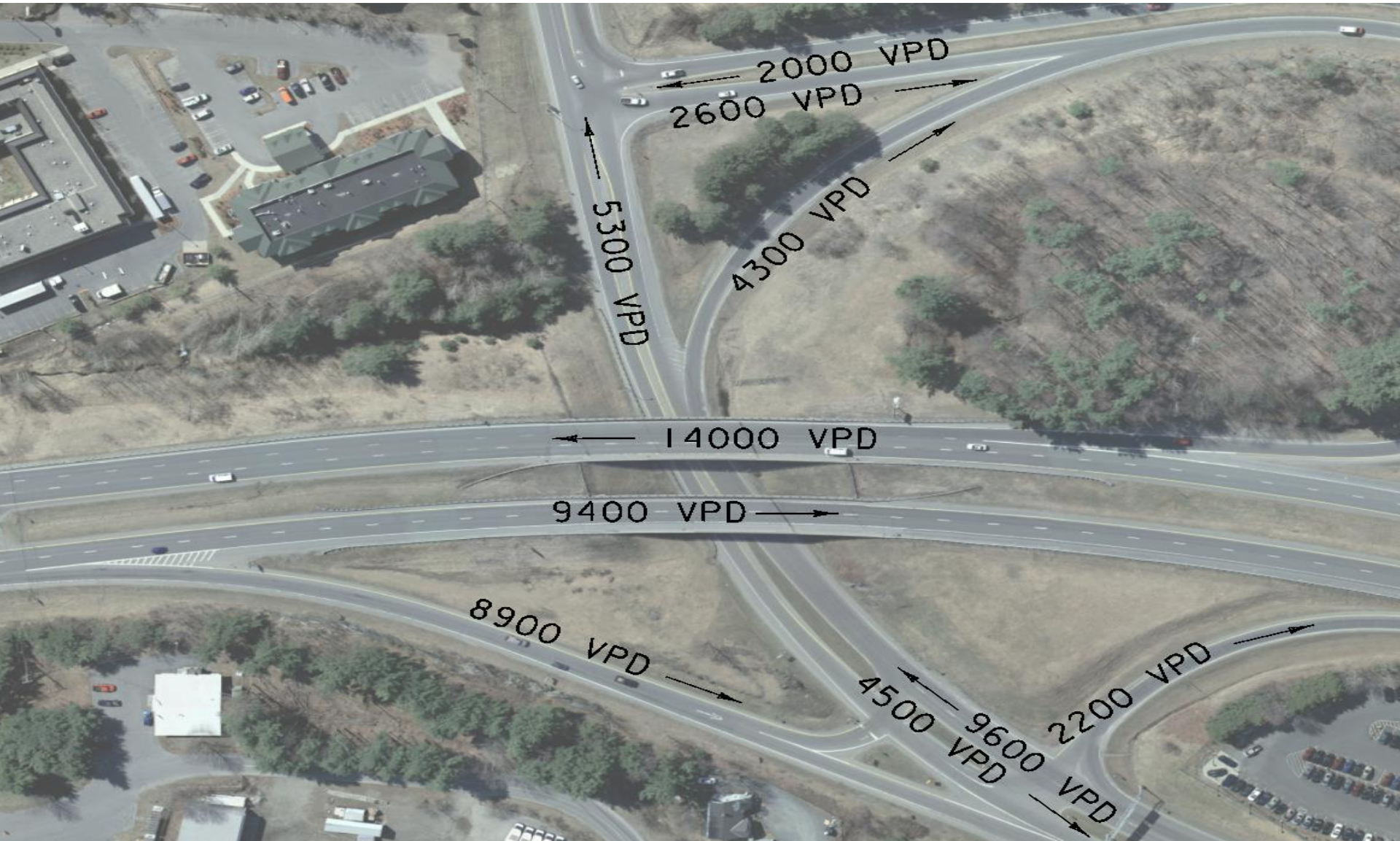
DIFFERENT ELEVATION AND
LIMITED SPACE

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

A group of professionals are gathered around a conference table in a meeting room, focused on reviewing documents and laptops. The room features a whiteboard with a map of Vermont, several laptops, and various papers and markers on the table. The scene is overlaid with a semi-transparent grey box containing the text '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

3-D Modeling from PCL



Construct new substructure under existing

3-D Modeling from PCL



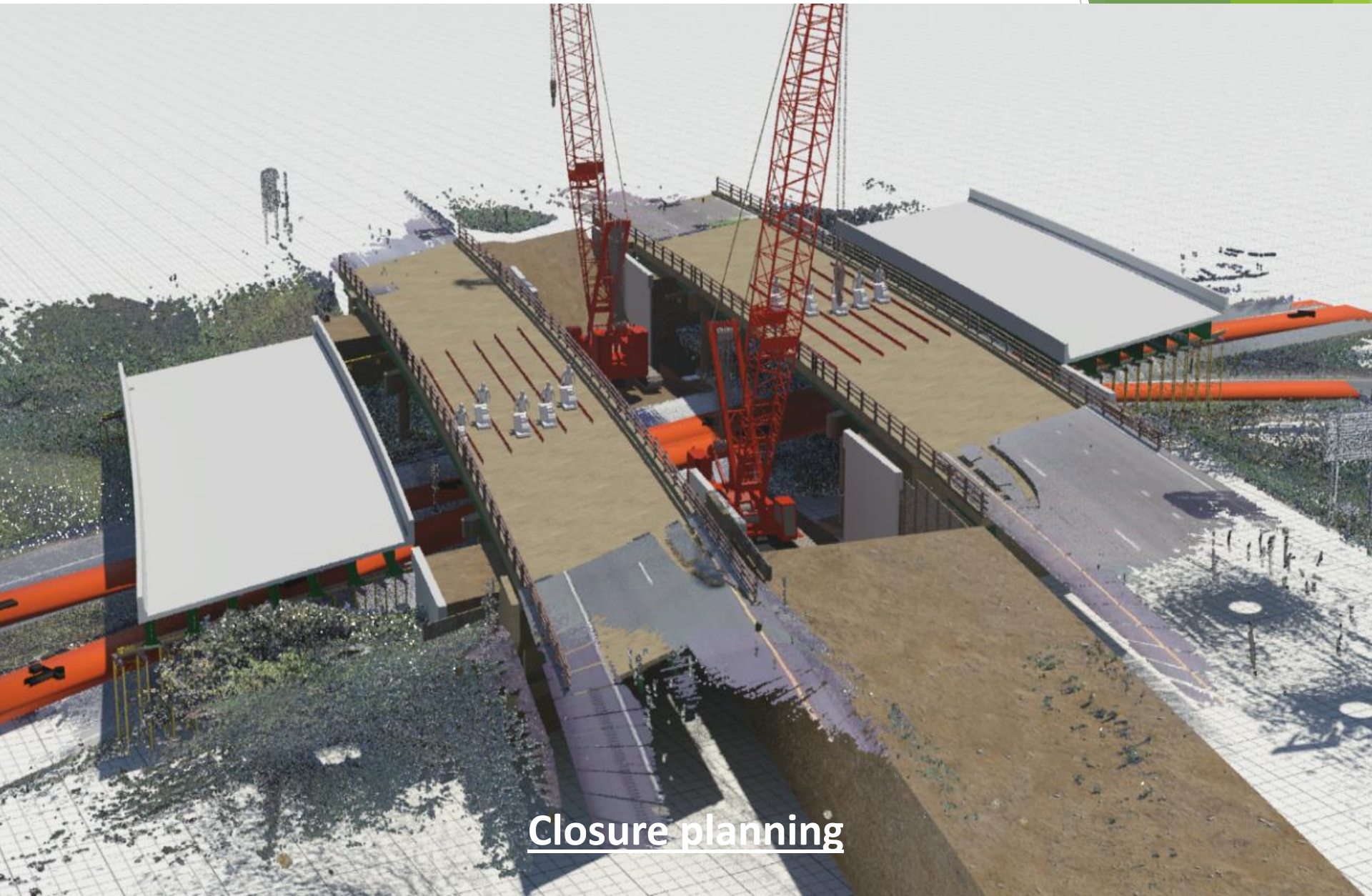
Construct new superstructure adjacent

3-D Modeling from PCL



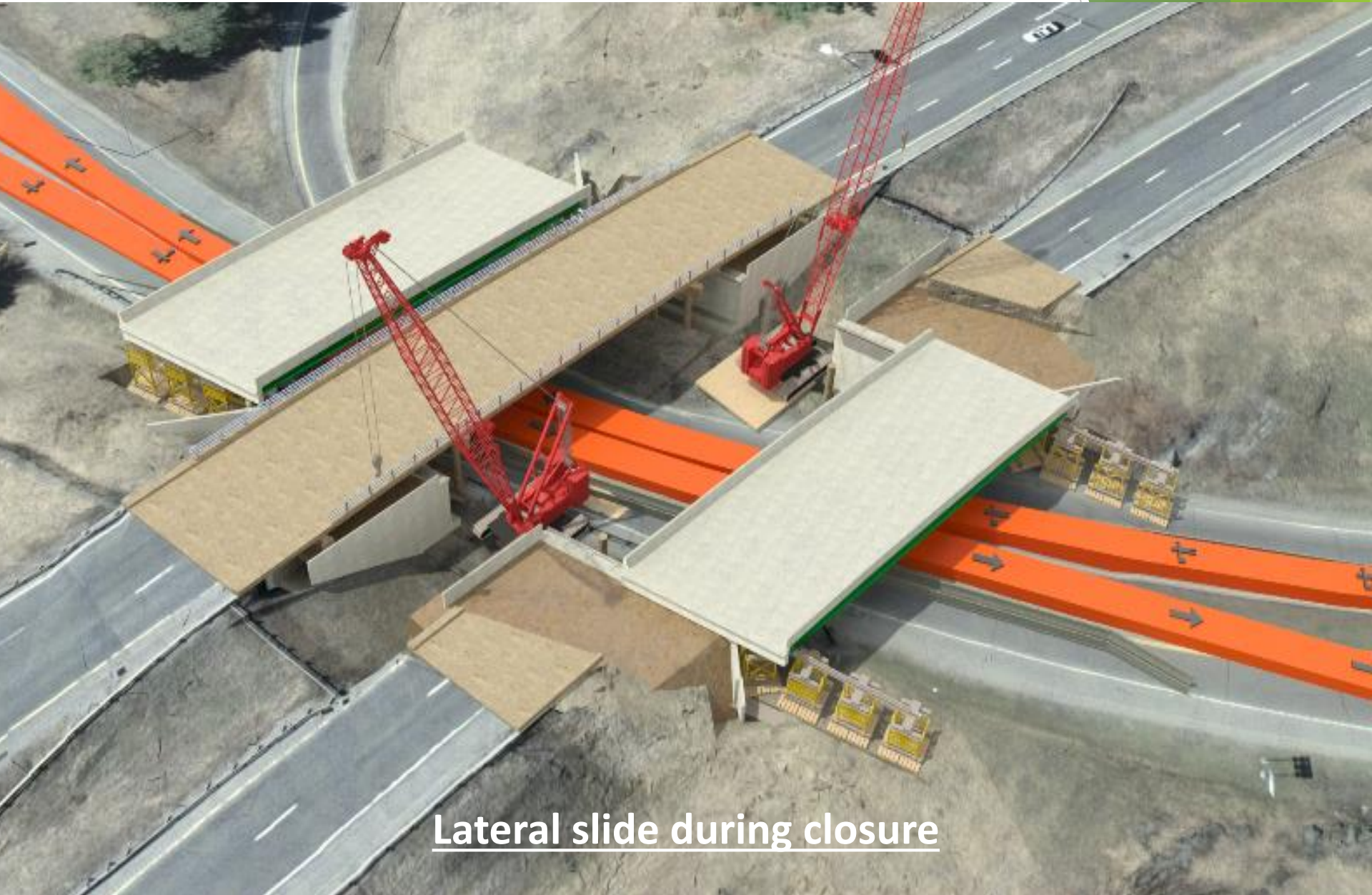
Slide over and through new

3-D Modeling from PCL



Closure planning

3-D Modeling from PCL



Lateral slide during closure

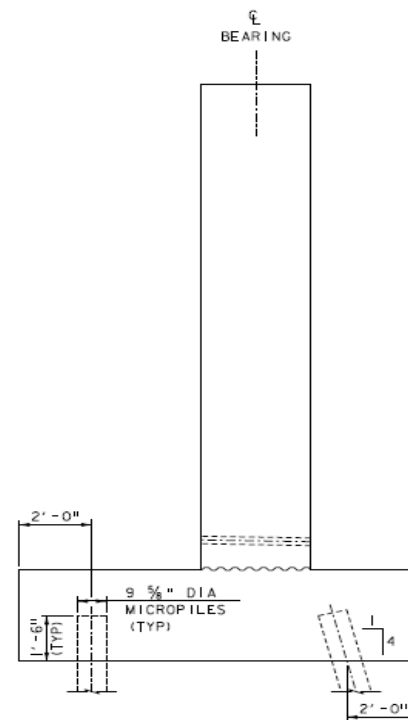
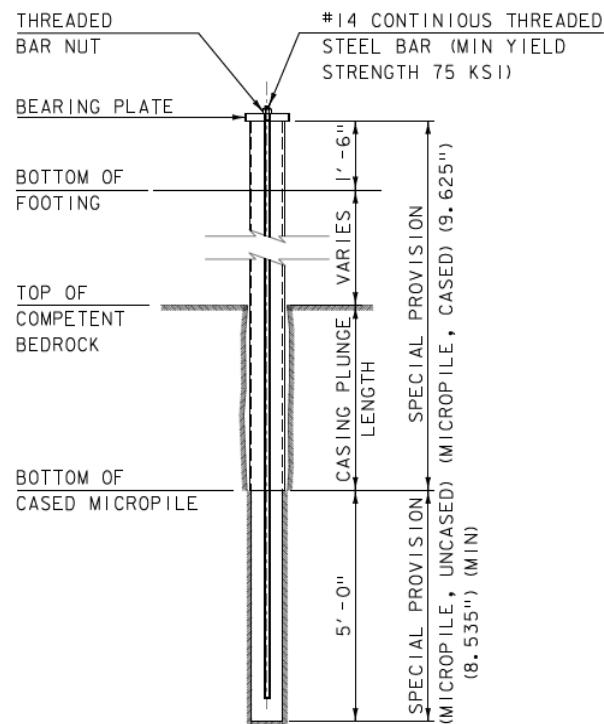
Benefits of Pairing CM/GC & ABC

- ▶ SIBC experience
- ▶ Partnering design and constructability
- ▶ Mitigate risk
- ▶ Accelerated project schedule
- ▶ Accelerated closure schedule
- ▶ Owner/Contractor invested in each other's success

Project Plans

► Foundation

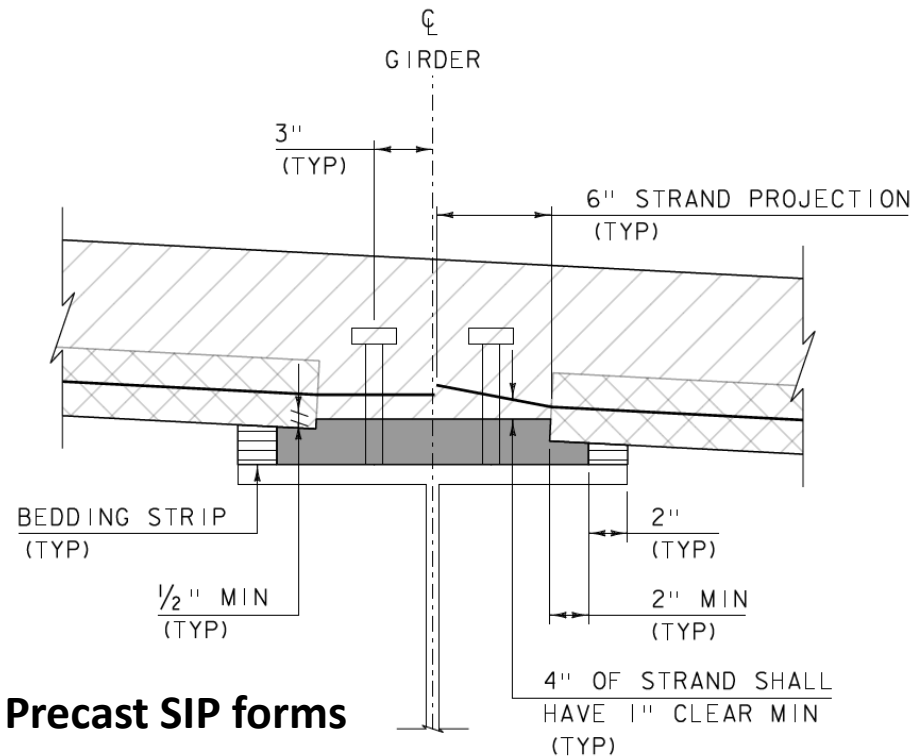
- Conceptual foundation plan - MSE walls with a shallow foundation
- Contractor recommended micropiles due to space constraints for wall reinforcing strips
- VTrans and PCL worked together to design and detail appropriate size based on machinery necessary to install under existing bridges



Project Plans

► Bridge Deck

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



Precast SIP forms

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

A group of approximately ten people, including men and women, are gathered outdoors at what appears to be a construction or project site. They are all wearing high-visibility yellow safety vests and hard hats. Some are holding professional video cameras on tripods, while others are looking at a smartphone. The background shows a dirt path, some greenery, and a clear sky. The overall scene suggests a media or outreach event at a project site.

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 pedestrians 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.



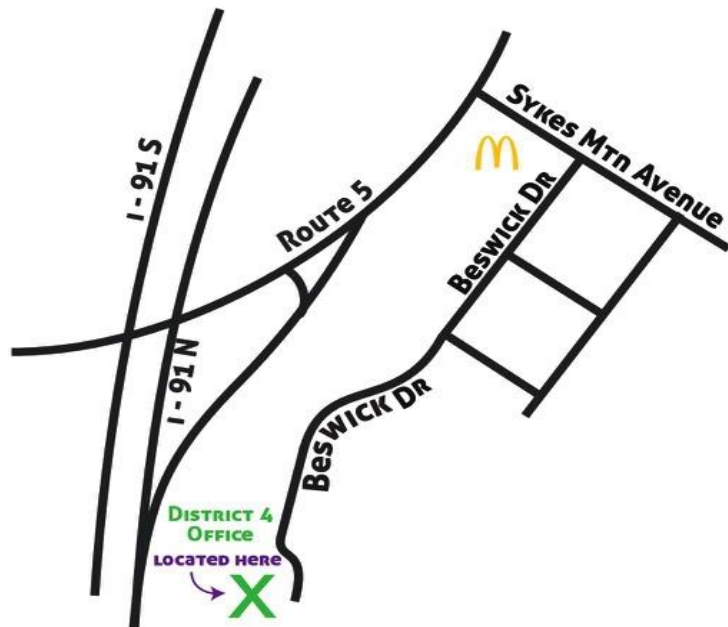
Construction Outreach

IT'S MOVING DAY !



I-91 Hartford
BRIDGES PROJECT

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.**

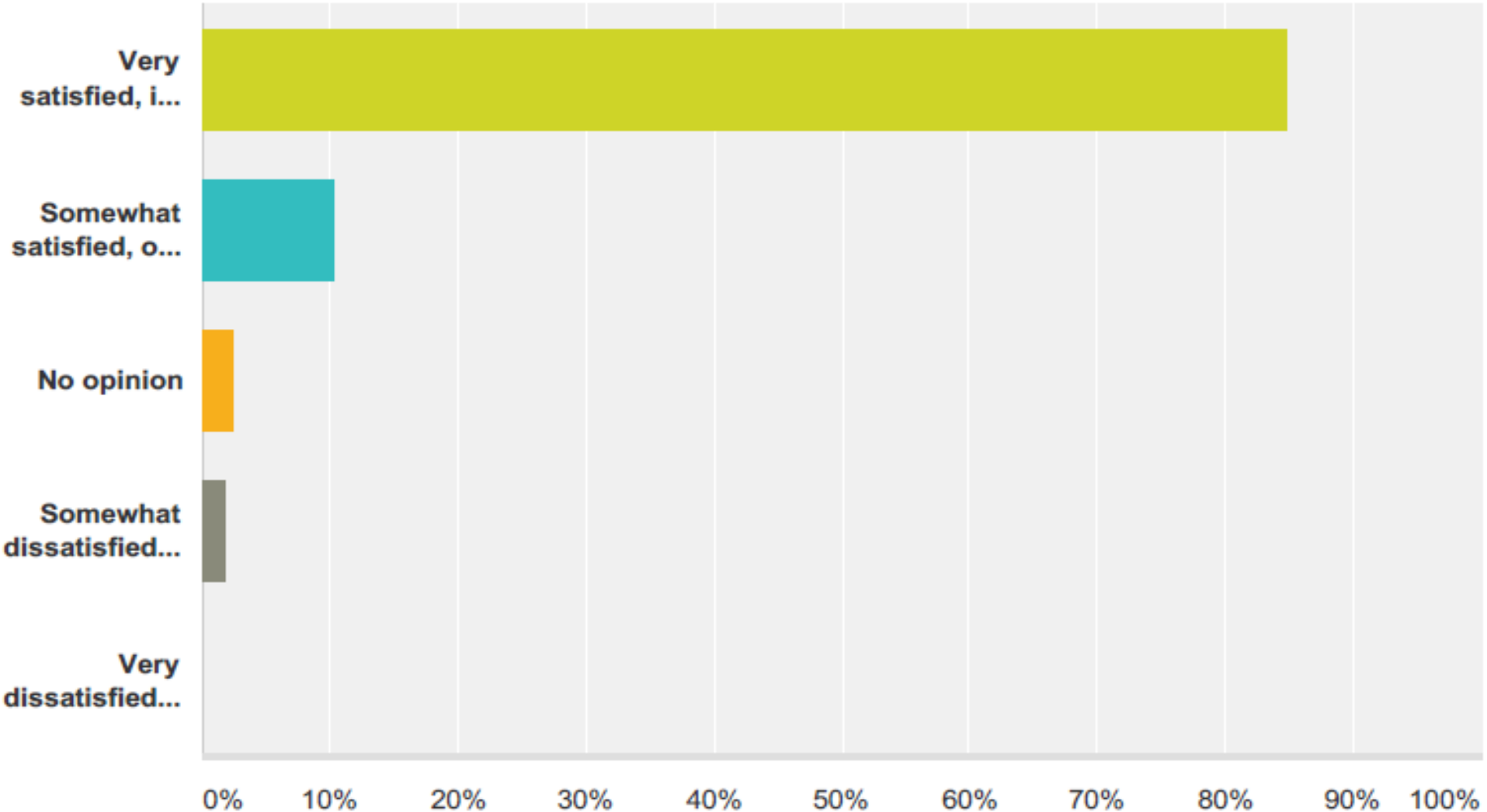
How WILL THE SLIDE HAPPEN? Hydraulic jacks will move the bridge 18 inches at a time, with 10-15 minute intervals between each slide. The total distance the bridge will move will be about 50 feet.

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

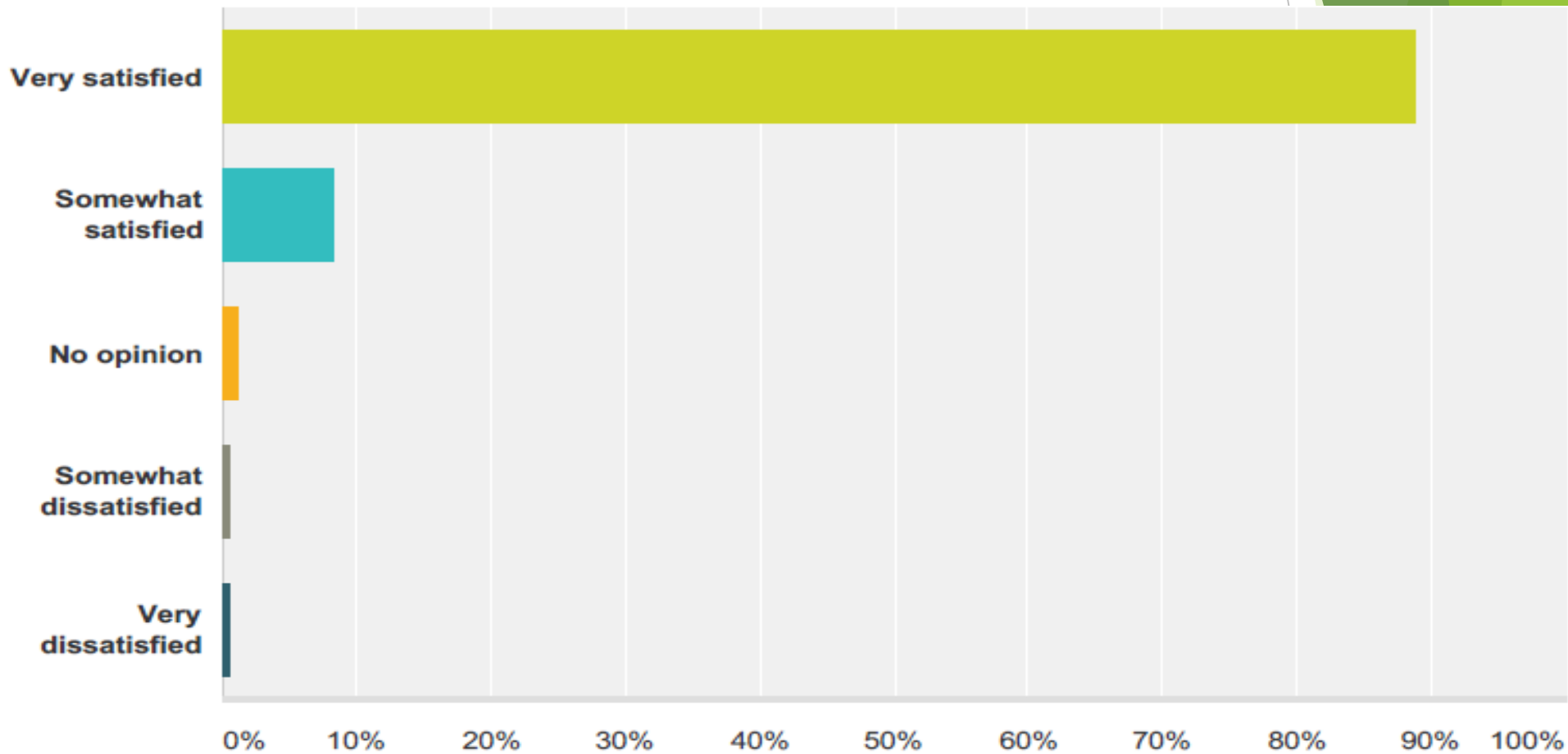
Survey Results

How satisfied were you with how the project was delivered?



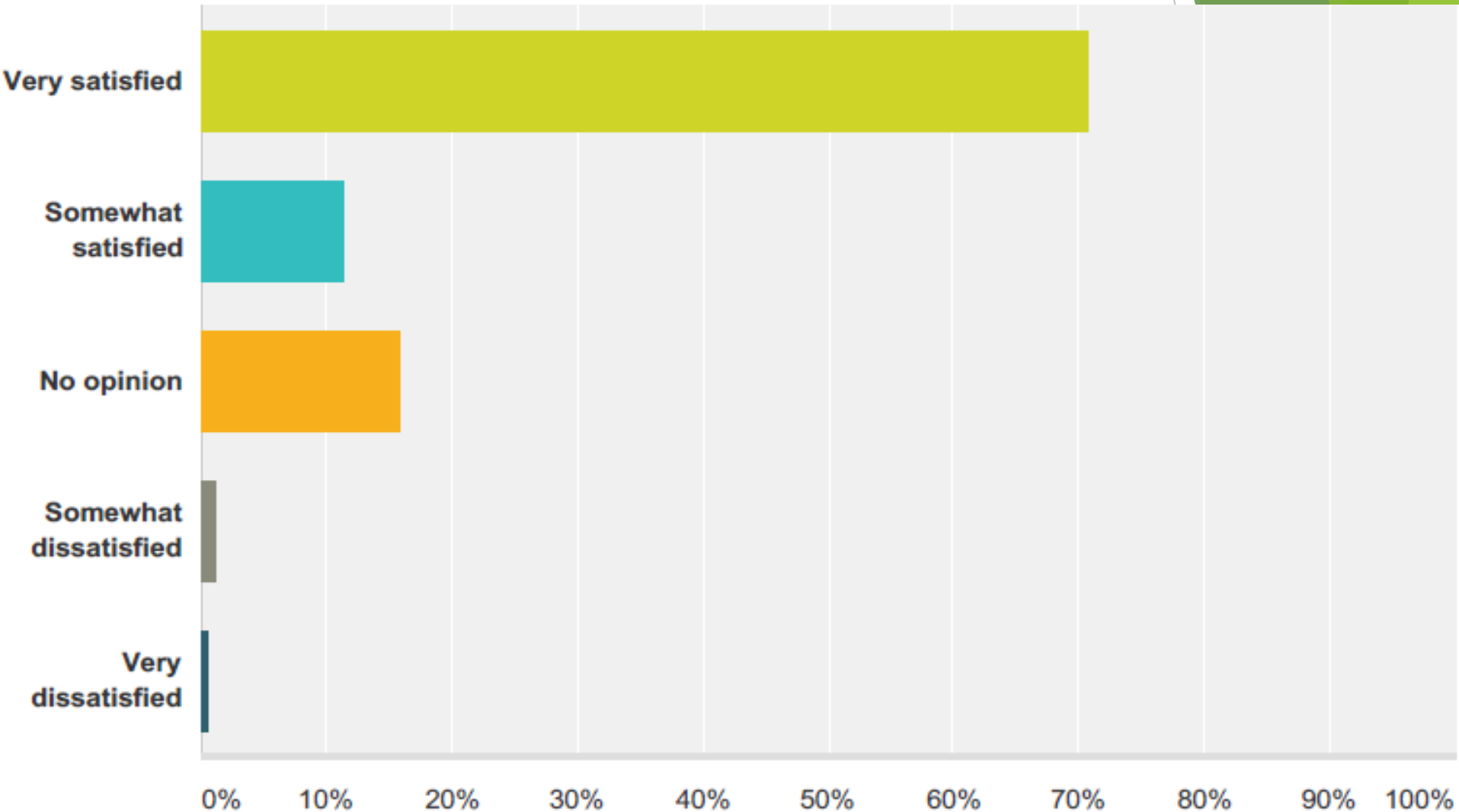
Survey Results

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

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



An aerial photograph showing a multi-lane highway bridge under construction. The bridge spans a road and is surrounded by greenery and residential buildings. The text "Accelerated Bridge Construction (ABC)" is overlaid in large white font across the center of the image. The bridge structure is visible, showing concrete supports and temporary construction elements. The surrounding area includes a parking lot with several cars, a house, and a road intersection.

Accelerated Bridge Construction (ABC)

Micropile Foundation



Footing on Bedrock



Abutment Construction



Abutment Construction



Abutment Construction



Temporary Supports



New Superstructure



Slide Support Beam

Structural Steel



Pre-stressed Concrete Deck Panels



Deck Pours



Approach Slabs



An aerial photograph of a multi-lane highway bridge under construction. The bridge spans a river or canal. Large white text is overlaid on the image, providing closure dates for Northbound (NB) and Southbound (SB) traffic. The surrounding area includes green trees, a parking lot with several cars, and some residential buildings. The bridge structure is partially completed, with visible steel beams and concrete supports.

Bridge Closures
August 28-31 (NB)
September 19-22 (SB)

Demolition



Demolition



Demolition



Demolition

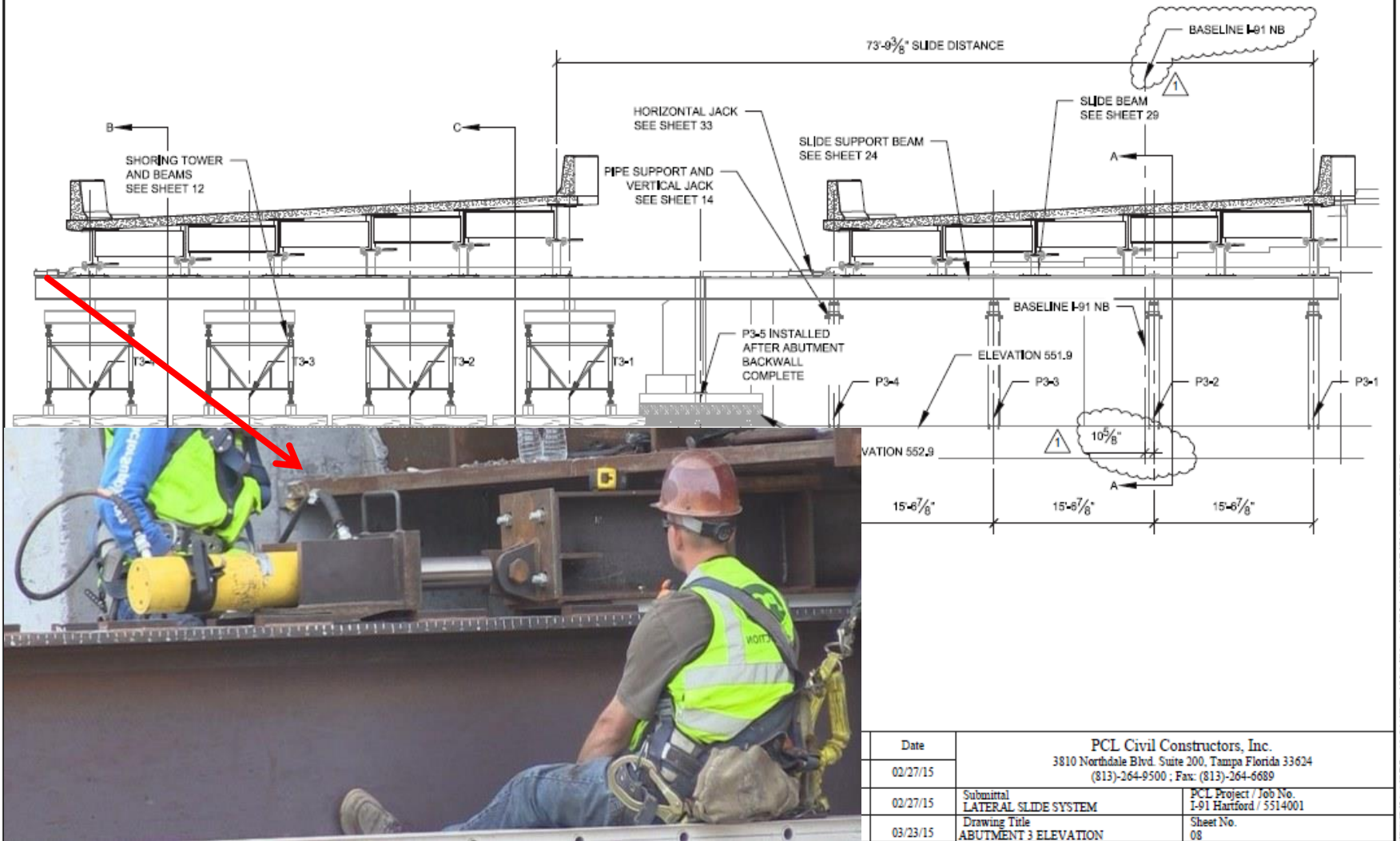


Demolition



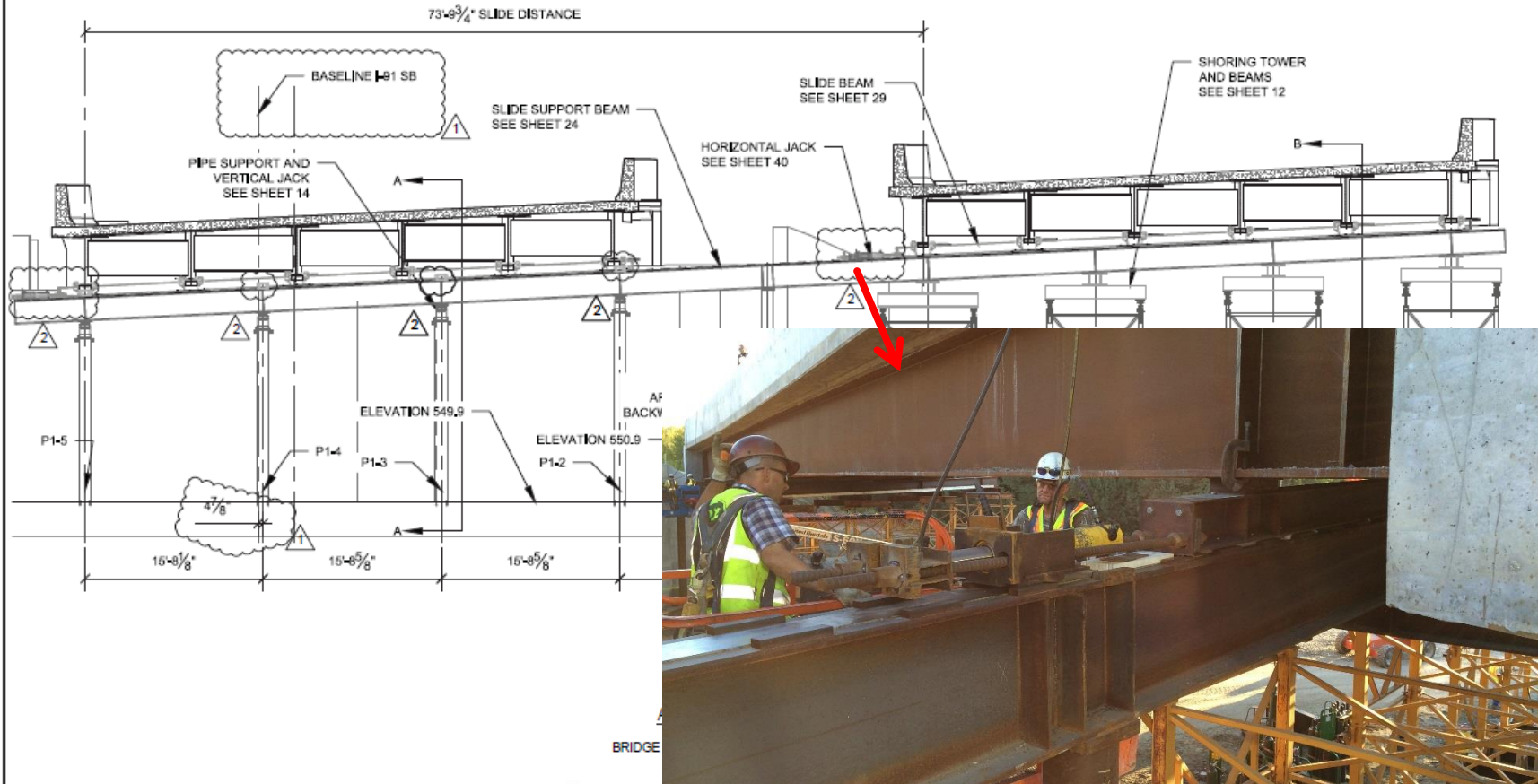
Horizontal Slide

Northbound Slide System (Bridge Pushed)



Horizontal Slide

Southbound Slide System (Bridge pulled)



| | | | | | | | | | | |
|---------------------|----------------------------------|--------------------|--------------------------|--|--|-----------|----------|------------------------------|---|--|
| Revision No. & Date | Vermont Agency of Transportation | | | | Drawing Status | Name | Date | PCL Civil Constructors, Inc. | | |
| Rev. 2. 9/01/2015 | Road No. | Country / City | Financial Project ID No. | | Sep 8 2015 8:56 AM FOR CONSTRUCTION | Drawn By | AJT | 02/27/15 | 3810 Northdale Blvd. Suite 200, Tampa Florida 33624 (813)-264-9500 ; Fax: (813)-264-6689 | |
| Rev. 1. 4/9/2015 | I-91 | Windsor / Hartford | DM 091-2(79) | | | Design By | TMD/ AJT | 02/27/15 | Submittal LATERAL SLIDE SYSTEM | PCL Project / Job No. I-91 Hartford / 5514001 |
| | | | | | | Check By | TMD | 03/23/15 | Drawing Title ABUTMENT 1 ELEVATION | Sheet No. 06 |

Approach Slabs



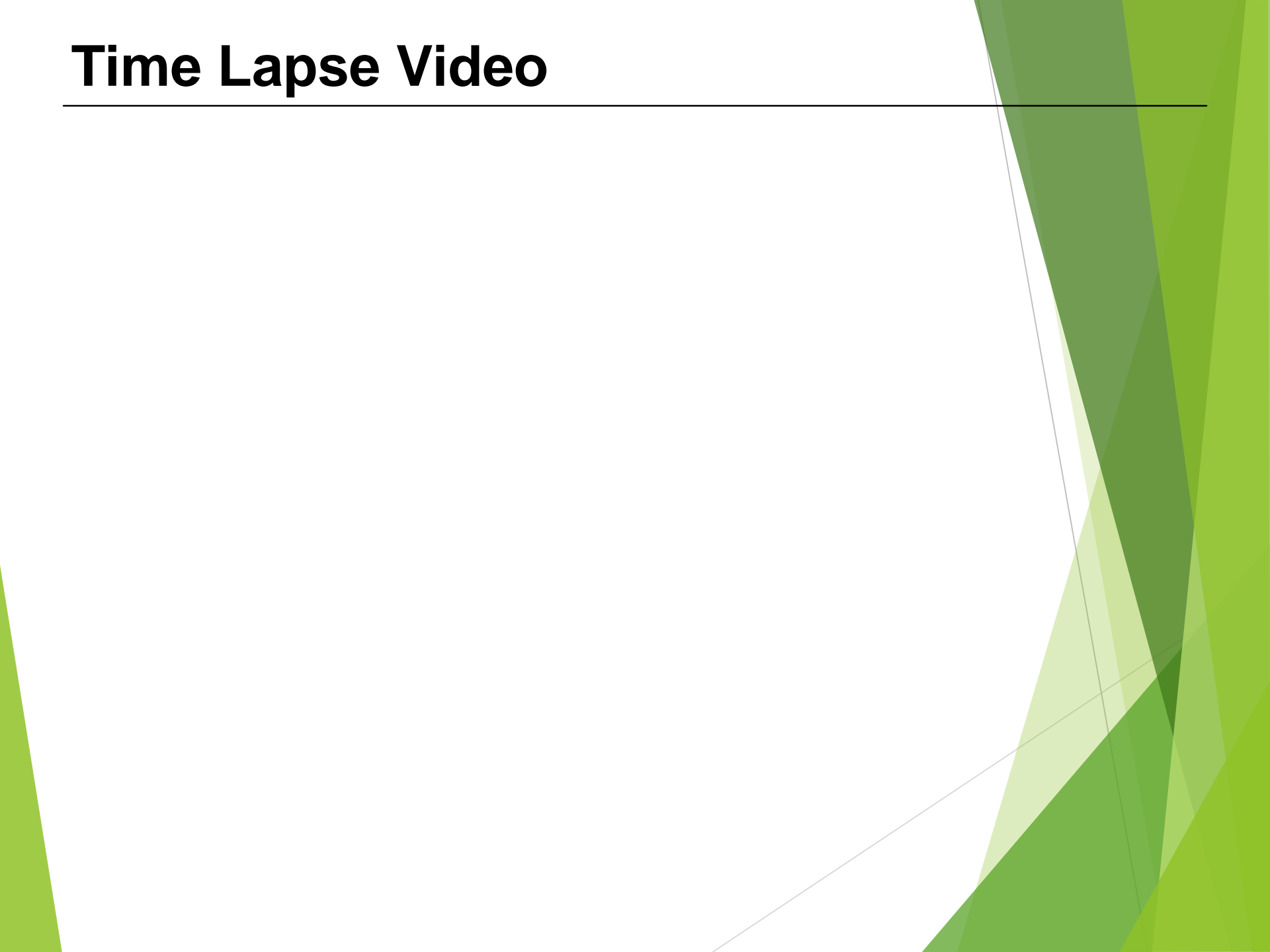
Keys to Success

- ▶ 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.

