Accelerated Bridge Program
VTRANS

Hartford Vermont Bridge Replacement Project
Slide-In Bridge Construction and CM/GC Project Delivery

Kristin Higgins, PE - VTrans Project Manager

January 28, 2016

Presentation Outline

- VTrans Accelerated Bridge Program
- Hartford Bridge Replacement Project Planning
- Construction Manager/General Contractor (CM/GC)
- Project Plans & Special Provisions
- Project Outreach
- Construction
  - Pre-Closure
  - Closure
- Lessons Learned
- Questions

Vtrans Accelerated Bridge Program

- Initiated in 2012 by Vermont's Secretary of Transportation
- Programmatic approach to delivering ABC projects
  - Utilize Accelerated Bridge Construction (ABC) technologies as first choice for bridge replacement
  - ABC must be appropriate – Not forced
- Focus Expedite project delivery
  - Utilize expedited project delivery strategies
  - Minimize project development and construction costs
  - Standardize project plans
  - Utilize alternative project delivery
- Since 2012 - 28 projects totaling $71.3 million
  - Hartford Bridge Project $11.1 million

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Hartford

Project Planning

Project Background

- Hartford project programmed in 2012
- Both structures on I-91 have suspended span steel connections and are fracture critical

Project Scope

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- Project scope called for complete bridge replacement
  - Wider bridges for maintenance
  - Future project on Rte. 5 to add a sidewalk and bike lanes
- Site constraints were steering us toward ABC
- Slide-in bridge construction 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

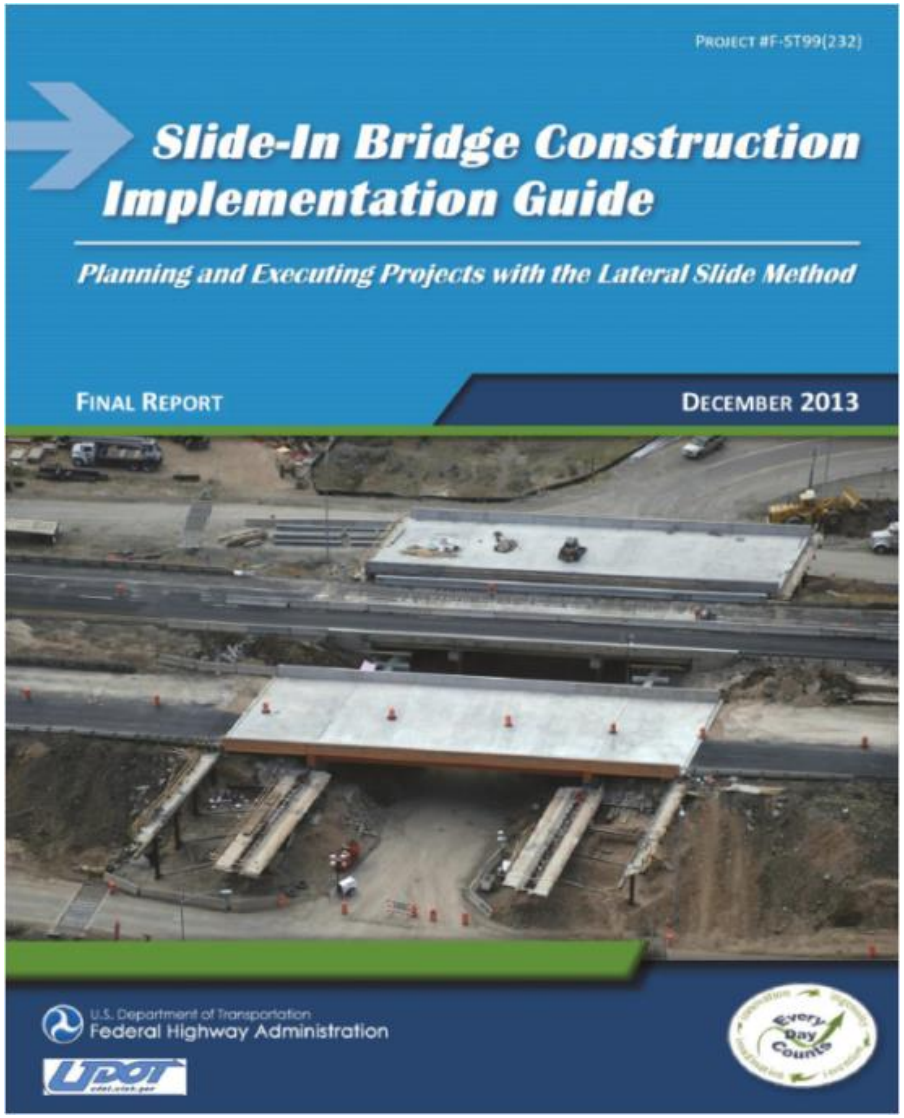

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Table 1-1
Common Applications of Slide-In Bridge Construction

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.
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 I91)**

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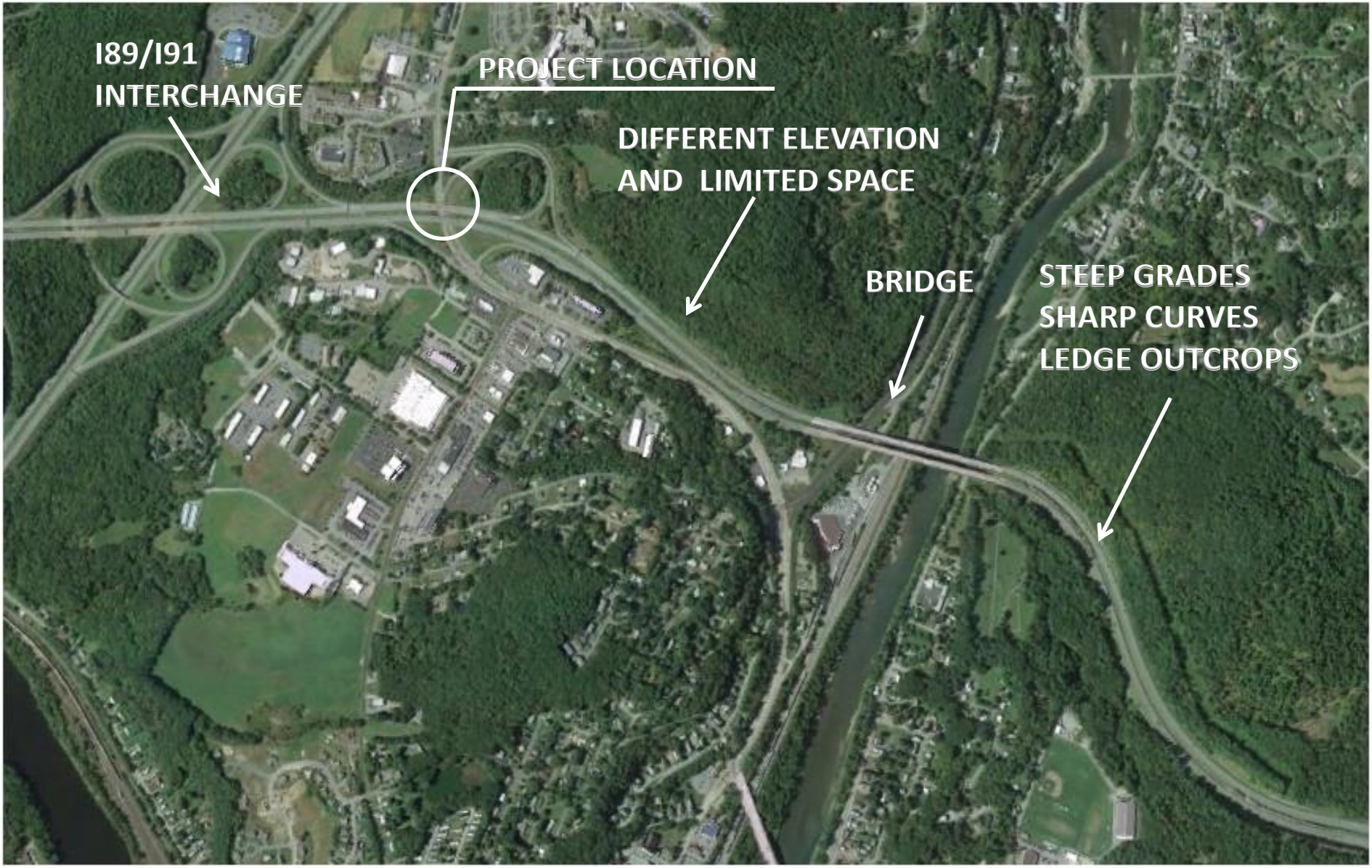
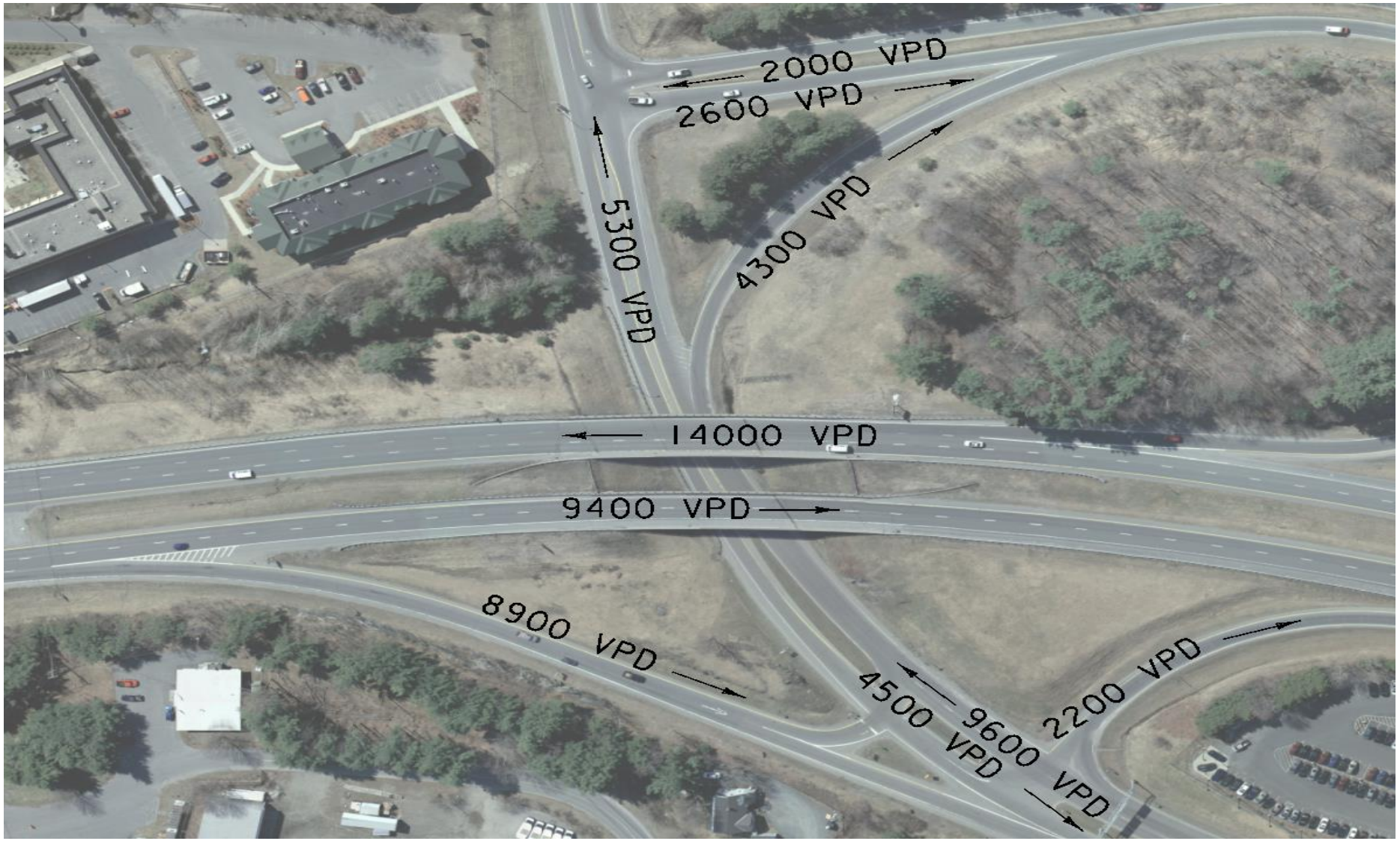
- Traffic on Bridge significant
- High User Costs (Rte. 5 and I91)
- **Replacement Bridge shorter than existing if complete reconstruction**
- **Geometric Constraints/Safety**
  - ✓ **No room for crossovers or temporary bridge**

Project Constraints



Traffic Volumes

- High traffic volumes over and under the bridge



Project Goals

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- No full closure of US-5
- Only two weekend closures of I-91
- Maintain pedestrian traffic
- One construction season
- High public satisfaction

Concerns with SIBC

- Lack of Design experience with Slide-in bridge construction
  - What needs to be engineered up front
- Lack of local contractor experience with Slide-in bridge construction
  - Vermont is a small state and has limited resources
  - Concern with risk of “Low Bid”
- Opted to pursue innovative alternative project delivery method of Construction Manager/General Contractor (CM/GC)

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ABC Planning With CB/GC

Implementing ABC thru CM/GC

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- Innovative contracting method supported by FHWA
- Competitive selection process
  - Technical Proposals submitted and scored
  - Interviews with shortlisted firms
- VTrans selected PCL Civil Constructors, Inc.
  - Experienced CM/GC firm
  - Experienced with bridge slides (SIBC)
  - Experience with heavy traffic construction

CM/GC

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- Contractor procured early in Design phase
  - CM/GC team works with design team
  - Incorporate means and methods into contract documents
  - Constructability input and reviews
  - Construction risk mitigation
  - Construction Schedules developed and refined
  - Construction cost estimates throughout design phase
  - Eventually builds the project if final cost agreed upon

- Requires an Independent Construction Estimator (ICE)
  - Independent source to validate construction cost
  - Independent source to validate means and methods

Benefits of Pairing CM/GC & ABC

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

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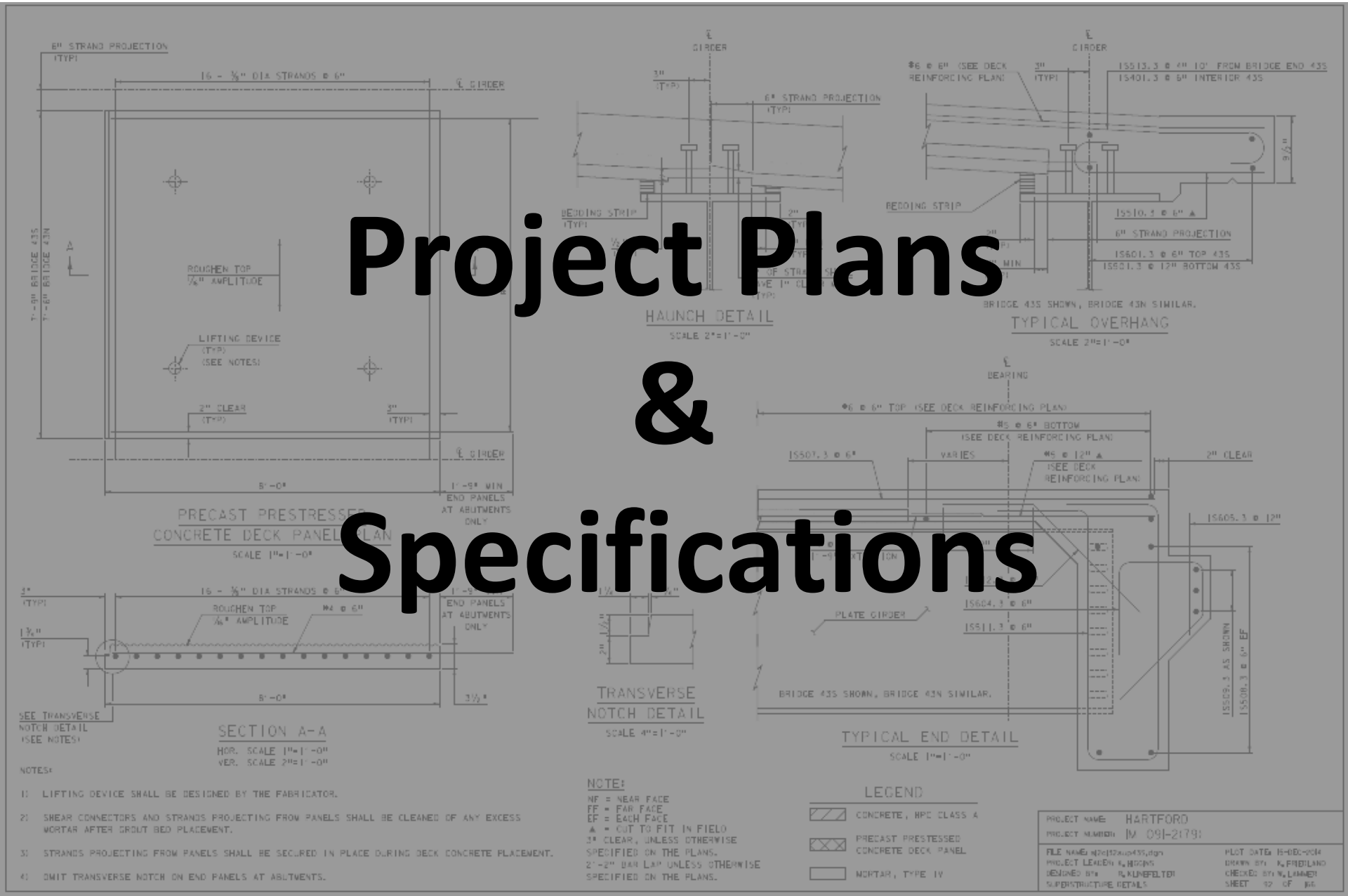
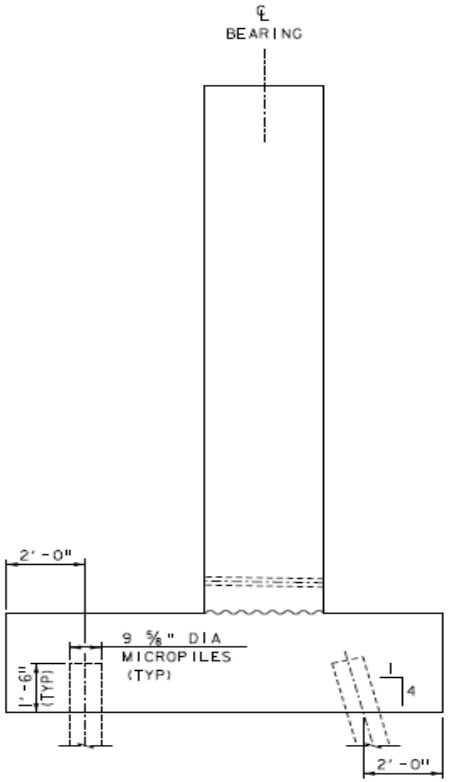
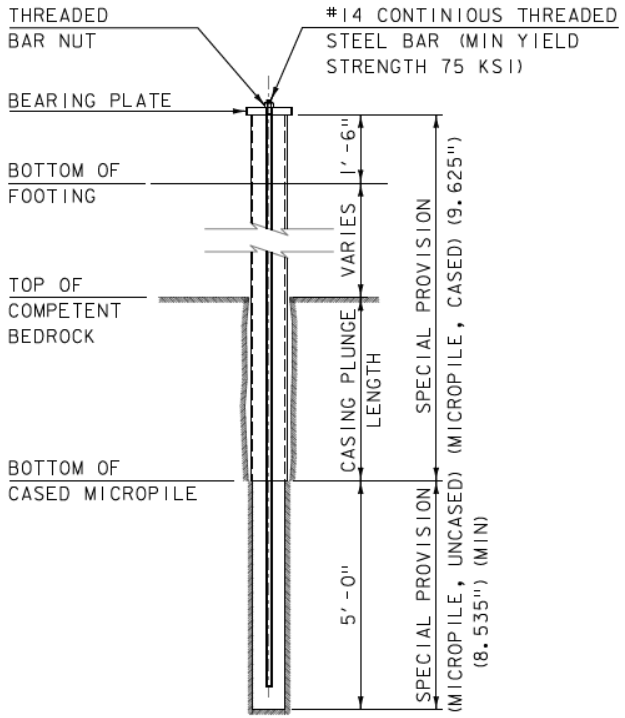


Project Plans & Specifications

Project Plans

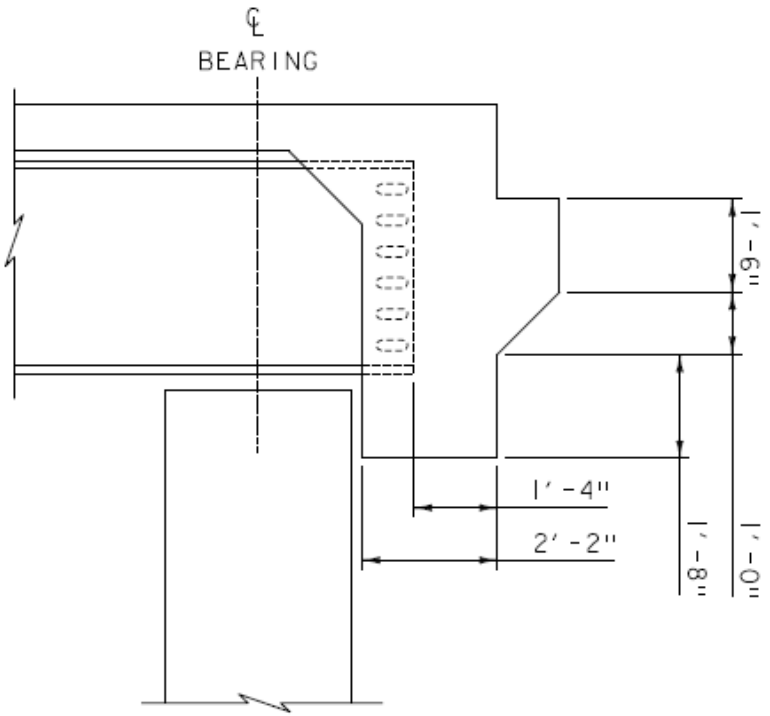
- Foundation
  - Conceptual foundation plan - MSE walls with a shallow foundation
  - Contractor recommended micropiles due to space constraints for wall reinforcing strips
  - VTrans and PCL worked together to design and detail appropriate size based on machinery necessary to install under existing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





Project Plans

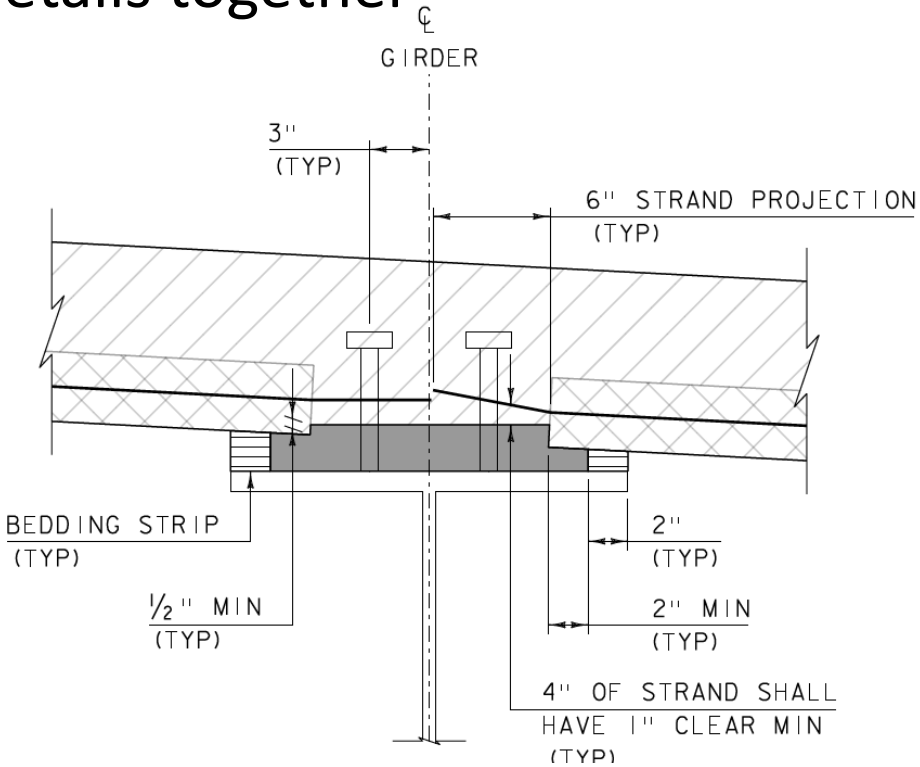
- Steel and Concrete Superstructure Geometry
  - VTrans design team recommended suspended backwall
  - Worked together with PCL to ensure clearance for slide and added a bearing stiffener to be fabricated at slide bearing location



Typical Section

Project Plans

- Bridge Deck
  - Contractor requested SIP precast deck forming panels
  - VTrans incorporated them into the plans and worked out all details together



Precast SIP forms

3-D Modeling from PCL

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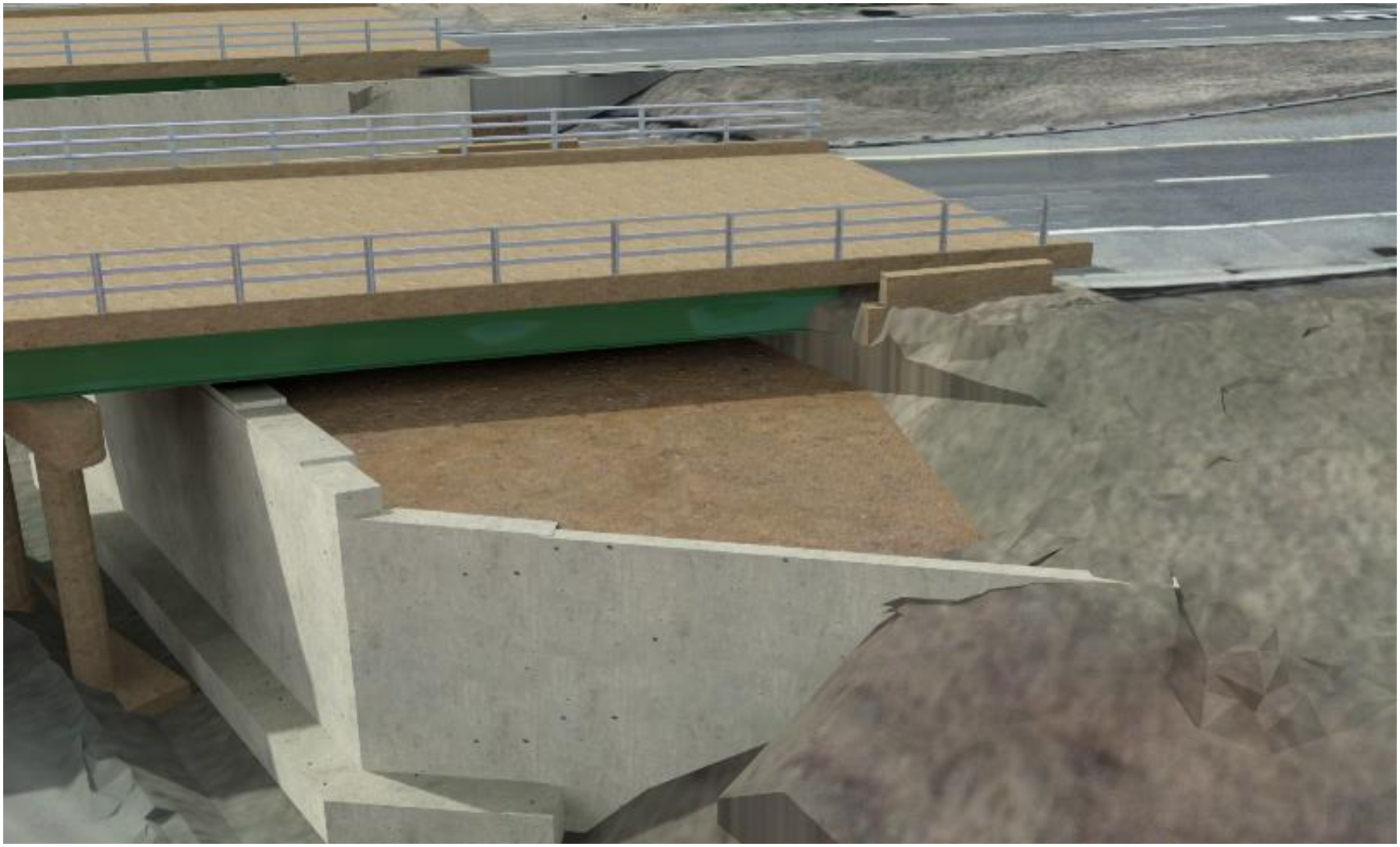

Construct new substructure under existing

3-D Modeling from PCL

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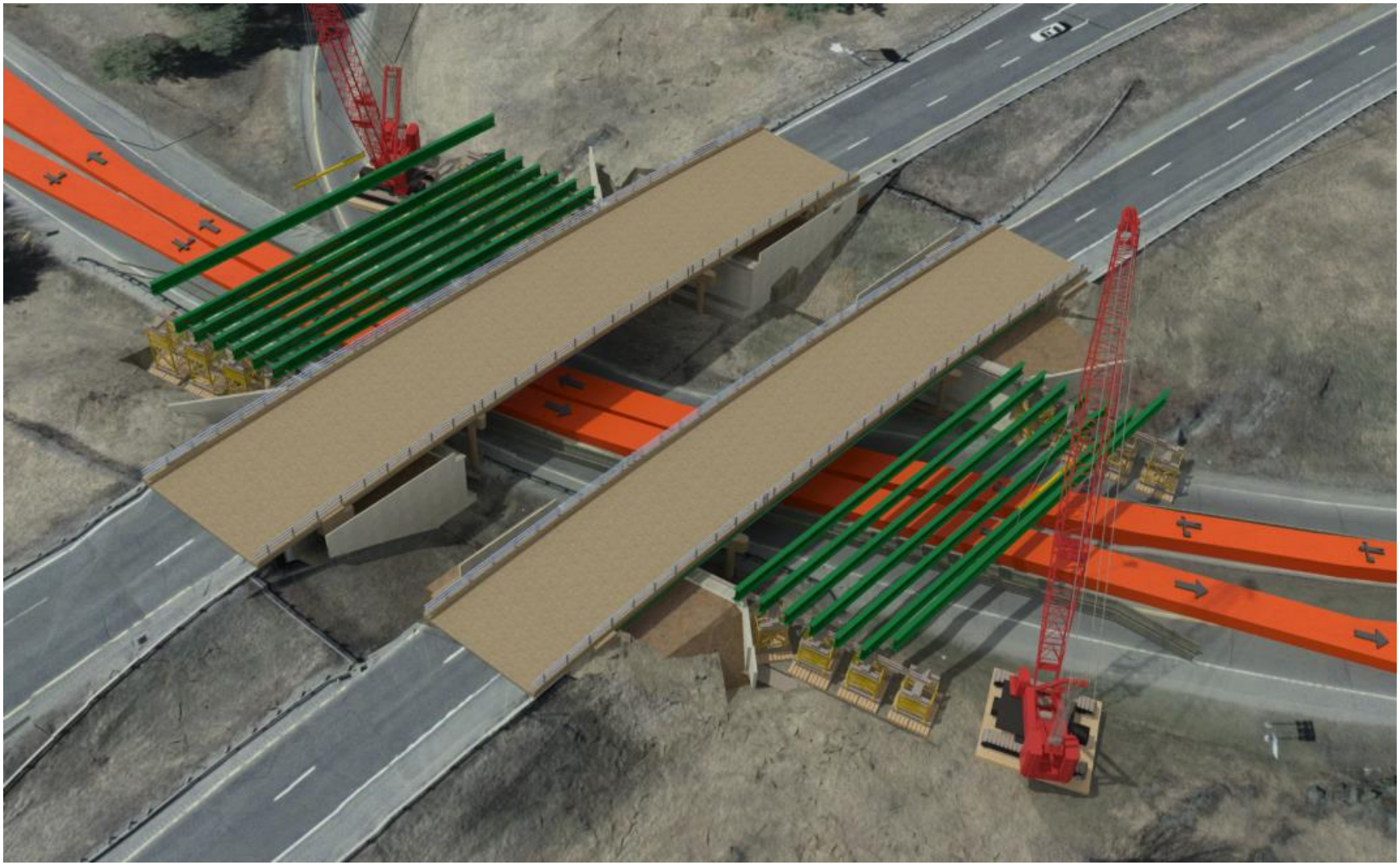
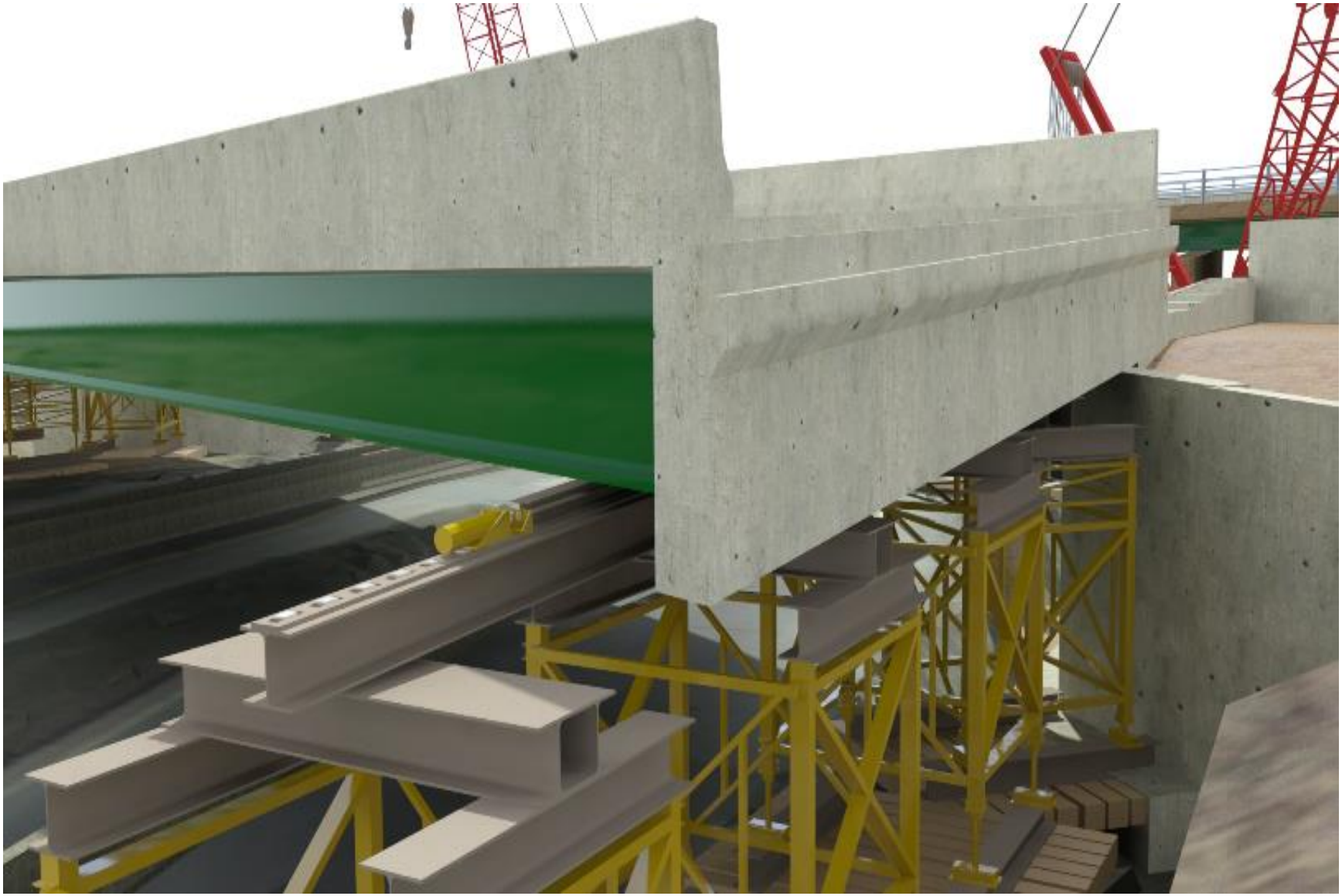


Construct new superstructure adjacent

3-D Modeling from PCL



Slide over and through new

3-D Modeling from PCL

Lateral slide during closure

Project Special Provisions

- Temporary Support and Horizontal Slide
  - Developed as performance specification
  - Placed all responsibility on contractor
  - Nothing specifically shown in plans
- High Early Strength Concrete
  - Performance based specification - 4000 psi before loading
- Pedestrian Shuttle
  - Used to maintain pedestrian access during closure
- Pavement Jet Dryer
  - Mitigated during discussion over paving costs

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Project Outreach

Public Outreach

- Hired Public Outreach Coordinator
  - Early collaboration with stakeholders and public officials
  - Developed a list of interested parties
  - Developed a project website with project fact sheets
  - Coordinated with local newspaper at the onset of the project

Project Fact Sheet

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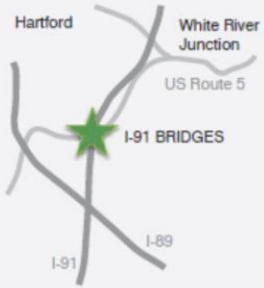
Project Factsheet May 2014



PROJECT MILESTONES

Preliminary Plans
April 2014
Permitting
August 2014
Right-of-Way Complete
August 2014
Final Design
October 2014
Contract Award
March 2015
Target Construction Schedule
2015

I-91 Hartford BRIDGES PROJECT

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HARTFORD (WHITE RIVER JUNCTION) I-91 BRIDGES

(Hartford IM 091-2(79) project)

Project Location: Town of Hartford in Windsor County on Interstate 91 over Route 5 in White River Junction approximately one half mile north of the junction of I-91 and I-89.

Project Purpose: The purpose of this project is to replace the existing bridges that carry Interstate 91 north and southbound over US Route 5 in Hartford, safely, efficiently and with the least possible impact to road users and the surrounding community. The structures were built in 1966. Age, weather and use have taken a toll on the concrete deck, beams and abutments of the two bridges. Two new bridges will be built during the 2015 construction season.

Accelerated Bridge Program (ABP): The Hartford I-91 Bridges Project has been assigned to the Vermont Agency of Transportation (VTrans) Accelerated Bridge Program, an approach that delivers projects faster, often using innovative techniques and always in collaboration with local communities. Typically, fast track bridge projects are completed in approximately half the time that it would take by conventional construction, often in just one construction season.

By reducing the time it takes to construct a new bridge, VTrans has been able to save money spent on design, utility and ROW impacts, and road closures as well as minimize disruption to travelers and commerce. The ABP encourages streamlining, standardizing design and plan preparation while exploring innovative contracting and construction techniques.

Partnership is a hallmark of the ABP program – with contractors, innovators from other states and local communities. To date, 12 bridges have been rebuilt using the ABP since the program was established in 2012, with 13 planned in 2014.

www.i91wrj.vtransprojects.vermont.gov

A Vermont First!

LATERAL SLIDE CONSTRUCTION

A construction method known as a lateral slide, will be used to replace the I-91 Hartford Bridges for the first time in Vermont. The slide will take place over two weekends, one for each bridge, but there will be a lot going on at the bridge site before the new bridges are slid into place. Here's how the project will work.

In the spring of 2015, construction will begin under the existing highway bridges. A new foundation (piers and abutments) or substructure will be built for each bridge. In addition, the replacement superstructure (bridge deck and support beams) will be constructed on temporary supports right next to the existing highway bridges. Both I-91 bridges will remain in service while construction is going on underneath and next to the bridges. Travel lanes on US Route 5 will be reduced from three lanes to two, but traffic will still flow in both directions throughout construction.

Once the new foundation and decks are constructed, the lateral, or sideways slide, can begin. VTrans will close a portion of the Interstate and reroute traffic onto the established detour route. Then the contractor will remove the existing bridge and slide the new superstructure into place on top of the substructure by physically pushing or pulling the bridge into place along lubricated rails.

One bridge, either the northbound or southbound bridge, will be moved at a time. This will require a short closure period of I-91 over one weekend while the bridge is moved into place. The other bridge will remain open while the slide is occurring. Once securely in position, the bridge will be reopened to traffic. The lateral slide will be repeated for the second bridge on another weekend. Traffic on I-91 will resume in both directions when the both bridges have been installed.

The lateral slide method was chosen because it will cause the least possible impact to the road users and the surrounding community.

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.

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Construction Outreach

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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 **from 2 p.m. to 7 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.


View of existing and new bridges
Photo courtesy of PCL

Can't visit the site to see the slide on August 29? That's OK. VTrans will have a live video feed on the project website all weekend and you can check out progress. Also, a time-lapse video will be made for future viewing online at

www.i91wrj.vtransprojects.vermont.gov

Questions? Contact Jill Barrett, **Call** (802) 272-1248 or **Write** jbarrett@fhiplan.com

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***Slide date is subject to change.

Friday
August 28, 2015
$1.00
Volume 64 — Number 81

VALLEY NE

Weekend Construction to Begin Tonight; Delays Expe

Jeremy Mackling, project manager at PCL, explains the construction of the new Interstate 91 bridges over Route 5 in White River Junction during a news conference at the site last week. The "slide-in" of the Int bridge is scheduled for this weekend. VALLEY NE

I-91 Bridge Plans Sliding Into

By Maggie Cassidy
Valley News Staff Writer

White River Junction — The Vermont Agency of Transportation is urging drivers and pedestrians to avoid the area around Interstate 91's Exit 11 interchange in White River Junction this weekend as construction crews plan to shut down the interstate's northbound lanes to replace the bridge over Route 5.

with conventional construction.

"We believe we're getting much better value for the taxpayer, but more importantly, less inconvenience long term for our customers," VTrans Secretary Sue Minter said at a recent news conference in White River Junction.

Crews from Florida-based PCL Construction plan to knock down the old northbound bridge this weekend and slide into place one of two new bridg-

ly closed, officia
vehicular traffic
be delayed up to
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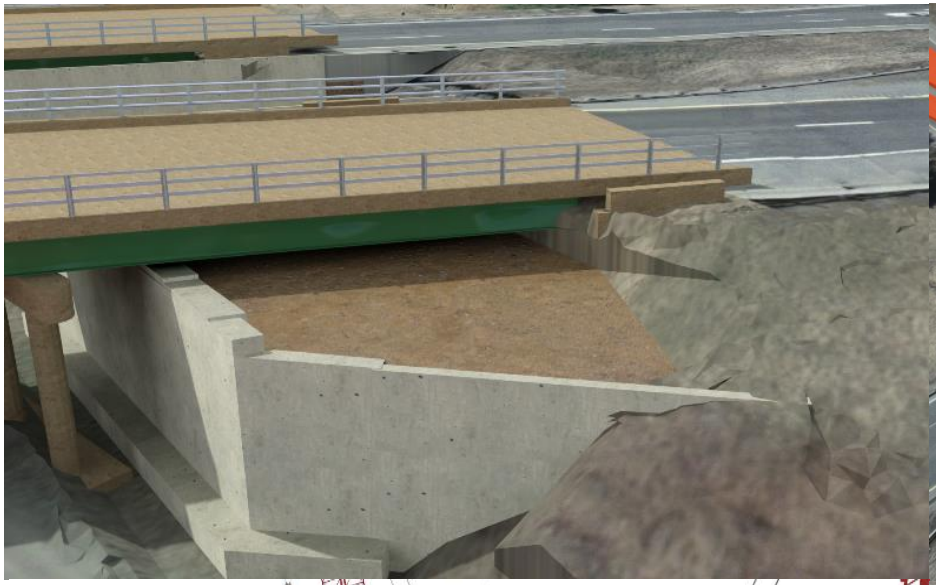
to one lane most
routes include V

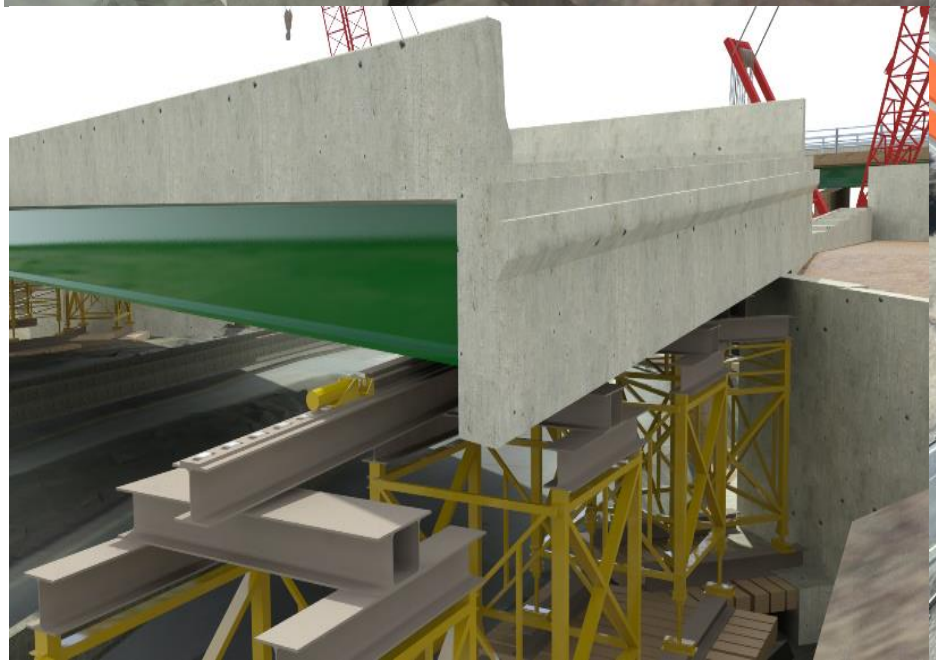
Barring a de
northbound road
at 6 p.m. and end

The detour wil
ers off of I-91 at

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

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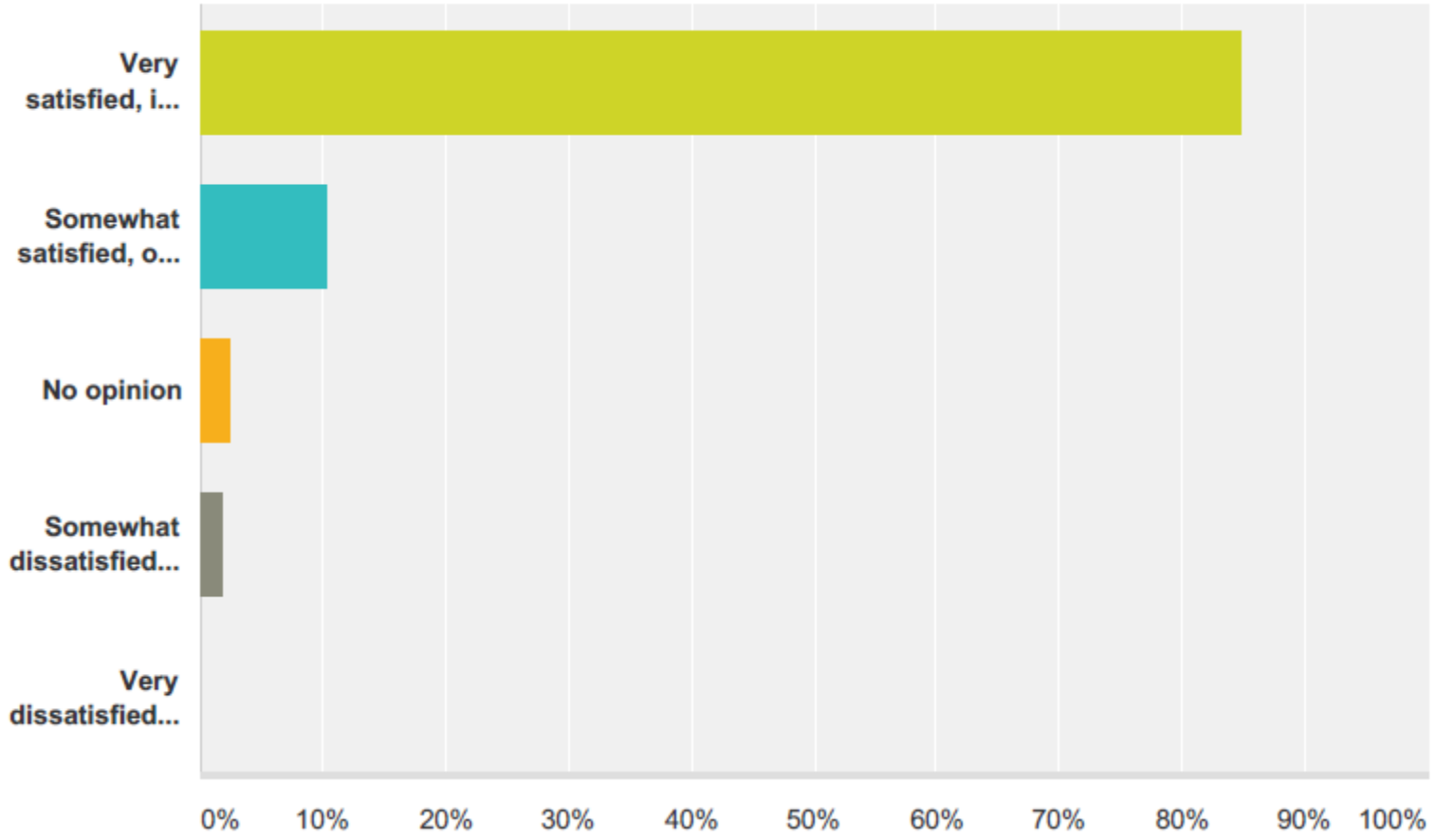
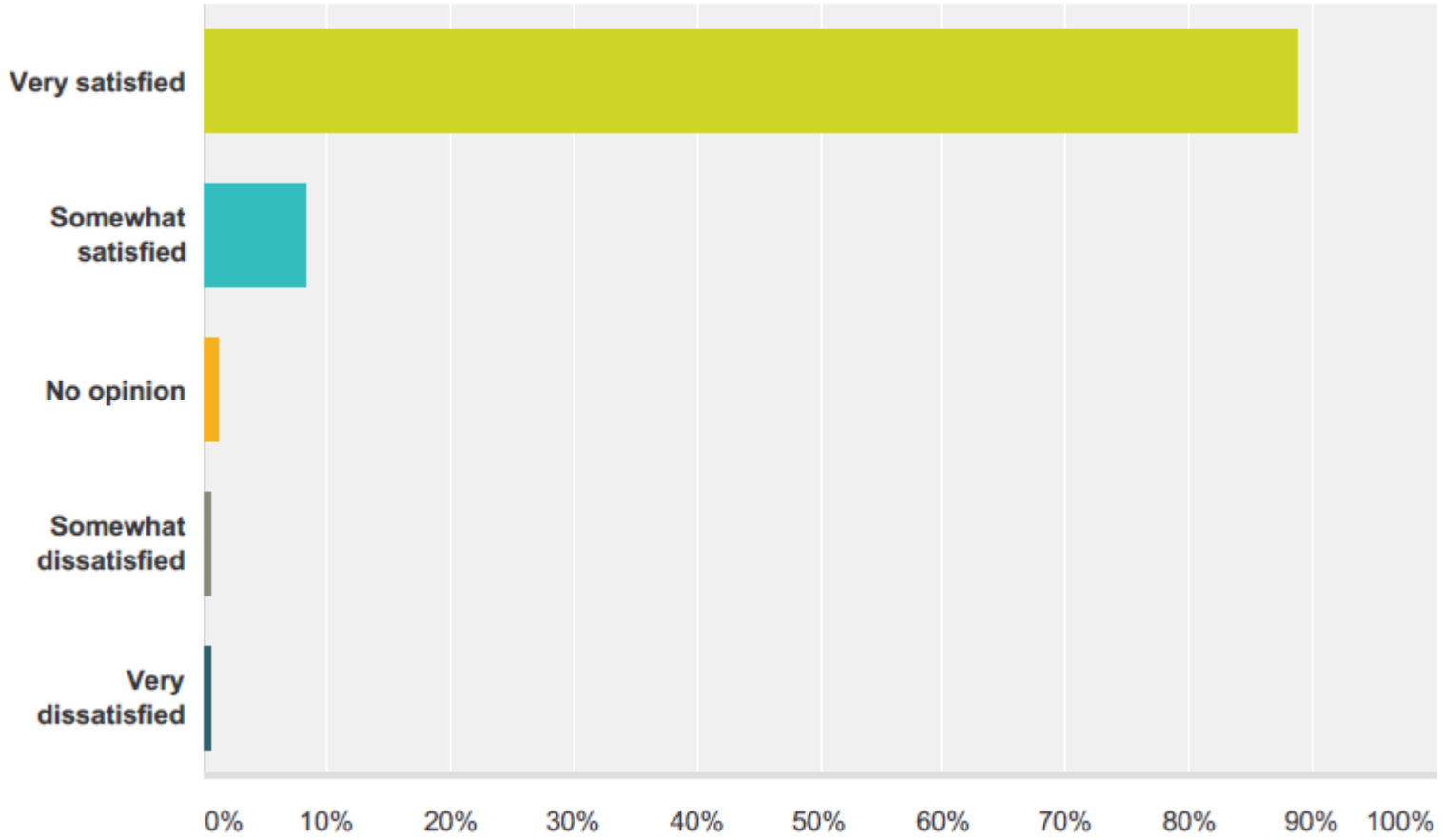
How satisfied were you with how the project was delivered?



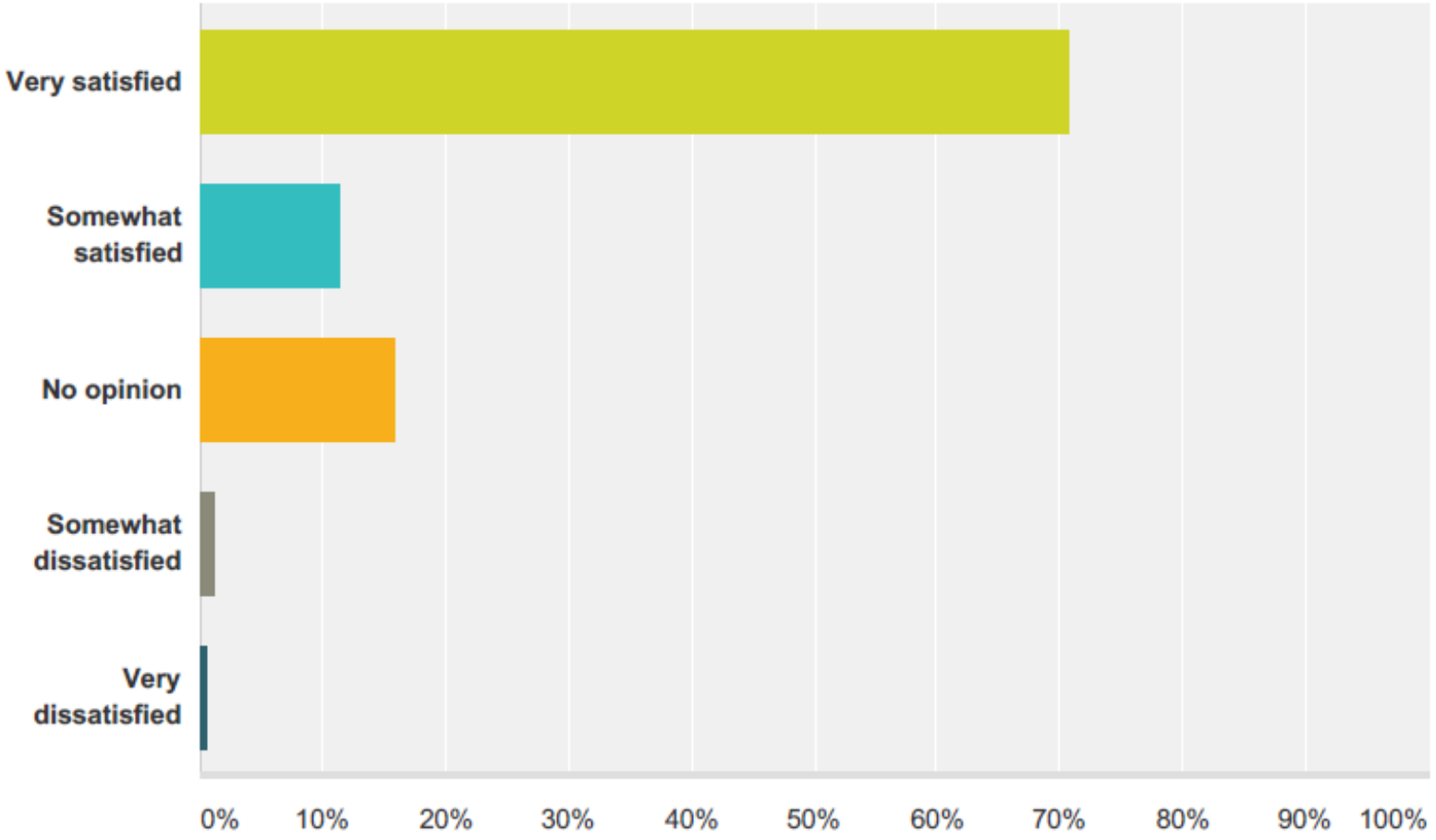
Survey Results

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)?



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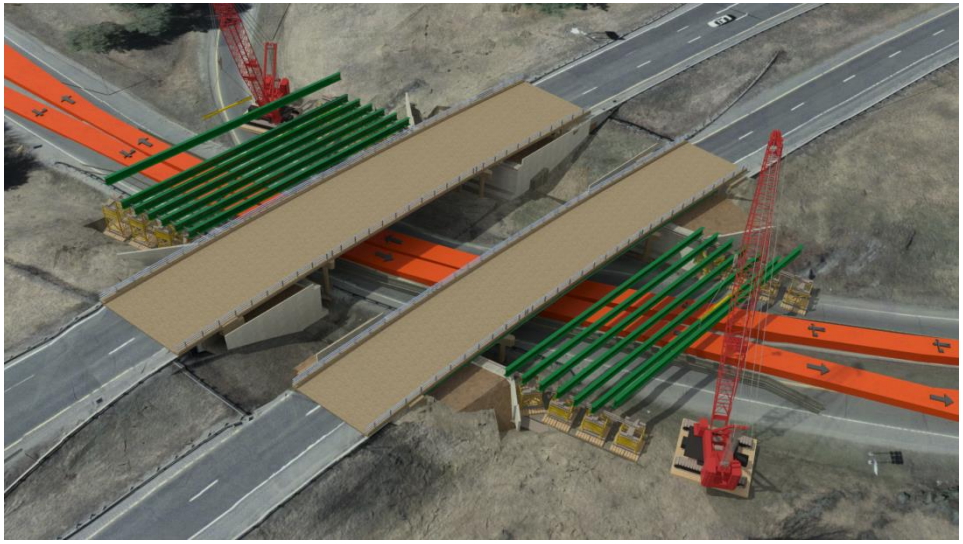
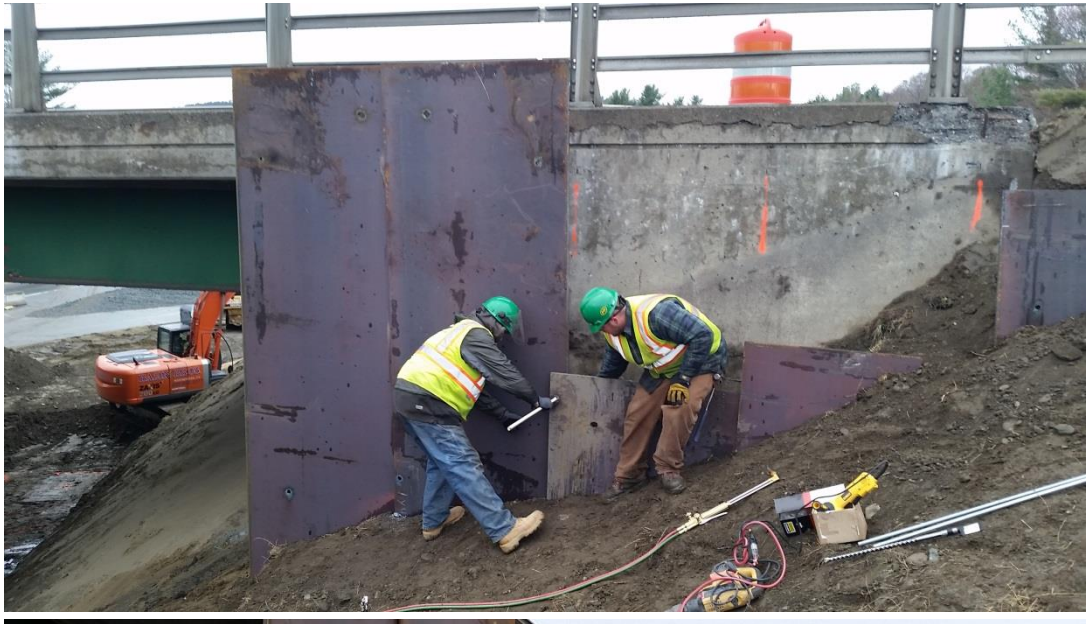
Construction

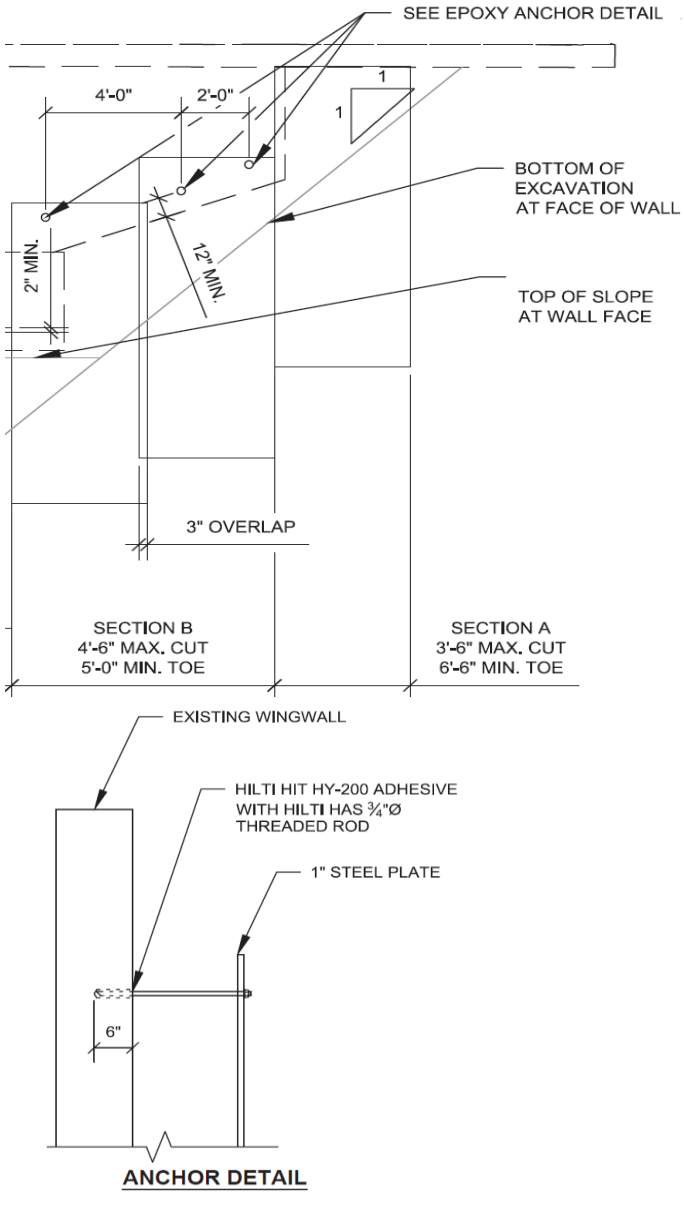
Construction and Public Access



- Contractor needed room to Construct project
- Route 5 reconfigured from 3 to 2 travel lanes
- Pedestrian access maintained
- Protective screen used to isolate construction
- March 23 – April 8

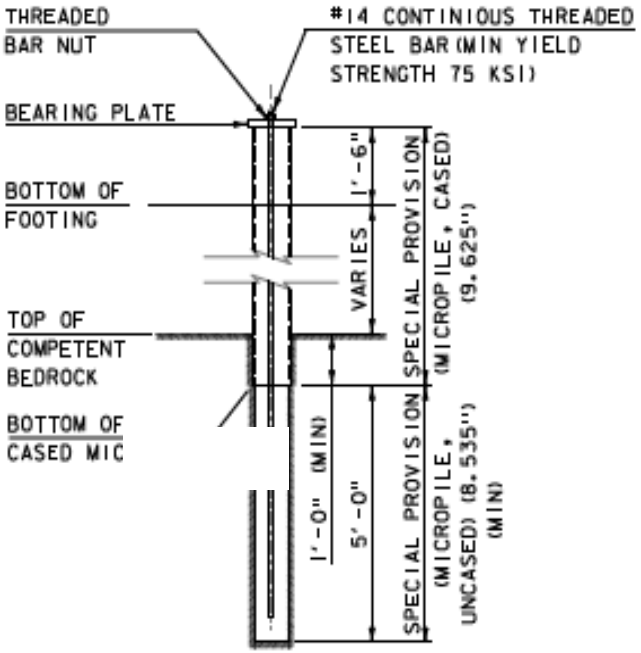
Shoring Existing Abutments



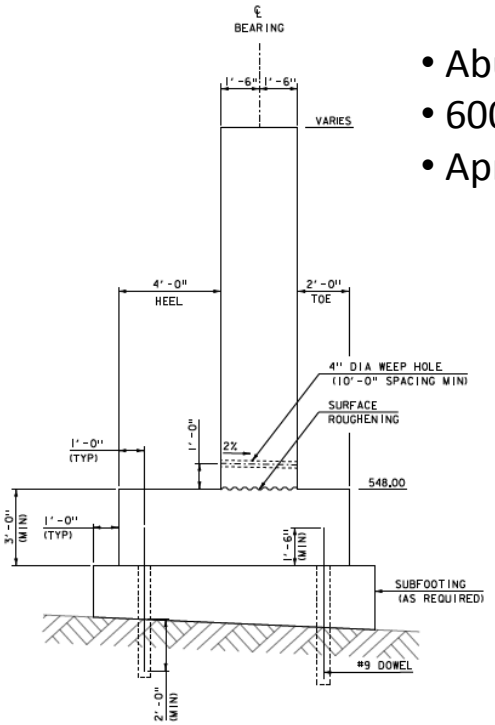


Micropile Foundation

- 3 of 4 abutments on Piles
- 66 piles total
- 1400’ in Earth (cased)
- 330’ in bedrock (uncased)
- April 13- April 30

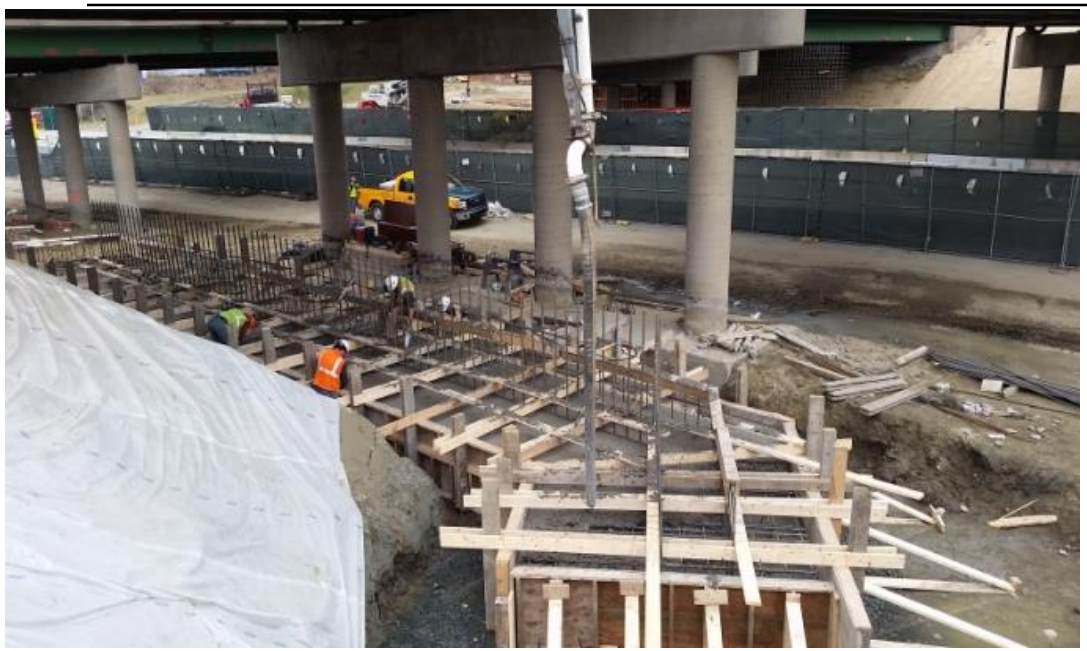


Footing on Bedrock



- Abutment 4 only
- 600 CY removed
- April 9 – April 21

Abutment Construction



- 4 Abutments
- 8 Retaining Walls
- 1,476 CY Class B (HPC)
- April 22 – June 6 (Critical Path)
- May 25 – July 25 (Non Critical Path)

Abutment Construction

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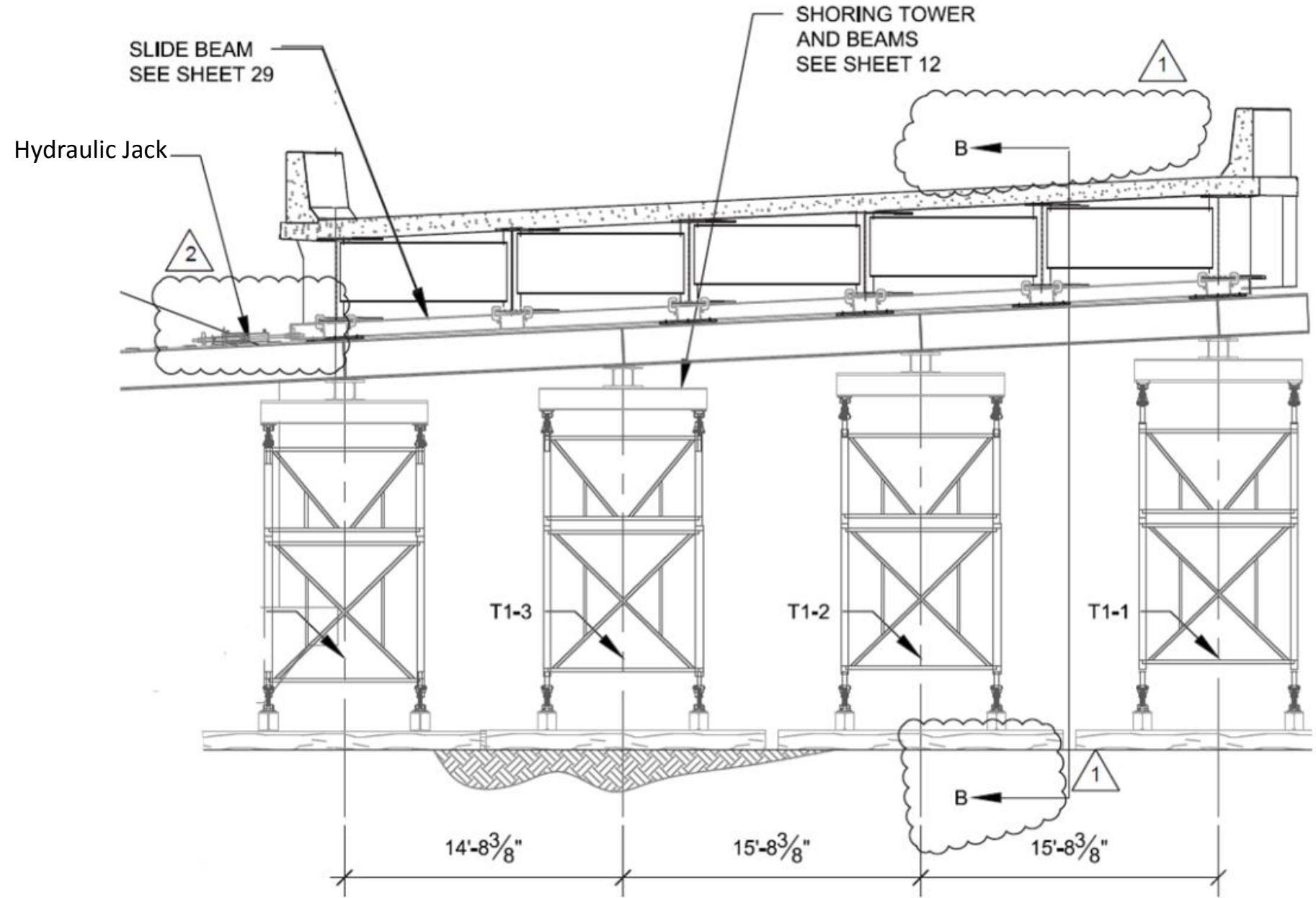
Temporary Supports



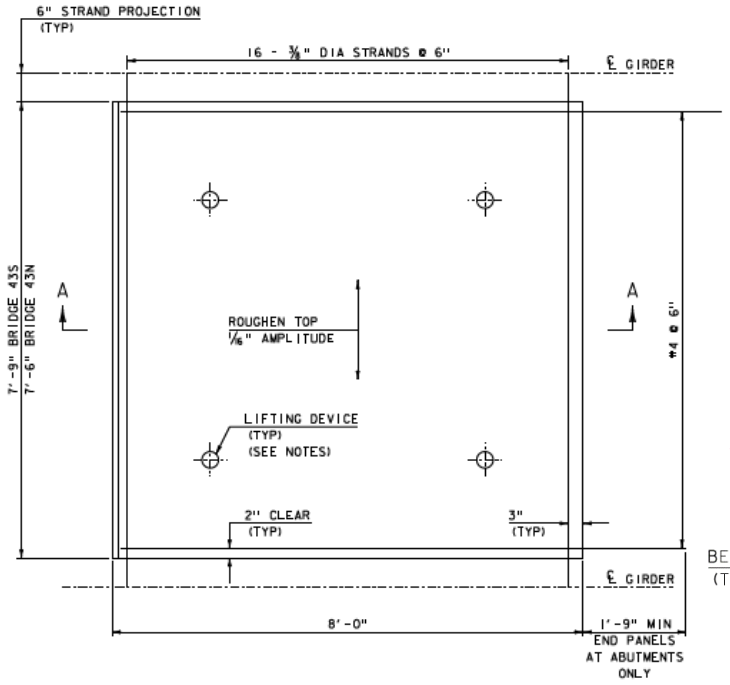
Temporary Supports

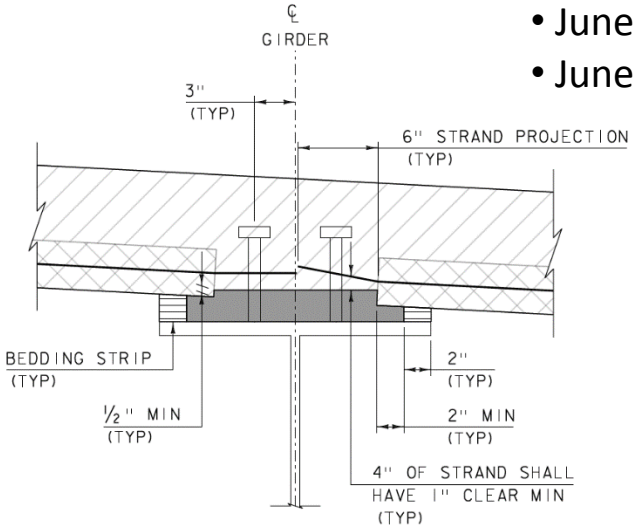
- Contractor designed and detailed
- Founded on large crane mats
- Coordinated with abutment construction
- May 4 - June 5

Structural Steel

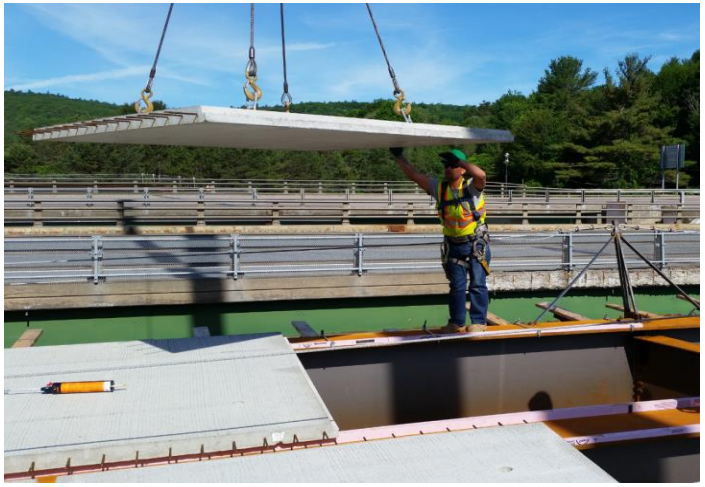
- Bridge 43N Hybrid section
  - Grade 70W bottom flange
- All steel erected at night
- June 8/9 Northbound bridge
- June 15 Southbound Bridge

Pre-stressed Concrete Deck Panels



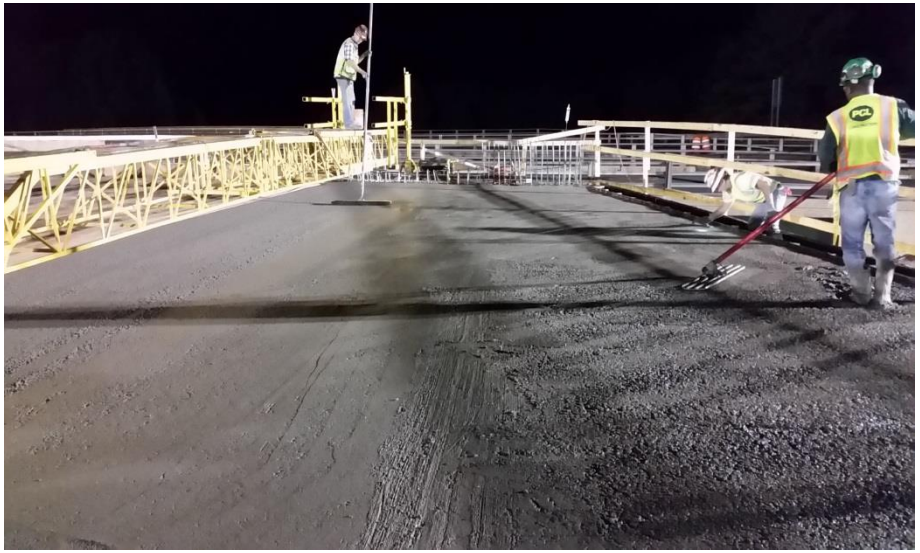


- 75 Panels per bridge = 150 Panels
- 3.5” x 8’-0” x 7’-6” and 7’-9”
- Class AA concrete at haunches
- June 15 – June 26 set panels
- June 26 – July 2 CIP haunches

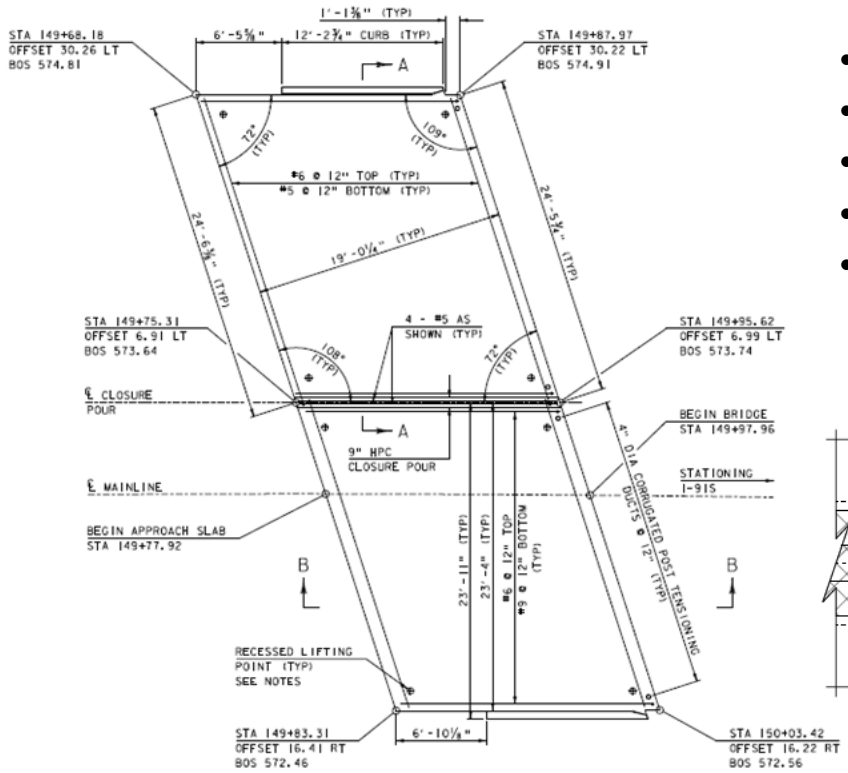


Deck Pours

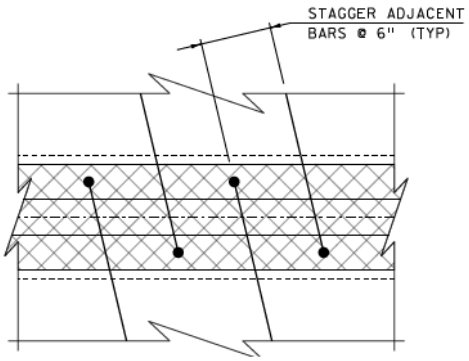
- 4000 psi Class A (HPC)
- 182 CY Northbound Bridge
- 197 CY Southbound Bridge
- Deck pours completed at night
- July 16 Northbound Bridge
- July 29 Southbound bridge

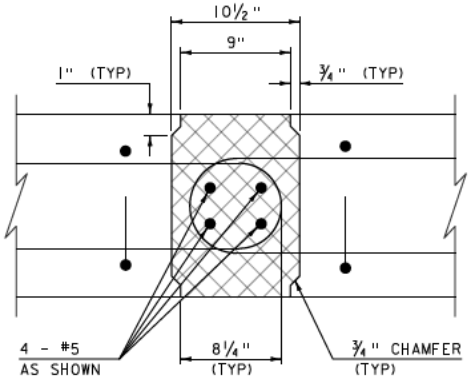


Approach Slabs



- Contractor self performed pre-casting
- Required fabrication drawings and QC plan
- 8 sections (2 per approach slab) cast in the median
- Mud slabs used for level rigid casting surface
- Approach slabs to be set in place during closure

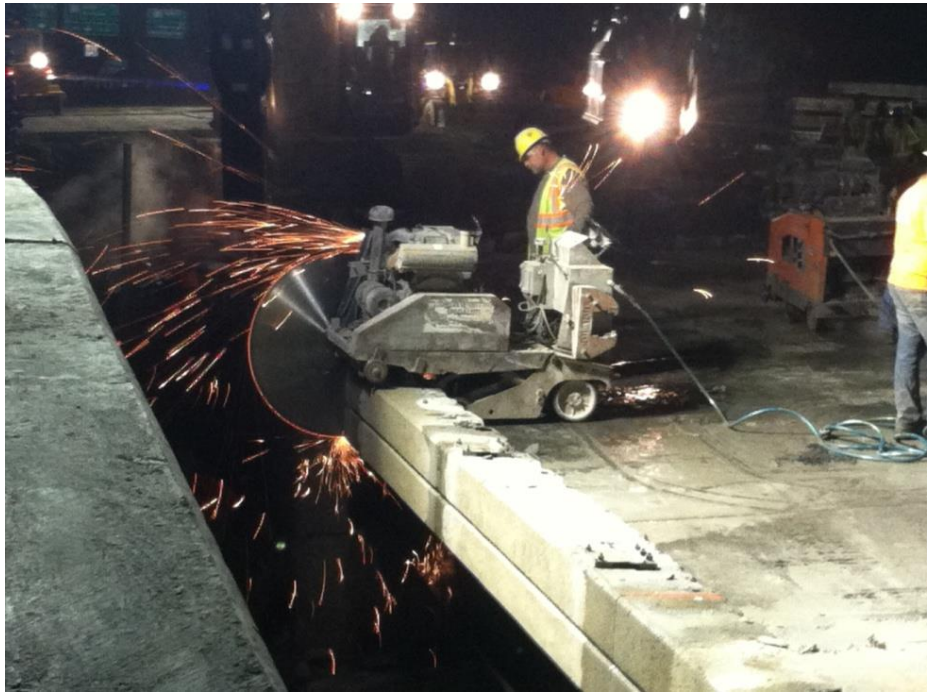





Bridge Closures
August 28-31 (NB)
September 19-22 (SB)

Demolition

- Riskiest operation of the project
- Allowed partial demolition prior to the closure
- Cut and remove several sections
- Hoe Ramming center sections only
- 90 workers on site for demolition
- NB Demo took 21 hours
- SB Demo took 18 hours



Demolition

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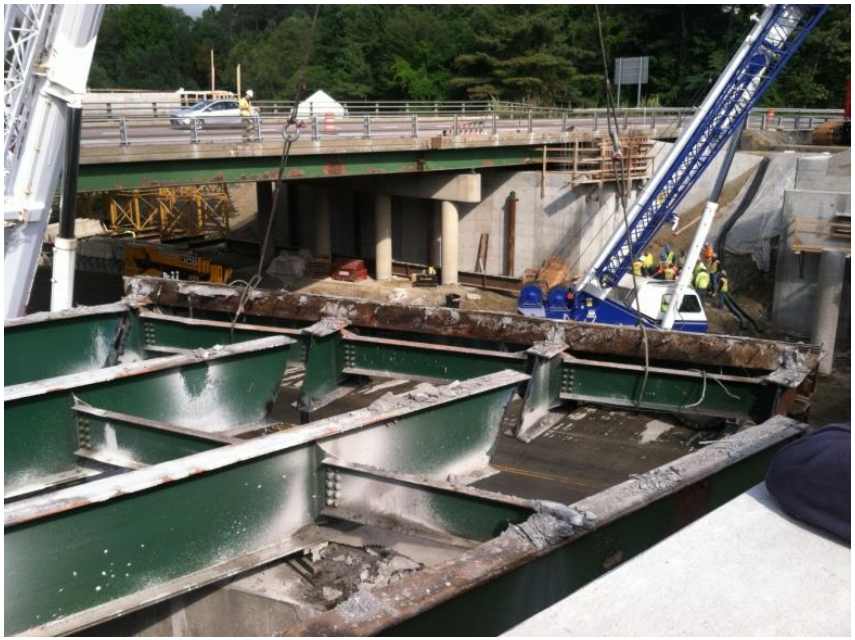
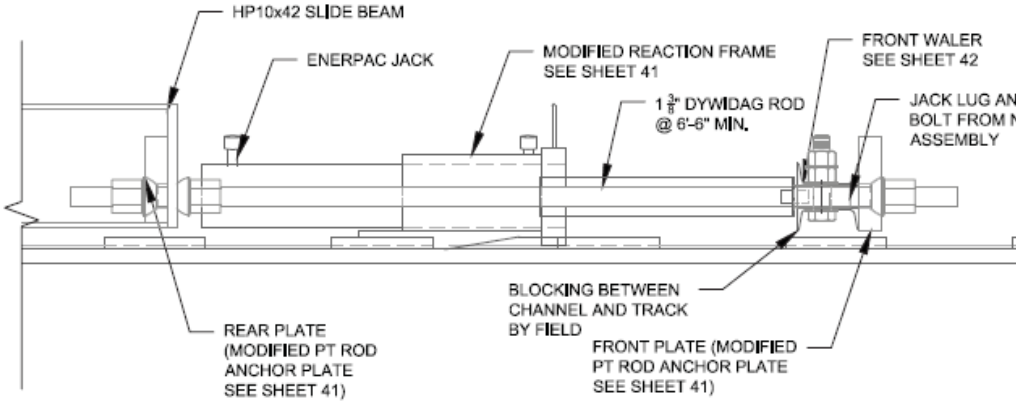
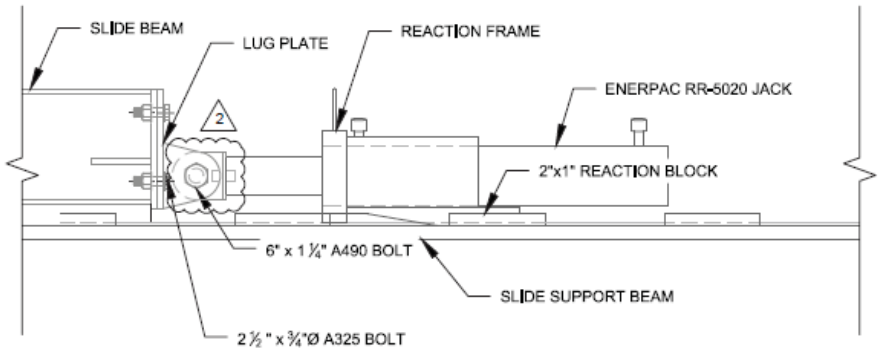


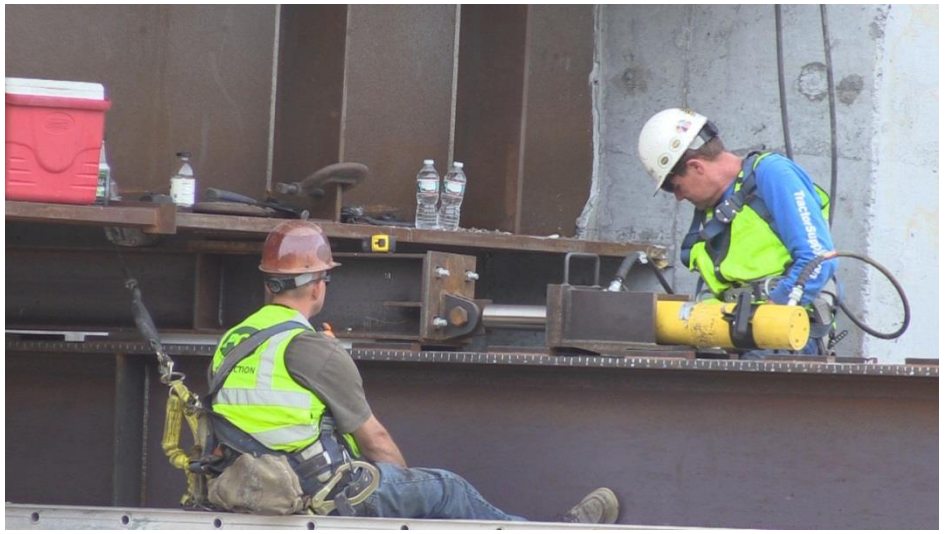
Horizontal Slide



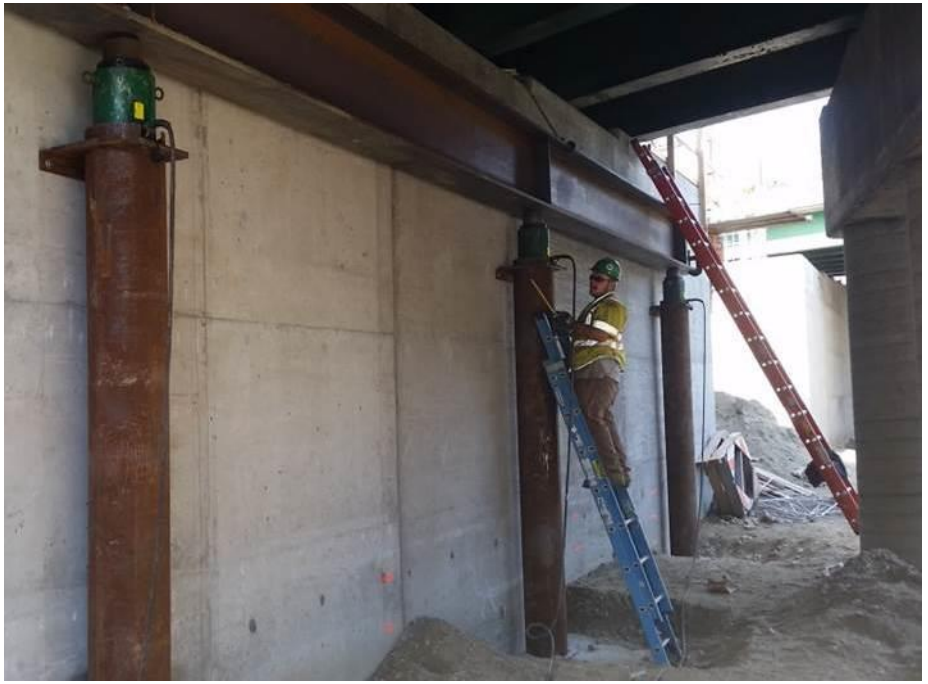
Southbound Slide System
(Bridge pulled)



Northbound Slide System
(Bridge Pushed)



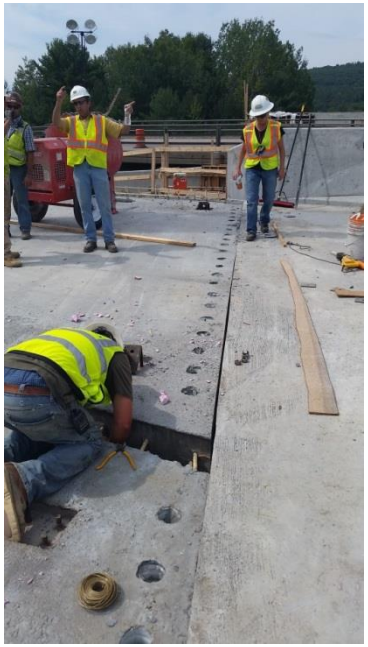
Horizontal Slide



- PTFE Pad on steel
- 409 cleaner used
- NB Slide 5 hours
- SB Slide 3.5 hours

Approach Slabs

- 2 sections set by crane
- Design Strength of 5000 psi required
- 4000 psi required prior to loading the approach slabs
- Rapid Set Concrete at bridge and Longitudinal joint
- Achieved 4000 psi in 1.5 hours NB and 3 hours SB
- NB approach slab set in 12 hours
- SB approach slab set in 10 hours



Time Lapse Video

Hartford Time Lapse.mp4

Keys to Success

- CM/GC is a great tool for trying new innovations, such as SIBC
- Procure the ICE early
- Communicate expectations externally (Public)
- Communicate expectations internally (Contractor & State)
- Deliberate selection of project personnel
- Continuity of Owner & Contractor PMs

More Keys to Success

Accelerated Bridge Program
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- Assemble strong team of subcontractors
- Project Team committed to aggressive schedules
- ABC Professional Engineer responsible for demolition sequencing and stability onsite during demolition
- ABC Professional Engineer responsible for bridge slide design and performance onsite for inspections, trial slide, and closure slides

Questions???

Accelerated Bridge Program
VTRANS

Hartford Project Website:
http://www.i91wrj.vtransprojects.vermont.gov