T.H.E. Conference 2016

Implementing ABC on Bridge Replacement and Rehabilitation Projects

Bala Sivakumar

HNTB

Outline

- Introduction to ABC
- ABC Technologies & Methods
- Implementing Prefab Systems
- Implementing Bridge Moves
- ABC Replacement Projects
- ABC Rehab Projects

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What is ABC?

What is ABC?

Accelerated Bridge Construction (ABC)

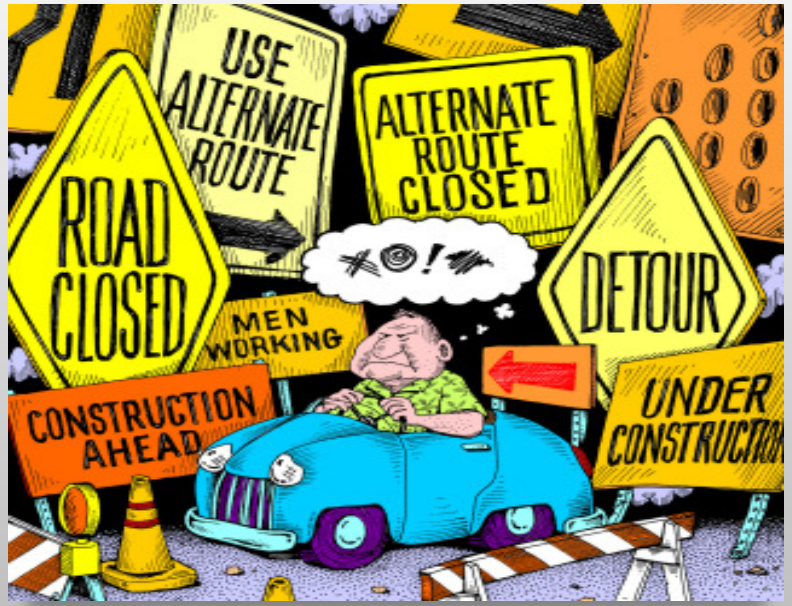
ABC is bridge construction that uses innovative methods to reduce **mobility impacts** when replacing/rehabilitating existing bridges.

ABC is a platform for innovation

Reasons for ABC?

Reasons for considering ABC include:

- Heavily traveled route (high ADT)
- Long or non-existent detours
- Part-width construction is not a preferred option



Cast-in-place construction is a sequential process
ABC allows work to be done in parallel – reduce schedule

ABC Advantages

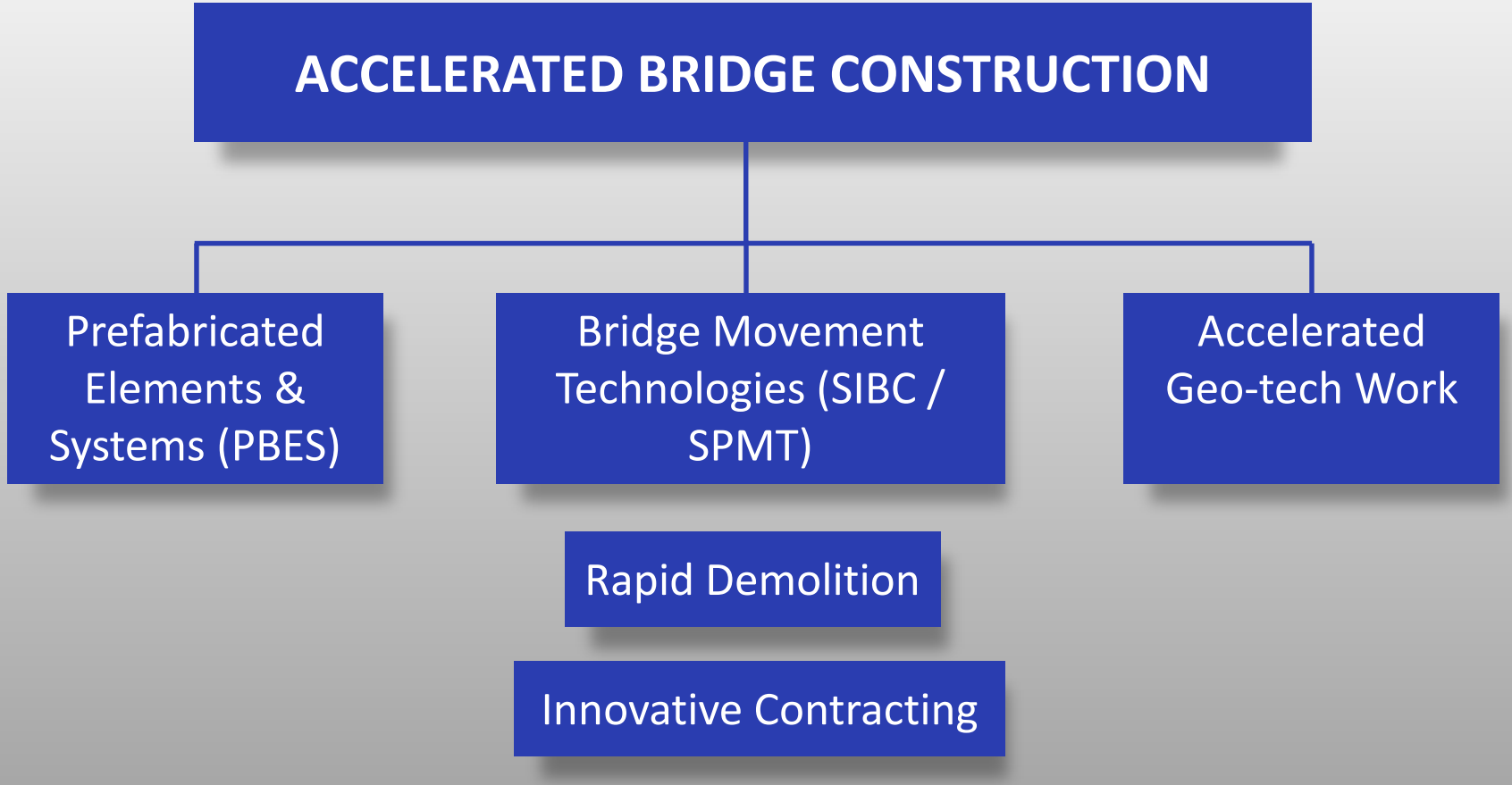
Reduces disruption to traffic

Safer; reduces exposure of workers and public

Better quality control due to prefabricated elements

Reduced environmental impacts

ABC Elements and Methods



Time Metrics for ABC – Mobility Impact Time

TRAFFIC IMPACTS WITHIN

Tier 1 **24 hours**

Tier 2 **3 days**

Tier 3 **2 weeks**

ABC – National Perspective

- 2200 + ABC projects to date (2014)
- 43 states have used ABC (2014)
- Several states have ABC programs for statewide implementation
- ABC candidates are selected using a screening process

ABC Technologies

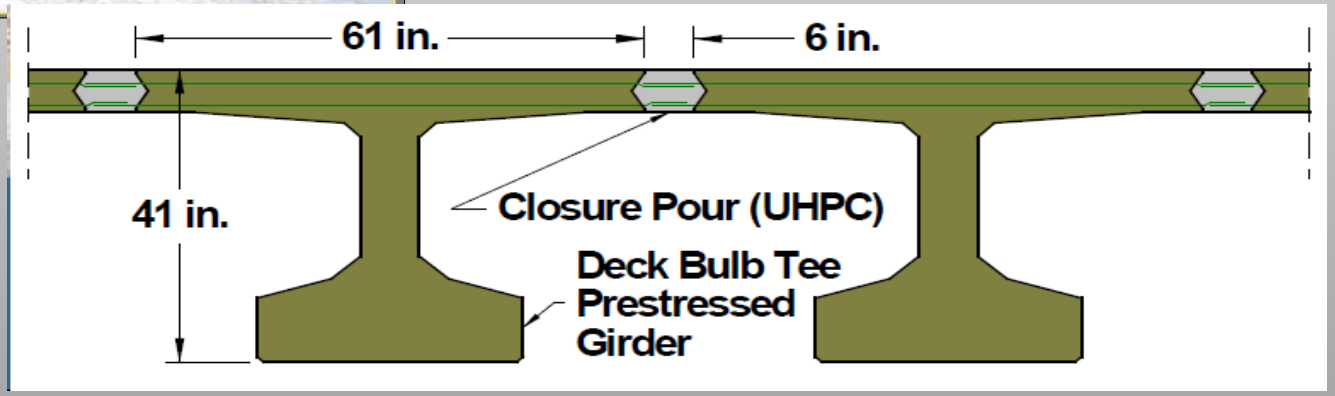
Full Depth Precast Deck Panels

Casting and curing decks is a slow process

MODULAR CONCRETE SUPERSTRUCTURE SYSTEMS

Pre-decked beams

- Concrete deck bulb tees
- Concrete Deck double tees



Prestressed Deck Bulb Tee — NY Route 31

MODULAR STEEL SUPERSTRUCTURE SYSTEMS

Prefabricated Abutment & Wingwalls

Bridge Movement Technologies

- Build the entire bridge superstructure and then move it into place in a few hours.
- Bridge movement technologies:
  - Slide-In Bridge Construction (SIBC)
  - Self-Propelled Modular Transporters (SPMT)
  - Float-In
  - Launching / Skidding

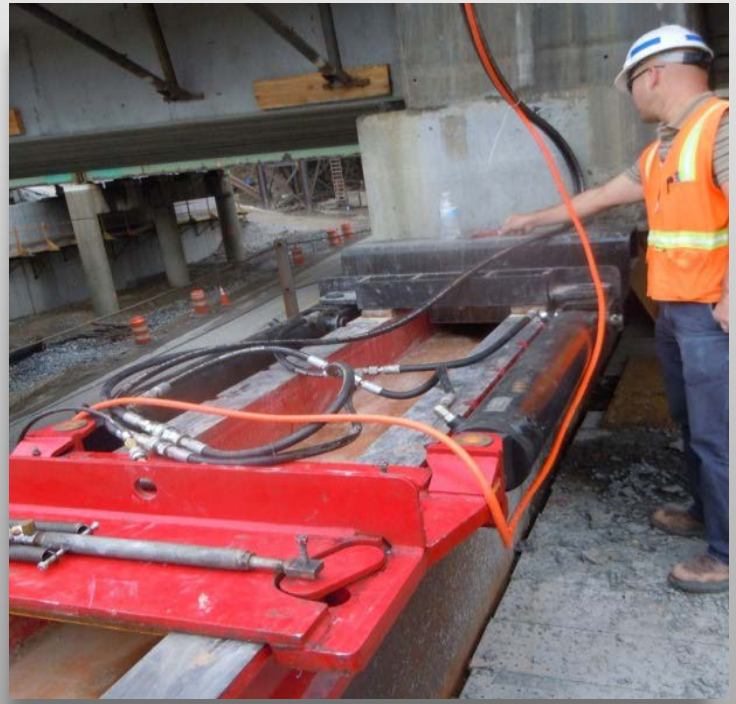
Roll-Out l Roll-In Hood Canal Bridge, WSDOT

Before During After

Roll-Out/Roll-In New York City Van Wyck Expressway

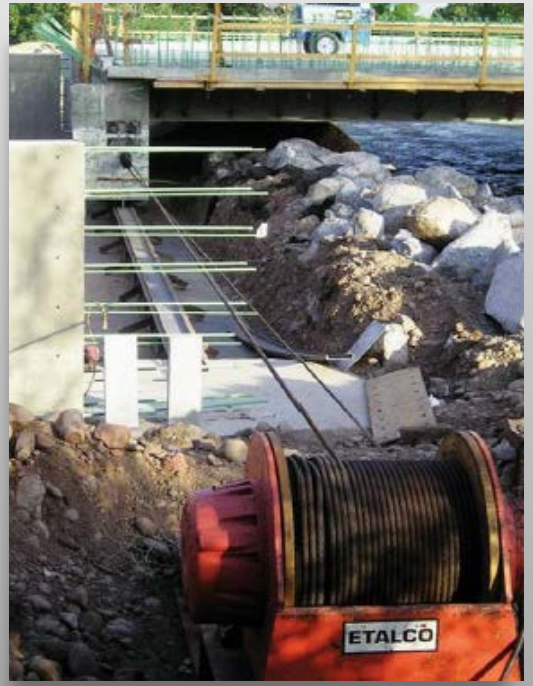
Bridge Slide Systems

Push/pull hydraulic jacks

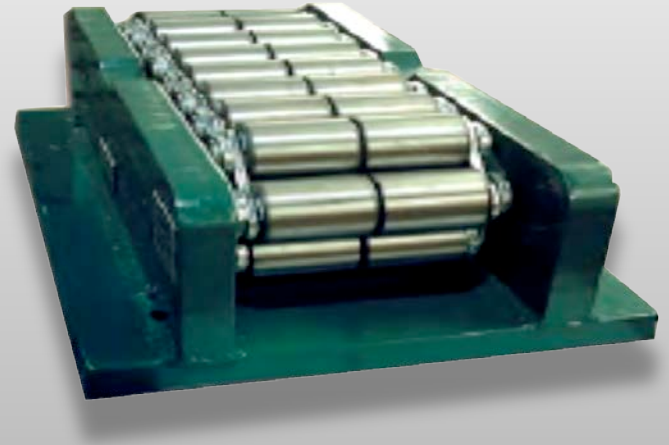


Pulling with

- **strand jacks**
- **power winch**

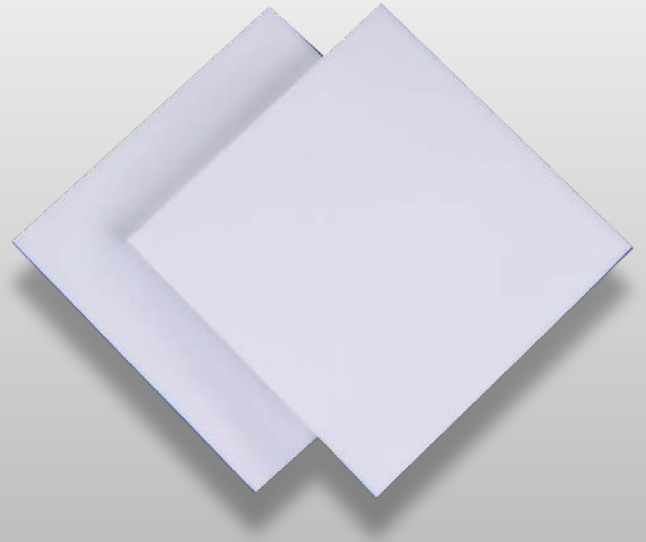


Slide Bearings



Roller Bearings

Coefficient of Friction: 5% of Vertical Load



Teflon-Coated Neoprene Bearing Pads

Coefficient of Friction: 10% of Vertical Load

Bridge Movement – Float-In

Self Propelled Modular Transporter (SPMT)

What is an SPMT?

- Multi-axle platform
- Each axle pivots 360 degrees
- Lifts, carries, sets large/heavy loads
- Each axle moves independently

Bridge Movement with SPMTs

ABC COSTS

MassDOT Study

- 2 similar parallel bridges: One conventional one ABC using PBES
- Conventional = $ 224 / SF
- ABC = $284 / SF
- 27% cost differential; These are NE prices

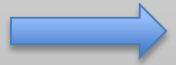
FIU Study

- FIU compared costs using 53 ABC projects in the FHWA ABC database with similar conventional projects
- ABC costs were 20% higher on average

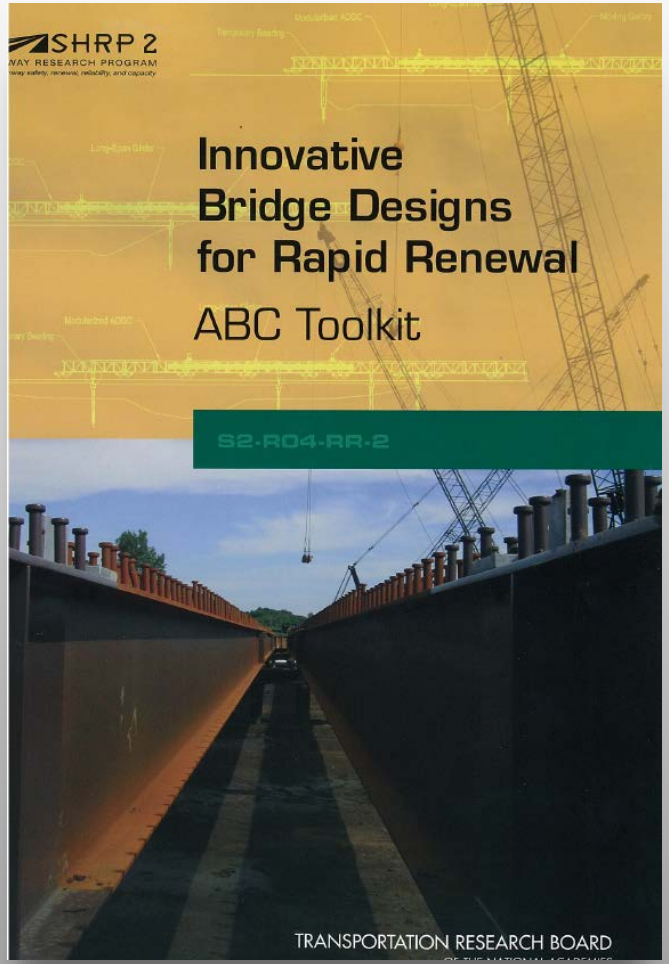
ABC DELIVERY

- Design-Bid-Build
- Design-Build
- Construction Manager / General Contractor

ABC Contracting

- Incentive / Disincentive  based on user delay costs
- A+B Bidding

ABC Resources SHRP2 ABC Toolkit



- Sample ABC plans
- Sample ABC design calcs.
- ABC Specs / Special provisions
- ABC erection concepts

Implementing PBES

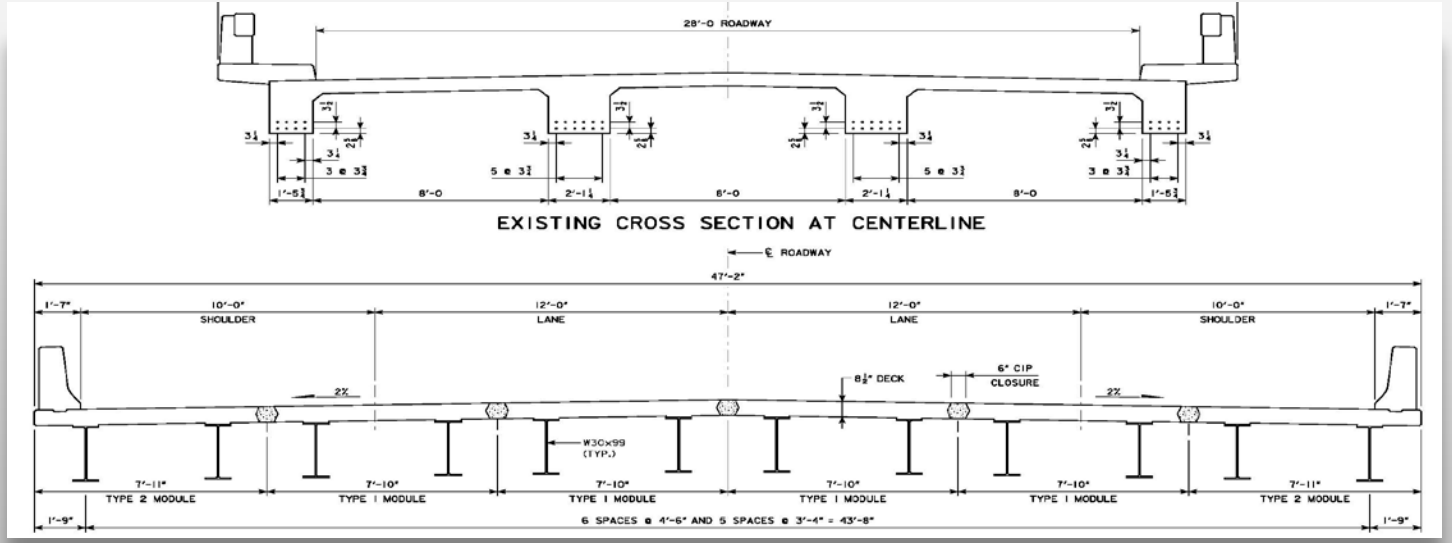
14 Day Bridge Replacement – Keg Creek Bridge, Council Bluffs, Iowa

- Total prefabricated bridge
- 3 Spans
- 14 day closure
- 14 day ABC period
- Opened November 1, 2011

Oct 17, 2011

Nov 1, 2011

Cross-Sections/Plan



Prefabrication Yard Adjacent to Bridge – Iowa Bridge Farm

Prefabrication of Abutments and Piers

52 K

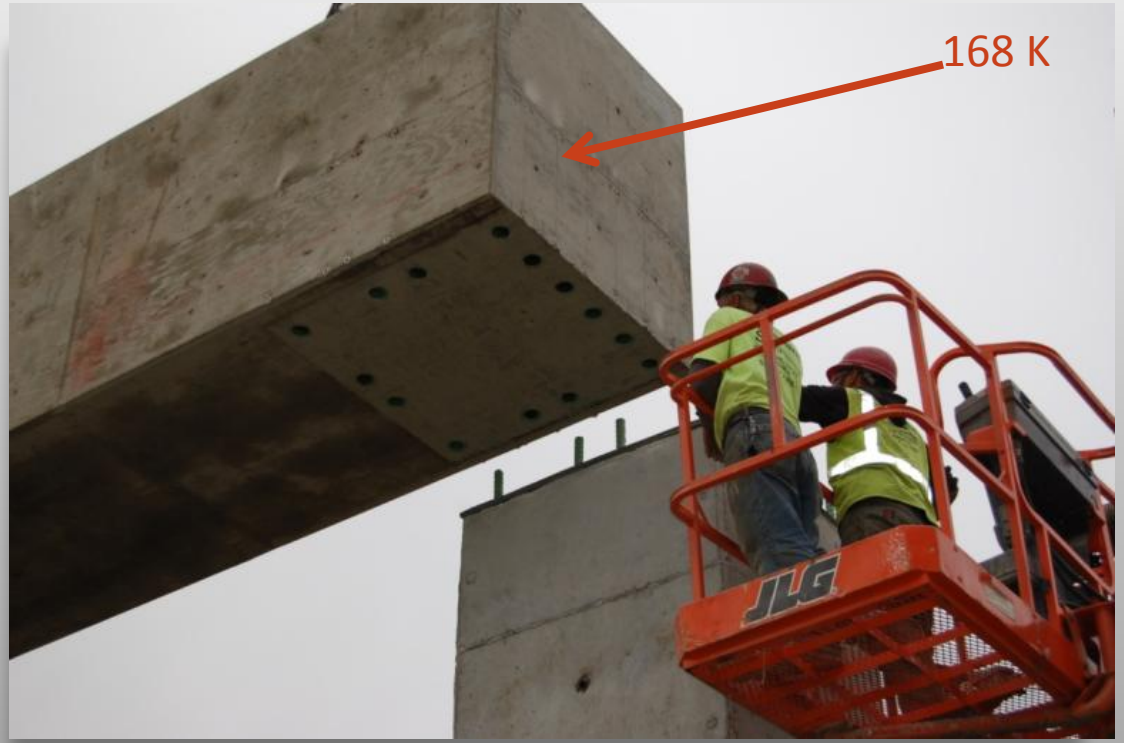
93 K

168 K

Precast Abutment Assembly – Days 3 and 4

Precast Pier Assembly – Day 5

- Pier caps: 168 kips
- Required two 110 ton cranes to lift into place



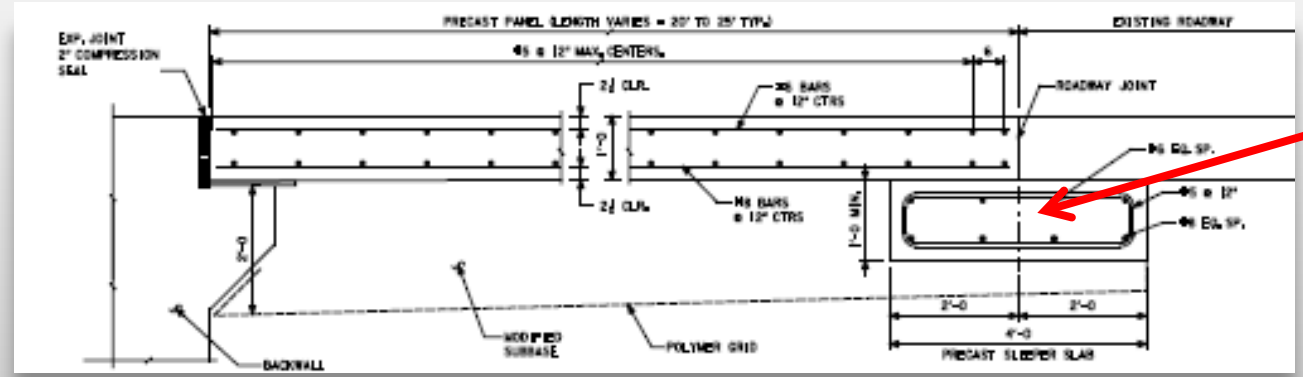
Erection of Superstructure Elements – Days 7 and 8

Erection of the Superstructure Elements – Days 7 and 8

Ultra High Performance Concrete Deck Closure Pours – Day 10

- Full moment transfer
- No post-tensioning required
- Only 6 in. wide; low-permeability
- 25,000 psi strength
- Steel fiber reinforcement

Precast Approach Slab — Day 10



Precast Sleeper Slab

Time Lapse – 14 Day Replacement

Implementing Slide-In Bridge Construction

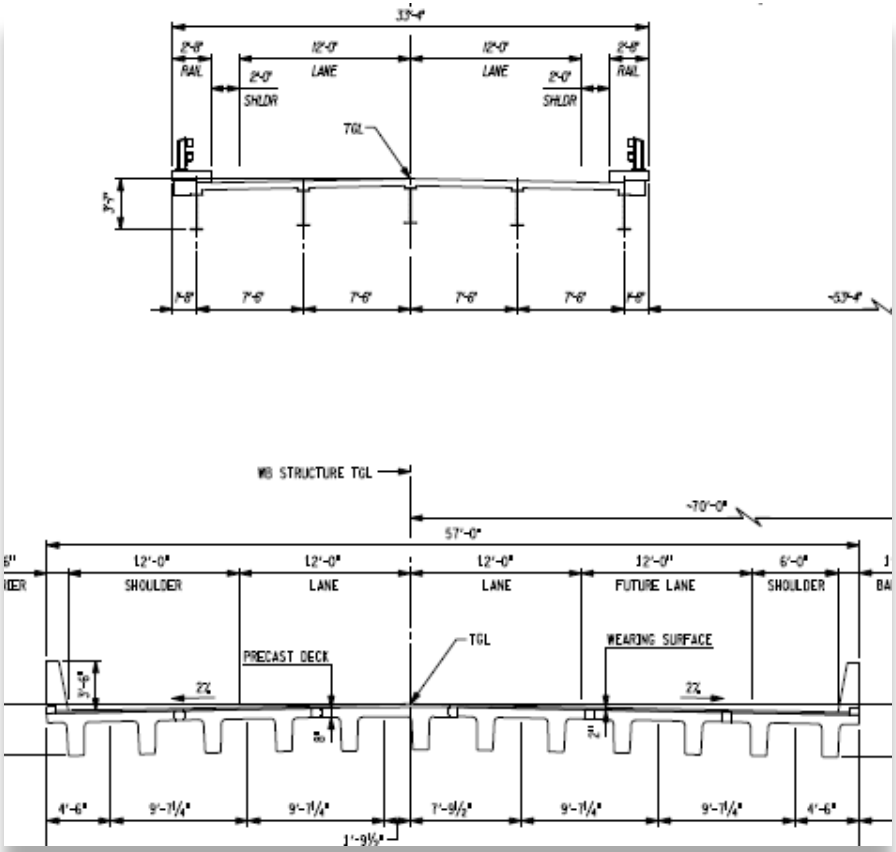
I-84 Bridges Slide-In Replacement — New York 2013

NY I-84 Bridges

- Over 75,000 ADT
- 16% trucks
- Existing bridges are too narrow for cross-overs
- 3 Span bridge replaced with single span
- One Saturday night closure per bridge

Superstructure Sections

- NEXT beams
- Precast approach slabs
- UHPC closure pour

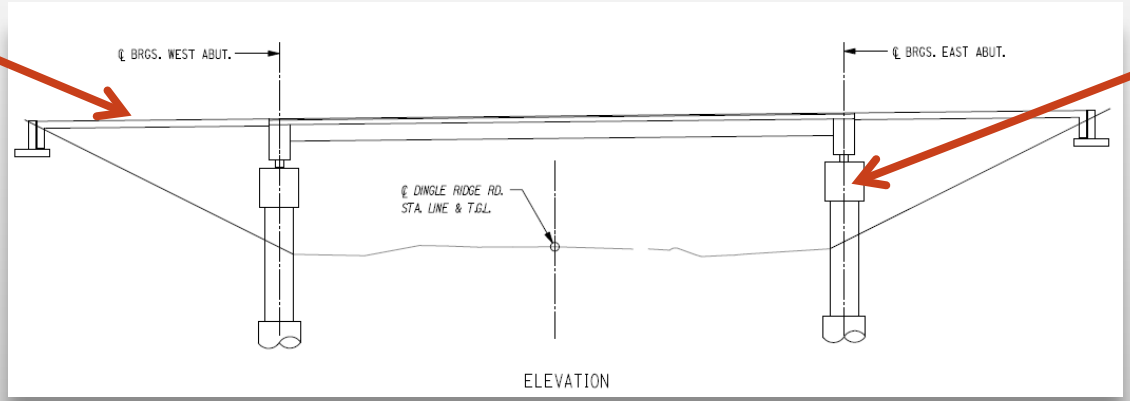


New Superstructures on Falsework

New Abutment Construction

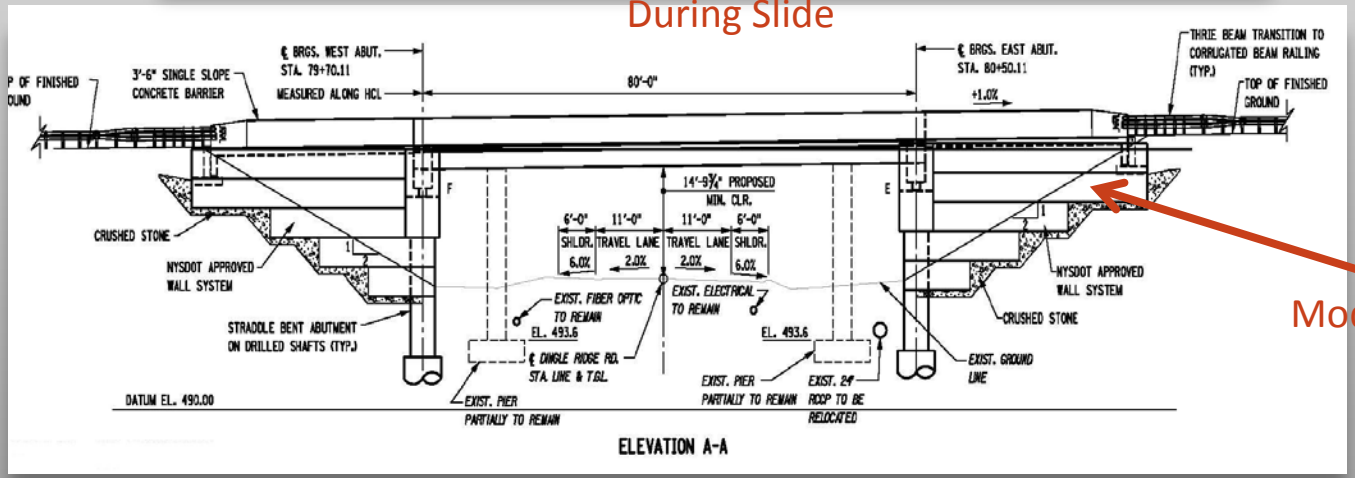
Slide-In Replacement Concept

Temporary end span



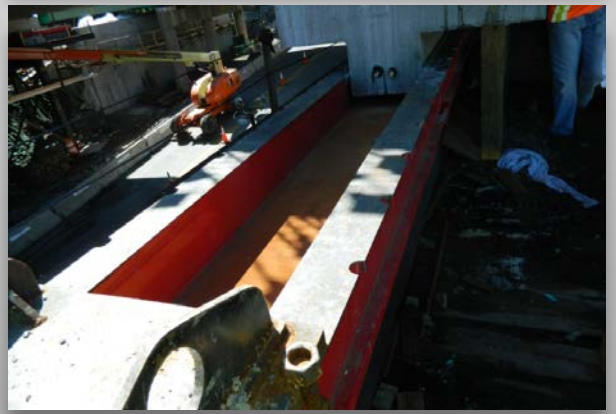
Slide Surface

During Slide



Modular walls

End Diaphragm and Slide Shoe



Bridge Slide – October 21, 2013

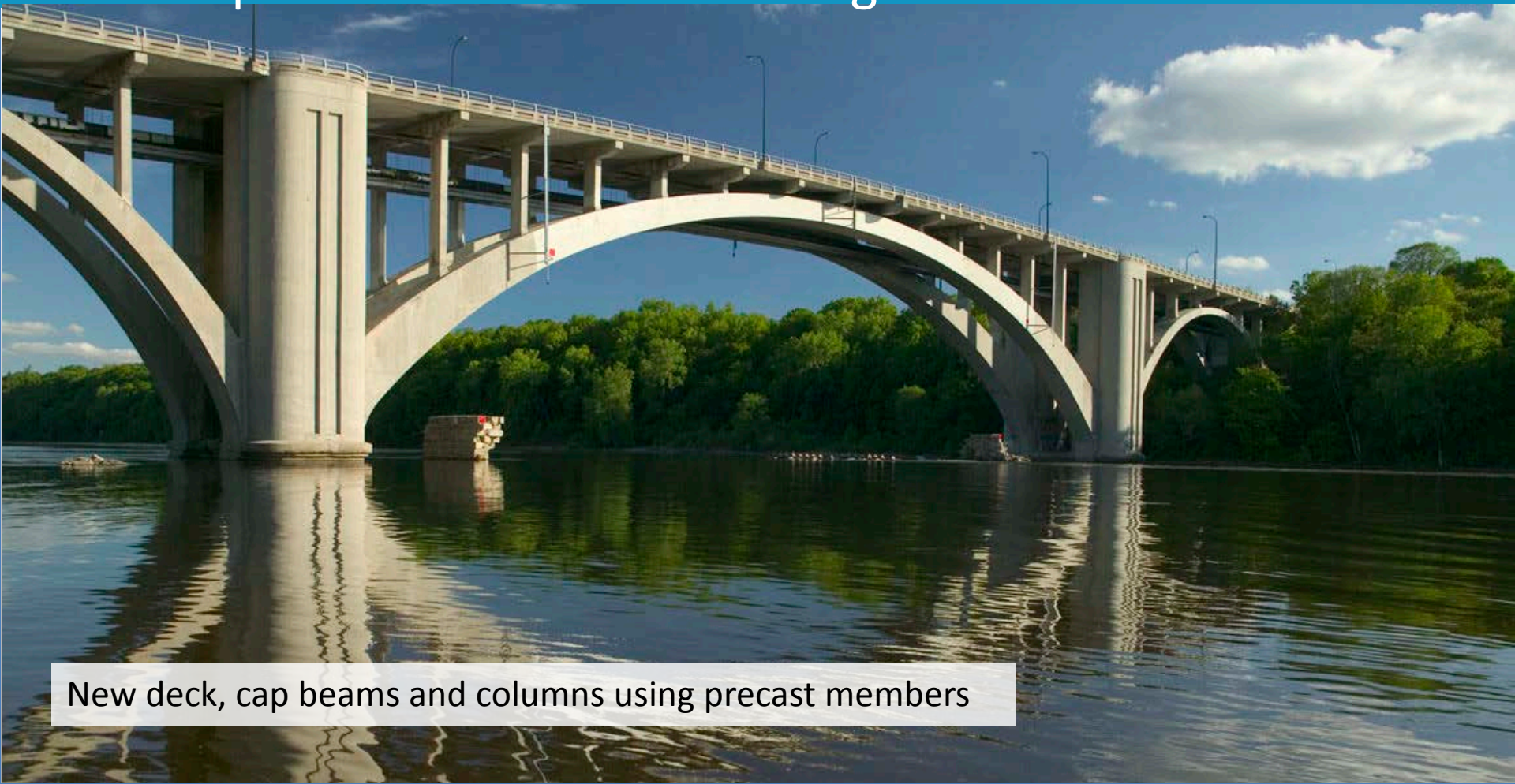
Both Bridge Slides Completed 10 Months After NTP

Time Lapse

ABC Rehab Projects

- PBES
- SPMT

Minneapolis Franklin Avenue Bridge Rehabilitation



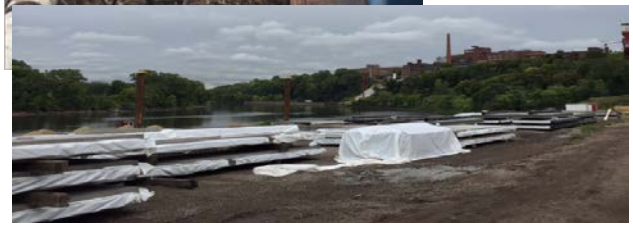
New deck, cap beams and columns using precast members

Minneapolis Franklin Avenue Bridge Rehabilitation

- Part-width construction is not cost-effective
- Cast-in-Place Construction: Requires full closure for two years
- ABC alternate: Full closure for 3 months
  - *Adjacent to Univ. of Minnesota campus*
  - *Closure can be timed to occur in summer months*
  - *On-site pre-casting by contractor*

On Site Pre-casting --- Franklin Ave. Bridge MN

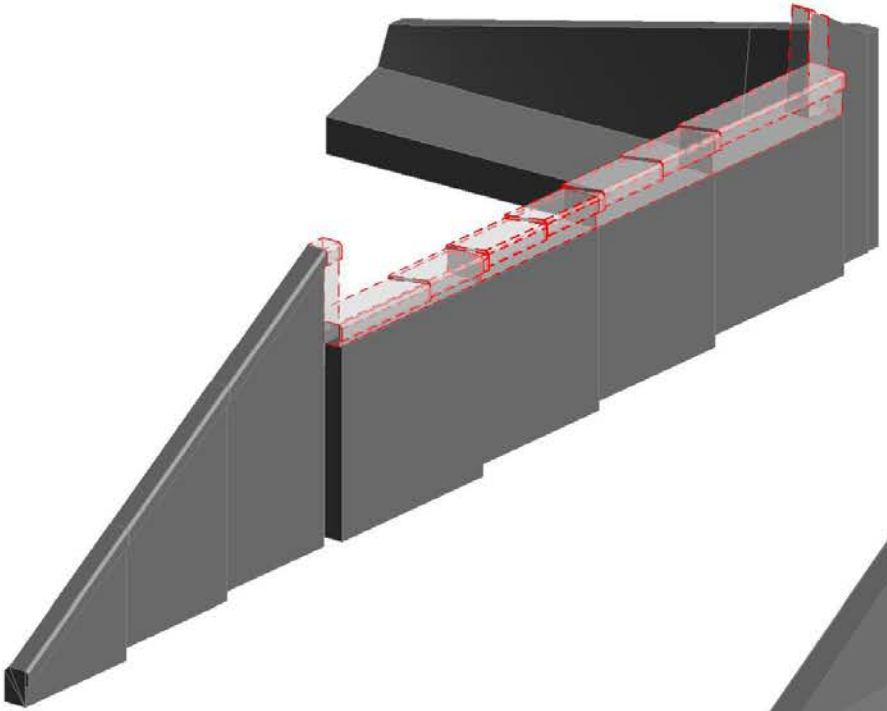
Steam Curing / Wet Curing of Slab Panels

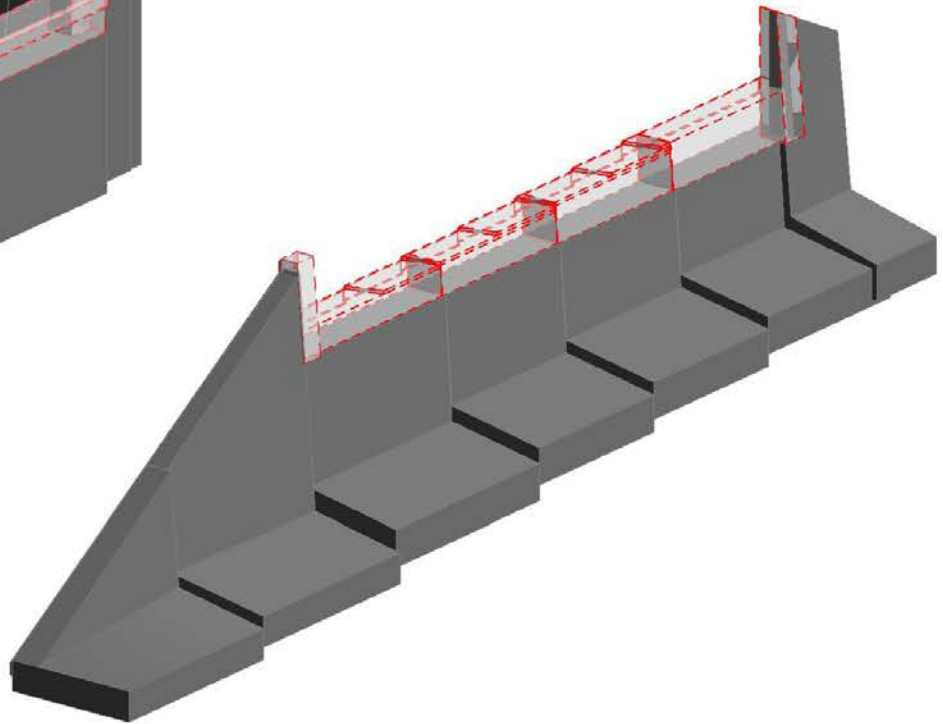


PennDOT State Route 30 Bridge – Weekend Replacement

- 54 Hour closure (Friday night – Monday Morning)
- Busy State Route (ADT 30,000) over local road in East Pittsburgh, PA
- Full superstructure and partial substructure replacement

Partial Demolition of Abutments / New Preacst Caps





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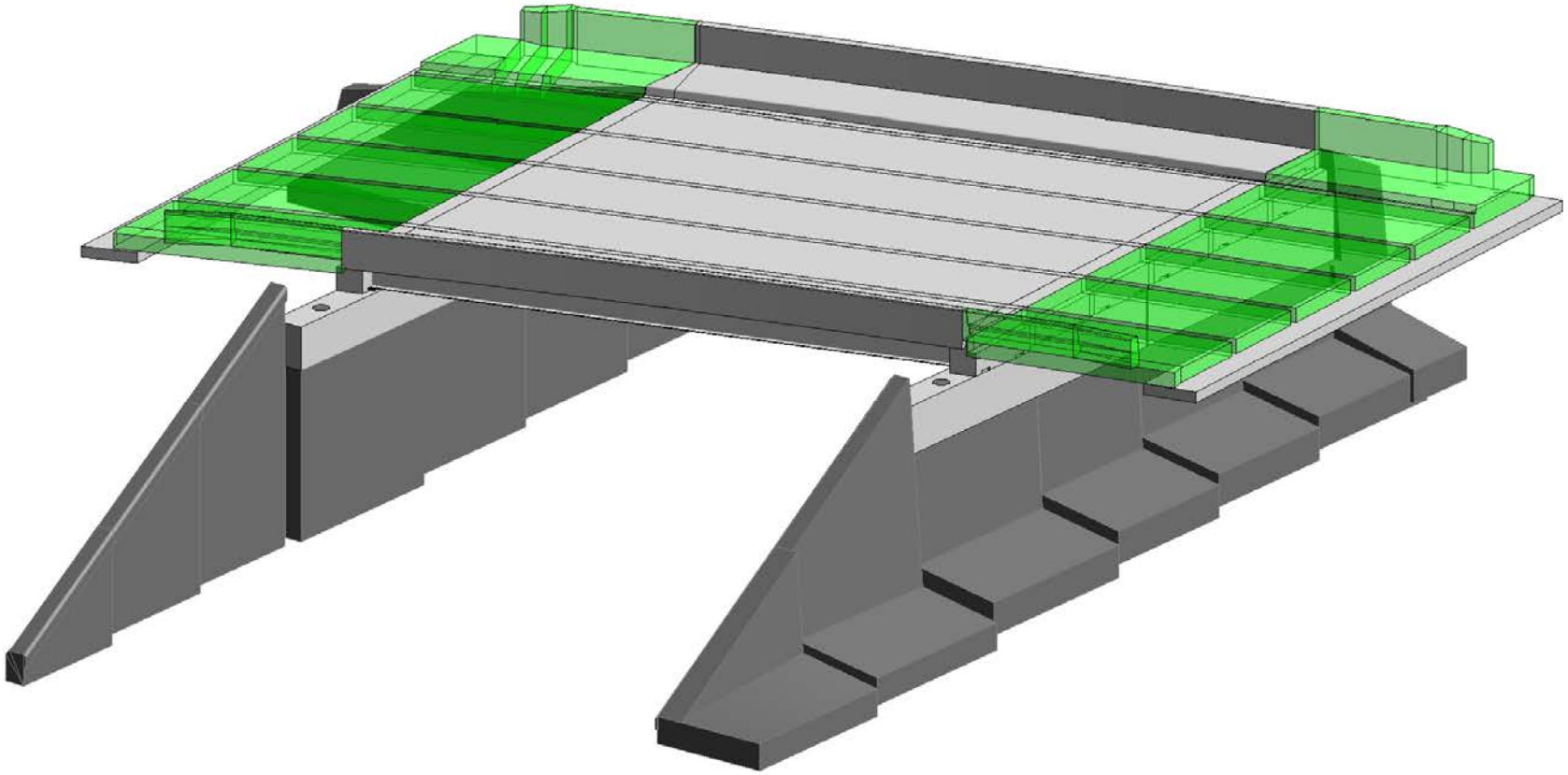
Steel Superstructure Modules -- Assembly

Bridge Model



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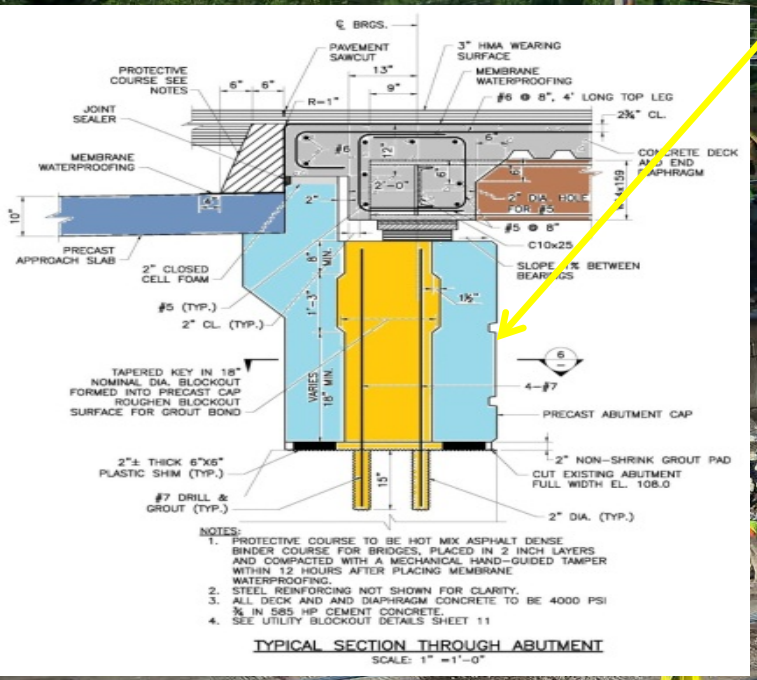
Weekend Superstructure Replacement Using SPMTs

Bridge Over Route 9 ; Massachusetts

Bridge Over Route 9; Site-Layout

Substructure Rehabilitation with Precast Caps



New Two-span Steel Superstructure on False-work

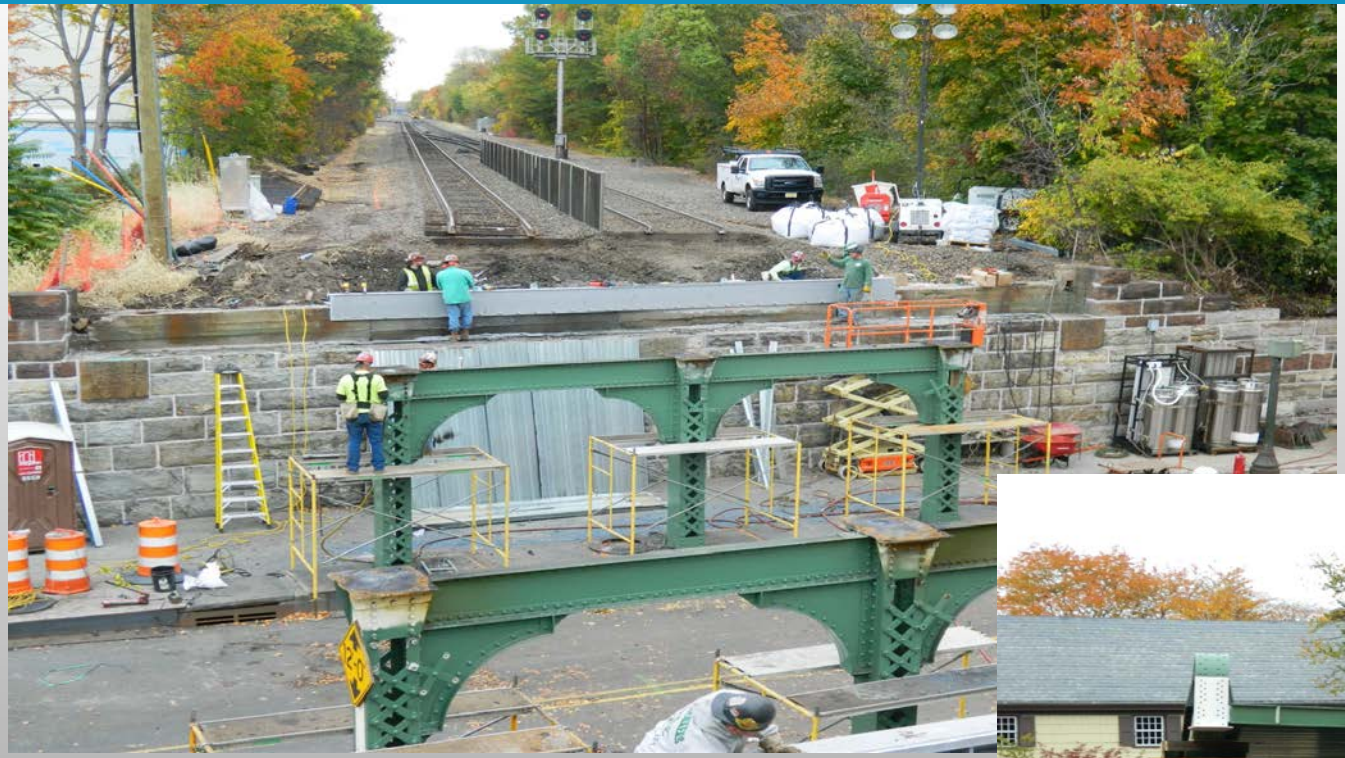
SPMT Move

New Superstructure on Rehabilitated Substructure

NJ Transit Bridge Replacement – Plainfield, NJ

- Weekend Superstructure Replacement with SPMT– October 2015
- Rehab Substructure

Substructure Rehab -- Saturday



New bridge assembled in station parking lot

Bridge Move – Saturday Night

Track Work -Sunday

Thank You

Questions ?