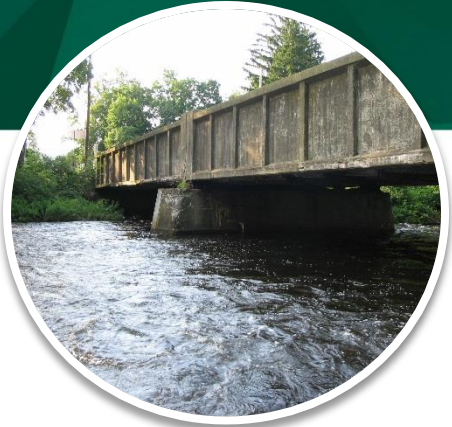


# Ten Days in August: An Accelerated Bridge Reconstruction

## Route 46 over Musconetcong River



**GPI** Greenman-Pedersen, Inc.  
Engineering and Construction Services

Speaker: Ryan J. Adams, P.E., S.E.

# Project Team

**Owner:** New Jersey Department of Transportation



**Designer:** Greenman-Pedersen, Inc.

# GPI

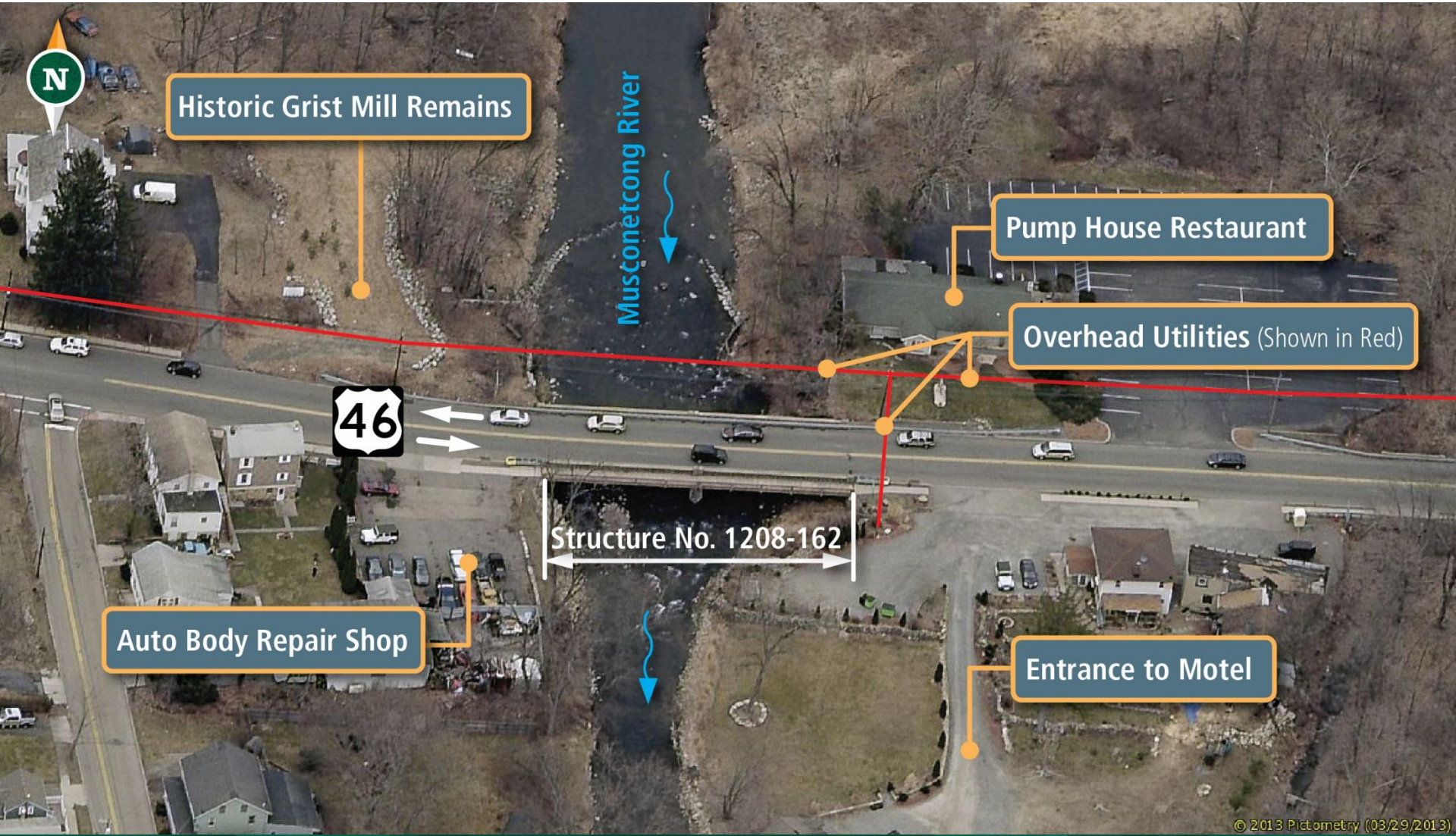
Greenman-Pedersen, Inc.

- Richard Grubb & Associates, Inc. – Cultural Resources
- So-Deep, Inc. – Subsurface Utility Investigation

**Contractor:** Creamer-Sanzari Joint Venture



# Introduction

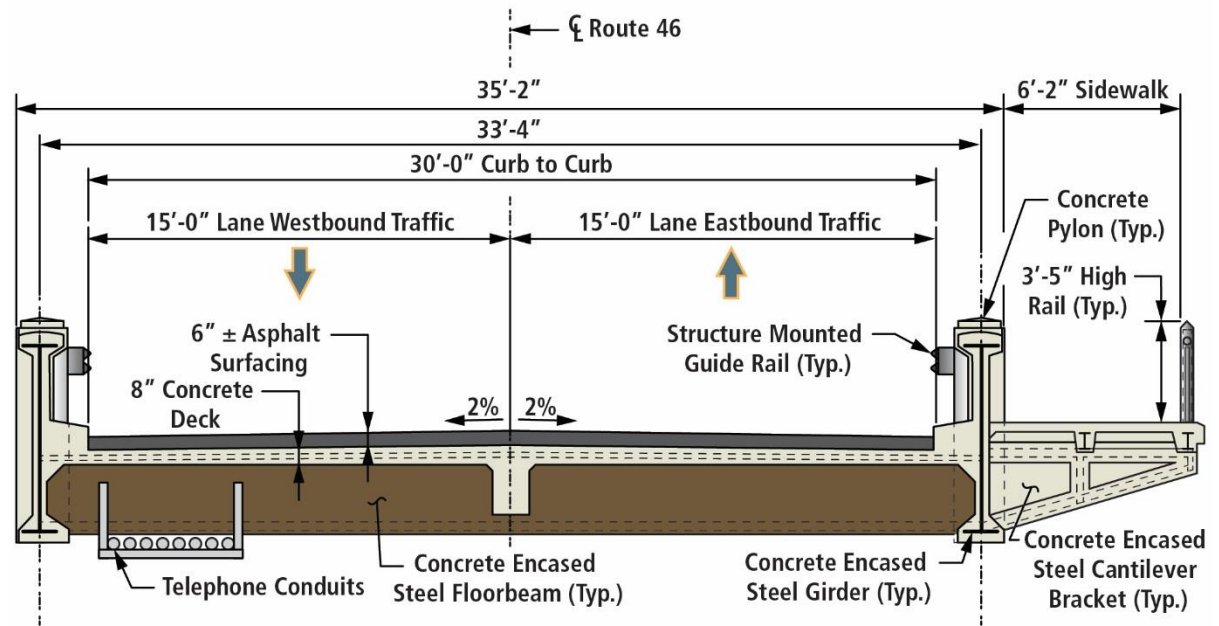


© 2013 Pictometry (03/29/2013)

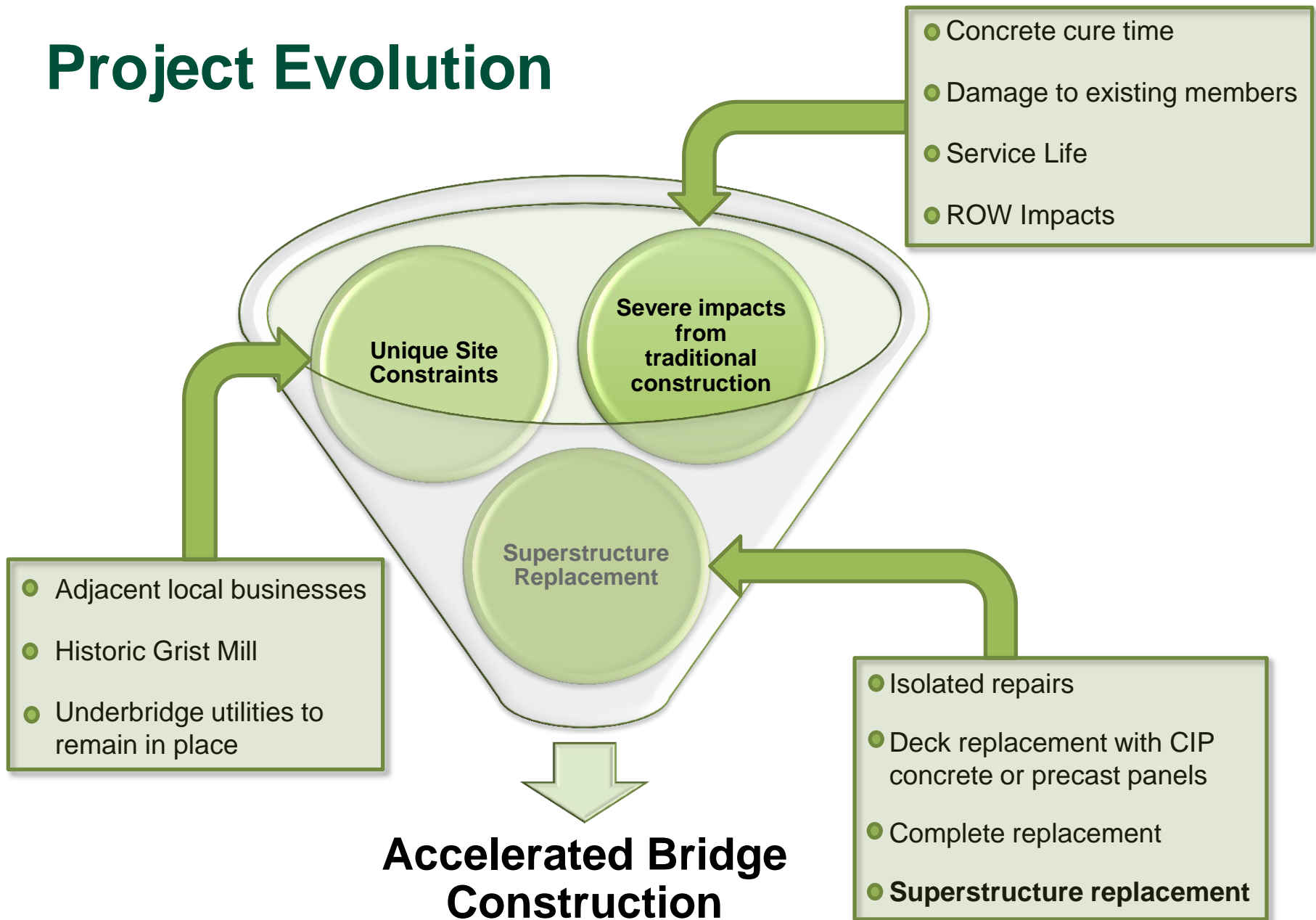


# Existing Structure

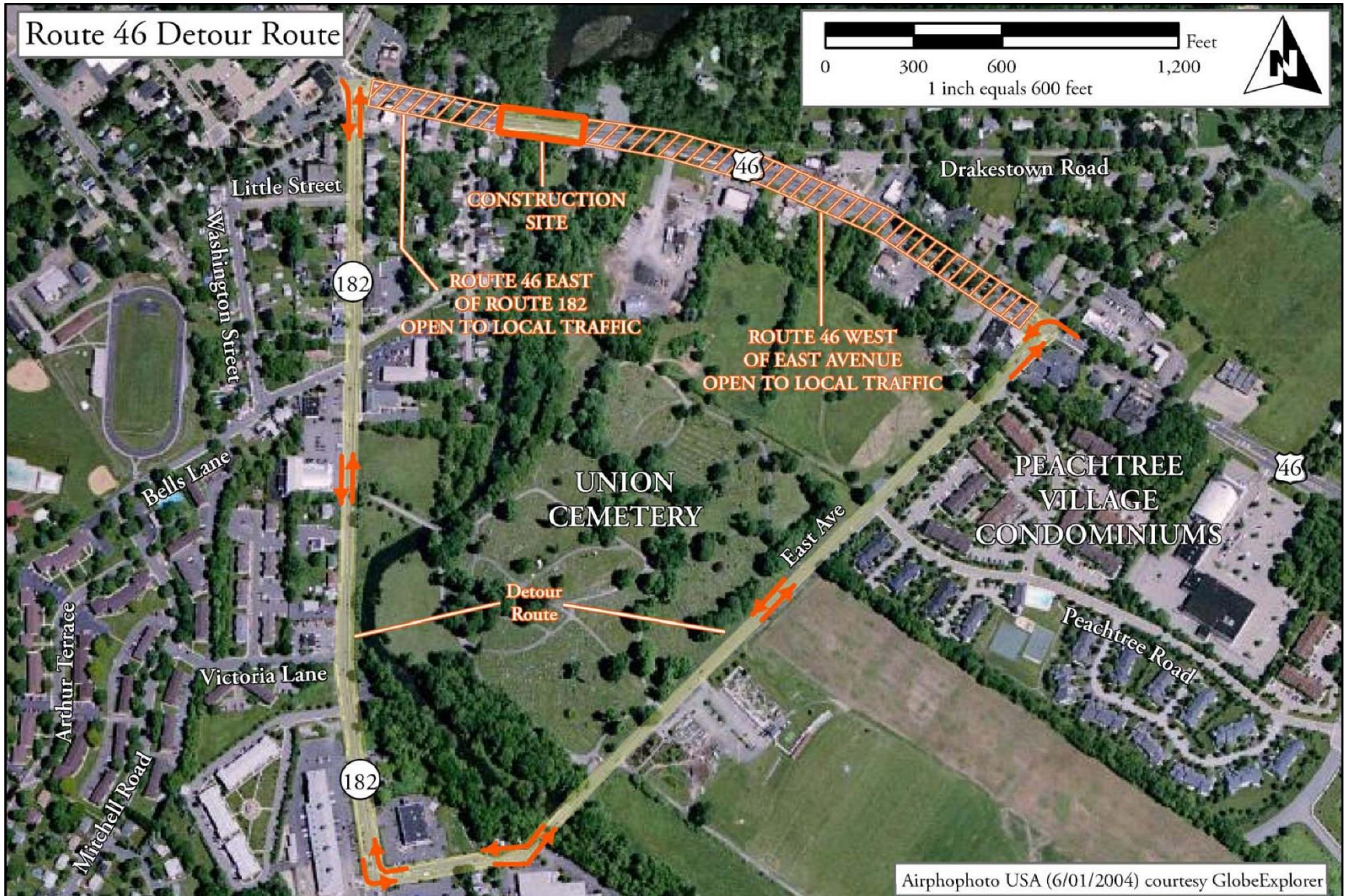
- Deck spalls, cracking, and contamination
- Superstructure encasement deterioration
- Section loss on exposed primary members
- Fracture critical
- Substructure seats heavily deteriorated



# Project Evolution

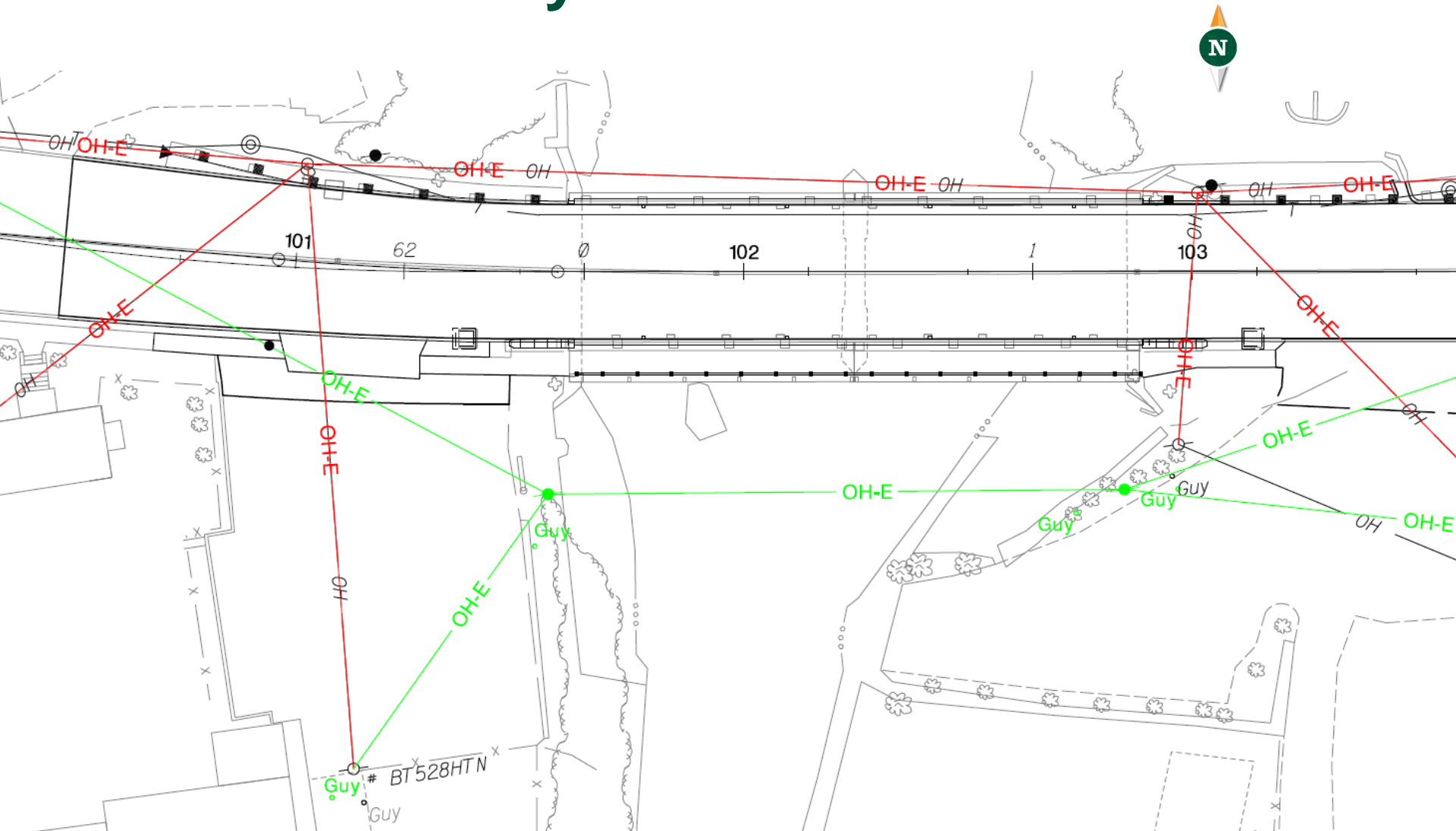


# Local Detour & Public Outreach





# Pre-Closure Work: Overhead Utility Relocation



# Pre-Closure Work: Temporary Shielding Installation



- Scaffolding system with plywood decking
- Met environmental permit restrictions (no work allowed in waterway)
- Easy access
- Integrated temporary utility support



# Pre-Closure Work: Pre-Assembly



- Critical for any project involving PBEs
- Separate fabricators required separate operations
- Following survey of precast substructure, set superstructure units based on actual pedestal heights
- Check for reinforcement conflicts in congested areas and camber differences
- Camber leveling was not needed due to identical strand pattern, similar cross-section, and rapid fabrication



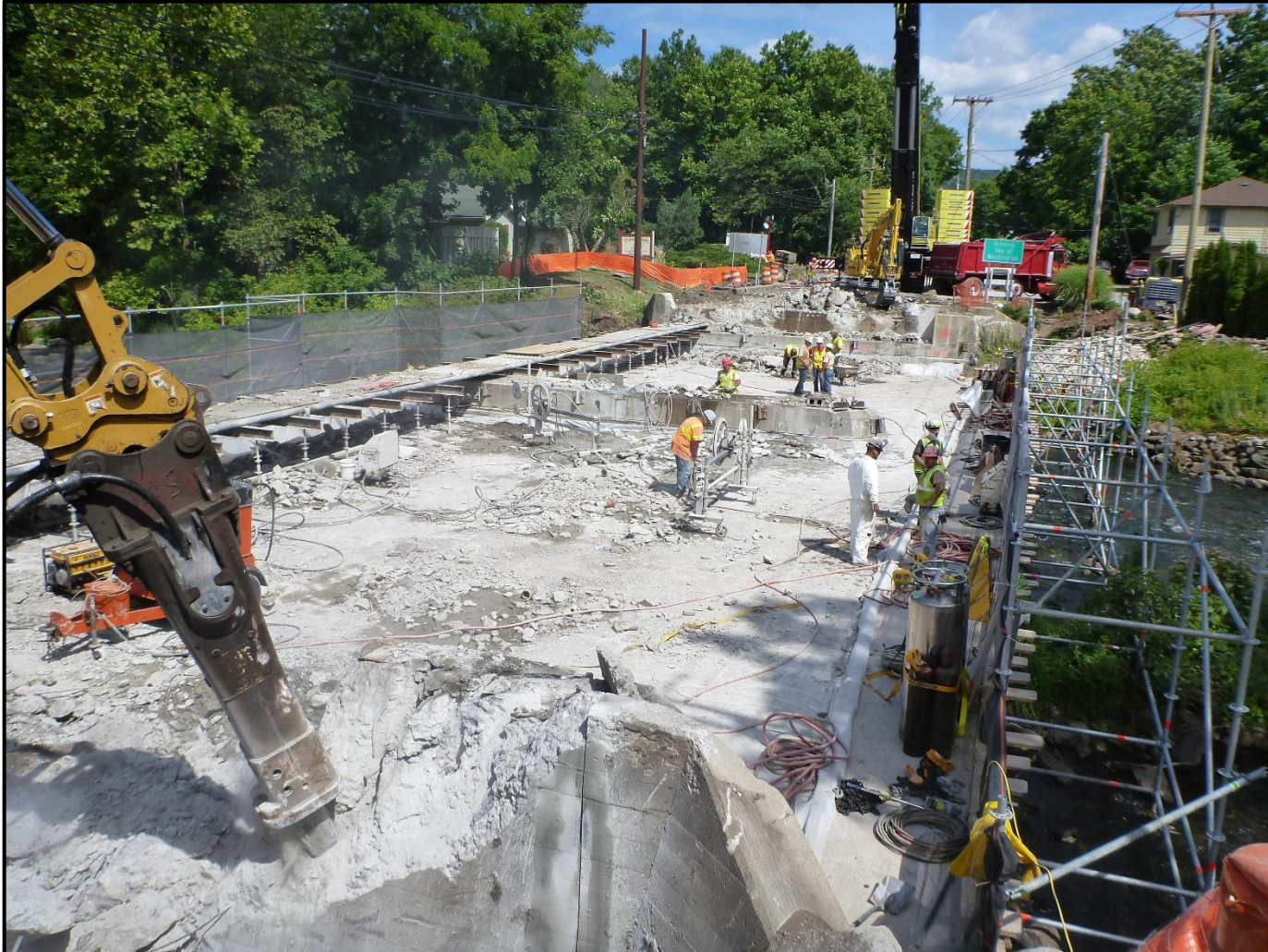
# Pre-Closure Work: Sidewalk Overhang Demolition



# Full Closure: Superstructure Demolition



# Full Closure: Substructure Demolition



# Full Closure: Substructure Demolition



# Full Closure: Substructure Demolition



# Full Closure: Substructure Demolition



# Full Closure: Substructure Demolition



# Full Closure: Substructure Demolition



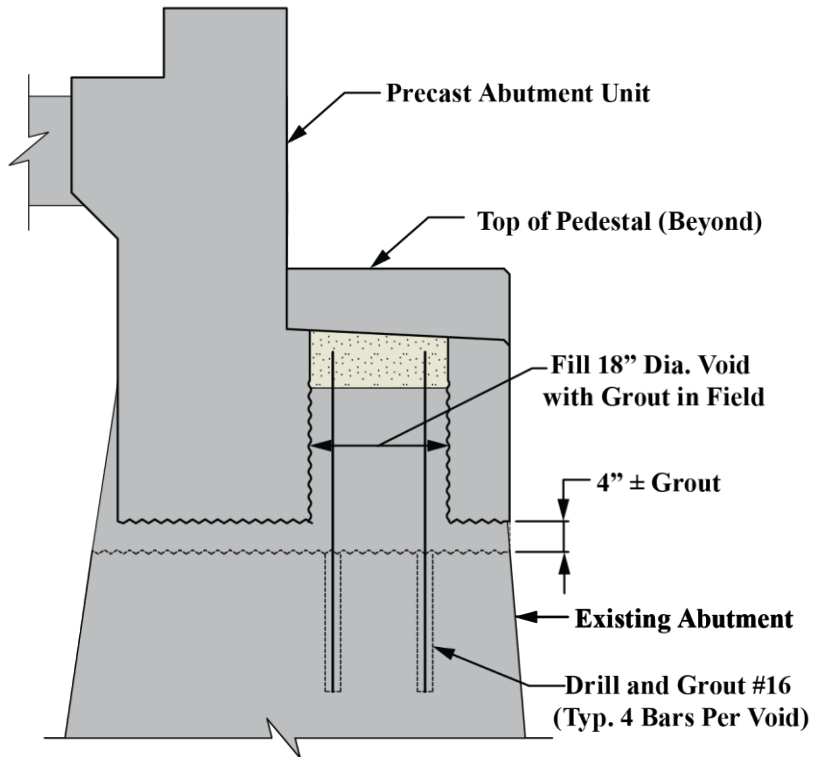
# Full Closure: Utility Relocation



# Full Closure: Substructure Unit Placement



# Full Closure: Substructure Unit Placement - Connection



# Full Closure: Grouting Substructure Units

Needed material to reach 3,000 psi in 6 hours!

## Epoxy Grout

Non-expansive

Superior resistance to  
chemical attack

Better bond to steel and  
concrete

Ultimate compressive strength  
12,000 psi – 15,000 psi

## Cementitious Grout

Coefficient of thermal  
expansion similar to concrete

Cheaper

Ultimate compressive strength  
5,000 psi – 7,000 psi



# Full Closure: Grouting Substructure Units



- Epoxy grout was only material that could meet high early strength requirement
- High-flow material (self-consolidating)
- Extended material with pea gravel in large voids to reduce heat generation
- Coefficient of thermal expansion approximately 3x that of concrete  
*(compared to 8x-10x for typical epoxy grouts)*

# Full Closure: Grout Pad Depth



- 4" depth was excessive (2" recommended)
- Pad was not properly cleaned before grouting operations
- Difficult to form

# Full Closure: Superstructure Placement



# Full Closure: Superstructure Placement



# Full Closure: Superstructure Placement



# Full Closure: Longitudinal Connection

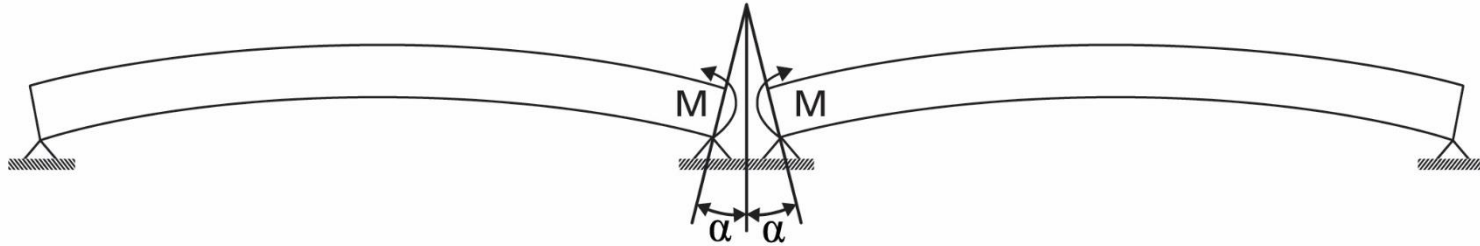


- UHPC is fluid – no deflection or form will leak!
- Exposed aggregate and pre-wet minimum 8 hours
- Support internally to eliminate insert voids
- Plastic wrap all forms
- Leak test or seal top of joint after cure



# Full Closure: Continuity Diaphragm

Due to the prestressing force, the beams will creep, causing the camber to increase. The rotation of the beam ends will be restrained by the continuity connection, generating fixed end moments (FEM):



The magnitude of the FEM is highly dependent on the age of the beams when continuity is established.

AASHTO recommends the contract documents require prestressed beams to be a minimum of 90 days old before continuity is established (~60% of creep is gone).

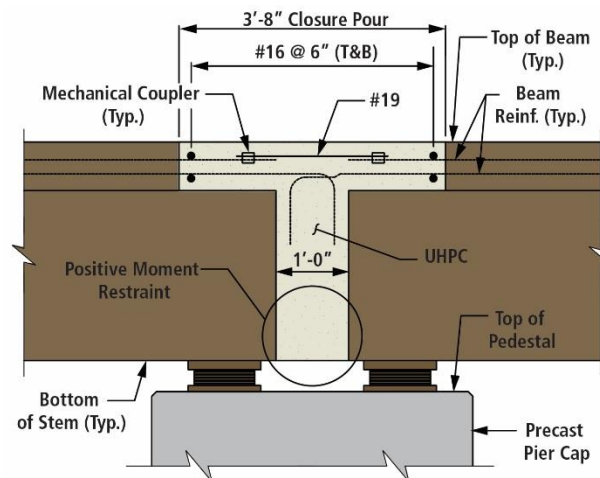
**Based on project schedule → only allowed 21 days!**



# Full Closure: Continuity Diaphragm

AASHTO allows 4 methods to design continuity connections:

1. Specify beams are at least 90 days old and design for  $1.2M_{cr}$ .
2. Design for  $1.2M_{cr}$  and use A5.4.2.3 with  $k_{td}=0.7$  to establish minimum age.
3. Consider bridge continuous if net stress at bottom of connection from SDL, settlement, creep, shrinkage, temperature gradient, and 50% LL is compressive.
4. Calculate the actual restraint moments and design for such.



# Full Closure: Continuity Diaphragm



# Full Closure: UHPC Pour – Equipment & Materials



# Full Closure: UHPC Pour – Joints



Pour #	Location	Duration	Quantity	Placement Rate
1	West Approach Slabs	1.0 hrs	1.5 CY	1.50 CY/hr
2	West Span Joints	2.0 hrs	2.5 CY	1.25 CY/hr
3	East Span Joints	2.0 hrs	2.5 CY	1.25 CY/hr
4	East Approach Slabs	1.0 hrs	1.5 CY	1.50 CY/hr
5	West Abutment Closure	2.0 hrs	4.0 CY	2.00 CY/hr
6	East Abutment Closure	2.0 hrs	4.0 CY	2.00 CY/hr
7	Pier Closure	3.5 hrs	7.5 CY	2.14 CY/hr

**13.5 hrs**    **23.5 CY**    → **1.70 CY/hr**



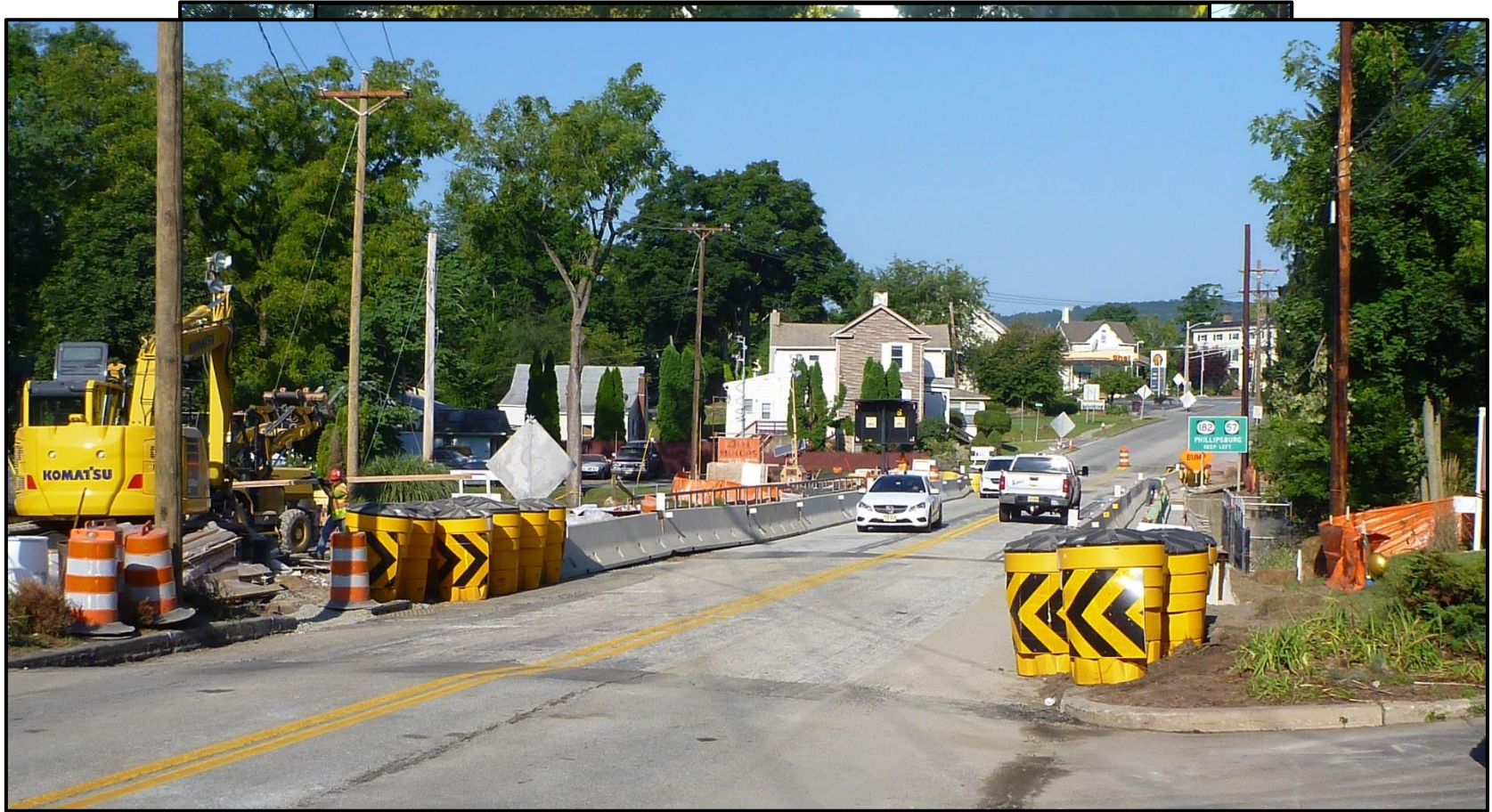
# Full Closure: UHPC Pour – Forming and Finishing



Strength necessary  
to load the bridge  
achieved after ~21  
hours from initial  
batch



# Full Closure: Final Touches



Install temporary concrete barrier and striping  
Load test  
Open to traffic  
Pave approaches



# Video:

## **Musconetcong River Bridge**

Route 46, Hackettstown, NJ

10-day Accelerated Bridge Construction

August 16-26, 2014



# Post Closure: CIP Barrier, Sidewalk, Railing



# Post Closure: Completion



# Community Feedback



**TOWN OF HACKETTSTOWN**  
MUNICIPAL BUILDING  
215 STIGER STREET • HACKETTSTOWN • NEW JERSEY 07840  
TEL: 908-852-3130 • FAX: 908-852-5728  
WWW.HACKETTSTOWN.NET

**MAYOR**  
Maria DiGiovanni

**MEMBERS OF COUNCIL**  
William Conforti  
Gerald DiMaio, Jr.

March 27, 2015

New Jersey Department of Transportation  
P.O. Box 600  
Trenton, New Jersey 08625-0600

Dear Sir/Madam:

The purpose of this letter is to formally and publicly commend the New Jersey Department of Transportation and their entire project team for an outstanding job in the design and reconstruction of the Route 46 over Musconetcong River Bridge. The Department was able to successfully replace this structurally deficient crossing in only ten days while balancing challenging site and traffic conditions in a historically and environmentally sensitive area of our town. The accelerated construction schedule greatly reduced the impacts to our town's residential and business communities, yet still resulted in a durable and aesthetically pleasing structure.

The Department was actively engaged with the Town of Hackettstown from the project's initiation through final construction. Several meetings were held with the project's stakeholders during the design phase, where the Department sought input from local officials on the best way to carry out the much-needed reconstruction of the Route 46 bridge. They understood the critical nature of bridge, which carries a large volume of traffic and sits immediately adjacent to several local businesses. Recognizing that traditional methods of construction would have severe impacts on our community, the Department and their design team developed an innovative solution with prefabricated bridge units to perform the reconstruction during a ten-day road closure.

Leading up to the accelerated construction period, the Department was extraordinarily proactive in alerting the community of the forthcoming detour. Public meetings were used in combination with notices hand-delivered by Department representatives to local businesses and residences, minimizing confusion for the traveling public. The proposed reconstruction was completed on schedule with minimal disruption to traffic during construction.

The Town of Hackettstown applauds the Department's ability to rehabilitate this deteriorating bridge with leading edge materials and accelerated construction techniques.

Sincerely,

  
Maria DiGiovanni  
Mayor of the Town of Hackettstown

**From:** TynansAutoService@comcast.net  
**Sent:** Saturday, August 30, 2014 10:19 AM  
**To:** Hirt, Deborah  
**Subject:** Kudos for a job well done!

*Route 46 / Musconetcong Bidge*

Congratulations on the completion of the Route 46 bridge project.

We just wanted to take this opportunity to thank you and the entire "bridge team" for the excellent planning, communication and implementation of this huge and much needed project.

As business owners, we felt that we were well informed throughout the process. The contractor held up his end of the agreement and was very organized in the replacement of the bridge.

We were only slightly inconvenienced during the 10 day period, and very glad it went so smoothly.

Thank you,

Jim & Tracy Tynan  
Tynan's Service Center Inc.  
6 Route 46  
Hackettstown, NJ 07840  
908-852-4468



# Additional Lessons Learned

- Specify formwork, shim, and insert material/requirements on plans.
- Ensure all forms are plastic wrapped (grout/UHPC).
- Minimize use of UHPC material as much as possible. (\$4,000/CY)
- Maximize pre-closure demolition activities.
- Pack a toothbrush...



# Thank you for your attention. Questions?



**GPI** Greenman-Pedersen, Inc.  
Engineering and Construction Services

Speaker: Ryan J. Adams, P.E., S.E.