The Barton Corner Bridge No. 518

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SHRP2 Solutions
Rhode Island Warren Avenue Bridge over I-195 Showcase

Project Location

The Barton Corner Bridge carries I-95 over Route 2 on the Warwick/West Warwick town line.

Vital Stats

Location:	Warwick/West Warwick, RI
Dimensions:	87 Feet Long x 105.2 Feet Wide
Traffic Counts:	I-95 – 72,000 V.P.D Route 2 – 29,300 V.P.D.
Design Speeds:	I-95 – 65 MPH Route 2 – 40 MPH
Notice to Proceed:	September 17, 2013
Completion Date:	November 20, 2014

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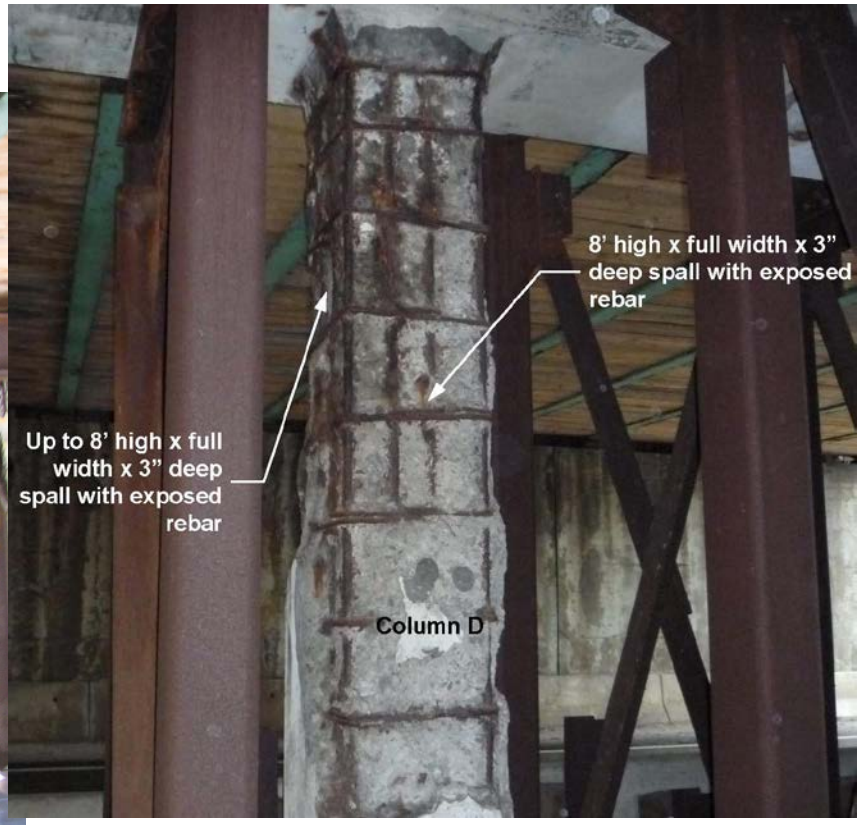
Project Overview

Built in 1958, the Barton Corner Bridge had surpassed its design life and was showing signs of aggressive deterioration. To avoid reducing its carrying capacity, a steel shoring system was installed in 2010 to support the bridge.



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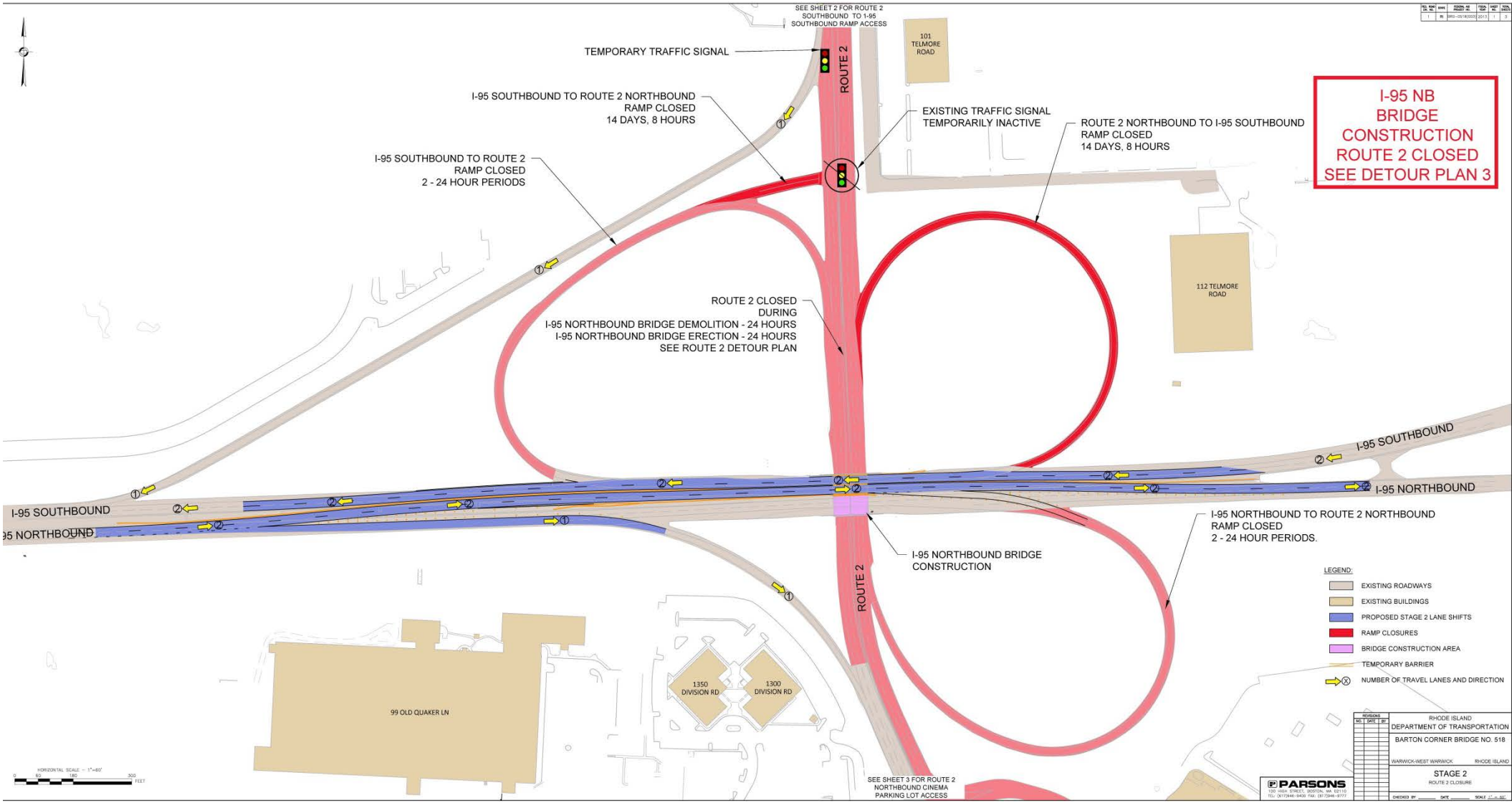
Lane Shifts – I-95 Northbound Bridge Construction

All four lanes of I-95 can fit on each barrel. The lanes were 11' wide with no shoulders.



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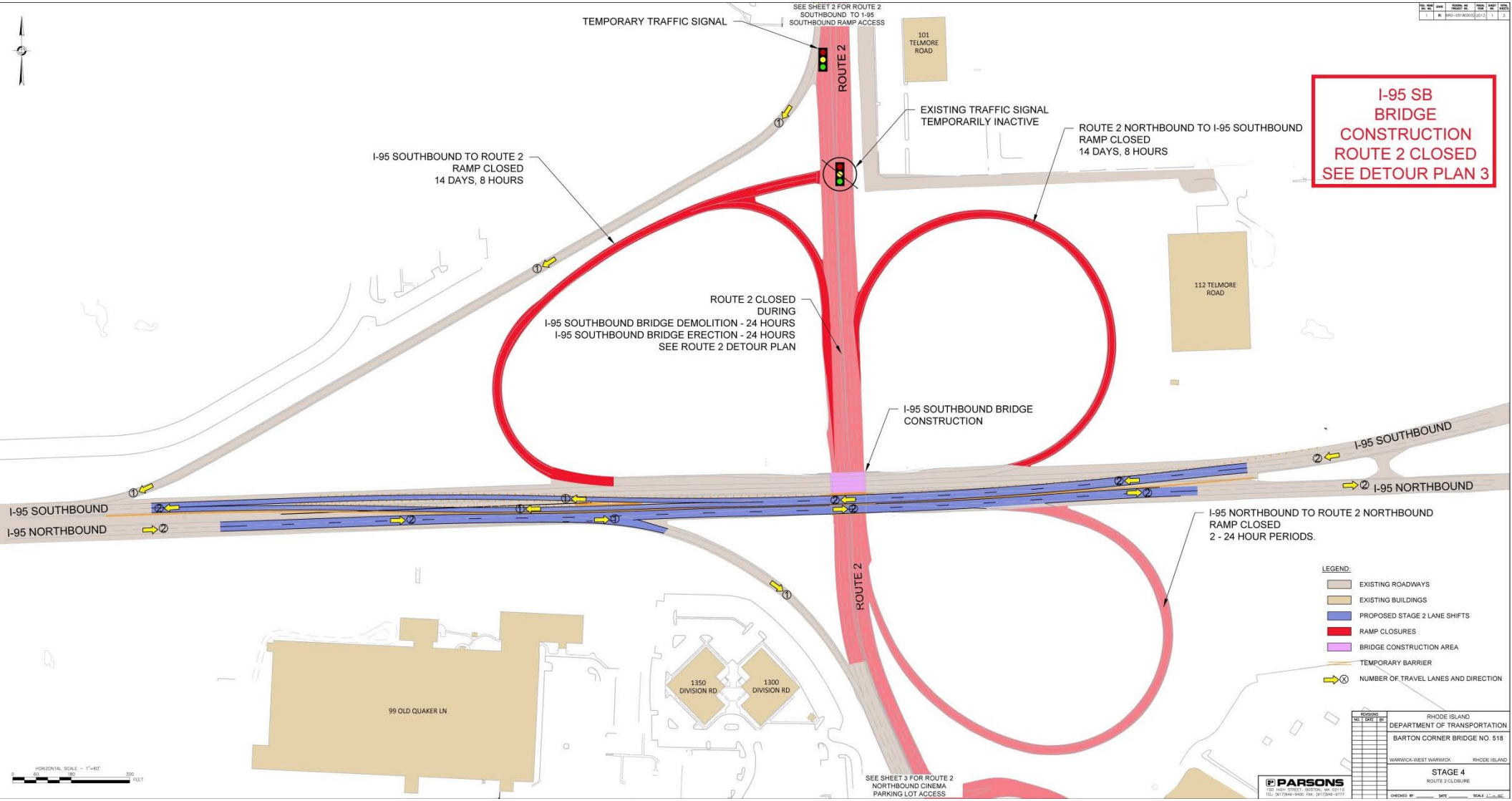
Lane Shifts – I-95 Southbound Bridge Construction

All four lanes of I-95 can fit on each barrel. The lanes were 11' wide with no shoulders.



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Time Constraints per the Contract

The Contractor was given the following Time Constraints:

- 14 Day Period to replace Northbound Structure
  - 24 hour period allowed for shutdown of Route 2 (Bridge Demolition)
  - 24 hour period allowed for shutdown of Route 2 (Bridge Erection)

- 14 Day Period to replace Southbound Structure
  - 24 hour period allowed for shutdown of Route 2 (Bridge Demolition)
  - 24 hour period allowed for shutdown of Route 2 (Bridge Erection)

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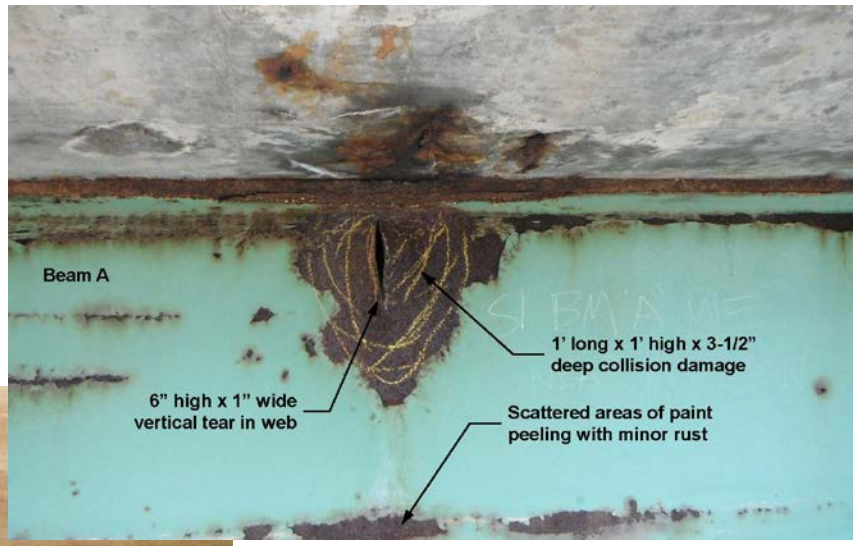
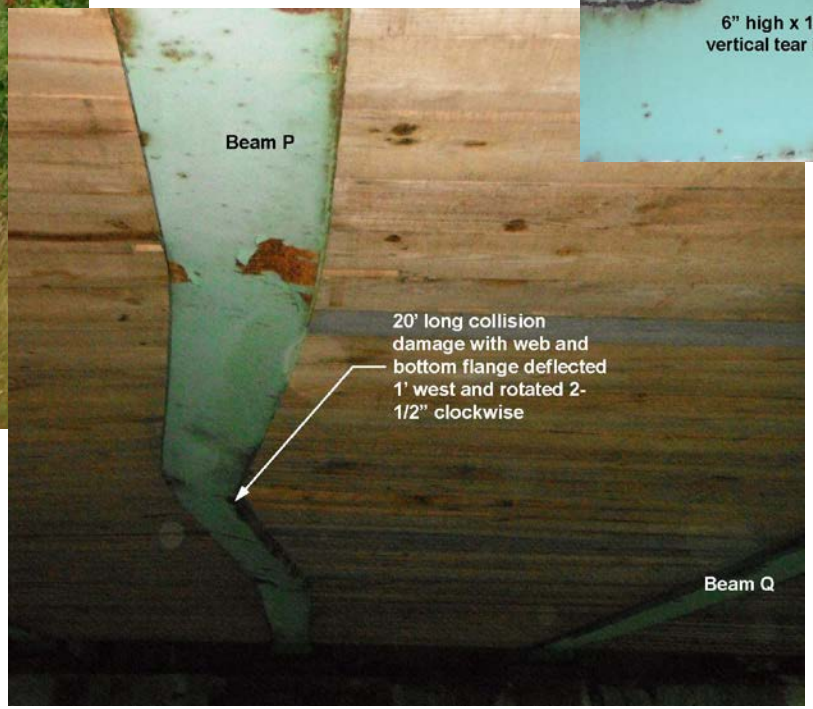
Vertical Clearance

The previous bridge structure had a vertical clearance of **14’-2”** and the new structure has a vertical clearance of **15’-1”**. This increase of 11” was achieved by using a shallower beam of W21X147 versus the original W27x84 for a savings of 5”. Also, I-95 profile was raised 6”.

The new vertical clearance dimension should help eliminate the below from happening….





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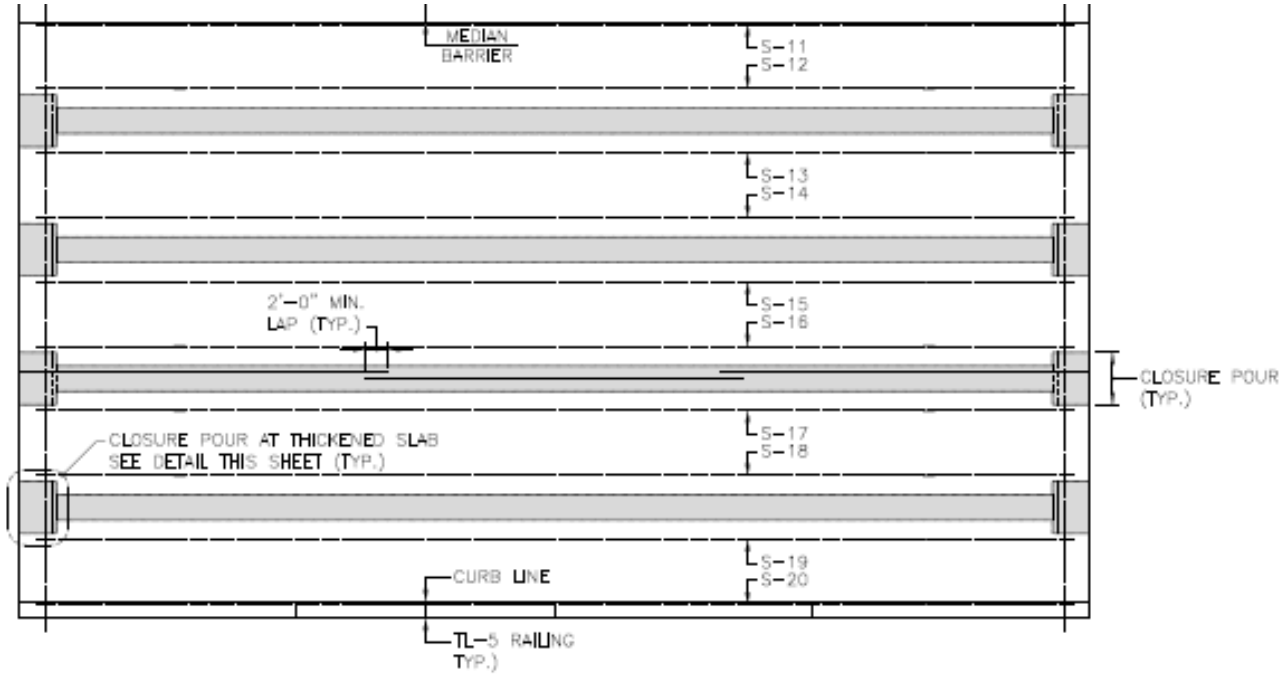
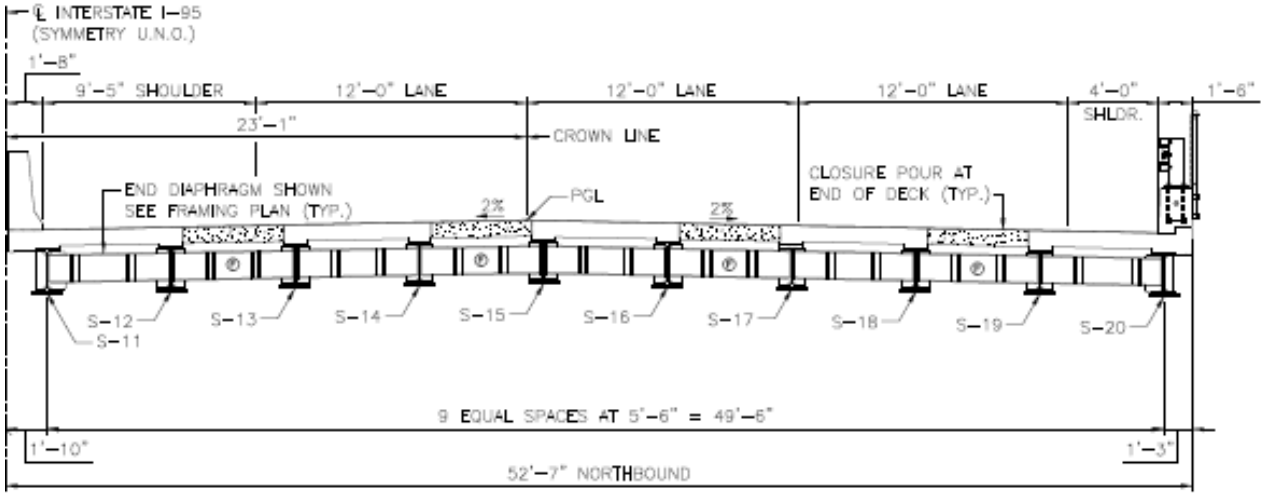
Prefabricated Bridge Units (PBUs)

This contract was originally advertised as prefabricated bridge units being placed with closure pours.

The PBUs consisted of two steel stringers with an integrally cast concrete deck. The 5 PBUs per bridge bound would then be erected onsite and then threaded with galvanized bars to connect the pieces. Once the rebar was tied a closure pour with a high early strength concrete would be placed.





DECK PLAN
SCALE ⅛" = 1'-0"

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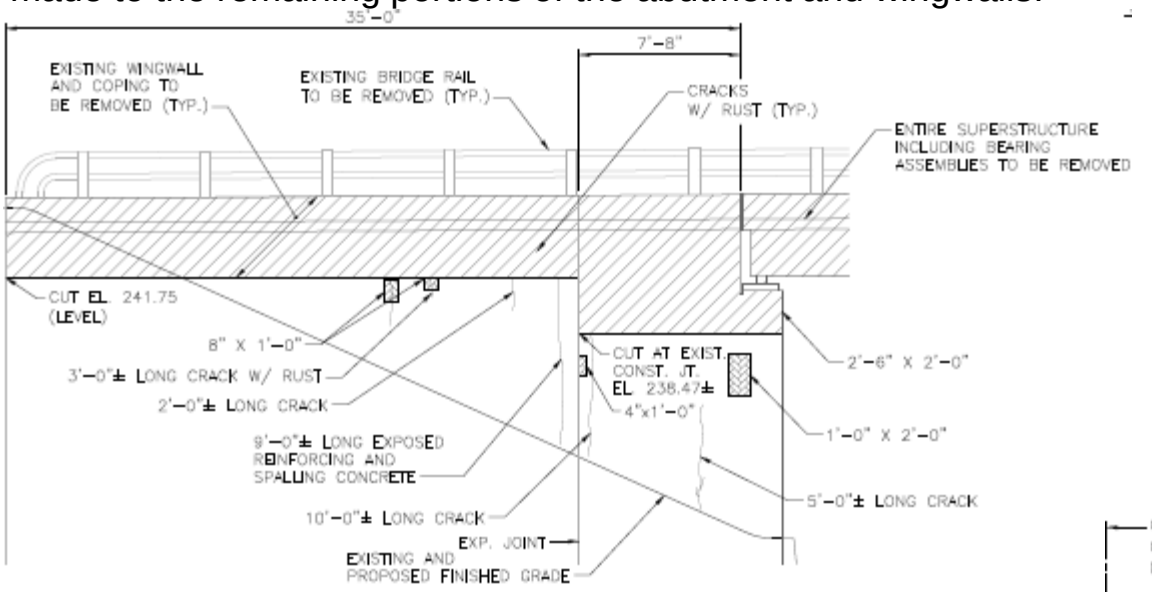
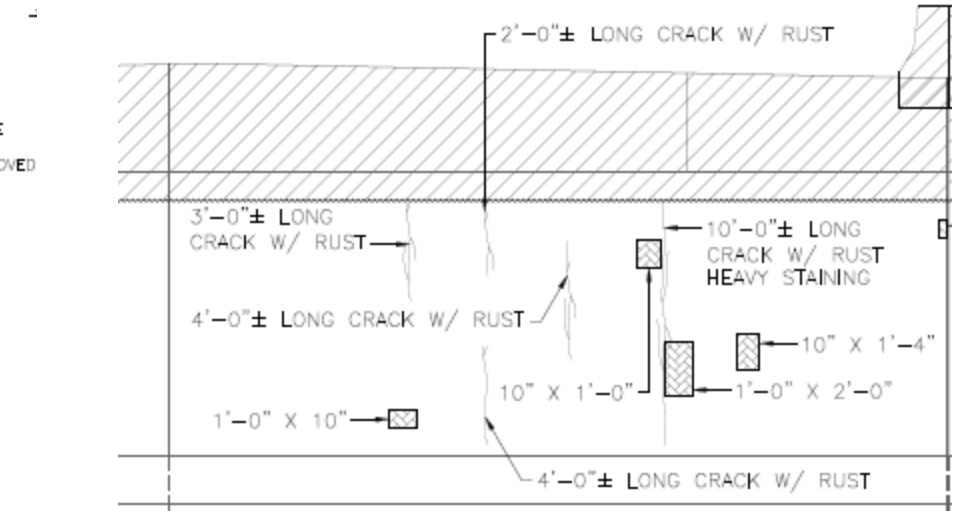
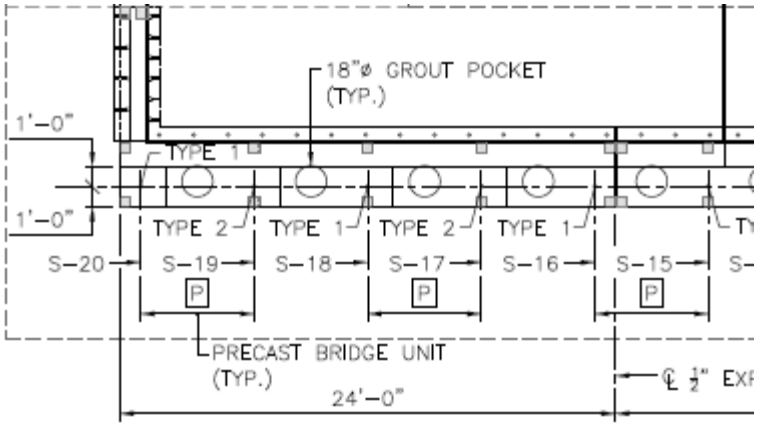
Precast Abutment and Wingwall Caps

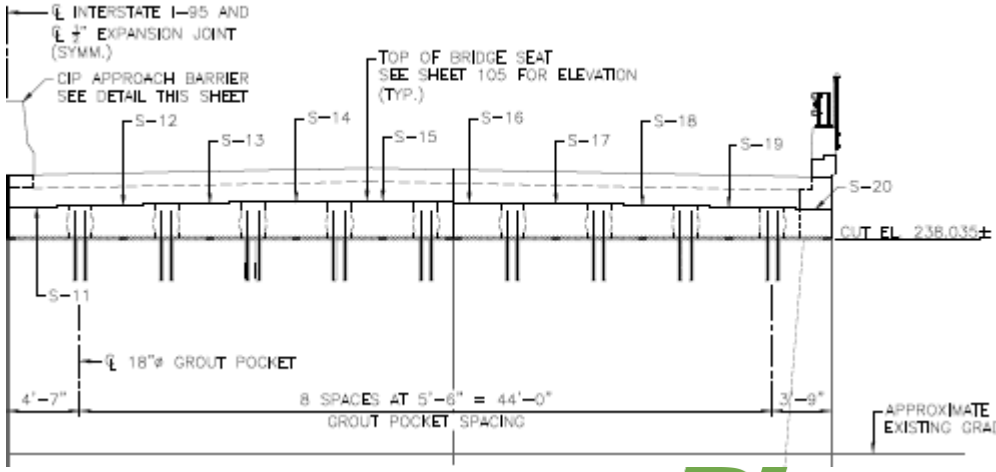
The abutment and wingwalls were in fairly good condition. A complete replacement was not needed.

The bridge beam seats had their fair share of water and chlorides leaking through the joints for many years and had to be replaced. The abutment was cut about 3' below the beam seat and new precast beam seats installed. Patch repairs were made to the remaining portions of the abutment and wingwalls.









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Abutment Repairs and Precast Caps

Alternate Proposal

The contractor, D'Ambra, submitted an Alternate Proposal of building the entire superstructures adjacent to Route 2 and then moving them into place using self-propelled modular transporters (SPMTs). The SPMTs and expertise of this move was provided by Mammoet.

The RIDOT would actually receive a better product, no longer would we have to worry about 10 closure pours. During the type study the use of SPMTs was explored, but the constraints were very tight and the RIDOT didn't feel comfortable forcing this method of construction onto our contractors.

D'AMBRA CONSTRUCTION

MAMMOET

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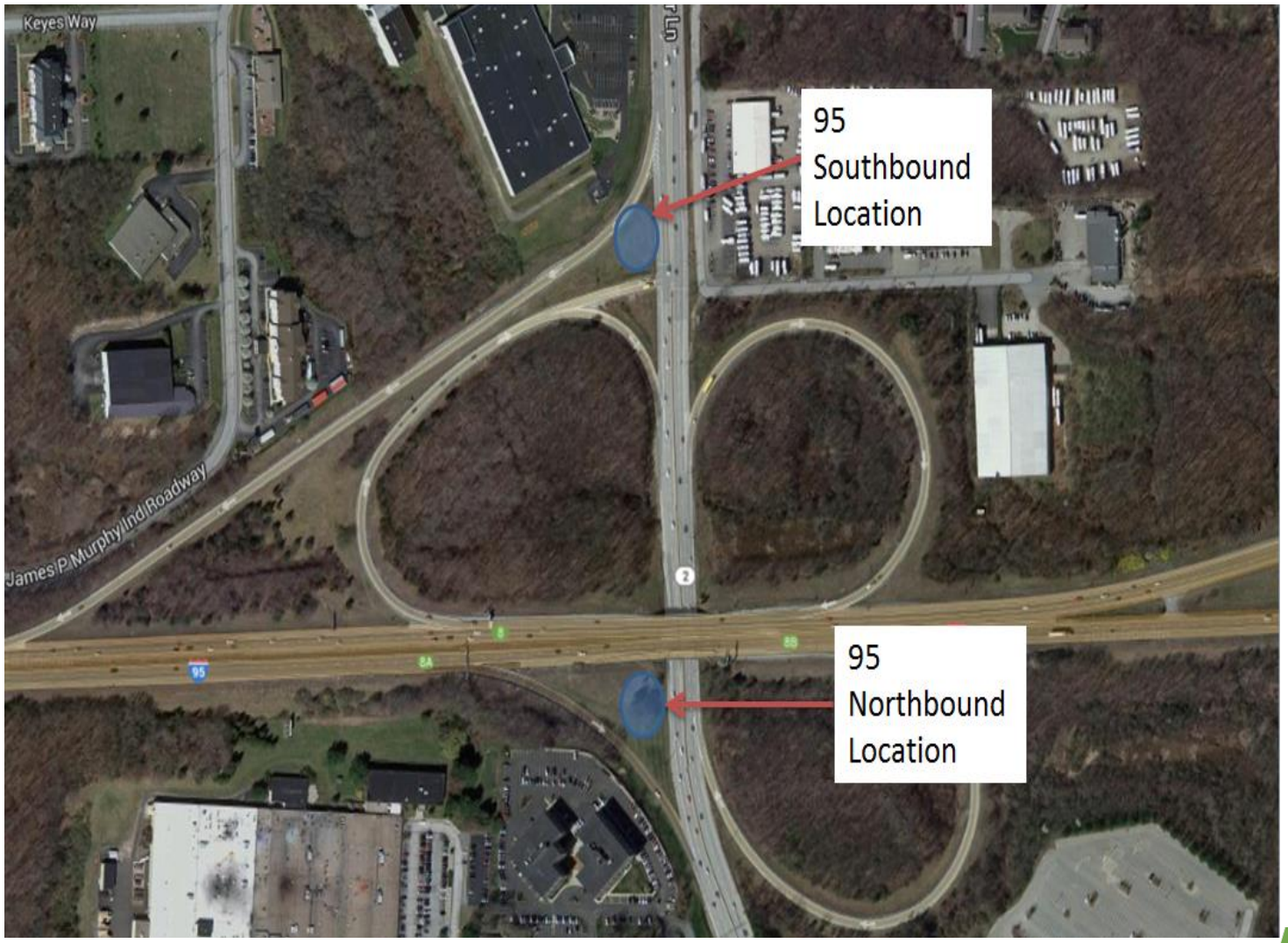
Offline Locations

- The I-95 Northbound structure was built adjacent to I-95.
- The I-95 Southbound structure was built about 900 feet from I-95.



Northbound and Southbound Construction Sites

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I-95 Northbound

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I-95 Southbound

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Shoring Towers

D’Ambra used EFCO Shoring Towers to support the superstructure.

I-95 Northbound

I-95 Southbound

Self-Propelled Modular Transporters (SPMTs)

FHWA Definition - A Self-Propelled Modular Transporter is a combination of multi-axle platforms operated through a state-of-the-art computer-controlled system that is capable of pivoting 360 degrees as needed to lift, carry, and set very large and heavy loads of many types.

SPMTs are motorized vehicles that move at walking speed and are capable of carrying large structures, such as bridges, from offsite locations, positioning them precisely into final position. The SPMT then exits the site, opening the area to traffic possibly within minutes or certainly within a few hours.

Each Bridge Weighed 440 Tons

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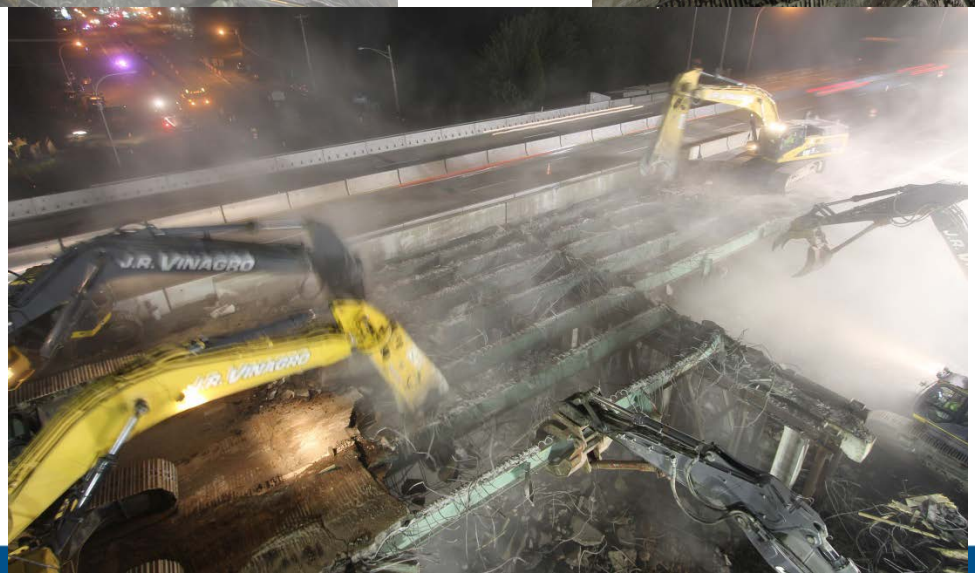
First Bridge Demolition – I-95 North

The I-95 Northbound structure was the first to be demoed and took place on Tuesday night August 19, 2014. Route 2 was shutdown at 10 PM and was opened at 5:45 AM (less than 8 hours of closure).

The deck and beams were all on the ground in under an hour and a half.



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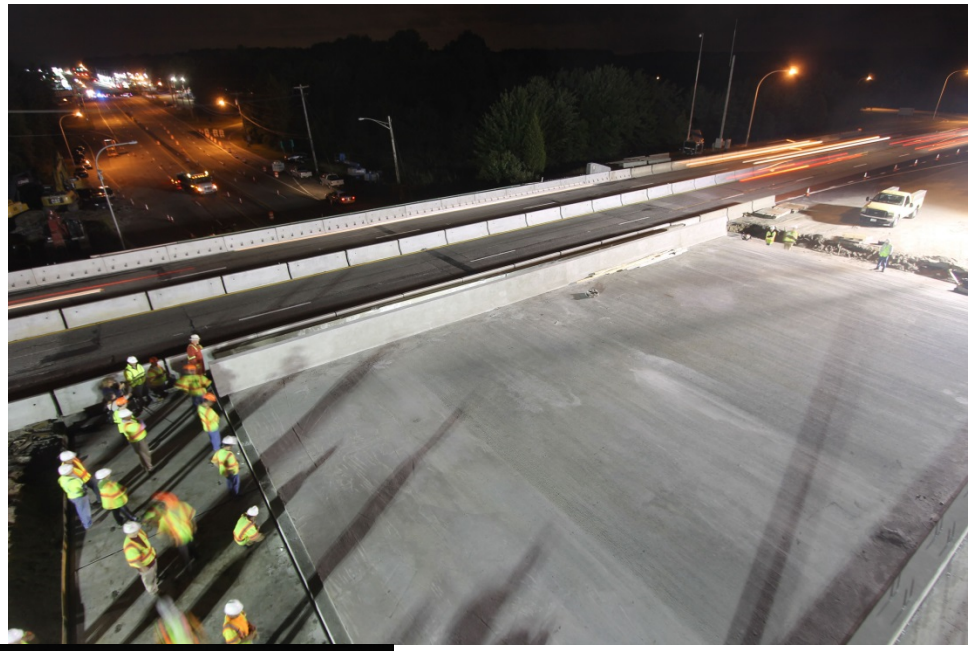
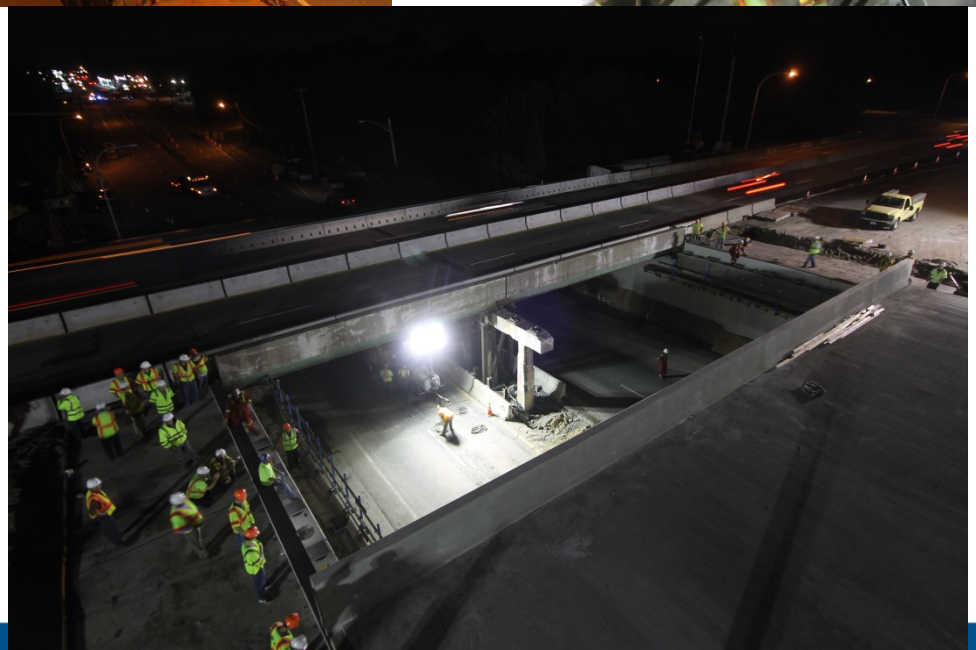
First Bridge Move – I-95 North

The I-95 Northbound structure was the first to be moved and took place on Thursday night August 21,2014. Route 2 was shutdown at 9 PM and was opened at 12:50 AM (less than 4 hours of closure).





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Second Bridge Demolition – I-95 South

The I-95 Southbound structure was the second to be demoed and took place on Monday night August 25, 2014. Route 2 was shutdown at 8 PM and was opened at 2:30 AM (less than 7 hours of closure).

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Second Bridge Move – I-95 South

The I-95 Southbound structure was the second to be moved and took place on Wednesday afternoon on August 27,2014. Route 2 was shutdown at 12:00 PM and opened at 3:50 PM (less than 4 hours of closure).

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Incentive/Disincentive

The amount of money for incentive/disincentive was found by using an analysis for the total road user cost.

- The total road user cost of closing Route 2 was $19,759 per hour
- The total road user cost for closing the I-95 ramps were $3,461 per hour

The Department decided on using $10,000 per bound on Route 2 and $50,000 per day on I-95.

There was no cap on the disincentive.

Route 2 traffic in this area is very high and would experience the most disruption. The Department decided to use the full user costs per hour to stress that the disruption to traffic flow and businesses be kept to an absolute minimum.

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Incentive/Disincentive Payout

D’Ambra Construction received $2,610,000.00 in an incentive payment of the possible $3,320,000.00.

Route 2:

- NB Demo - $320,000 ($480,000)
- NB Move - $400,000 ($480,000)
- SB Demo- $340,000 ($480,000)
- SB Move - $400,000 ($480,000)

I-95:

- NB Bridge - $550,000 ($700,000)
- SB Bridge - $600,000 ($700,000)

Total contract amount = $6,434,000.00 + $2,610,000.00 = $9,044,000.00
(low bid) (incentive)

Within 3% of our Engineer's Estimate of $8,823,606.62

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Before And After

Old Two-Span Bridge

New Single-Span Bridge

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Completed Bridge

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Lessons Learned

- Don’t use exposed concrete deck!
  - Very small margin of error to achieve correct deck grades
    - Had to have multiple surveys to check elevations
    - Had to revise I-95 pavement leveling course many times

•Recommend asphalt overlay

- Watch the bridge bearings!
  - An elastomeric bearing was overloaded when being placed on beam seat
  - Luckily D’Ambra ordered two extra bearings
    - New thinner sole plate was ordered
    - Bearing was replaced on October 24, 2014

•Recommend ordering extra bearings

Over Compressed Bearing

New Bearing

Time-Lapse Video

Thank You

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