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SHRP2 SOLUTONS

Innovative Bridge Designs for Rapid Renewal

Peer-to-Peer Exchange Workshop

Atlanta, GA

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INTRODUCTION

VIJAYKUMAR THAKER, PE

- EXECUTIVE MANAGER
- NEW JERSEY DEPARTMENT OF TRANSPORTATION
- MASTER OF SCIENCE (STRUCTURES) RENSSELAER POLYTECHNIC INSTITUTE, TROY, NY
- 31 YEARS OF BRIDGE DESIGN EXPERIENCE

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INTRODUCTION

HARDEV DAVÉ, CPM

- PROJECT MANAGER
- NEW JERSEY DEPARTMENT OF TRANSPORTATION
- MASTER OF SCIENCE (STRUCTURES) NEW JERSEY INSTITUTE OF TECHNOLOGY, NJ
- 23 YEARS OF DESIGN/CONSTRUCTION & PROJECT MANAGEMENT EXPERIENCE

Innovative Bridge Designs for Rapid Renewal

Rapid Renewal is another name for ABC

What is ABC?

Accelerated Bridge Construction

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Innovative Bridge Designs for Rapid Renewal

Considerations for selection of ABC:

- High Traffic Volume (Get in/Get out)
- Safety Concerns
- Community Involvement
- Urgency (Is the project an emergency project?)
- Is the bridge an evacuation route, or over railroad or navigable waterway?

Decision to employ ABC is made during early scoping studies

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New Jersey Budget

- $800 Million/Year for Bridge Const./Rehabilitation
- 50 % Rehabilitation (Average 9 Bridges/Year)
- 35 % Replacement (Average 5 Bridges/Year)
- 15 % Locally Owned Bridge – Approximately 8 To 10 Bridges Replacement/Rehabilitation Per Year

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Selection Criteria

- Traffic Volume
- Local/Stakeholder Approval
- Staging/Detour
- Construction Duration
- Environmental Factors
- Urgency/Need
- Cost

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ABC requires use of innovative:

- **Planning** (Traffic Demand, Construction Schedule & Community Involvement)
- **Design** (PBES: Prefabricated Bridge Element System, NEXT (Northeast Extreme Tee) Beam®)
- **Materials** (Use of Precast and High Early Strength concrete)

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Primary reasons for ABC are:

- To reduce onsite construction period
- To improve safety due to reduced exposure time in the work zone
- To improve components quality due to fabrication in a controlled environment

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SOME OF ABC PROJECTS IN STATE OF NEW JERSEY

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RT. 1 OVER MULBERRY & RT. 1 OVER OLDEN AVENUE SUPERSTRUCTURE REPLACEMENT

First Hyper Build Project in State of New Jersey (Year 2006)

- Utilized Pre-Fabricated Superstructure Units
- Construction Duration: Completed Over 2 Weekends
- Each Bridge is Approximately 65 to 85 Feet Long & 42 Feet Wide
- Project Cost: $3.5 Million

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RT. 1 OVER MULBERRY & RT. 1 OVER OLDEN AVENUE SUPERSTRUCTURE REPLACEMENT

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RT. 1 OVER MULBERRY & RT. 1 OVER OLDEN AVENUE SUPERSTRUCTURE REPLACEMENT

LESSONS LEARNED

- **Superstructure could not fit between the bridge back walls -** Requires an accurate survey
- **Quality of riding surface due to number of longitudinal joints and cross slopes -** Consider an overlay or diamond grinding to mitigate these issues

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ROUTE 280 OVER MORRISTOWN-ERIE RAILROAD SUPERSTRUCTURE REPLACEMENT

- Utilized Pre-Fabricated Superstructure Units
- Construction Duration: Completed in 3 Weeks
- 3 SPAN - 110 Feet Long by 56 Feet Wide
- Project Cost: $4.0 Million

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ROUTE 280 OVER MORRISTOWN-ERIE RAILROAD SUPERSTRUCTURE REPLACEMENT

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ROUTE 280 OVER MORRISTOWN-ERIE RAILROAD SUPERSTRUCTURE REPLACEMENT

LESSONS LEARNED

- **Precast bolt-down parapet not in 100% contact with the slab**

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ROUTE 287/DURHAM AVENUE - DECK REPLACEMENT

- Utilized Exodermic Panels
- Three Span Structure
- 212 Feet Long by 56 Feet Wide
- SKEW – 56 Degrees
- Duration: 5 Weeks Each Stage – Total 2 Stages
- Project Cost: $2.0 Million

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ROUTE 287/DURHAM AVENUE - DECK REPLACEMENT

LESSONS LEARNED

- Due to Heavy Bridge Skew & Composite Design, too many closure pours were required
- A challenge to achieve variable cross slope

Overlaid the structure to achieve smooth riding surface and variable cross slopes

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Rt.46 OVER BROAD STREET - SUPERSTRUCTURE REPLACEMENT

- Two Span Bridge with Continuous For Live Road
- 87 Feet Long By 68 Feet Wide
- Constructed in 2 Stages
- Construction Duration: Each Stage was Constructed Over One Weekend
- Project Cost: $2 Million

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Rt.46 OVER BROAD STREET
SUPERSTRUCTURE REPLACEMENT

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Rt.46 OVER BROAD STREET
SUPERSTRUCTURE REPLACEMENT

LESSONS LEARNED

- **Prefabricated Superstructure units were constructed in upside down position -** Required to be designed without consideration for prestress effect for upside down fabrication

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Rt.3 OVER RIVER ROAD

- NEXT BEAM
- Single Span Structure
- 56 Feet Long
- SKEW – 2 Degrees
- 3 STAGES
- Project Cost: $2.2 Million

Rt.3 OVER RIVER ROAD

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Rt.3 OVER RIVER ROAD

LESSONS LEARNED

- Contractor should submit all working drawings together and not in a piece meal for components of the unit
- Pay attention to details

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PULASKI SKYWAY
REHABILITATION

Pulaski Skyway Rehabilitation

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- Pulaski Skyway is a 3 ½ miles long viaduct that links Newark, NJ at Raymond Blvd. & Jersey City, NJ at Tonnele Ave. Circle
- The Skyway consists of 118 spans
- The Skyway crosses over the Hackensack & Passaic Rivers, South Kearny, various railroads and roadways, including the New Jersey Turnpike
- It is a direct Link to New York City via Route 139 and the Holland Tunnel
- Center Ramp locations provide local access to and from the Skyway
  - Broadway Ramp – SB entrance, NB exit to Jersey City
  - Kearny Ramp – SB exit to Kearny, NB entrance

PULASKI SKYWAY REHABILITATION

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PULASKI SKYWAY
REHABILITATION

Contracts #3 and #4
Currently Under Construction

Contractor began removing the existing NB concrete deck in May 2014

NB section of the Skyway prepared for the installation of the precast deck panels

Severe deterioration of top flange of the existing floor beam

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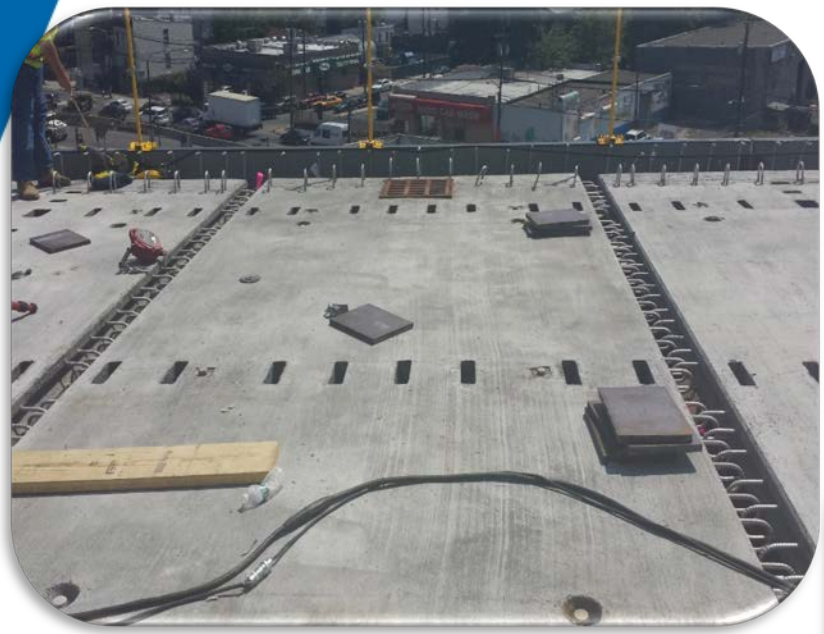
PULASKI SKYWAY
REHABILITATION

Contracts #3 and #4
Currently Under Construction

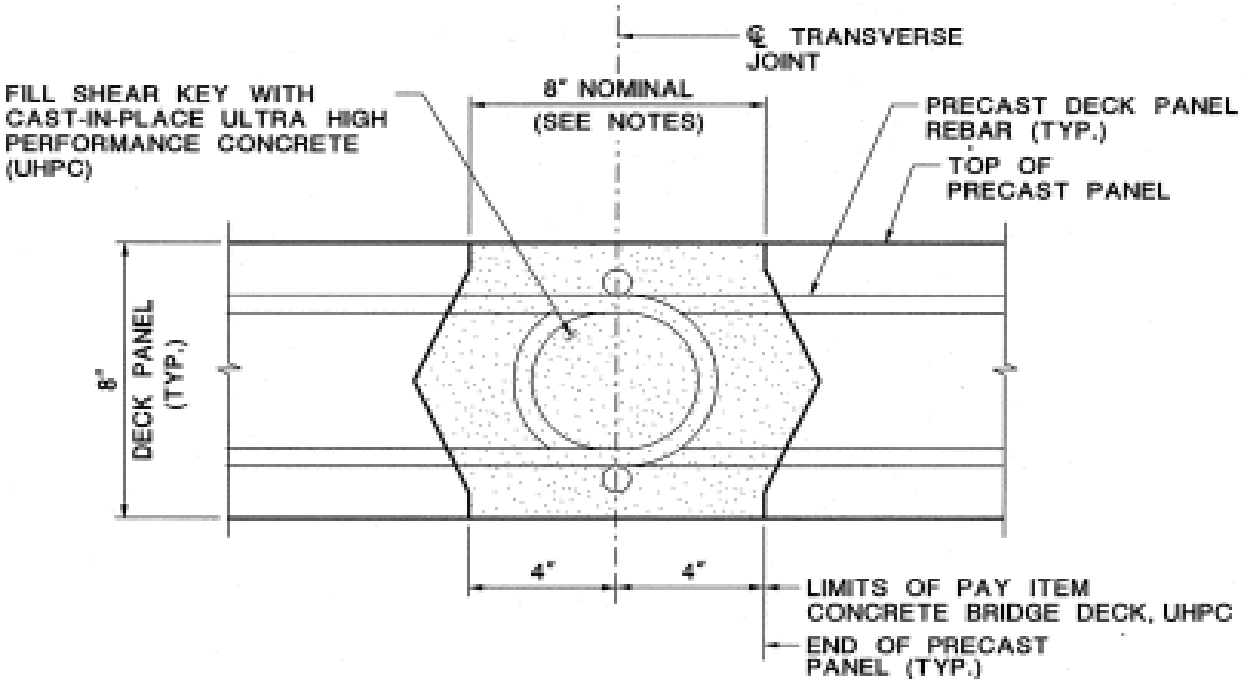


Precast Deck Panels – The deck system on a majority of the Skyway will consist of Precast Full Depth Deck Panels

Exodermic Deck Panels – The design also incorporated Precast Exodermic Deck Panels at the eastern end and in/around the Broadway Ramp where weight was a concern due to planned widening

Deck Connections

- **UHPC Transverse Joints**
- Minimize joint width (reduction in embedment length)
- **Extensively tested and proven in field applications**
- Durability



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PULASKI SKYWAY
REHABILITATION

Deck Connections

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PULASKI SKYWAY
REHABILITATION

Deck Connections

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Other ABC Projects

- Van Dyke Road and Greenwood Ave Bridges Over CSX Rail Road
- Route 202/Passaic River (Total bridge replacement)
- Rt.280 EB Over Passaic Ave & Eagle Rock Bridges
- Route 9 over Green Street
- Route 9 over Main Street
- Route 38 over Route 70
- Gordons Corner Road over Route 9
- Route 440 Ramps
- Route 18 over Route 1
- Creek Road over Route 295
- Route 3 over Passaic River
- Route 29 over Wickecheoke Creek
- Route 46 over Musconetcong River
- Rote 46 over Hackensack River

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- State of New Jersey does NOT have specific program funded towards ABC
- Based on traffic demand & community input, State of NJ has a process where in CD phase, various alternates are considered and ABC is always one of the alternates

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NJ Route 10 over Passaic River, Superstructure Replacement

Using Accelerated Bridge Construction Systems

Morris & Essex Counties, New Jersey

- Hardev Davé, NJDOT Project Manager

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Existing Conditions

- Bridge was structurally deficient and functionally obsolete
- Traffic volumes over 43,000 vehicles per day
- Accelerated Bridge Construction Systems with use of Precast Approach Slabs and NEXT Beam® solutions
- One of the first uses of the NEXT Beam® for a Design Project by the New Jersey Department of Transportation

AWARDS

- Project received DISTINGUISHED AWARDS from ACEC and NJ ALLIANCE FOR ACTION and was presented at 2014 AASHTO Conference in Miami, Florida.
- It also received the "National Recognition Award" in ACEC's 2015 Engineering Excellence Awards Gala in Washington, D.C.

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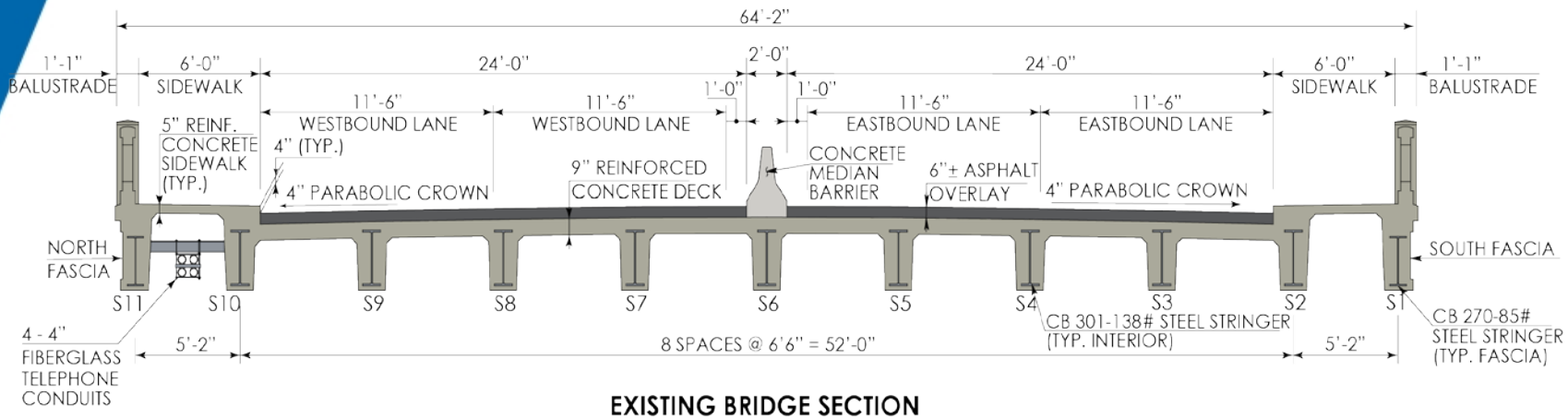
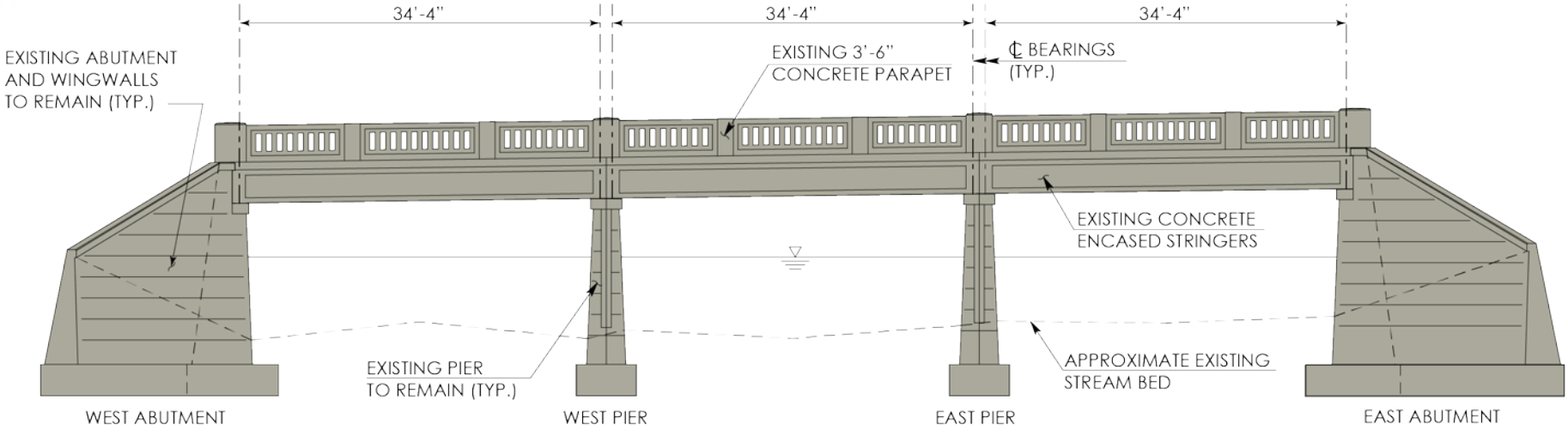
Existing Cross Section and Elevation



EXISTING BRIDGE SECTION



EXISTING BRIDGE ELEVATION

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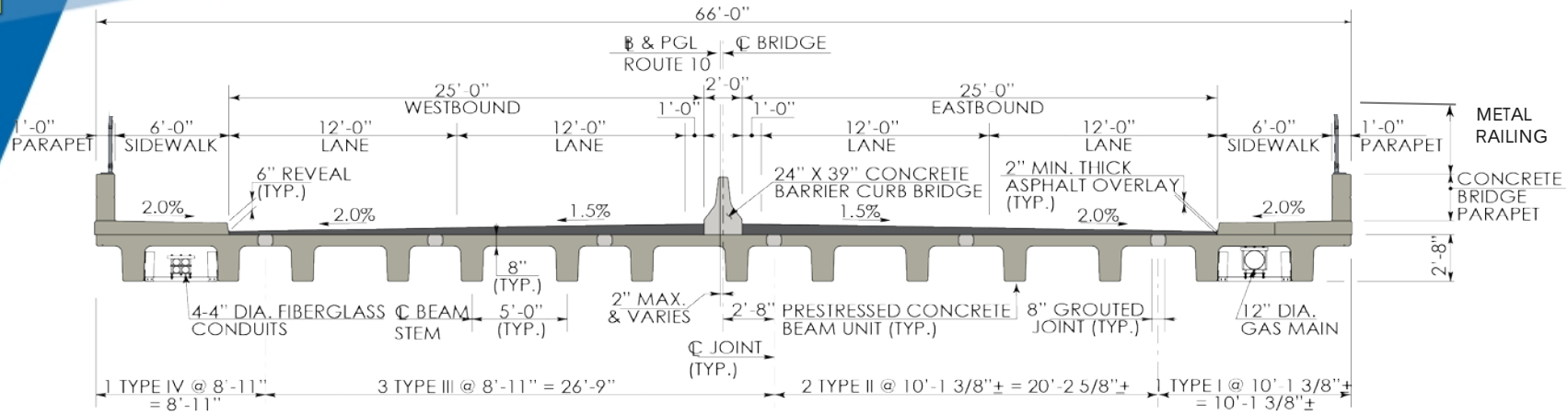
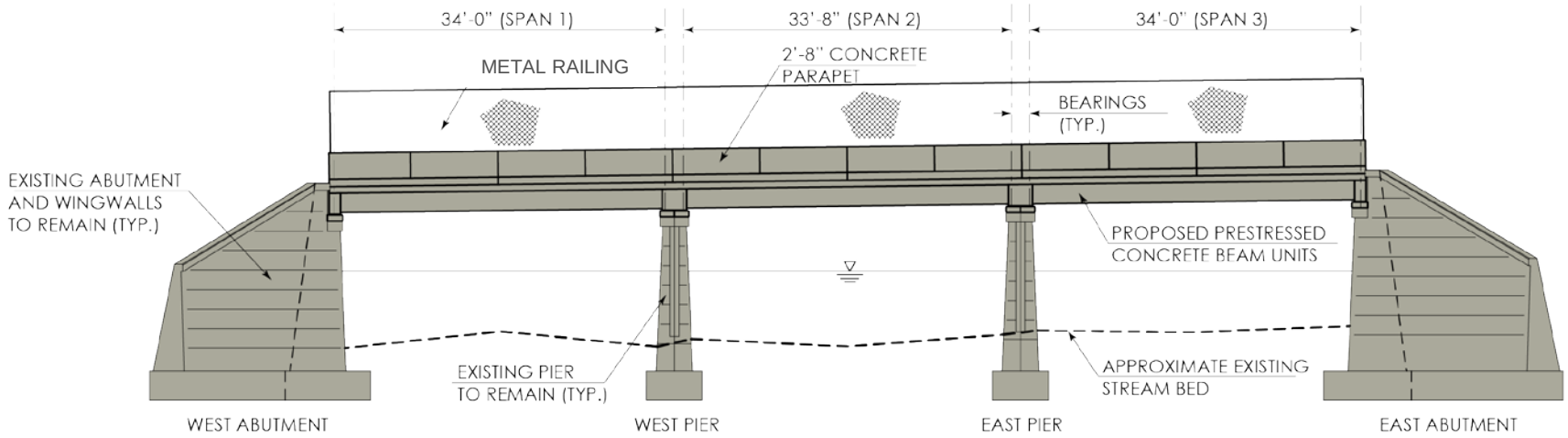
Proposed Cross Section and Elevation



PROPOSED BRIDGE SECTION



PROPOSED BRIDGE ELEVATION

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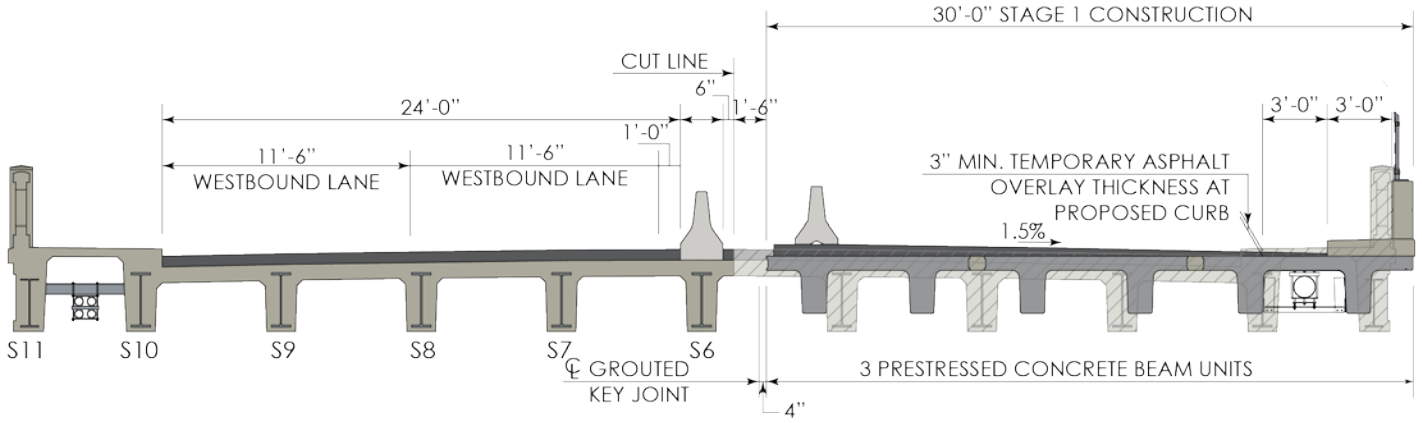
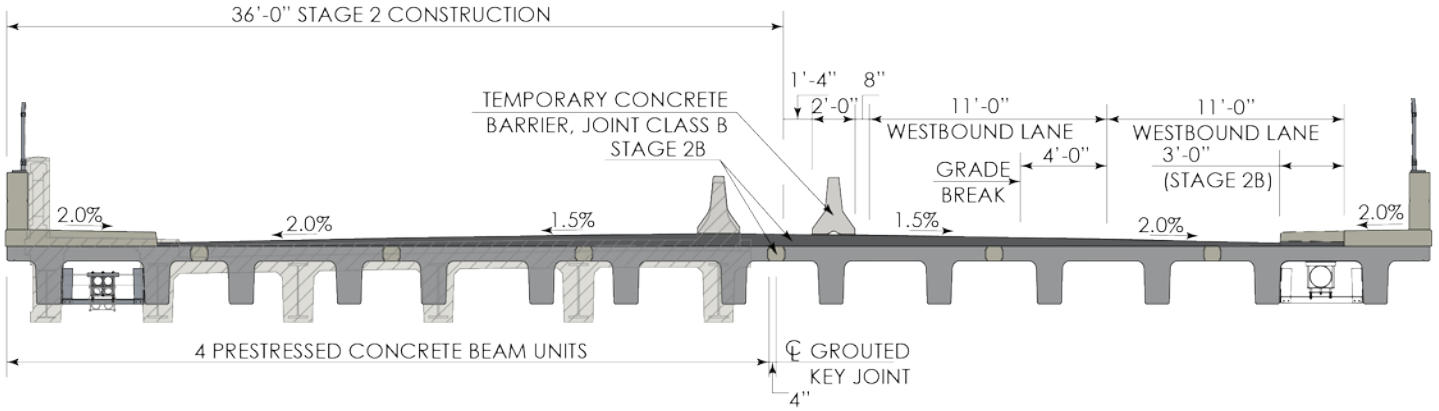
Staged Bridge Construction



STAGE 1



STAGE 2

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Existing Conditions

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Stage 1

- Asphalt Removal
- Abutment Tie Back Preparation

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Stage 1

- Tie Back Install & Remove Span 1

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Stage 1

- Span 2 Removal

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Stage 1

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Stage 1

- Span 1 thru 3 Erection

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Stage 1

- Superstructure Continuity and End Diaphragm Pours

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Stage 1

- Approach Slab and Pavement Removal

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Stage 1

- Install Sidewalk, Parapet and Railing

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Stage 1

- Install Precast Concrete Approach Slabs

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Stage 1

- Install Overlay on Approach Slabs & Bridge

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Stage 2

- Tie Back Installation & Superstructure Removal

- Erection

- Continuity & End Diaphragm Pours

- Install Sidewalk, Parapet & Railing

- Install Precast Concrete Approach Slabs

- Install Concrete Overlay on Approach Slabs & Bridge

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Final Bridge Condition

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