

Delaware Department of Transportation



Bridge 1-717: I-95 over SR7

Precast Panel Deck Replacement



Presented to: FHWA/DelDOT Accelerated Bridge Construction Workshop on September 17, 2015
Presented by: John Milius, PE AECOM

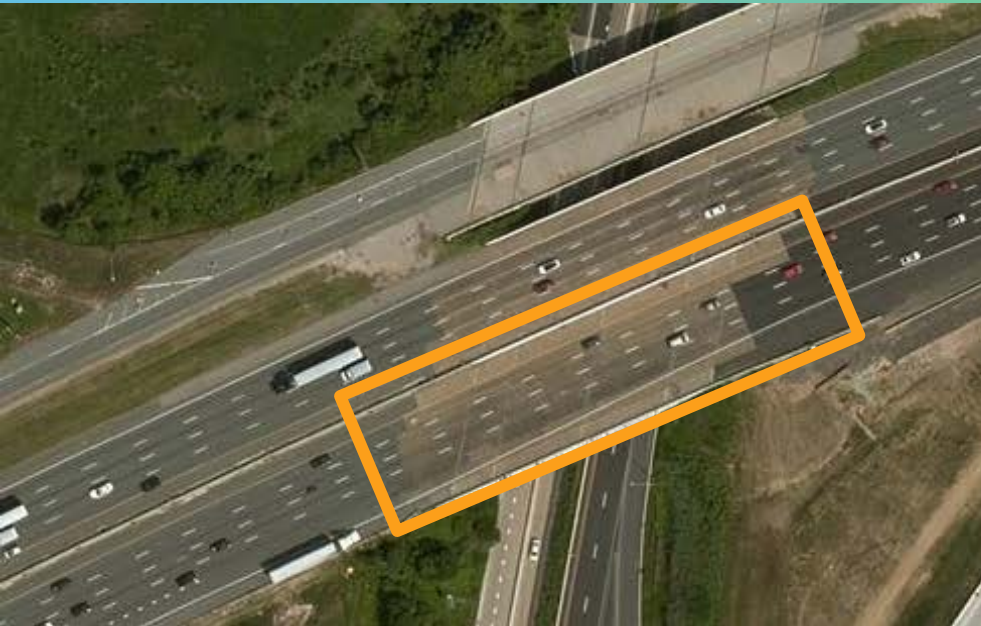
AECOM

Agenda

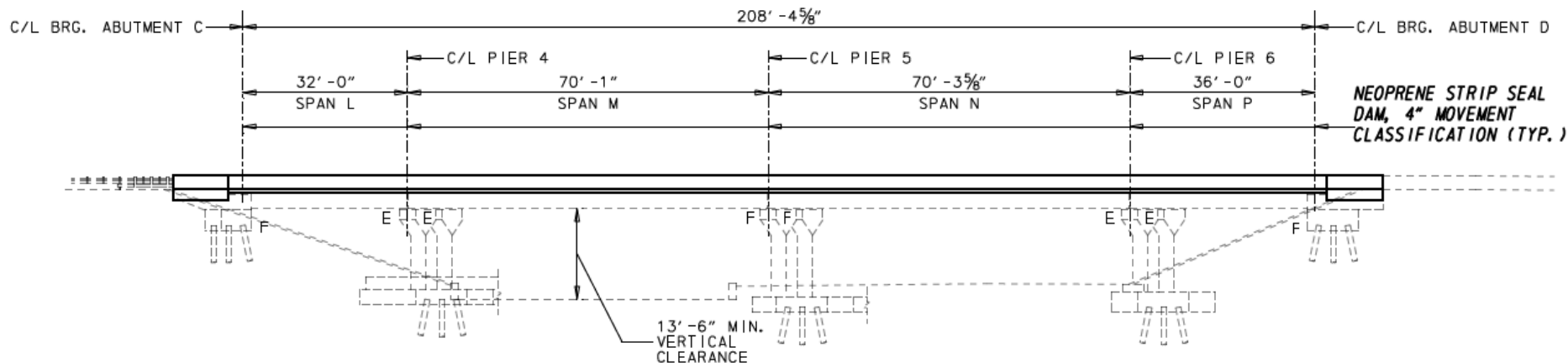
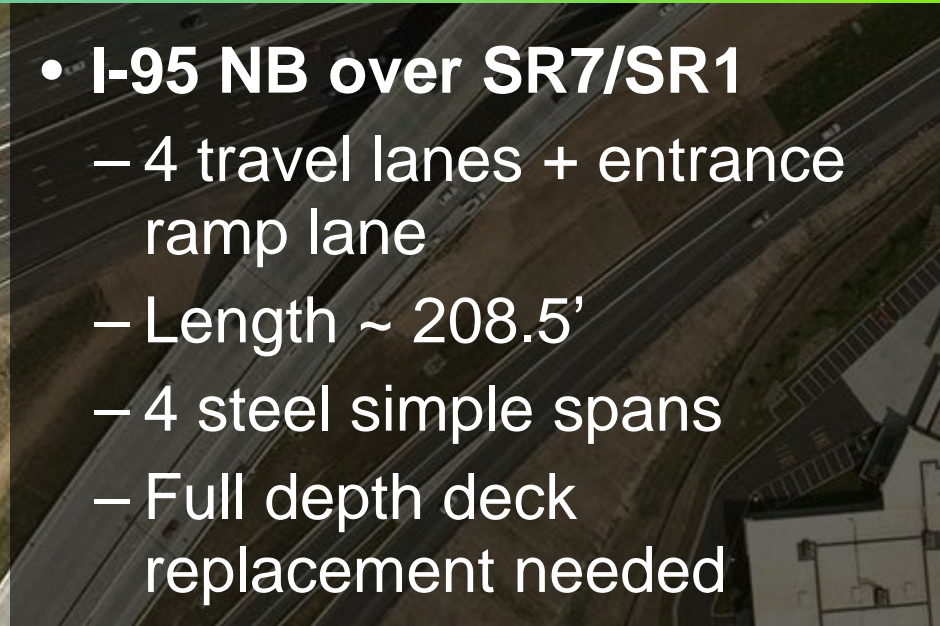
- Project Overview
- Why use ABC?
- ABC Superstructure Replacement Alternatives Considered
- Precast Panel Options Considered
- Staging Alternatives Considered
- Selected Deck Replacement Option
- ABC Design Details
- Questions



Project Overview



- **I-95 NB over SR7/SR1**
 - 4 travel lanes + entrance ramp lane
 - Length ~ 208.5'
 - 4 steel simple spans
 - Full depth deck replacement needed



Project Goals



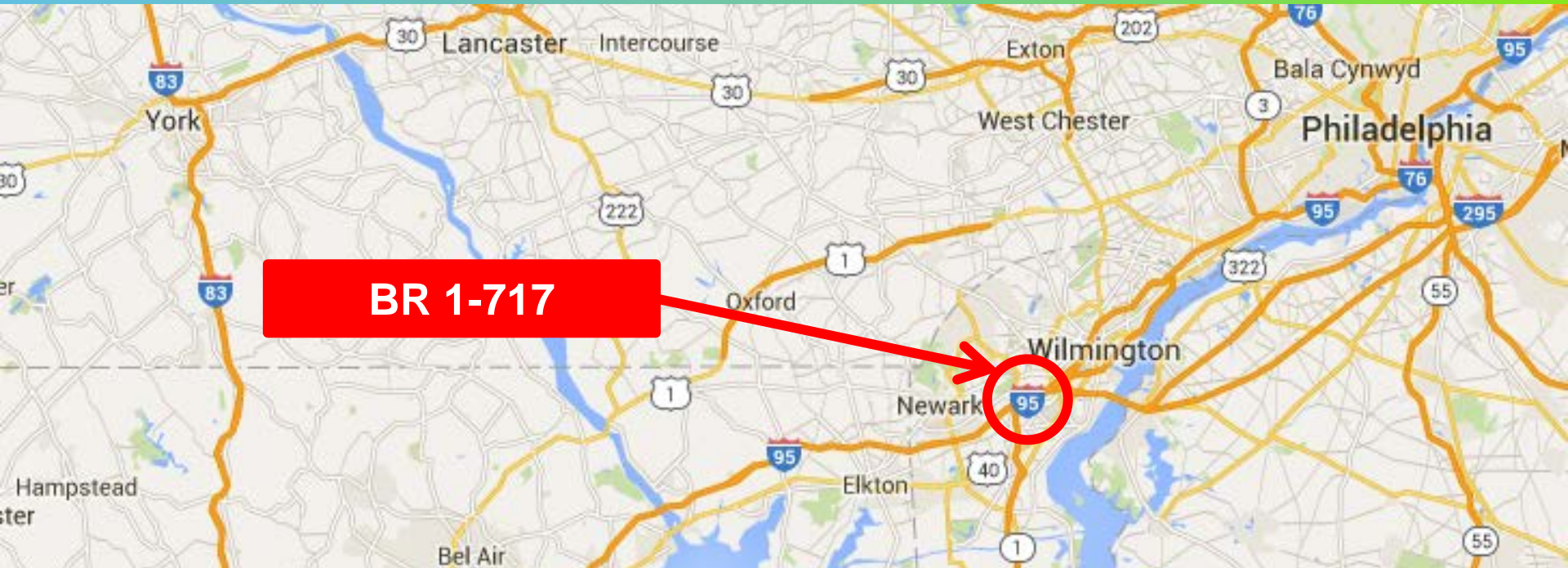
- Replace bridge deck
- Update bridge barrier to meet AASHTO TL-4 requirements (currently TL-4 adjacent to structure)
- Minimize impacts to traffic

Project Constraints



Limited staging area adjacent to structure

Why Accelerated Bridge Construction?



- I-95 is a key artery in Delaware (ADT = 85,000 in 2011)
- Traffic impacts must be minimized

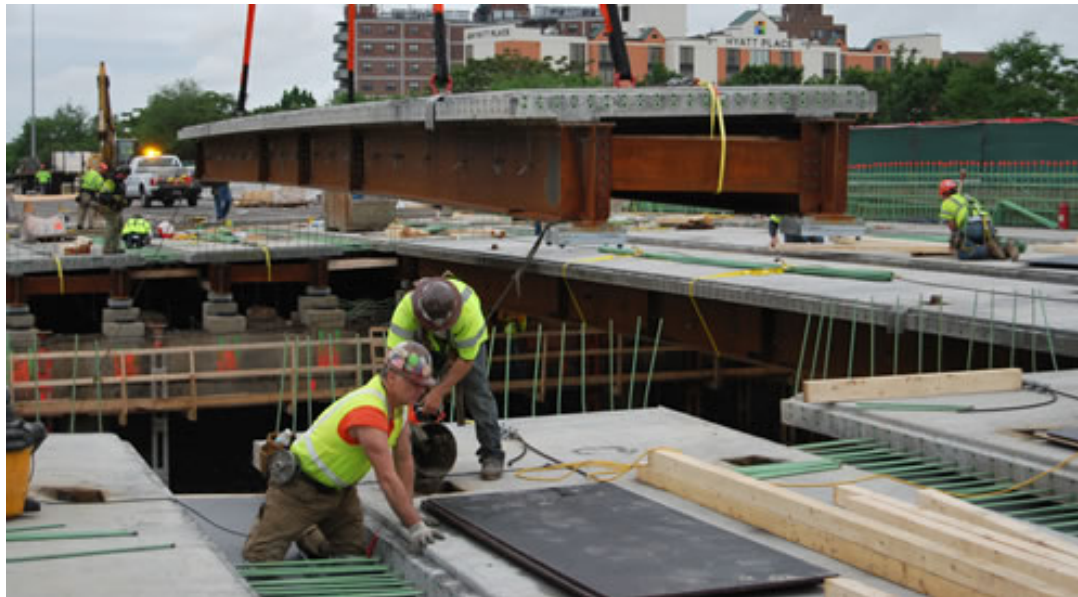
ABC Superstructure Replacement Alternatives

- Only Steel Alternatives Considered
 - Existing Substructures to Remain
 - Vertical Clearance
- New Steel Girders w/ Pre-Fabricated Deck Sections
- Simple Spans vs. Continuous Span Options Explored



ABC Superstructure Replacement Alternatives

- Longitudinal Launching
- Slide-In Construction
- Conventional Crane Construction
 - Modular Superstructure Segments (Inverset)



Decision for Deck Replacement

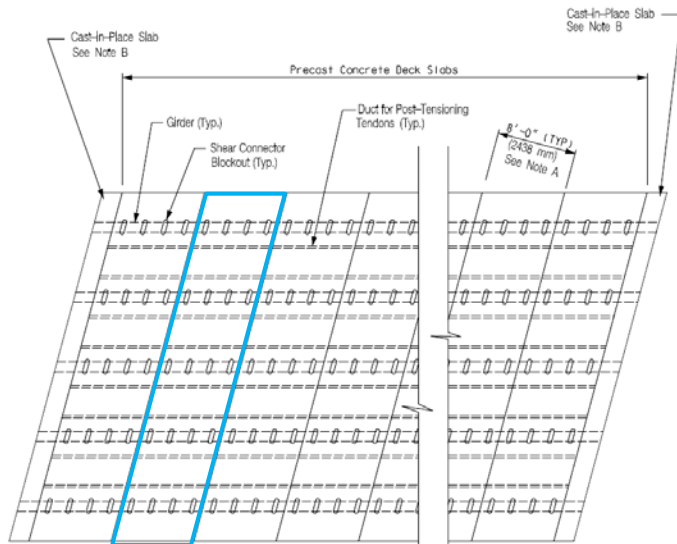
- Existing Steel Beams in Good Condition – Recently Cleaned and Painted
- Replacement of superstructure would cause:
 - Likely need to strengthen or modify substructures
 - Subsequent increases in construction costs
 - Delay in construction schedule



Precast Panel Options Considered

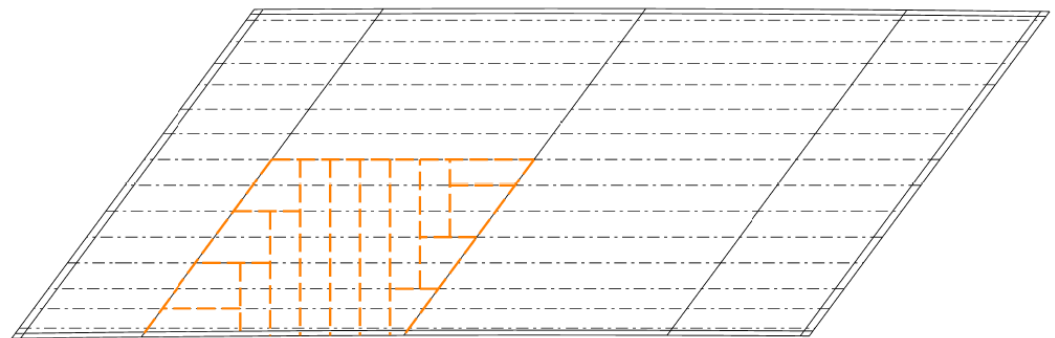
Panel Orientation

- Panels oriented in transverse direction (typical)
 - Not feasible due to skew angle and large width to span ratio of structure
 - For skews > 30 degrees, panel joints must be perpendicular to beams
- Panels oriented in longitudinal direction



Full Depth Precast Concrete Deck Slabs. PCINER-02-FDPCDS. p. 6.

Transverse Panel Layout



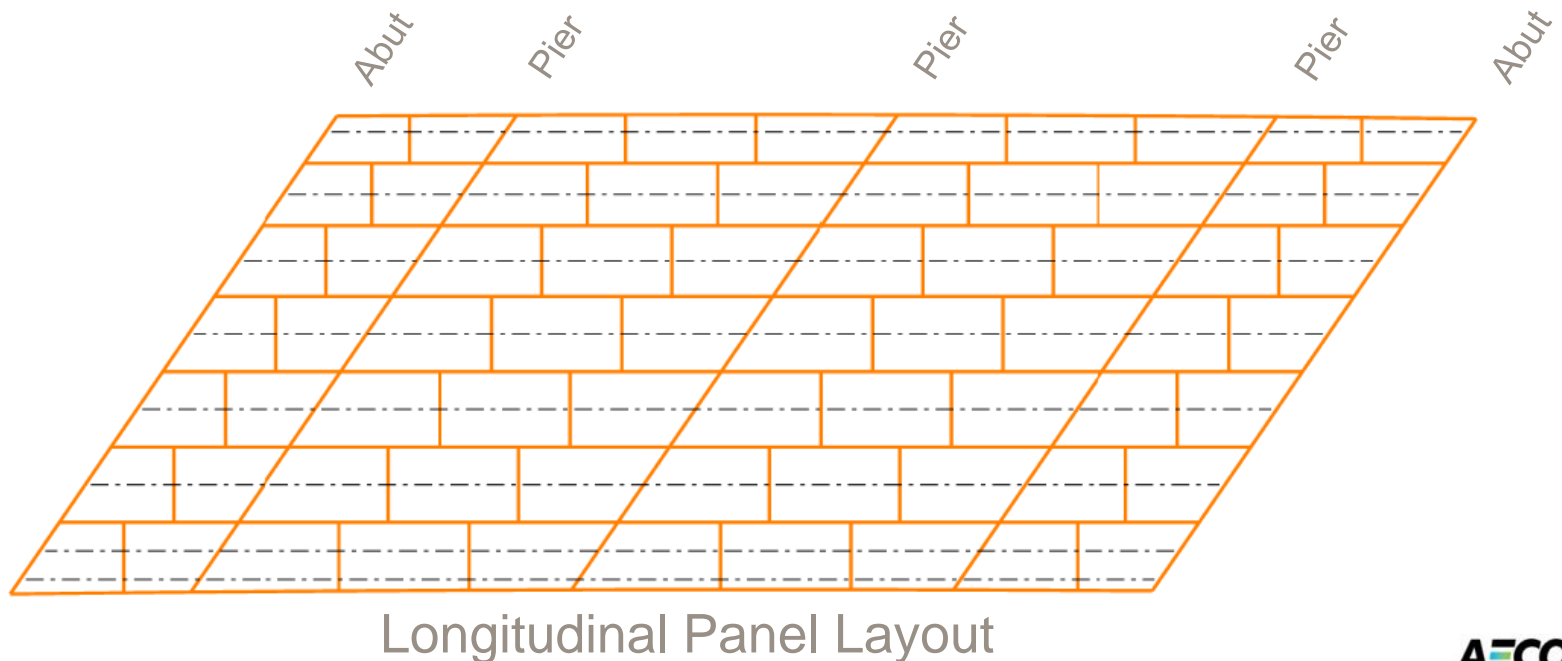
BR 1-717 Transverse Layout



Precast Panel Options Considered Cont'd

Panel Orientation

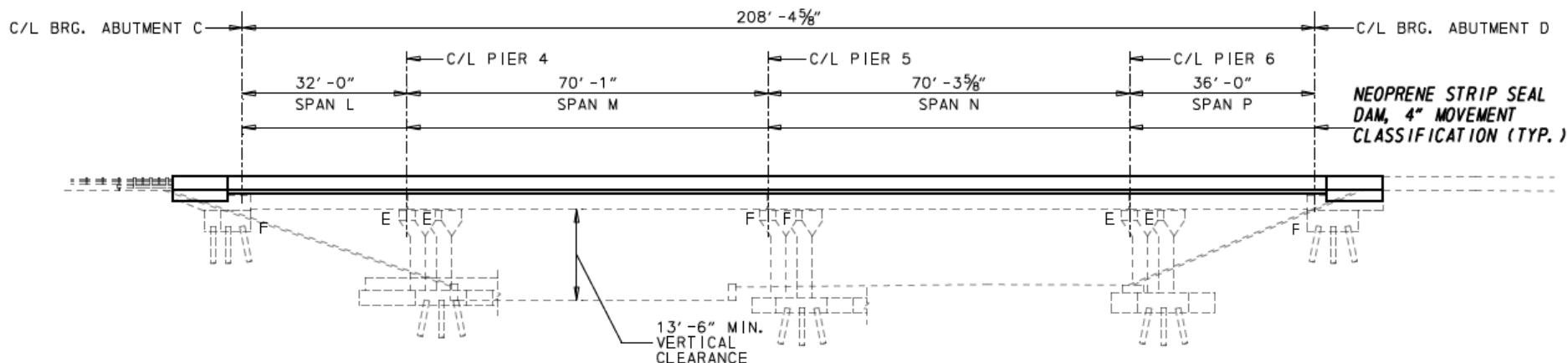
- Panels oriented in transverse direction (typical)
 - Not feasible due to skew angle and large width to span ratio of structure
- Panels oriented in longitudinal direction



Precast Panel Options Considered Cont'd

Deck Joint Considerations

- Currently 4 Simple Spans with Joints over each Support
- Deck Replacement Options:
 - Install New Deck Joints (5 Deck Joints to Remain)
 - Provide Link Slab to Eliminate Deck Joints
 - Simple-Made-Continuous Steel Beams to Eliminate Deck Joints (Uplift at End Supports)



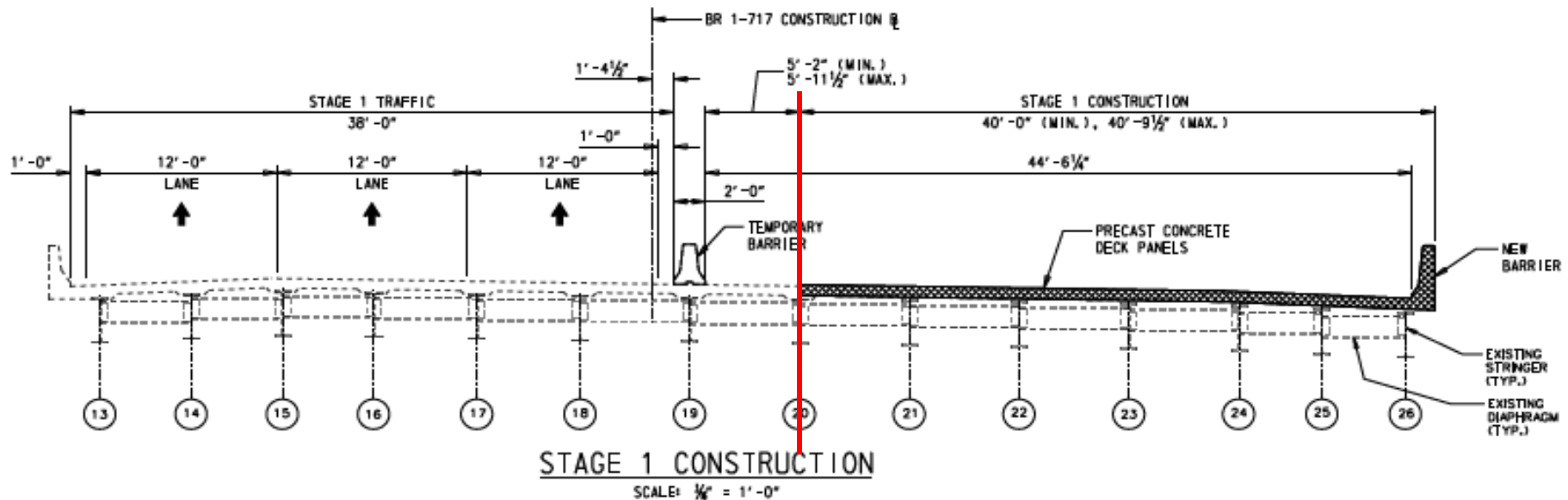
Single Stage Alternative



MOT Considerations

- Provide cross-over to SB structure?
 - Not feasible given proximity of RT1 interchange.
- Half-width Construction
 - Additional Bridge Width Due to Ramp

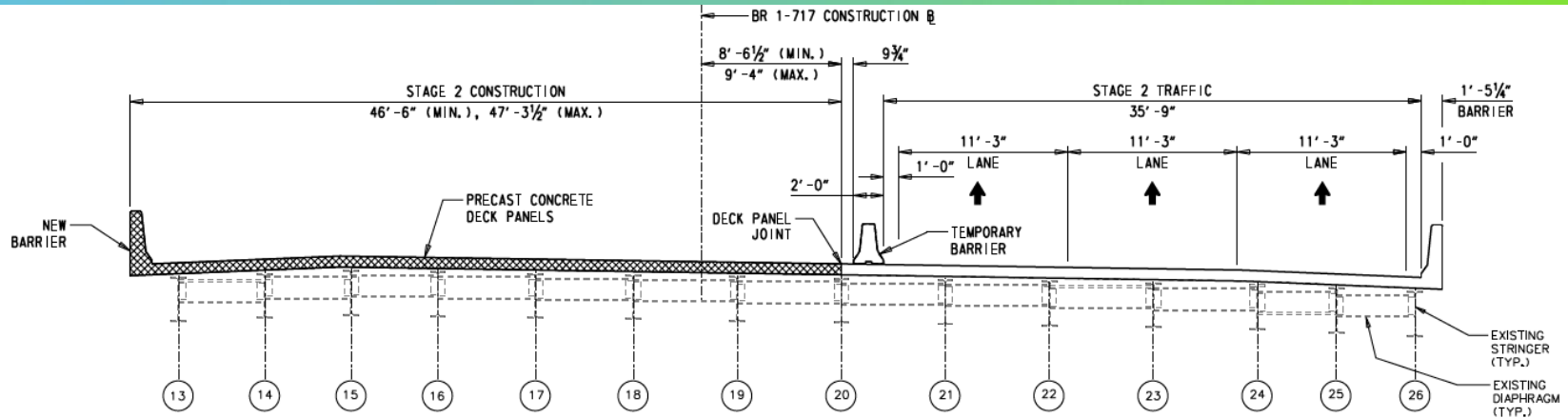
Dual Stage Alternative



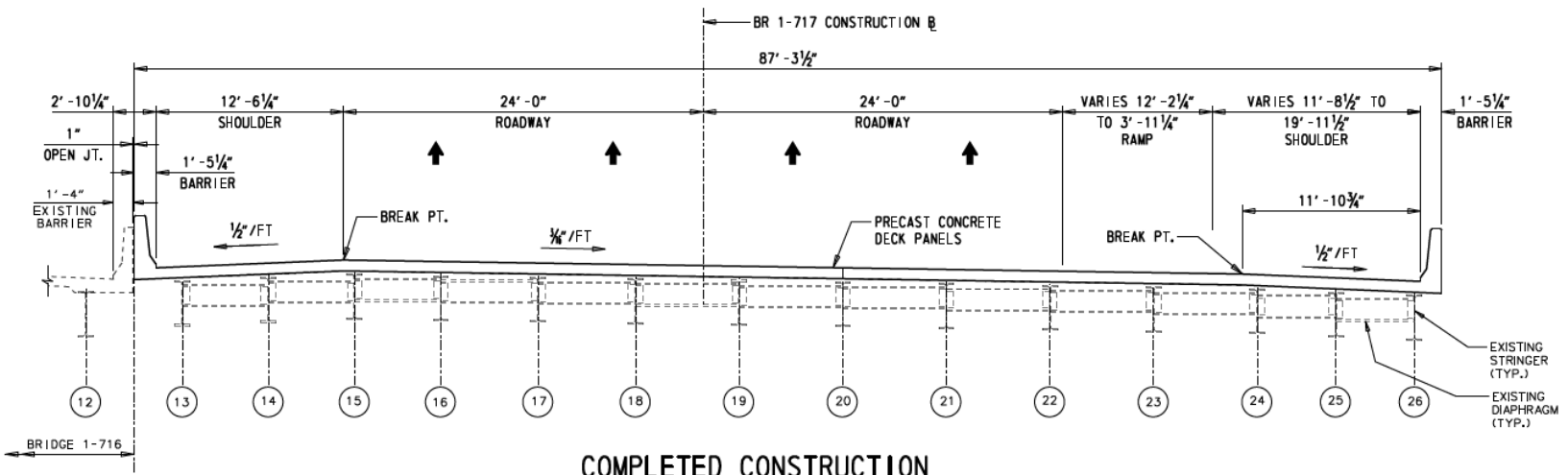
MOT = Half-width Re-decking

- Construction Staging = 2 Stages
- 10 days per stage
- Divide stages at girder line 20
- Maintain 3 lanes of traffic within each phase

Dual Stage Alternative Cont'd



STAGE 2 CONSTRUCTION

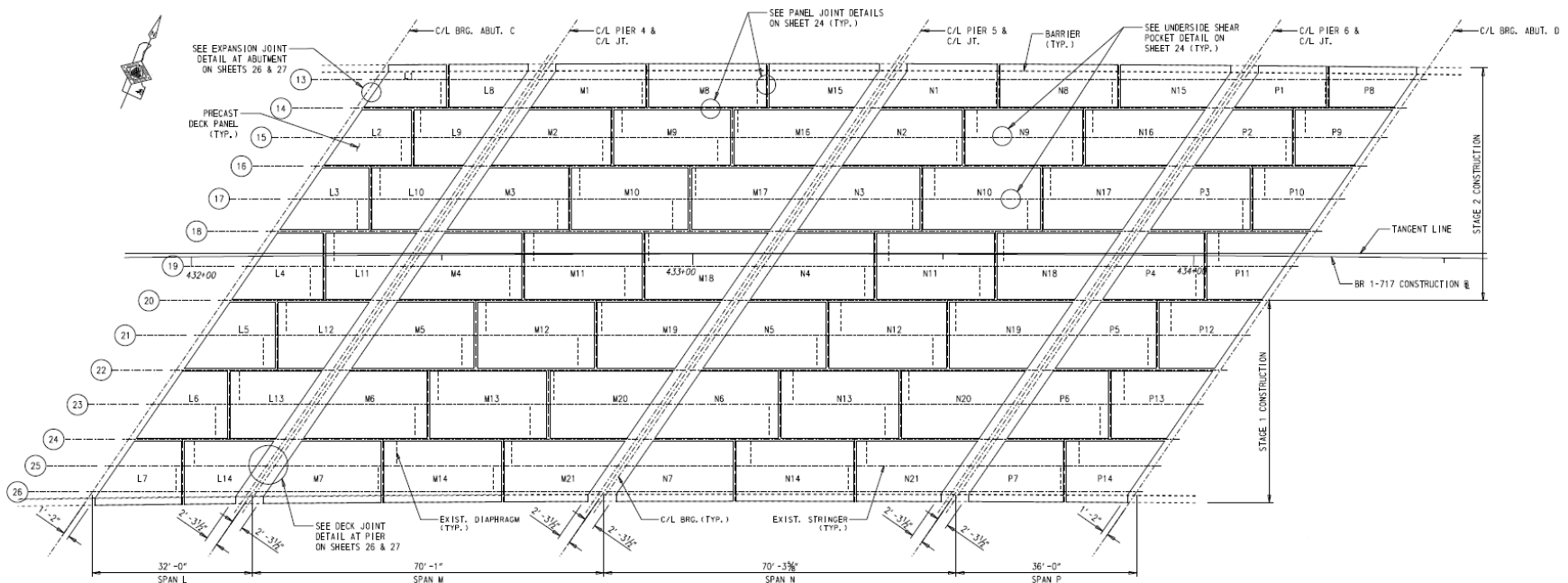


COMPLETED CONSTRUCTION

• Construction Stage Schedule Continued

Selected Deck Replacement Option

- Panels run longitudinally and span across two bays
- UHPC joints utilized to reduce lap lengths
- Deck joints to be placed in field using blockouts
- Use of UHPC eliminates need for post-tensioning

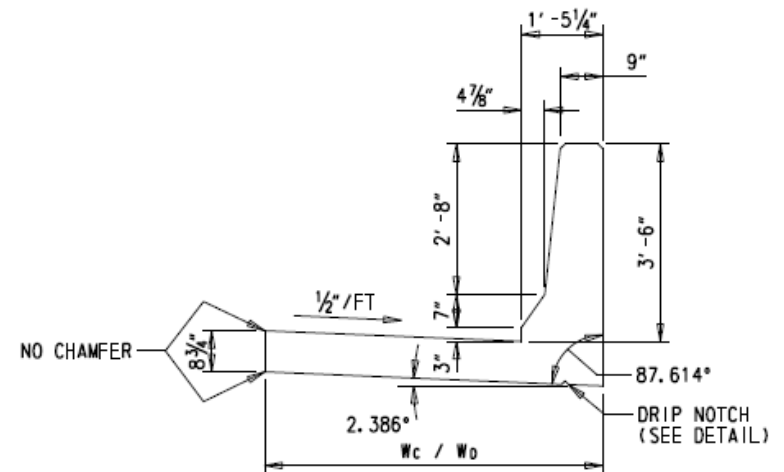


ABC Design Details - Panel Design

- Panels designed as typical CIP deck
- Use of UHPC joints provides rebar continuity
- Barrier precast onto exterior panels to expedite construction

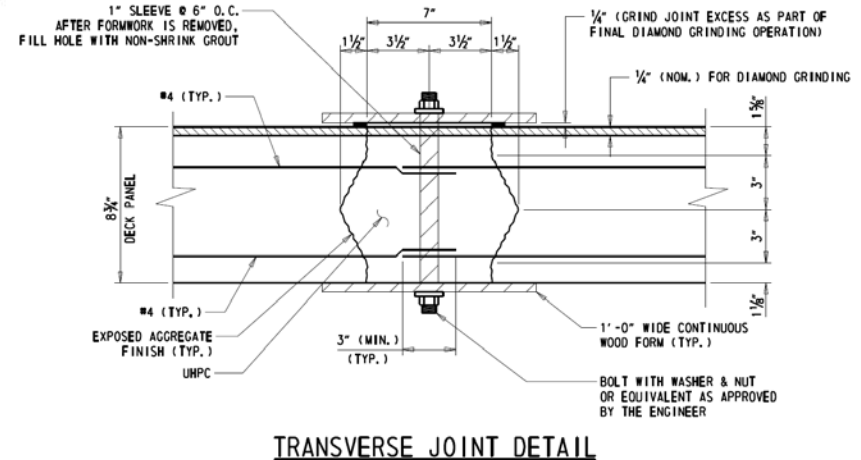
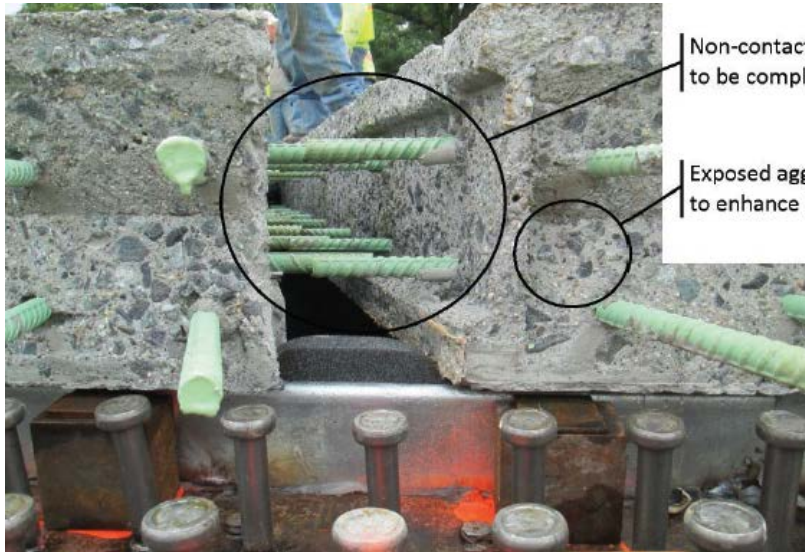
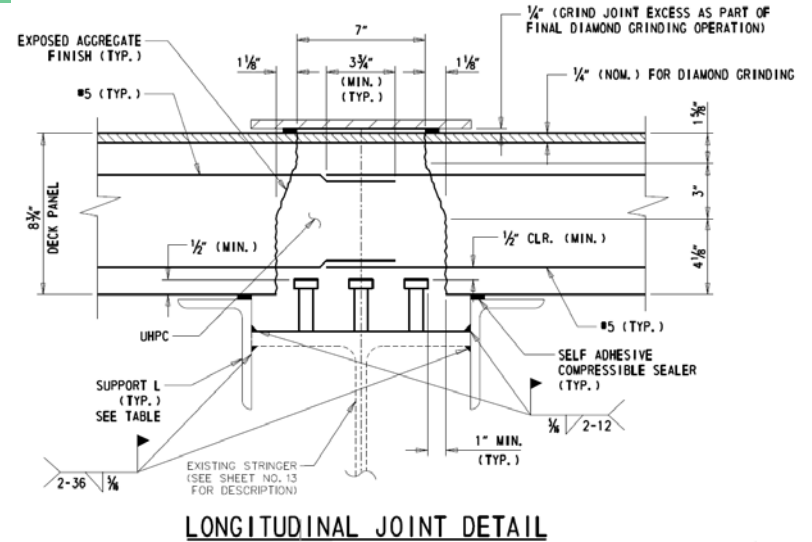


Design and Construction of Field-Cast UHPC Connections. FHWA-HRT-14-084. p. 28.



ABC Design Details - Panel Joints

- 7" nominal joint width
- UHPC permits use of non-contact lap splices within joint

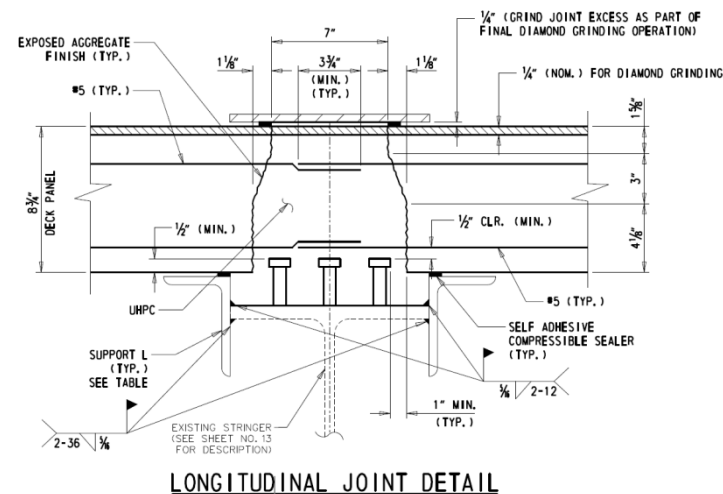
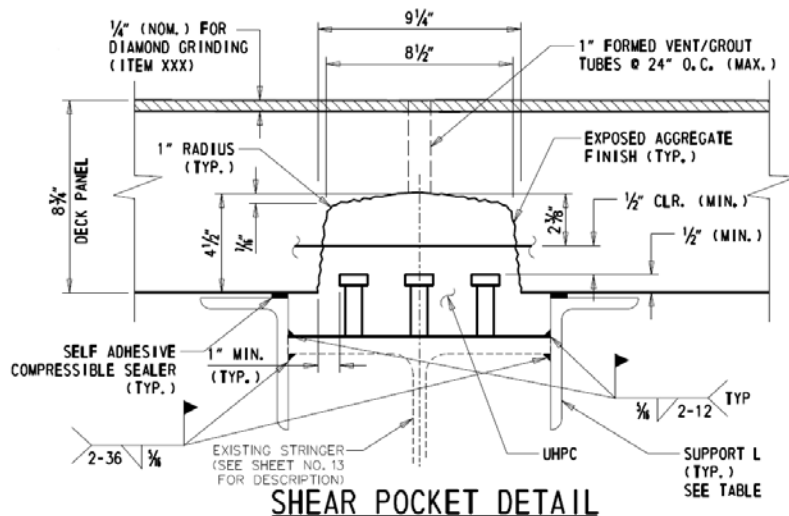


ABC Design Details - Panel to Girder Connection Details

- Panels connected through cast-in-place UHPC trough/joint
- Shear studs remain below rebar mat to avoid interference
- Panel elevation set by angles to avoid need for leveling screws



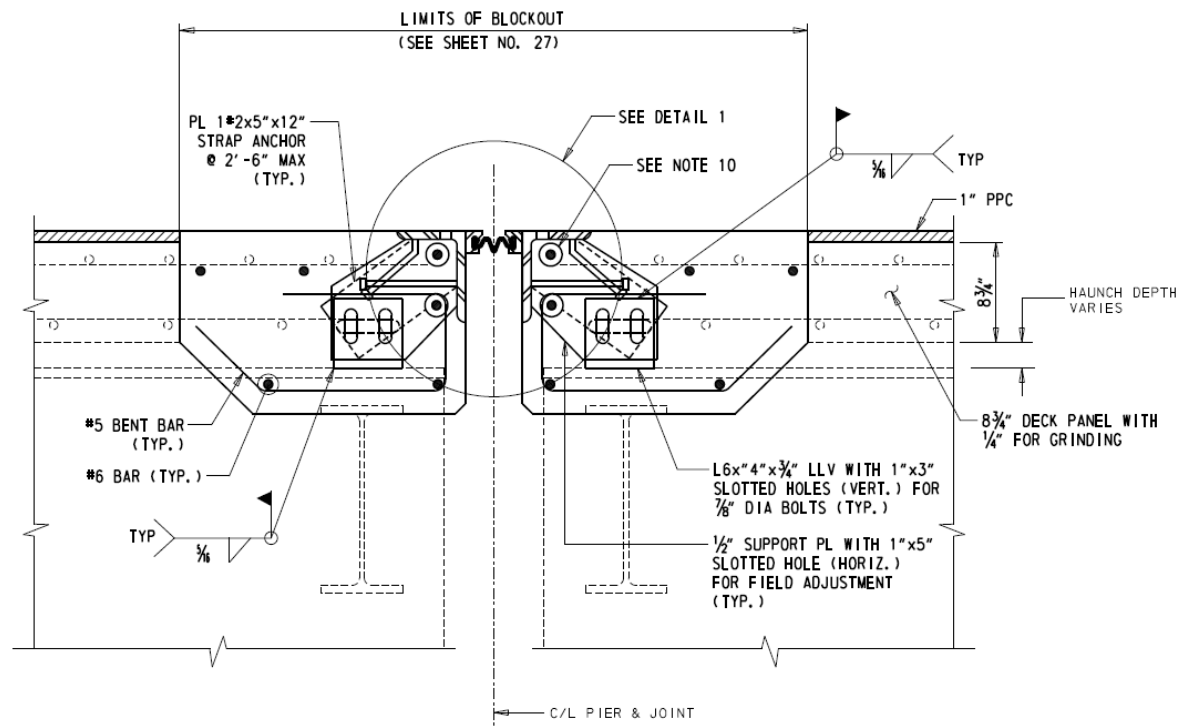
Ultra-High Performance Concrete Composite Connections for Precast Concrete Bridge Decks. FHWA-HRT-12-042. p. 5.



ABC Design Details - Strip Seal Blockout Details

- **Strip seals field cast into closure pours**

- Eliminates issues with alignment of extrusion
- Closure pour required at diaphragms anyway
- High early strength concrete used rather than UHPC to minimize cost



ABC Design Details - Deck Finish

- **PPC (Polyester Polymer Concrete) Overlay Proposed**

- Deck panels include additional ¼” of cover on top for grinding profile if necessary
- 1” PPC overlay provided on bridge deck to:
 - Provide smooth riding surface
 - Protect concrete joints from water / chlorides infiltration
 - Adjust for final profile



Questions & Answers

