THE NEW NY BRIDGE

Accelerated Construction – Using Precast Concrete Deck Panels on the New NY Bridge Approach Spans

Brian P. Cresenzi, PE

National Concrete Consortium – September 19, 2018

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GOAL

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To provide an overview of the design, fabrication, and installation of the New NY Bridge approach span precast concrete deck panels.

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LEARNING OBJECTIVES

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- Project background
- Project quality organization
- Deck panel overview
- Installation sequence
- Project benefits of precast panels
- On-site concrete and production

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MY PROJECT ROLE

- Materials engineer for NYSTA construction oversight team
- Work for HNTB: NYSTA's design and construction oversight engineer
- Responsible for developing oversight materials sampling and testing programs to comply with FHWA requirements
- Advise NYSTA on materials related issues

PROJECT LOCATION

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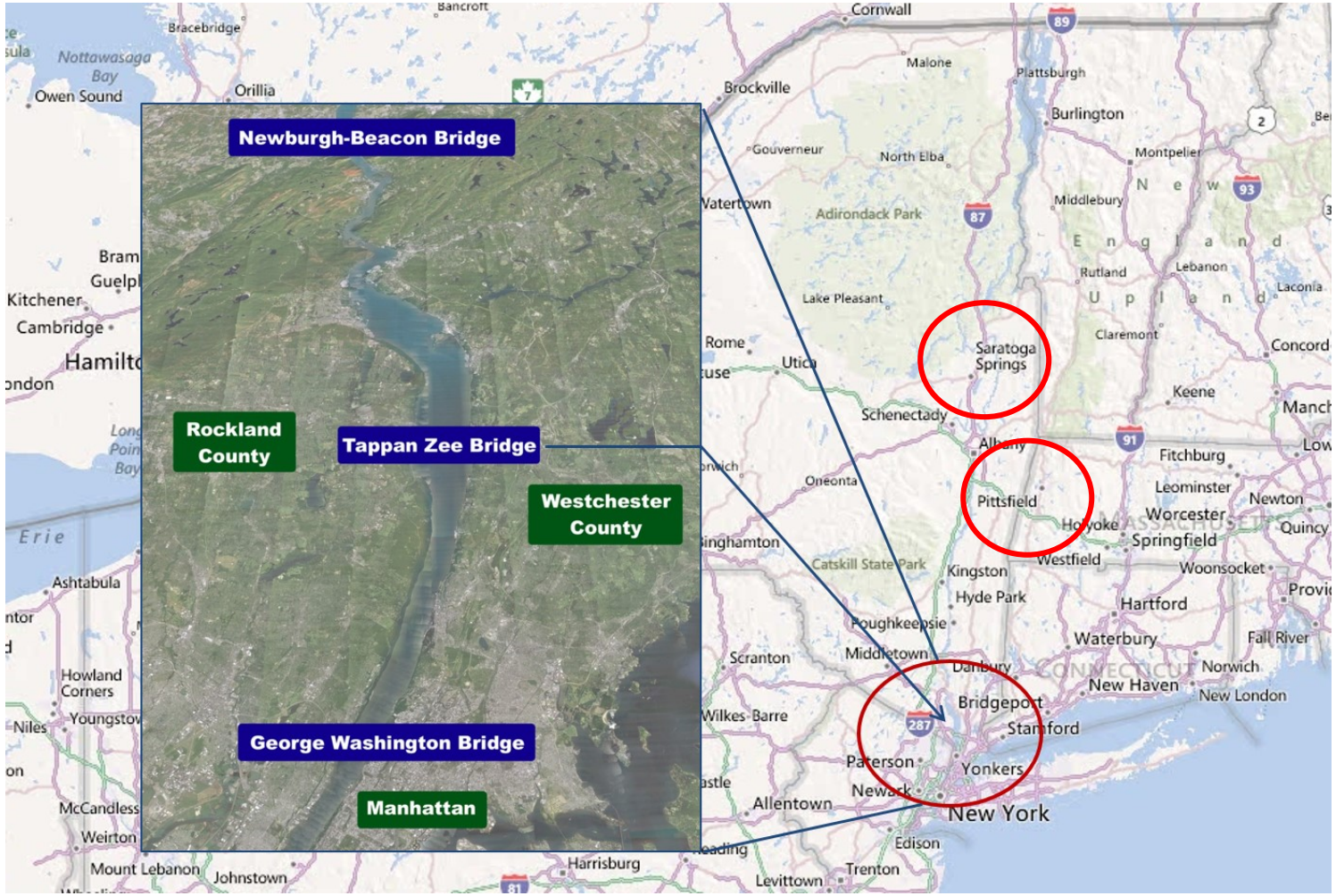

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OLD TAPPAN ZEE BRIDGE

THE NEW NY BRIDGE

- Spanned Hudson River (Westchester – Rockland)
- Carried NYS Thruway – Interstate 87/287
- 3.1 miles long
- Opened in 1955 by NYS Thruway Authority
- 140,000 AADT
- Functionally obsolete, fracture critical

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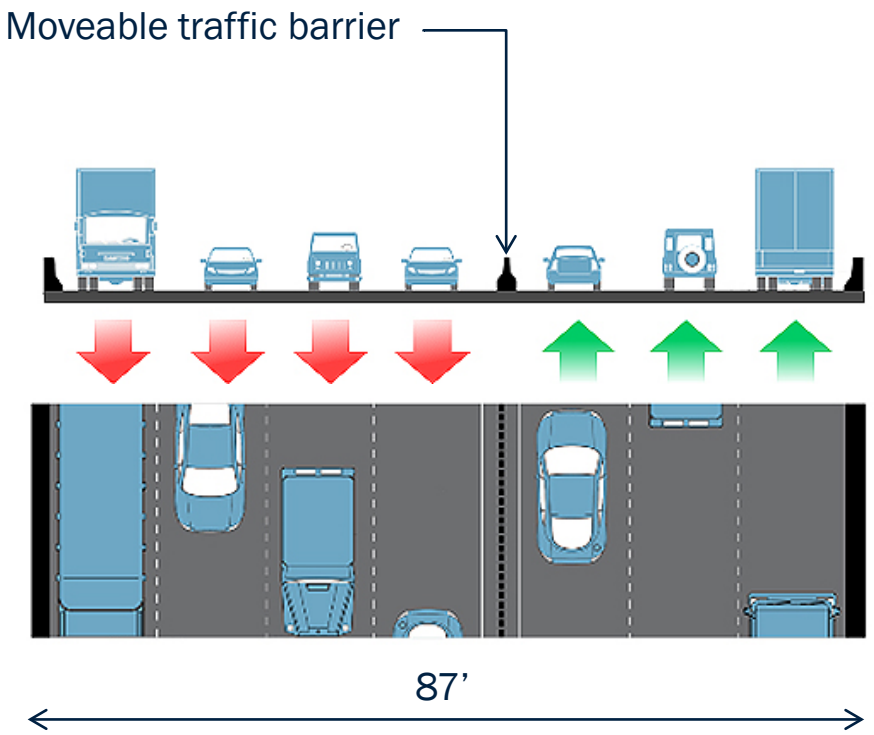
OLD TAPPAN ZEE BRIDGE



Tappan Zee Bridge

1 span, 7 lanes

11’ lanes with movable traffic barrier

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- Two bridges, built just north of old bridge
- 100-year service life
- Cable stay center span of 1,200 feet, 515-foot back spans
- First major use of design/build in NY
- Tappan Zee Constructors, LLC (TZC) – $3.142 billion
- Notice-to-proceed – January 2013

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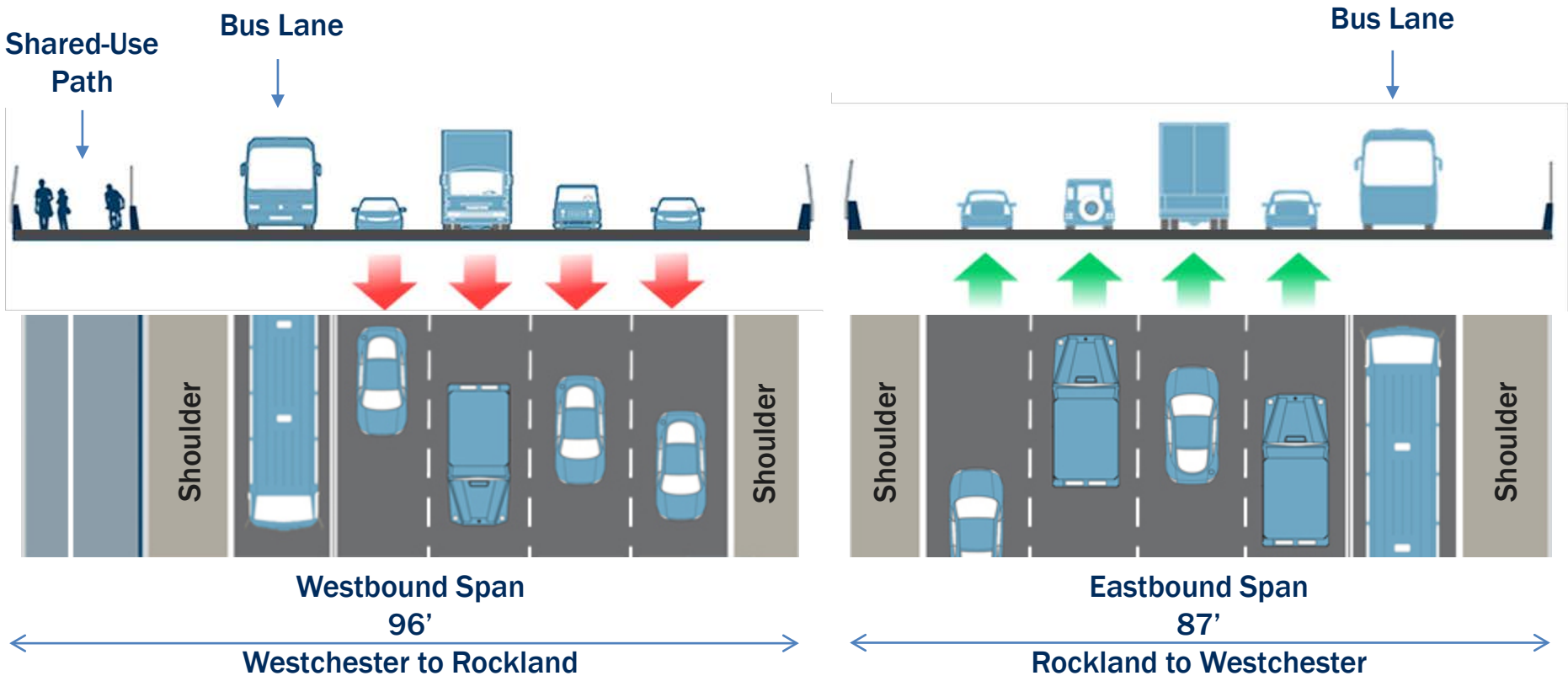
NEW NY BRIDGE



2 spans, 8 general traffic lanes,
4 shoulders, 2 bus lanes, shared-use path

OLD AND NEW BRIDGES

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PROJECT QUALITY ORGANIZATION

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- QC – plant process control
- QA – independent acceptance company hired by TZC
- Oversight (OV) – owner's validation of contractor's results
- Contractor performing acceptance testing (QA & QC)
- Federal regulations (23 CFR 637) require owner's validation of contractor's results

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DECK PANEL OVERVIEW

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- Produced by Unistress in Pittsfield, MA
- Approach span panels (WB + EB) = 5,366 panels
- Approach spans: 2 or 4 panels wide, depending on location
- Installation rate = 15 to 22 panels per day

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DECK PANEL OVERVIEW – DESIGN

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- 10 – ¾” thick
- Galvanized rebar, top clear cover = 2 – ¾”
- Composite with steel girders, 2” – 4” haunches
- Rebar dowels for barrier, stud pockets, leveling bolts, lifting lugs
- Scuppers, valve boxes, and light pole deck extensions
- Location dependent sizes, largest = 11’-11” x 46’-9”

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DECK PANEL OVERVIEW – CONCRETE

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- Fly ash, low w/cm
- Mix design submitted by precaster to meet constructability and project specifications
- Extensive preproduction testing → 100 year service life
- Production testing by plant QC, monitored by QA
- Casted 10 panels per day on average

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DECK PANEL OVERVIEW – CONCRETE

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- Fresh properties and strength
- Freeze-thaw (ASTM C666)
- Scaling resistance (ASTM C672)
- Shrinkage (ASTM C157)
- Chloride migration coefficient (NT Build 492)
- Hardened air void parameters (C457)
- Water soluble chlorides (C1218)

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DECK PANEL OVERVIEW – QUALITY

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- QC and QA inspected during panel fabrication
- QC and QA inspected each panel after completion
- Periodic OV visits to precaster
- QC, QA, and OV inspections at project site prior to installation

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APPROACH SPAN GIRDERS AND STRINGERS

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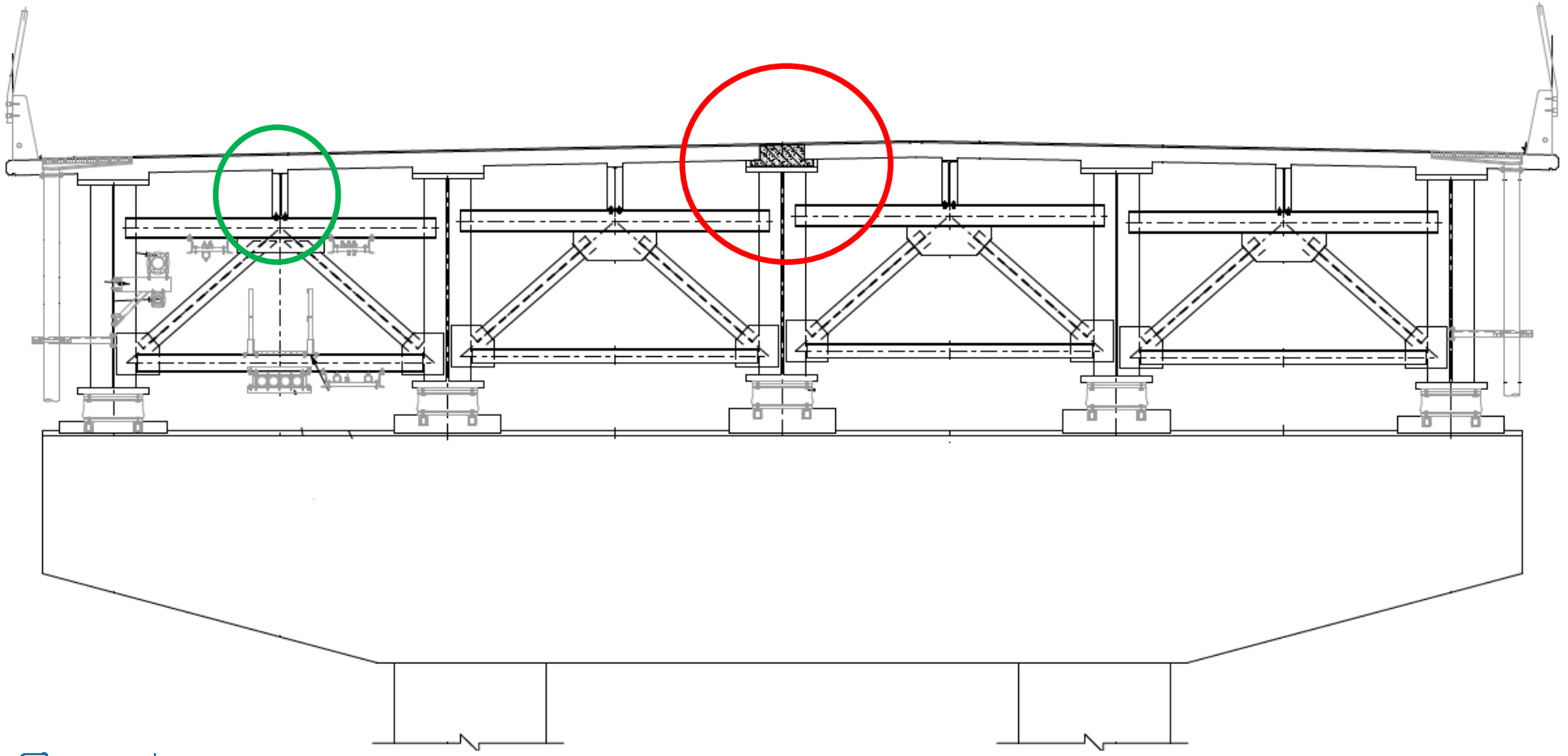

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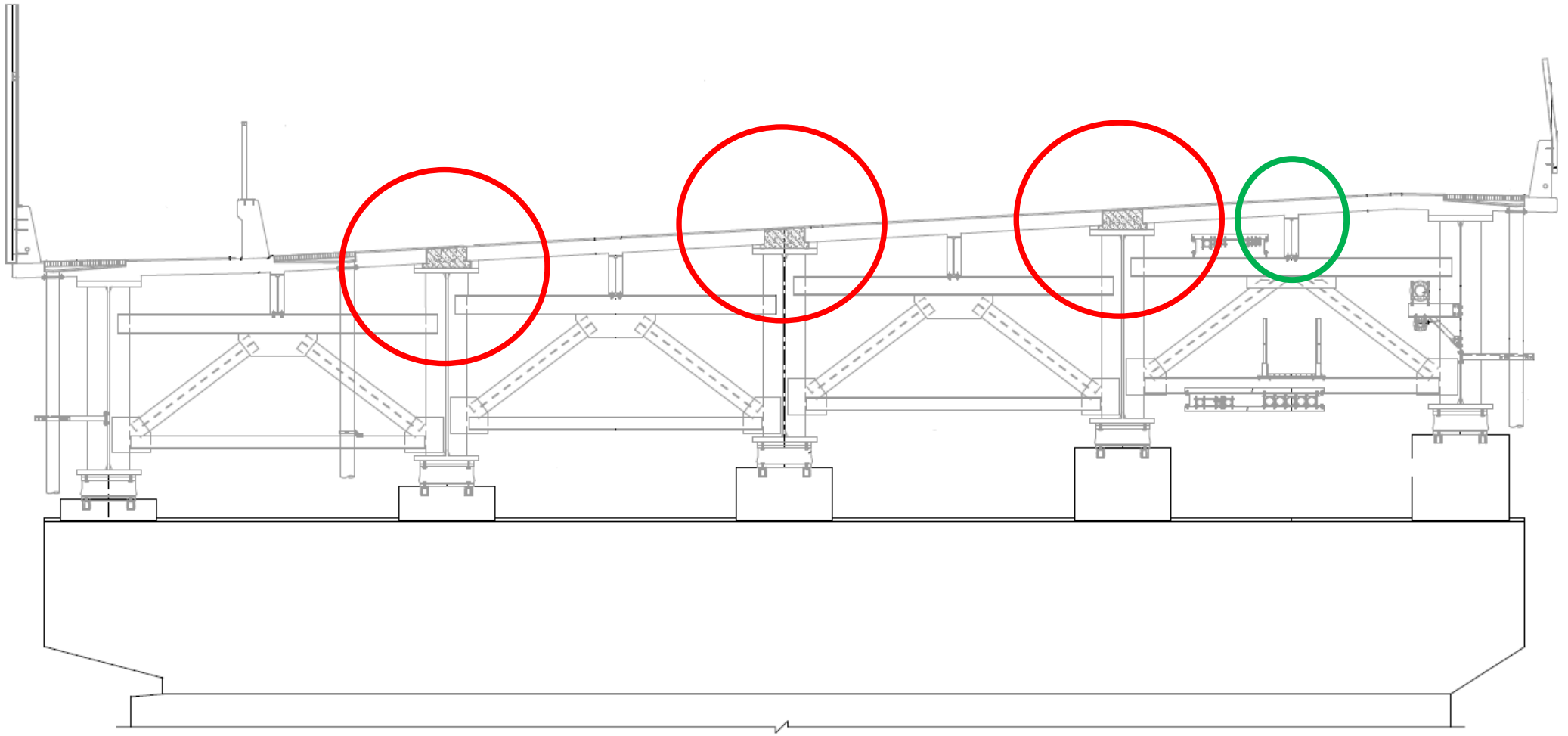

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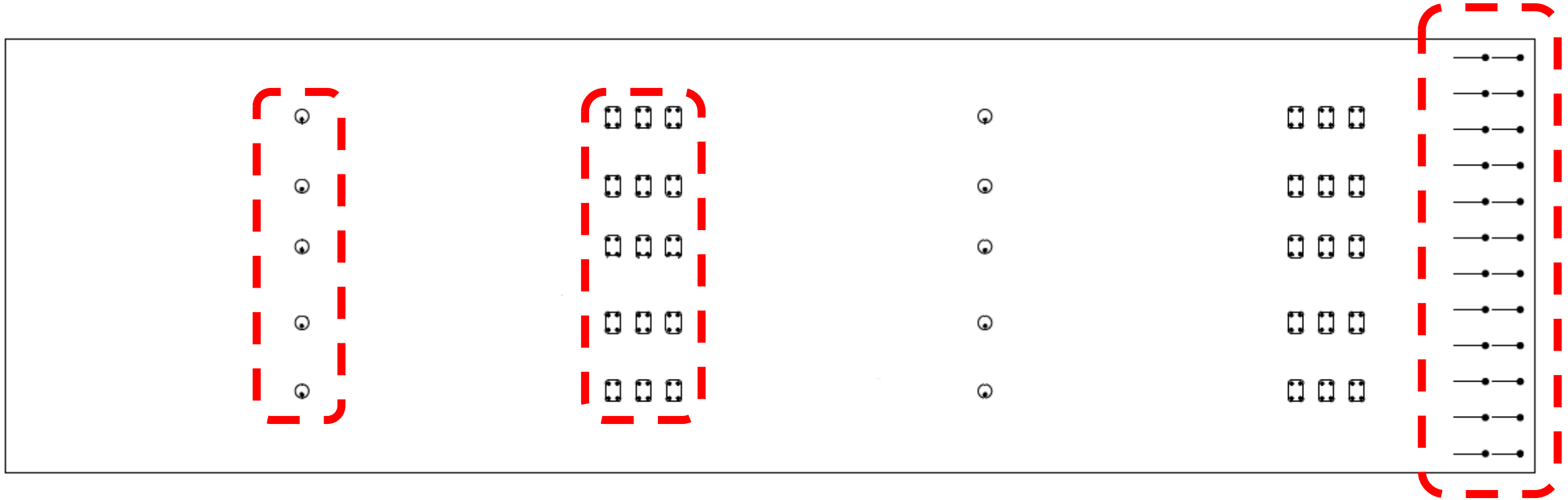
DECK PANEL PLAN



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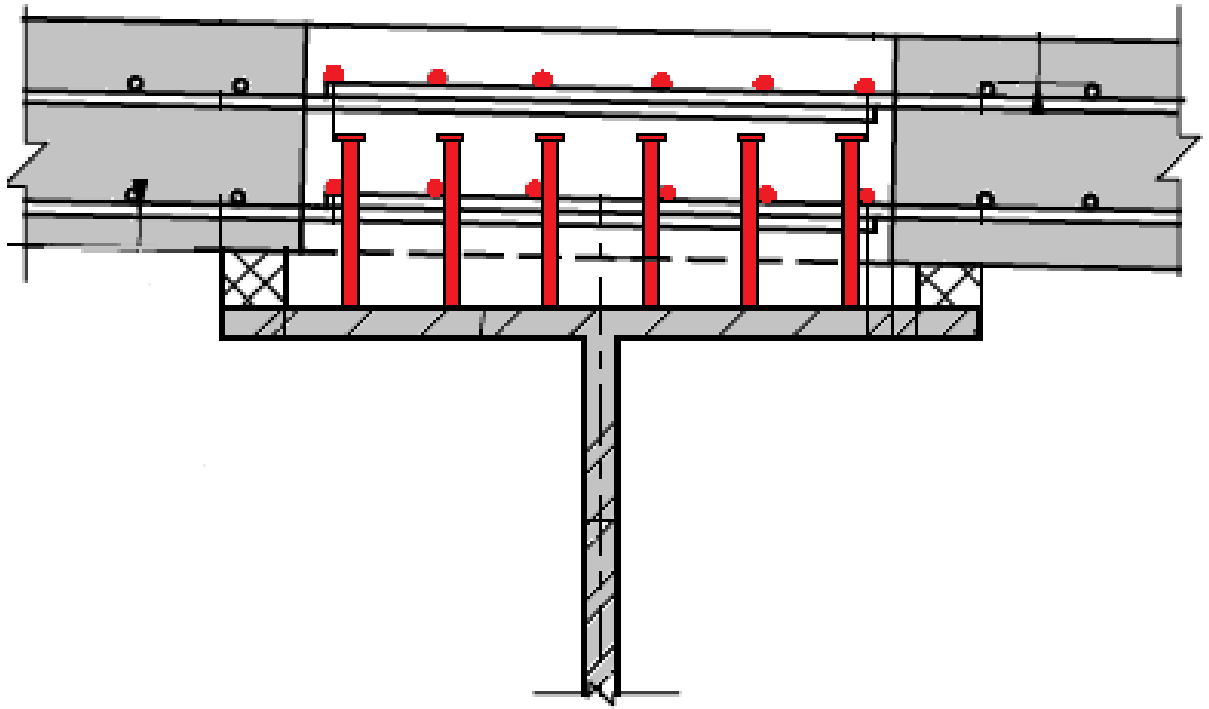
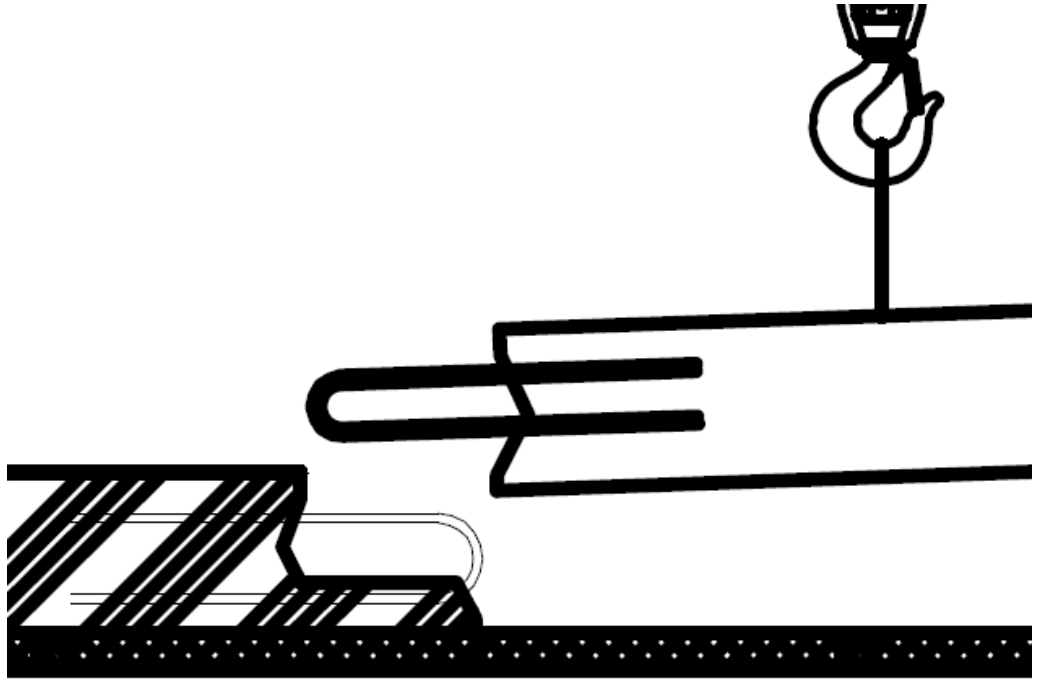
LONGITUDINAL DECK PANEL JOINTS



- Occurs over girders
- Shear studs
- Longitudinal reinforcement depending on girder flange width

TRANSVERSE DECK PANEL JOINTS



- Spaced at approximately 12’ spacing
- Add additional bars for longitudinal reinforcement

INSTALLATION SEQUENCE

- Cast and ship deck panels
- Install structural foam
- Install and level panel
- Shear studs / closure reinforcement
- Closure and haunch pours

CASTING DECK PANELS

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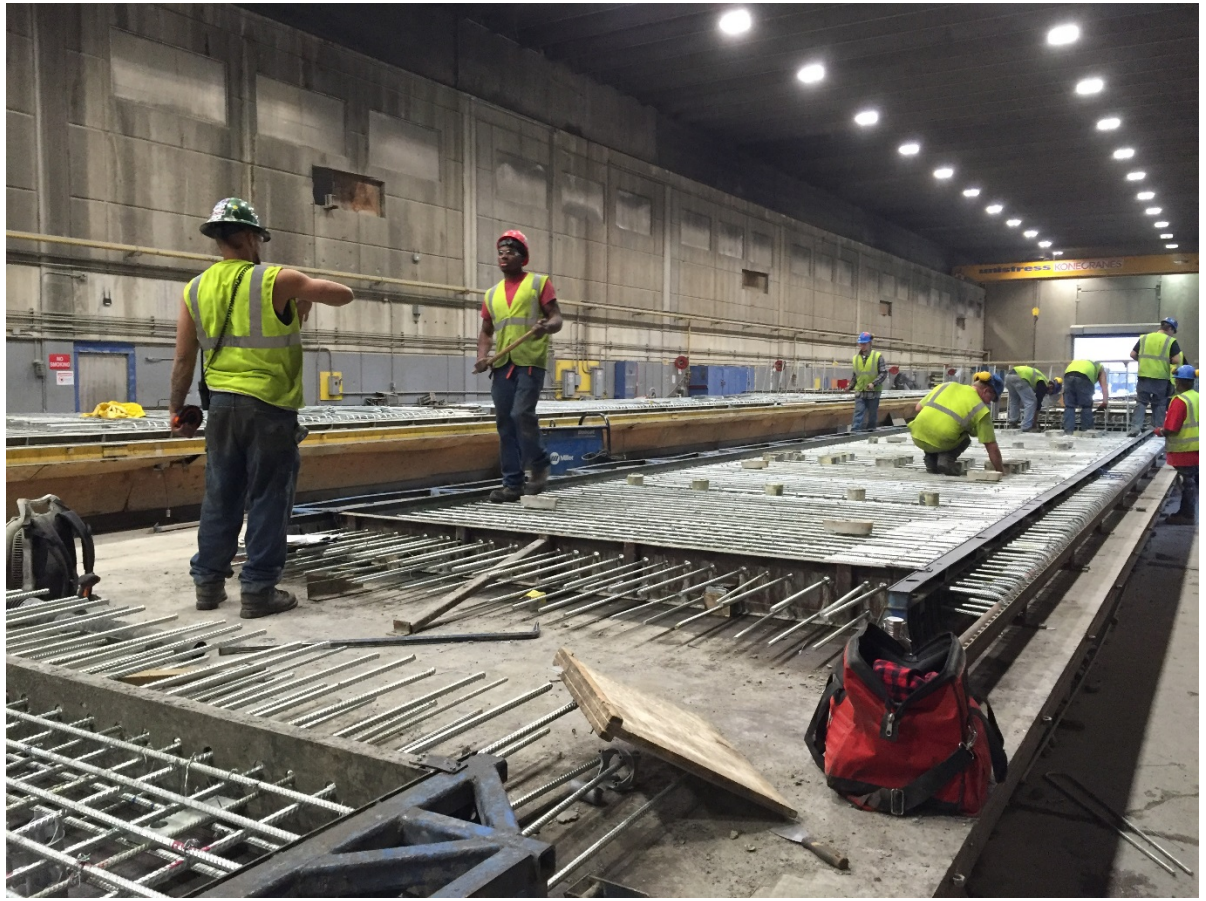

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PORT OF COEYMANS, NY

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SHIPPING DECK PANELS

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INSTALL STRUCTURAL FOAM

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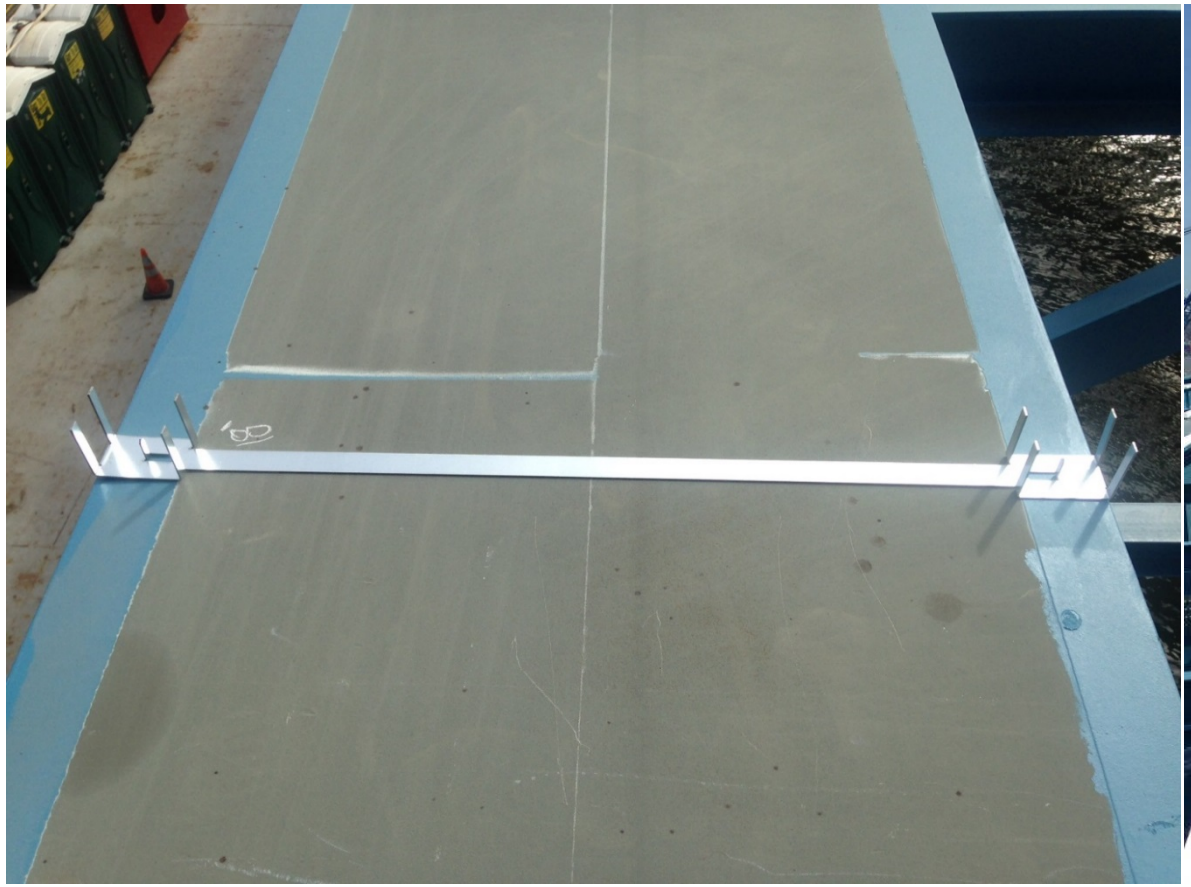

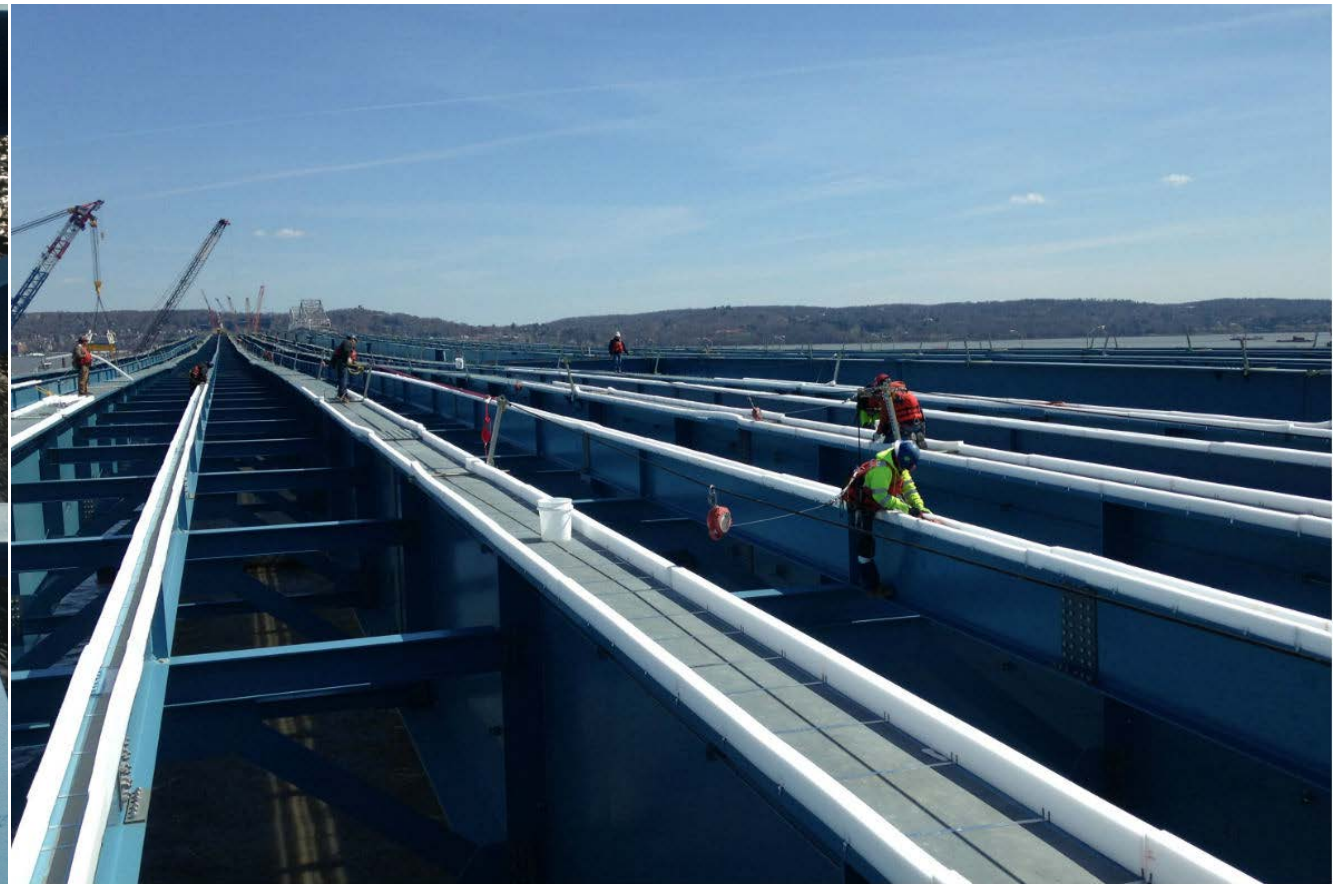

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INSTALL AND LEVEL PANEL

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INSTALL AND LEVEL PANEL

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INSTALL AND LEVEL PANEL

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SHEAR STUDS

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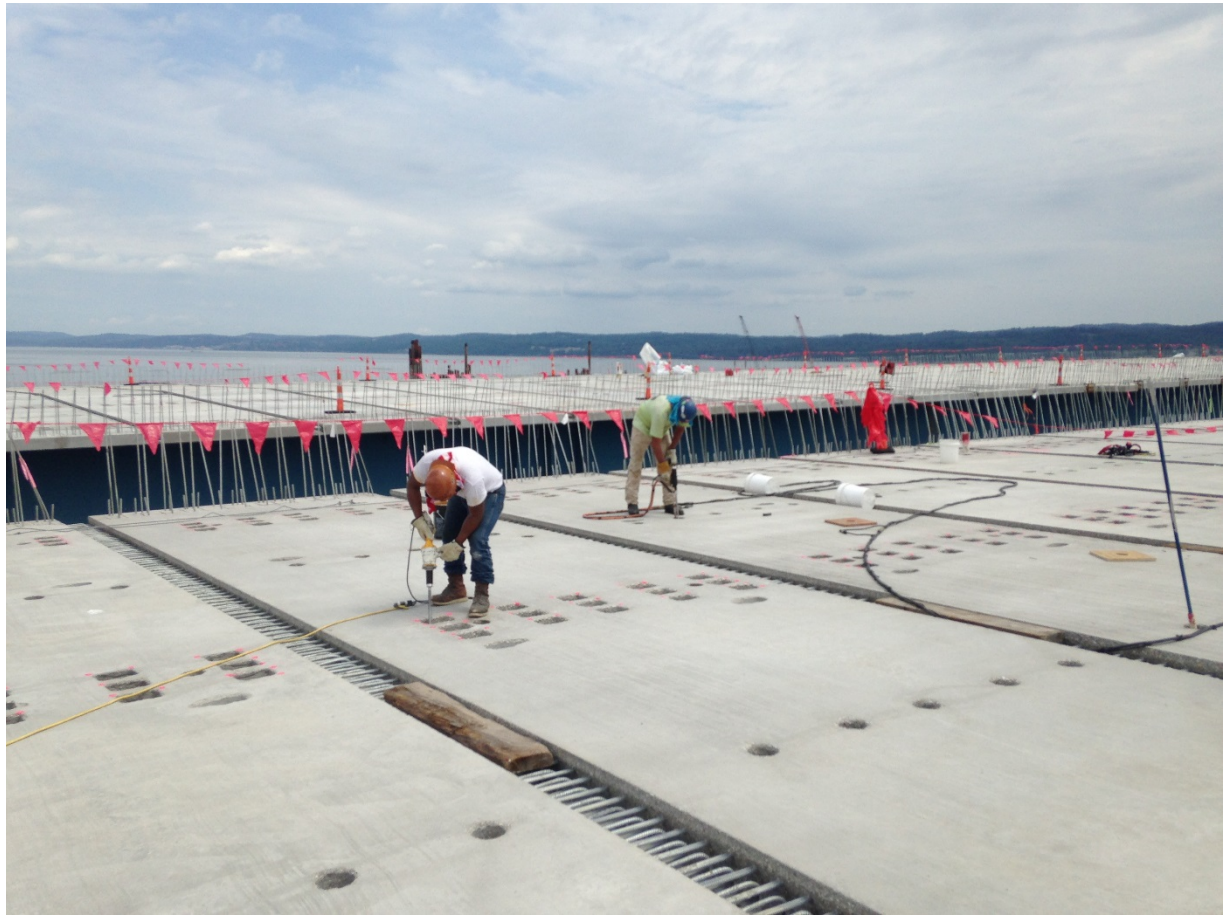

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CLOSURE REINFORCEMENT

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CLOSURE / HAUNCH POURS

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CLOSURE / HAUNCH POURS

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- Closure pours = 10,121 CY
- 9,262 CY from batch plants, 859 CY from shore-based supplier
- Average placement size = 65 CY

- Haunch pours = 5,216 CY
- Used self-consolidating concrete
- 4903 CY from batch plants, 313 CY from shore-based supplier
- Average placement size = 35 CY

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COMPOSITE DECK

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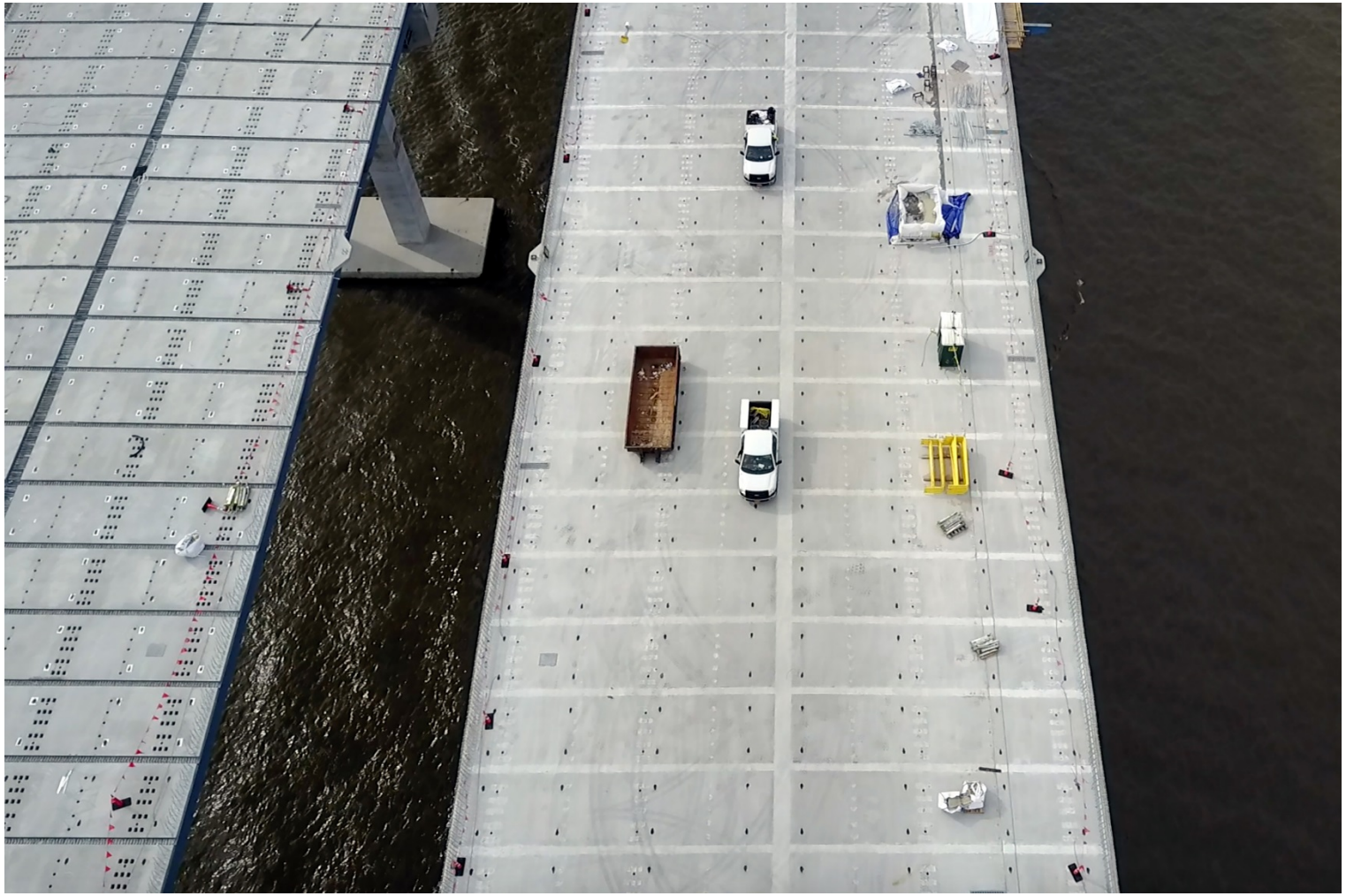

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WHAT HAPPENS NEXT?

- Install barrier reinforcement
- Cast barriers
- Fill lifting lug and leveling bolt holes
- Surface preparation: Mill and shot blast deck
- Install waterproofing membrane
- Pave with Rosphalt wearing surface → waterproof asphalt

BENEFITS OF PRECAST DECK PANELS

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- Panel production: September 22, 2014 – July 17, 2017
- First steel girders: June 17, 2015
- 950 deck panels cast before first steel erected
- Saved 80,000 CY of cast-in-place concrete, reduced on-site plants
- Simplified work to meet tight schedule

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BENEFITS OF PRECAST DECK PANELS

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- Eliminated installation of metal decking
- Eliminated significant amounts of field rebar installation
- Reduced field crew sizes
- Reduced sizes of field concrete placements, simplified curing

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ON-SITE CONCRETE

- 100-year service life requirement
- High durability concrete (low w/cm, slag, fly ash)
- Extensive pre-production testing
- Production testing program per NYSDOT MM 9.2
- Special production durability testing (NT Build, C457, C1218)
- QA, QC, and OV developed a joint testing program

CONCRETE PRODUCTION

- Three NYSDOT certified, barge-based batch plants
- Shore-based ready mix supplier
- Over 250,000 CY of concrete placed to date
- 212,000 CY from batch plants; 38,000 CY from shore-based supplier

BARGE- BASED BATCH PLANT

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- Plant barge
- Supply barge (cement, slag, water, admixtures)
- Testing barge (plants 1 and 2)
- Two aggregate barges (coarse and fine aggregates)
- Waste barge

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BARGE-BASED BATCH PLANT

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TESTING AND AGGREGATE BARGES

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BATCH PLANT TESTING BARGE

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INSIDE BATCH PLANT TESTING LAB

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SUPPLY BARGE

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CONCLUSION

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Precast concrete deck panels were a critical component of the New NY Bridge construction in order to meet the tight project schedule.

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Q&A SESSION

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