ROUTE 37 EB MATHIS BRIDGE – NJ'S LARGEST PRECAST EXODERMIC DECK REPLACEMENT

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JULY 2018 ABC WEBINAR

BRIDGE LOCATION & STATUS

Status: Mathis Bridge precast deck work completed 5/2017

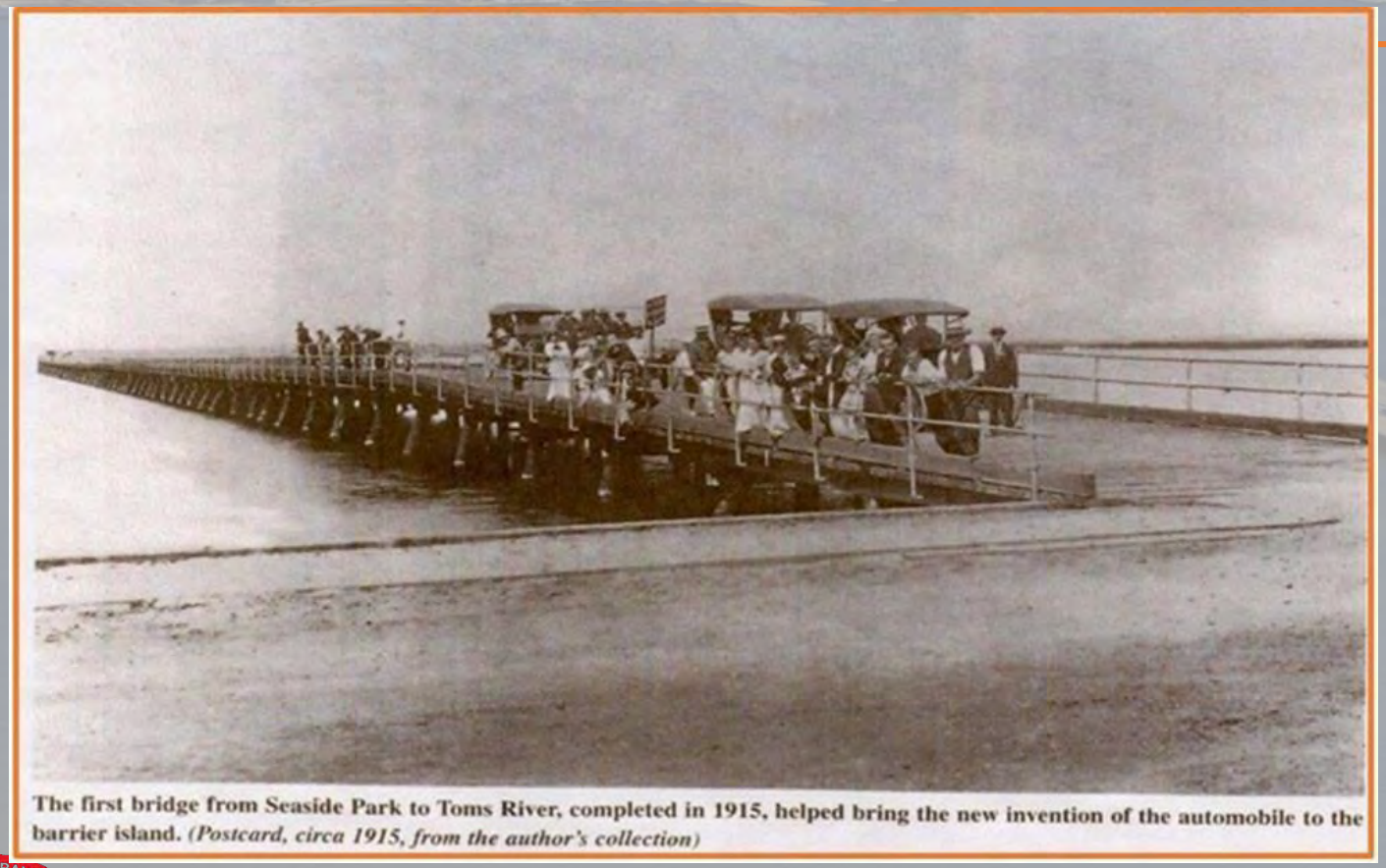
MATHIS BRIDGE

- Constructed in 1950
- Length = 4,877’
- Spans = 66
- Carries Eastbound Traffic
- Steel multi-stringers
- Original Reinforced concrete deck

TUNNEY BRIDGE

- Constructed in 1972
- Length = 4,878’
- Spans = 50
- Carries Westbound Traffic
- Steel Multi Girder/RC deck

ORIGINAL CROSSING



The first bridge from Seaside Park to Toms River, completed in 1915, helped bring the new invention of the automobile to the barrier island. *(Postcard, circa 1915, from the author's collection)*

- Circa 1915
- Connected the mainland to seaside heights
- Helped to bring the "new invention" of automobiles to the barrier island

PRECAST DECK WORK COMPLETED

- 63 approach spans redecked – precast Exodermic (176,000 SF)
- Precast deck Work completed one season ahead of schedule
- Bearings (658 units) Replacement
- Substructure Repairs and Structural Steel Repairs
- Mechanical/Electrical Component Replacement and Upgrades
- Safety: Gates, Traffic Signals, Railings, Catwalks
- Minor Improvement to available lane width

PRE-REHABILITATION CONDITIONS

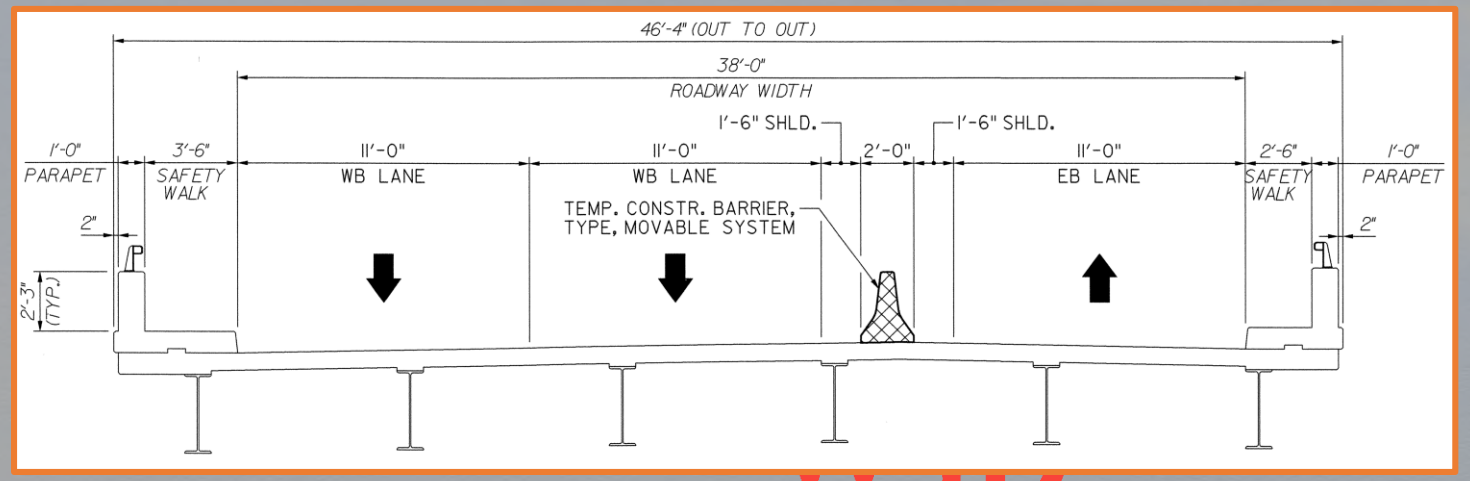
- Repair patches and spalls
- Narrow lanes

PRE- REHABILITATION CONDITIONS

- Excessive movement and frozen rocker bearings
- Extensive rusting typical on bearing steel

OPTIMAL, SEASONAL CONSTRUCTION STAGING

- Original concept included two EB/WB lanes, and
- Major preparatory / restoring work to the WB bridge
- Traffic/Evacuation study resulted in one EB/two WB lanes in off-peak seasons
  - Eliminates one construction season up front and one at the end on Tunney
  - Allows Contractor access to entire structure
  - Allows panels to be built full width and avoids a longitudinal joint



PROJECT CONSTRAINTS

Primary Constraints

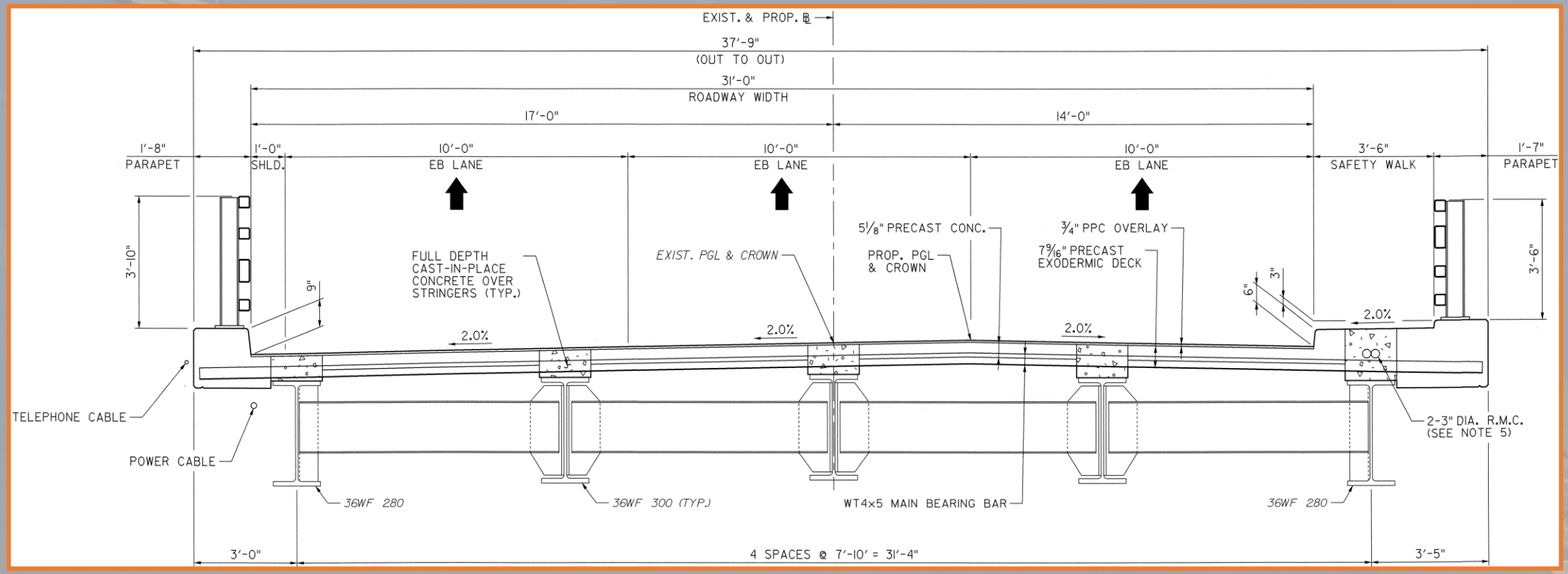
- Deck thickness and impacts to roadway profile
- Dead load limits
- Rapid construction for mile long structure
- Minimize impacts to vehicular and marine traffic
- Cold weather construction (November through April)
- Cost effective solutions

DECK STUDY

Alternatives studied

1. Conventional CIP deck meeting NJDOT standards
2. Reduced thickness CIP deck
3. Precast Concrete – Full Depth Panels
4. Precast Concrete – Partial Depth Panels with CIP topping
5. Precast Exodermic Deck
6. CIP Exodermic Deck
7. Partially Filled Steel Grid Deck

DECK REPLACEMENT TYPICAL SECTION

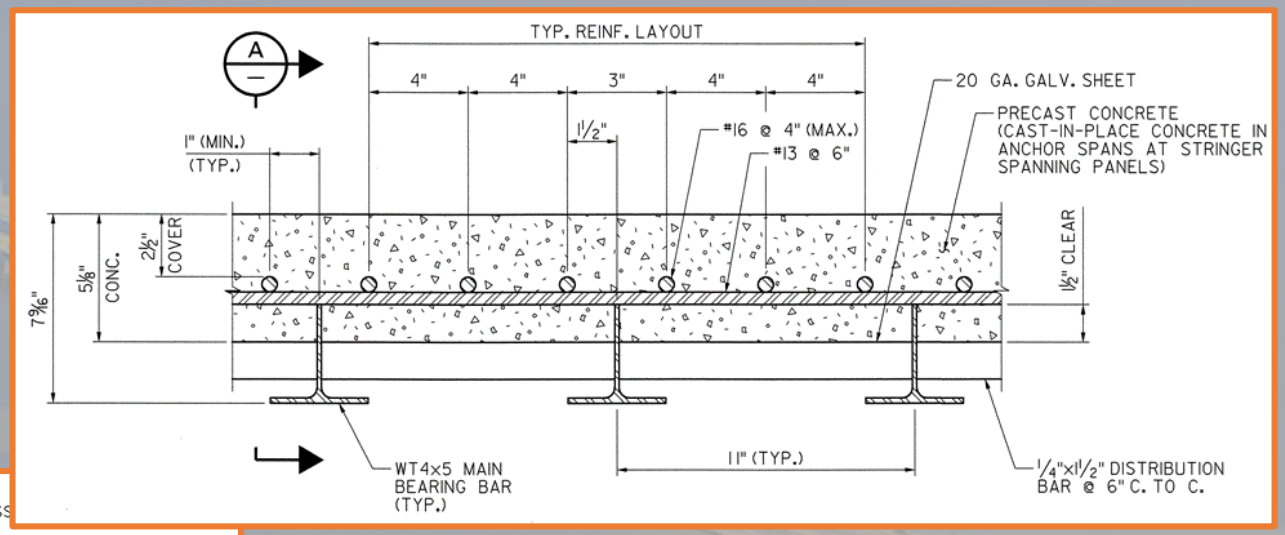


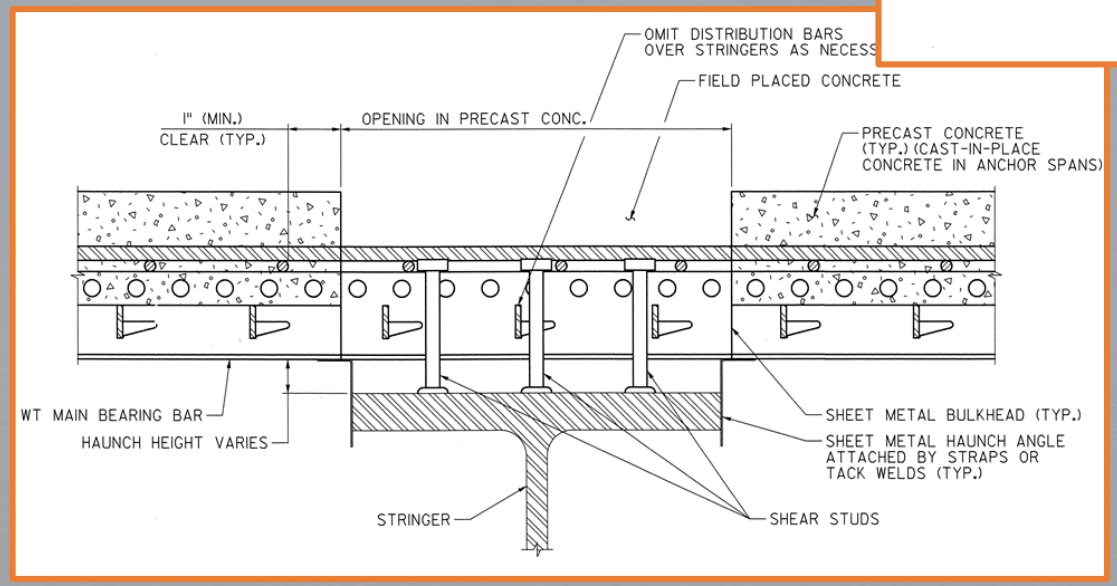
Typical Section of reconstructed Approach Spans

REHABILITATION DESIGN
DECK TYPE STUDY

Precast Exodermic Deck Selected

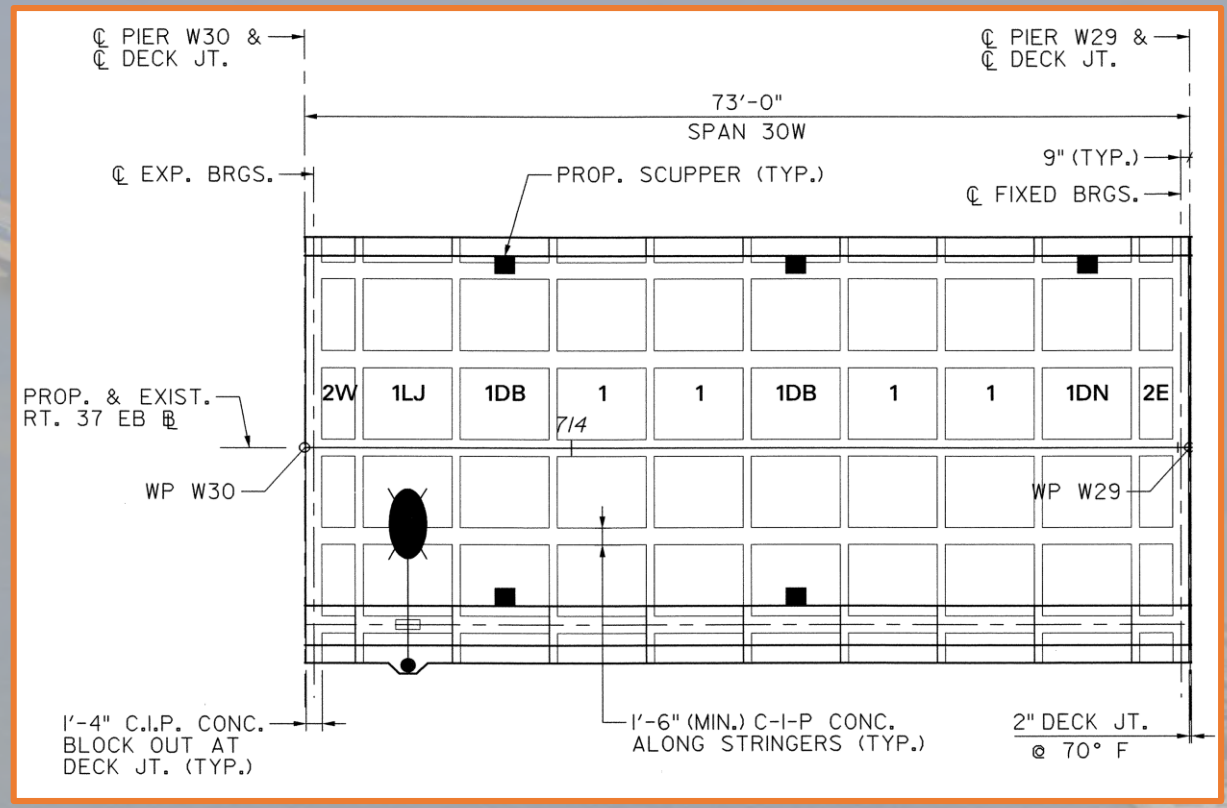
- Rapid, controlled construction
- Cold weather constraints addressed
- Offsite construction
- Lightweight 7-9/16” deck with ¾” overlay





REHABILITATION DESIGN
REPETITIVE DETAILS FOR REPEATED SUCCESS

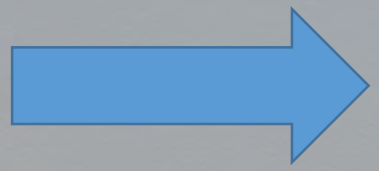
- Tangent horizontal alignment
- 63 identical span lengths
- Repetitive, Type 1 & 2 panels cover 150,000 SF (85% of deck area)
  - Panels contain minor modifiers such as scuppers and lighting standards
- Railing anchors, scupper frames cast with panels
- Steel rails ~10,800 LF, off-site fabrication
- Closure pours based on performance specs



CLOSURE POUR OPTIONS

Areas of closure pour
- 8” wide transverse splice joints between panels
- 18” wide full depth pours over stringers
- Deck joint blockouts

Alternatives studied
- Ultra HPC
- High Performance Grout
- Quick setting concrete



Provide performance requirements - Contractor flexibility

CONSTRUCTION ACTIVITIES
SEASONAL SHIFTING OF TRAFFIC

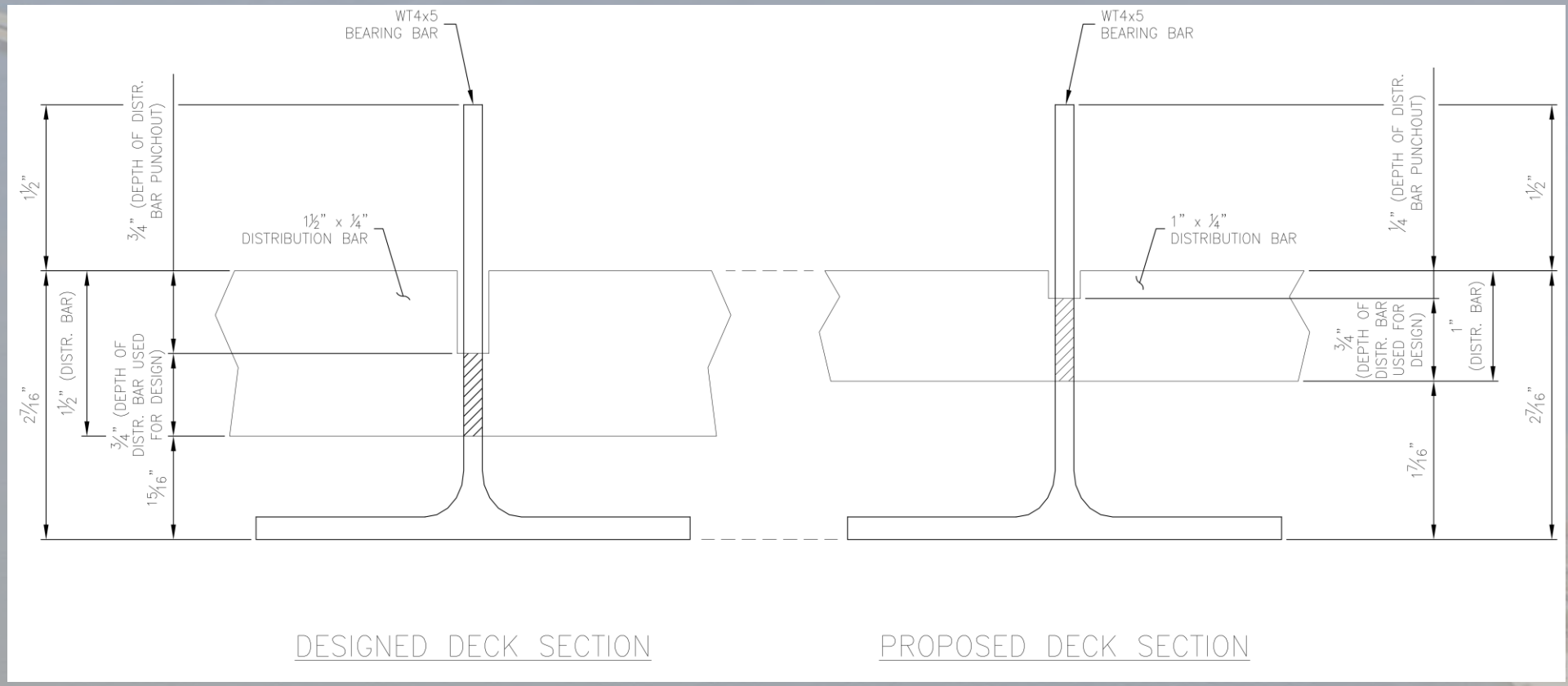
- East Approach roadway - traffic shift each season
- Movable, steel Barriers, TL-4 rated, easy shift in case of evacuation

CONSTRUCTION ACTIVITIES
GRID FABRICATION

LB FOSTER PLANT IN BEDFORD, PA.

CONSTRUCTION ACTIVITIES
DECK DETAILING

- Alternate details for steel grid by fabricator
- Need to rework casting dyes
- Slightly reduced dist. Bar height for early panels ONLY to help schedule



CONSTRUCTION ACTIVITIES
PRECAST PANEL PRODUCTION

FORT MILLER PLANT, NY – Production started 11/9/2015
Target production – 5 to 7 panels/day, typ. span in less than 2 day

Galvanized reinforcement t/o

High Performance Concrete t/o

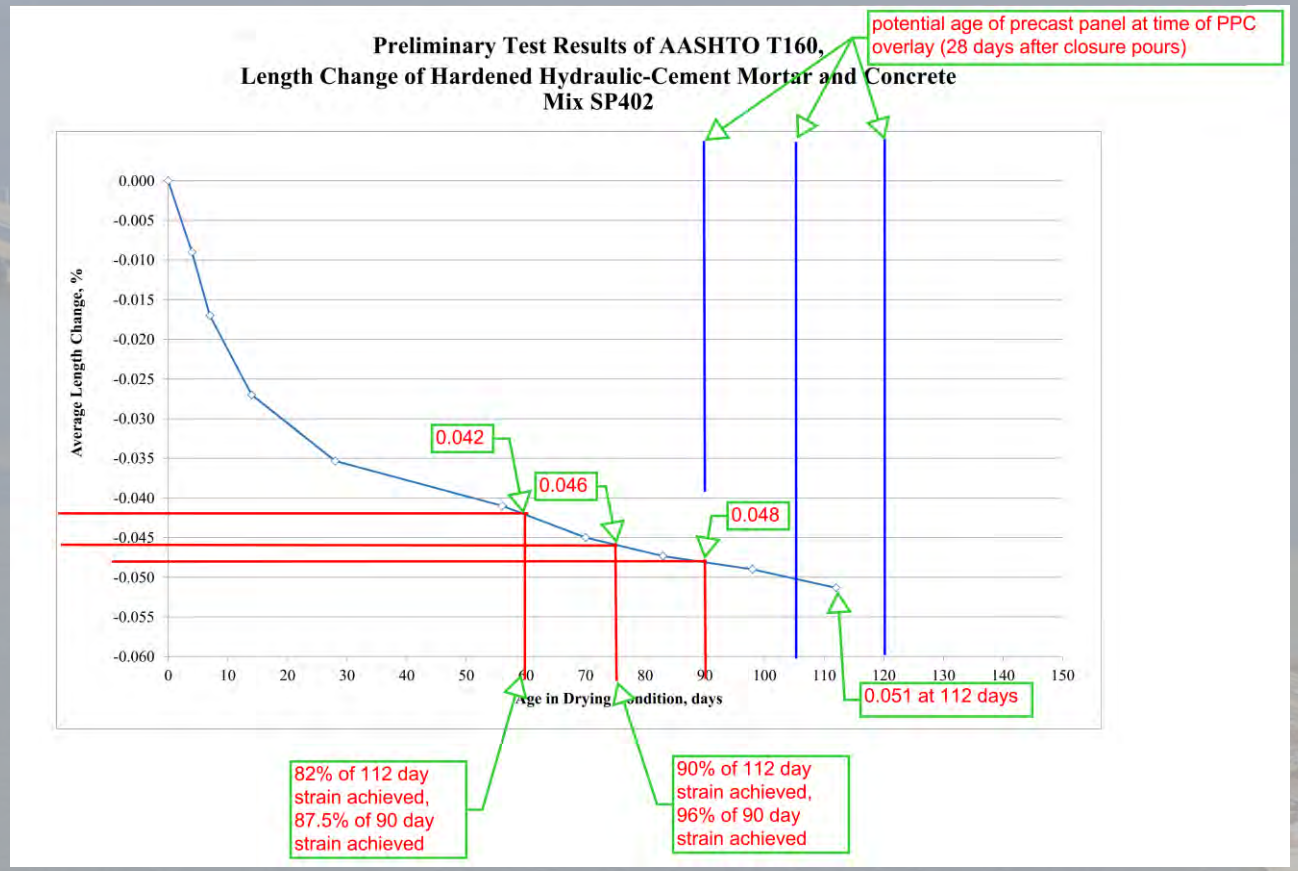
CONSTRUCTION ACTIVITIES
TYPICAL DEMOLITION – ACM ABATEMENT

Transite buried conduit and Asbestos window caulking

CONSTRUCTION ACTIVITIES
DECK DETAILING

Production Challenges

- Change of precasting sub-contractor
- Panel production fell behind
- Form stripping in 12 hours
- Curing time reduction – strength based
- 120 day maturation from casting was specified and met for season 2
- 90 days permitted based on shrinkage data provided -**1st season only**
- Approval letter also received from overlay manufacturer



CONSTRUCTION ACTIVITIES
CONDUIT FITTINGS

- NJDOT standard includes expansion fittings
- Special combination expansion/deflection fittings were specified and theoretically verified to fit
- In the field “the fittings would not fit”.
- Field adjustments were not successful
- Fittings were revised to expansion fittings or deck joint rails field modified

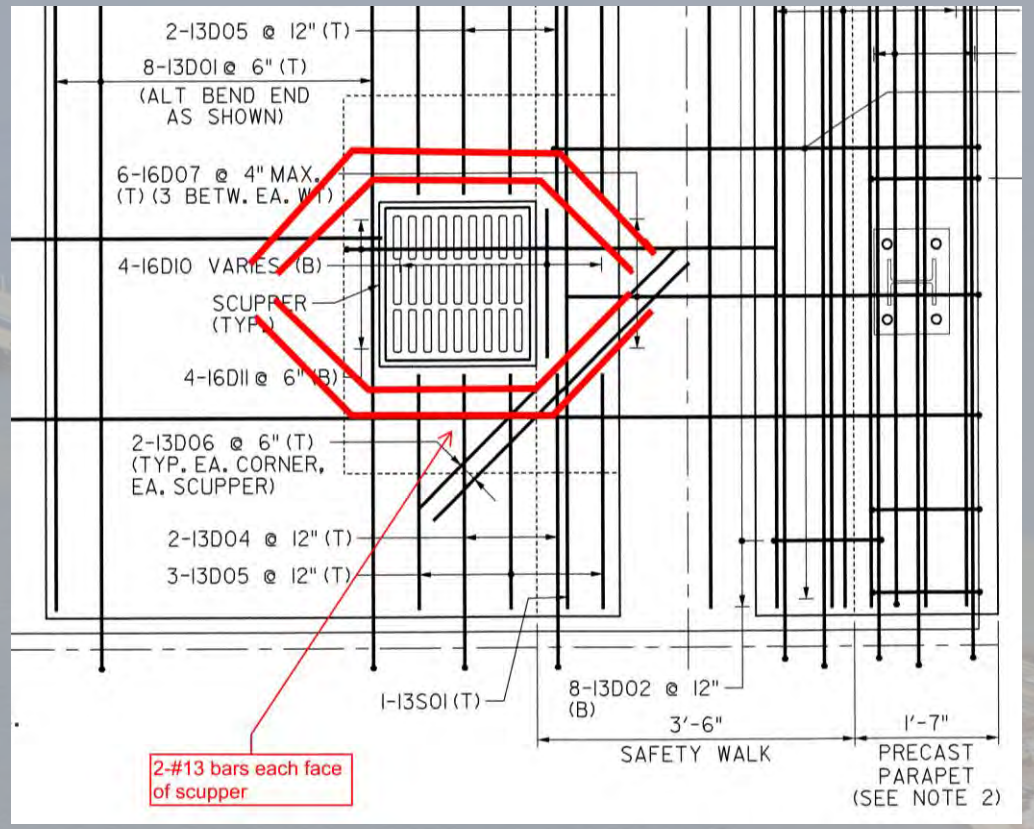
CONSTRUCTION ACTIVITIES
RAILING FIT-UP

- One side of joint often demonstrated fit issues in the first season
- Slotted holes used in second season

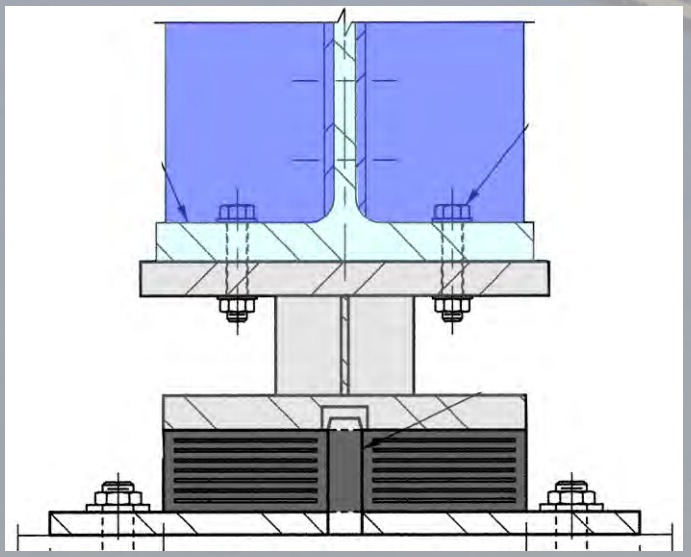
CONSTRUCTION ACTIVITIES
DECK DETAILING

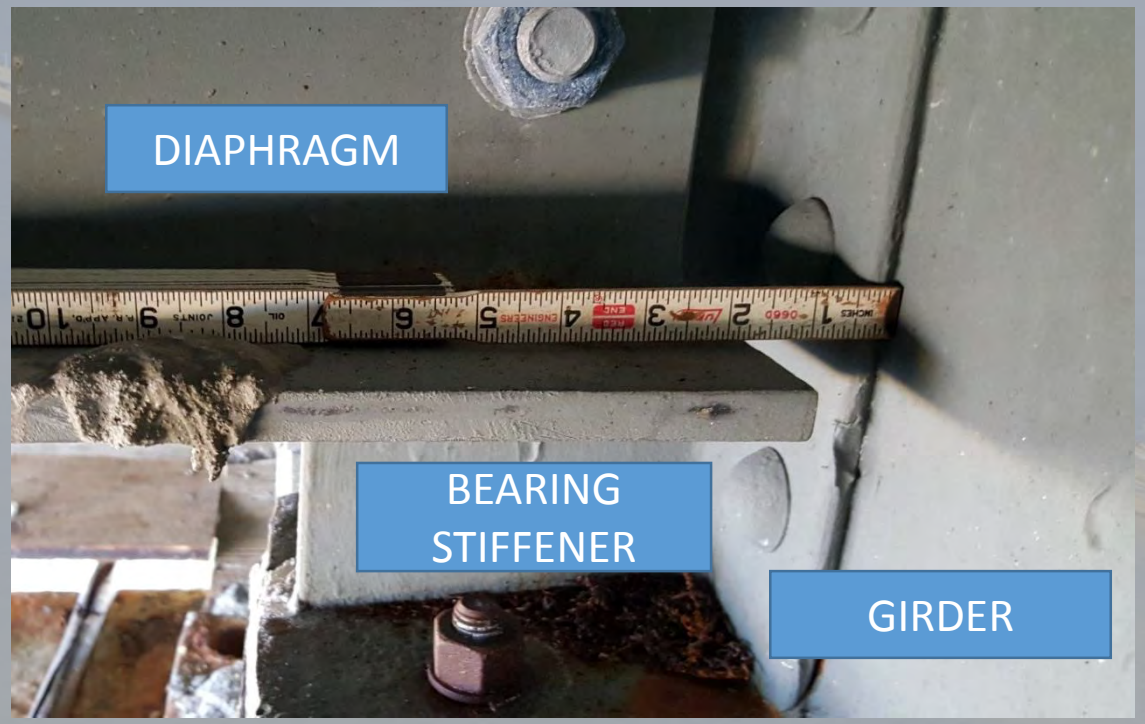
Panel Revisions

- Interferences with WT flange
- Interferences with scuppers
- Fit issues at special panels
- All easily addressed by adjustments to rebar (rotating bars, or replacing 180 degree hooks with 90's and other shapes)



CONSTRUCTION ACTIVITIES
DIAPHRAGM FIT-UP





- New Diaphragms installed prior to bearing replacement
- Led to conflicts with bolt installation for new bearings
- Next shipment of diaphragms were shop notched to fit

CONSTRUCTION ACTIVITIES
PROPOSED BEARING ALIGNMENT

- At five (of 66) piers existing rockers were fully tilted, re-using holes for fit was difficult
- 3/8” x 2” long welds at each bolt location designed by Contractor
- Bearings had enough capacity for deformation
- length of bolts and conflict resulting from early installation of diaphragms

CONSTRUCTION ACTIVITIES
EXISTING DECK DEMOLITION

- Safespan shielding/work platform
- 3,300 LF of bridge demolition in the second season

CONSTRUCTION ACTIVITIES
PRECAST PANEL INSTALLATION

Precast Panel Installation

- Timber Matting progressed with work to distribute crane loads
- Most picks from roadway/Tunney
- Barge and crane in use – but limited

CONSTRUCTION ACTIVITIES
PRECAST PANELS - WESTERLY SPANS

CONSTRUCTION ACTIVITIES
CLOSURE POUR PUMPING

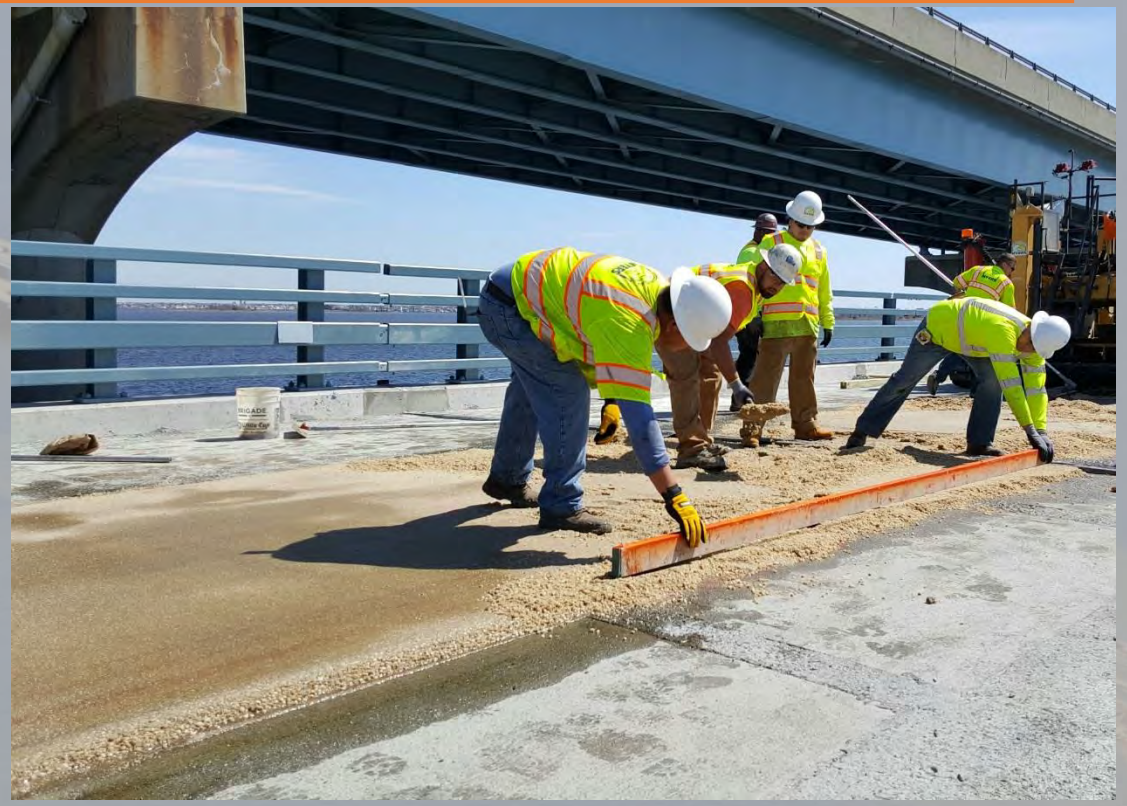
CONSTRUCTION ACTIVITIES
CLOSURE POURS

- High Early Strength Concrete
- 72 hours wet cure followed by curing compound
- Cylinder breaks to demonstrate 4000 psi

CONSTRUCTION ACTIVITIES
CLOSURE POURS

High Early Strength Concrete

CONSTRUCTION ACTIVITIES
PPC OVERLAY



PPC –pumping & finishing

EAST APPROACH SPANS COMPLETE 4/2016
WEST APPROACH SPANS COMPLETE 4/2017

Average Production Rates

- Demolition of deck & diaphragms – one span per day (73'x35')
- Installation of deck and railings– one span per day
- Closure Pours – 6 to 8 spans per day, then cure for a minimum of 3 days before next pour begins
- Overlay by lane – 20 spans per day
- SIGNIFICANT TIME SAVINGS OVER CIP OPTION

BASCULE AND FLANKING SPANS

PROJECT BIDDING

- Six Bids Received
  - Low Bid ~$56M (Schiavone Construction Co. LLC)
  - High Bid ~$75M,
  - Engineers Estimate ~$72 Million
- Precast Deck cost is $79/SF including closure pours, reinforcement steel, railing anchors, and galvanized reinforcement steel (similar to estimated cost and CIP deck)

DECK ITEM DESCRIPTION	UNIT	CONTRACT QUANTITY	UNIT COST	TOTAL COST
SHEAR CONNECTOR	UNIT	83,000	$7.22	$599,260.00
CAST-IN-PLACE EXODERMIC BRIDGE DECK SYSTEM, HPC	SF	6,179	$67.71	$418,380.09
CONCRETE CLOSURE POUR	CY	1,774	$730.21	$1,295,392.54
PRECAST EXODERMIC BRIDGE DECK SYSTEM	SF	176,076	$54.22	$9,546,840.72
POLYESTER POLYMER CONCRETE OVERLAY	CF	9,082	$224.59	$2,039,726.38

PROJECT SCHEDULE

- Contract allowed **three shutdowns** for all work
- Baseline schedule targeted **two shutdowns** for all precast work
- **Target achieved** – precast work completed 1 season ahead
- 19 easterly spans - season 1, 42 westerly spans - season 2
- Two anchor CIP spans recently completed in last shutdown
- Bearing replacement and miscellaneous work completed

PROJECT TEAM

- Owner: New Jersey DOT
- Designer: **WSP USA, Prime Consultant**
- Subconsultants:
  - **Hardesty & Hanover – Mechanical/Electrical/Structural – Bascule Span**
  - **IH Engineers – Substructure repairs, deck joints, and railings**
  - **Brinkerhoff Environmental Services – Asbestos abatement oversight**
- Construction Inspection: Jacobs Engineering
- Contractor: Schiavone Construction Co. LLC
- Exodermic Deck support: Bridge Grid Flooring Manufacturers Assoc.
- Deck Materials: Steel Grid – LB Foster
  Precaster – Fort Miller

QUESTIONS