THE CONCRETE USED TO BUILD OHIO'S TALLEST BRIDGE

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April 27, 2017

LOCATION

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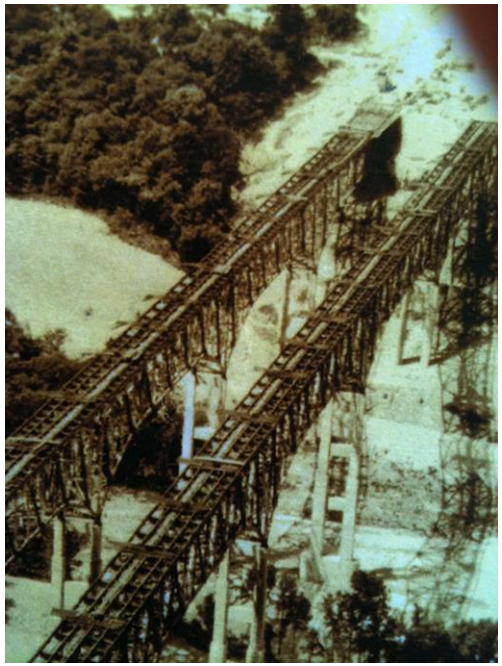
EXISTING STRUCTURES

- Built in 1964/65 by Bethlehem Steel
- Type: Steel Deck Truss Bridge
- Cost: $5,000,000



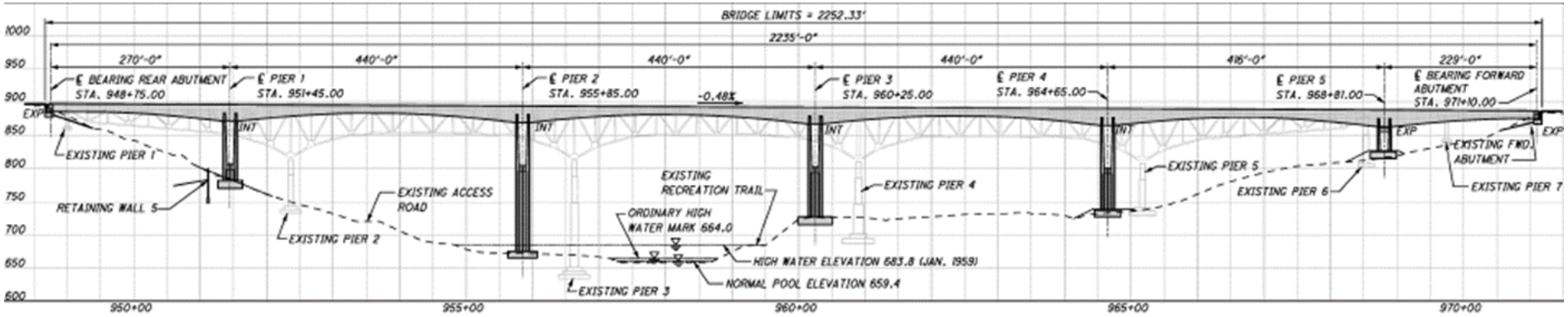
EXISTING STRUCTURES

- Reasons for Replacement
  - Need new deck, parapets & painting
  - Approximate cost of $30-35 million to rehab
  - Deficient shoulder width
  - Load Restrictions of 80,000 lbs

THE NEW STRUCTURES

- Cast-in-Place
- Balanced Cantilever Construction
- Post Tensioned
- Segmented Box
- Project award $88,133,160
- NTP Date: June 26, 2010
- Completion: Summer, 2017

BRIDGE PROFILE



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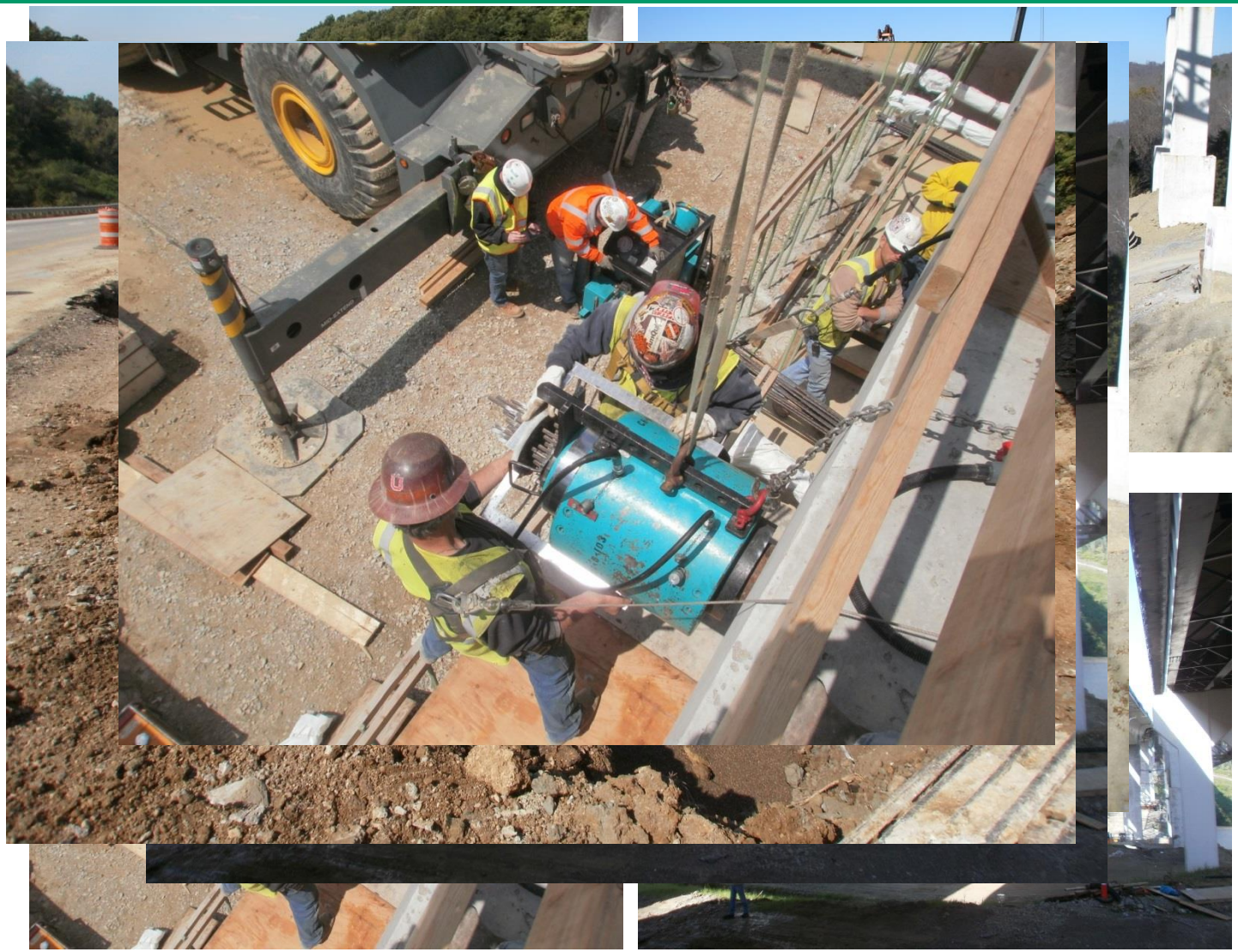
CONSTRUCTION



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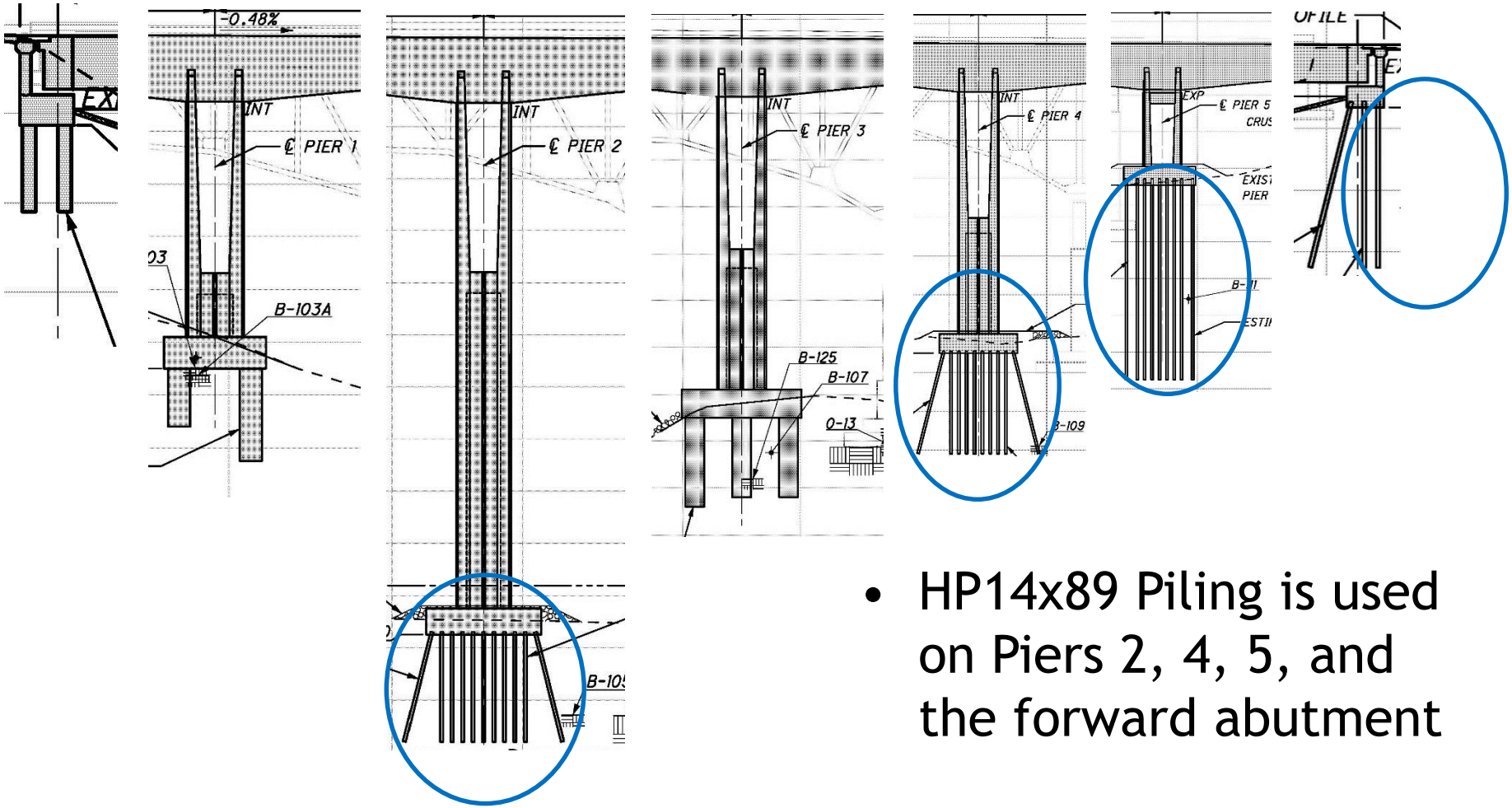
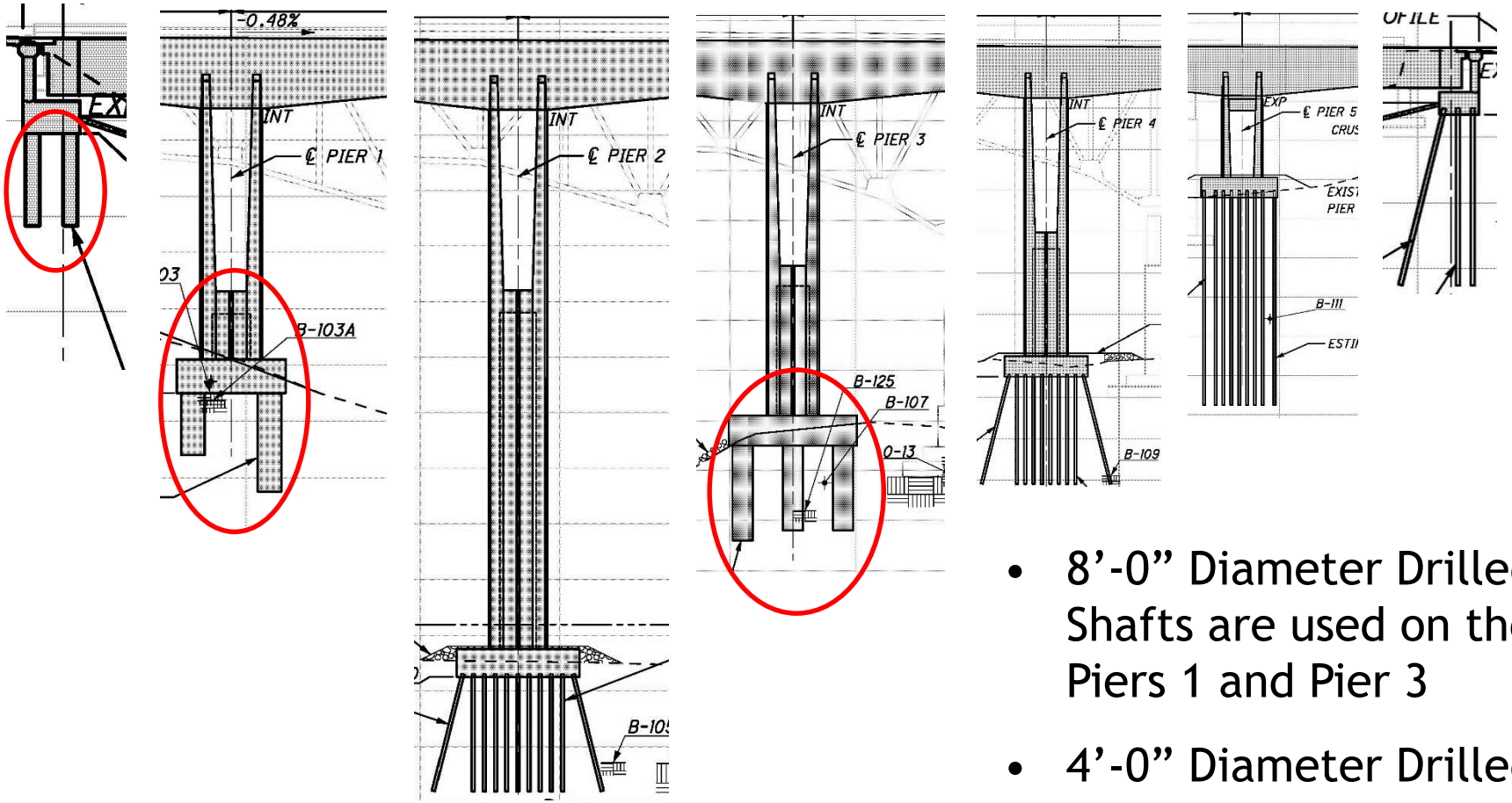
PILING



- HP14x89 Piling is used on Piers 2, 4, 5, and the forward abutment

PILING

DRILLED SHAFTS



- 8’-0” Diameter Drilled Shafts are used on the Piers 1 and Pier 3
- 4’-0” Diameter Drilled Shafts used on abutment

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DRILLED SHAFTS

FOOTINGS

- Footing measurements range from 44’x44’x10’ to 51’x51’x17’
- Footings built on 99 pile or 6-8 drilled shafts and approximately 137,300 lbs of reinforcing
- Footings contain 700 CY to 1600 CY of concrete

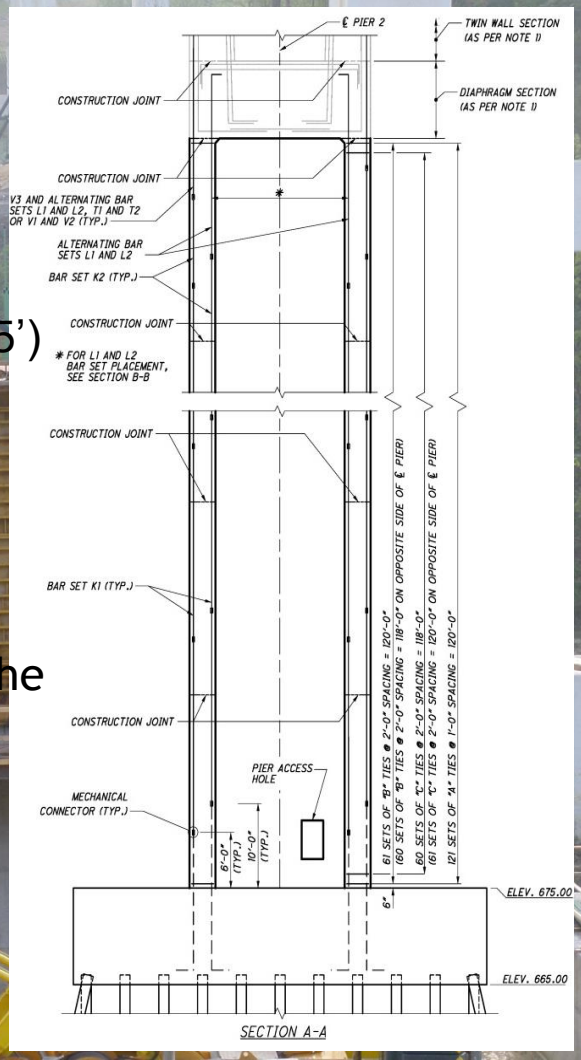
PIER BASE AND DIAPHRAGM

Pier Diaphragm

- Contains 107 CY of concrete
- Contains 54,714 lb of reinforcing
- 8’-0” thick (Split into two lifts 2.5’ and 5.5’)

Pier Base at Pier 2

- Contains 860 CY of concrete
- Contains 165,916 lb of reinforcing
- Approximately 121’-0” from TOF to the top of base
- Base Interior is accessible



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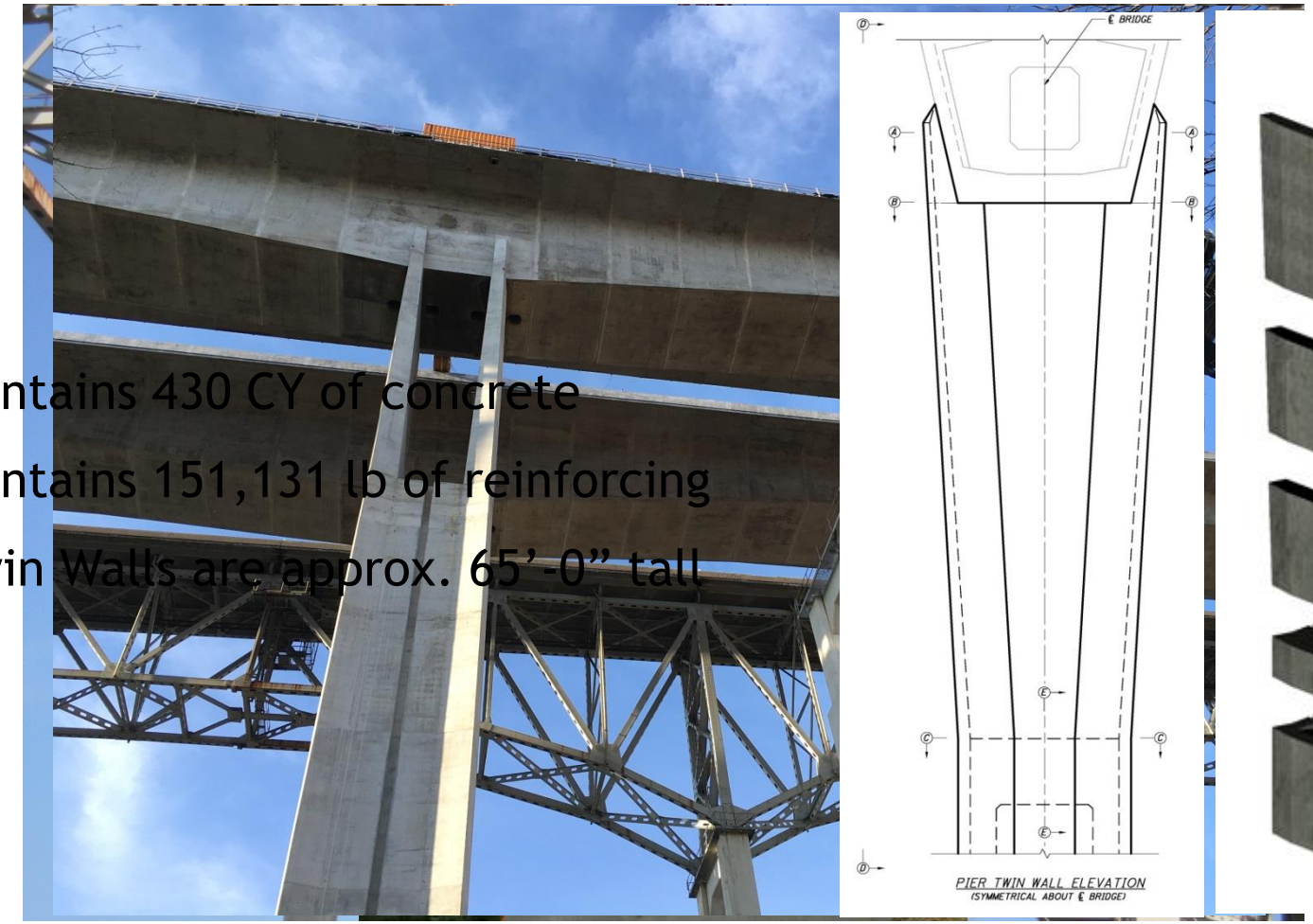
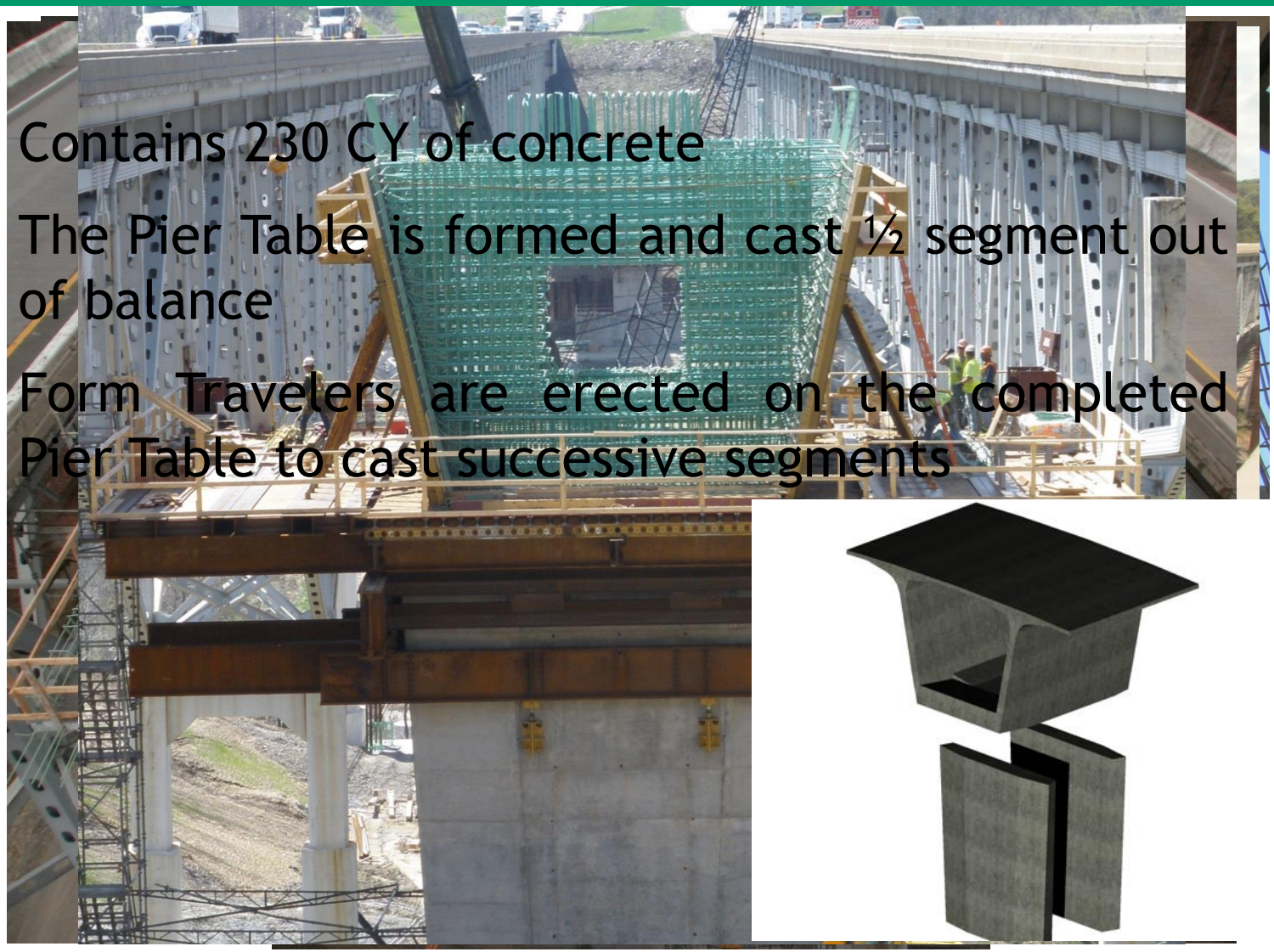
TWIN WALLS

- Contains 430 CY of concrete
- Contains 151,131 lb of reinforcing
- Twin Walls are approx. 65’-0” tall



PIER TABLES

- Contains 230 CY of concrete
- The Pier Table is formed and cast ½ segment out of balance
- Form Travelers are erected on the completed Pier Table to cast successive segments



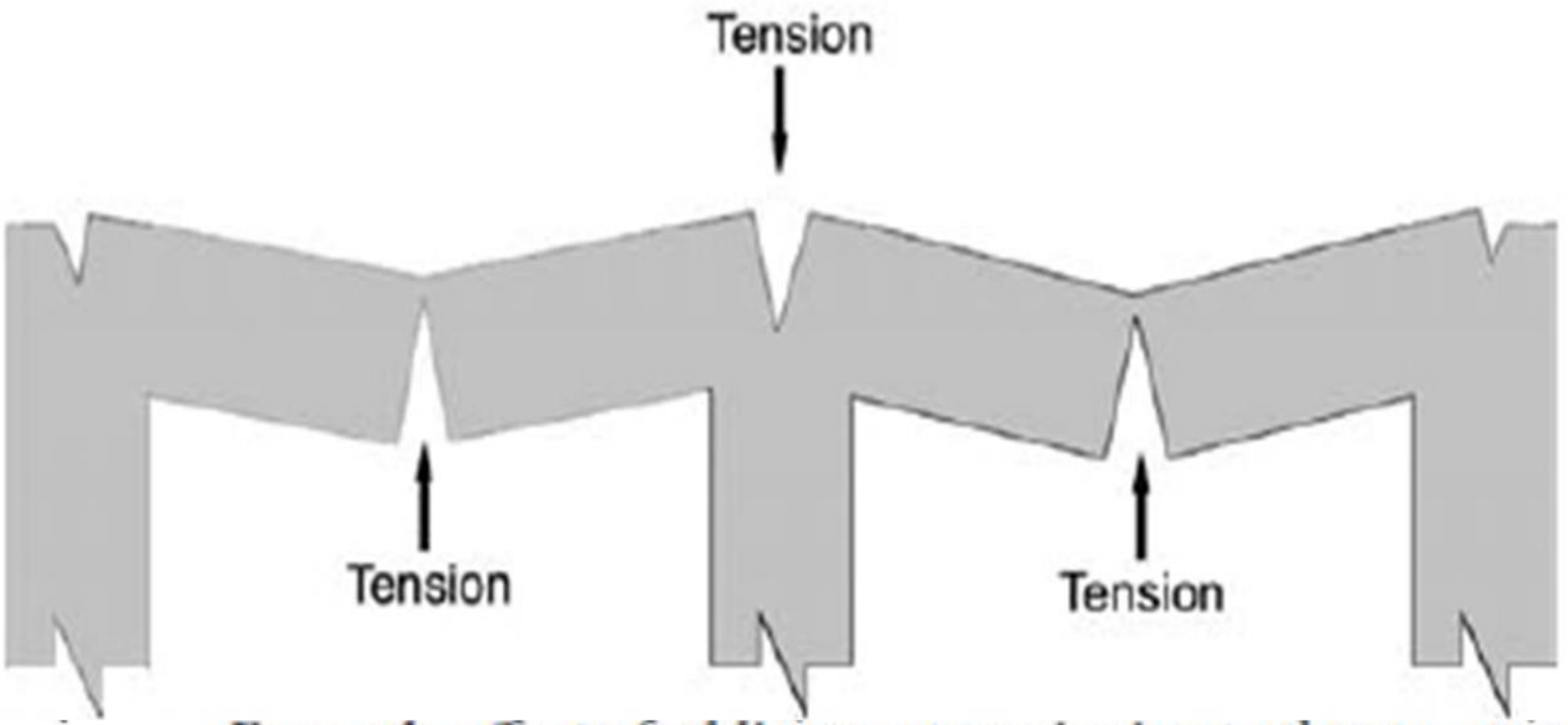
CONCRETE BOX GIRDER – TRAVELERS

- Form Travelers are erected once the Pier Table has been formed and concrete has been placed
  - Hydraulics are used to lift form sections and to advance the travelers

- The Form Travelers are constructed primarily of steel with some wood sections that can be cut to form the geometry of the segment

CONCRETE BOX GIRDER- TRAVELERS

POST TENSIONING COMPRESSION



- **Under Dead Load- Tension effects are addressed**

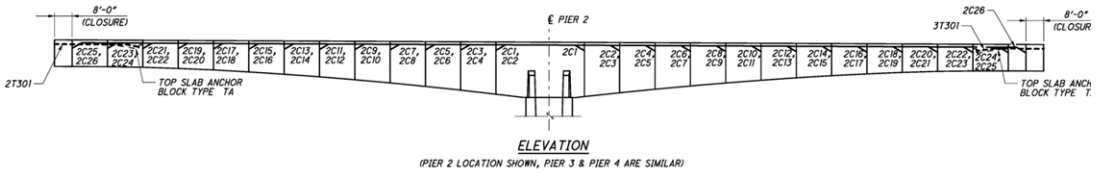
POST TENSIONING COMPRESSION

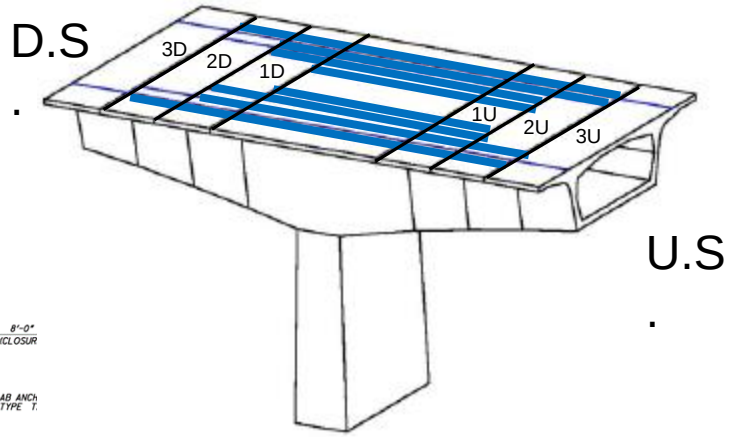
- 5 Types of Post Tensioning
- Longitudinal Cantilever Tendons
- Bottom Span Tendons
- External Tendons
- Transverse Deck Tendons
- Bar Tendons

POST TENSIONING

LONGITUDINAL TENDONS (NEGATIVE MOMENT)

- Typically 12, 19, or 22 strands
- 527, 835 or 967 Kips, respectively
- Stressed 2 Tendons per Segment





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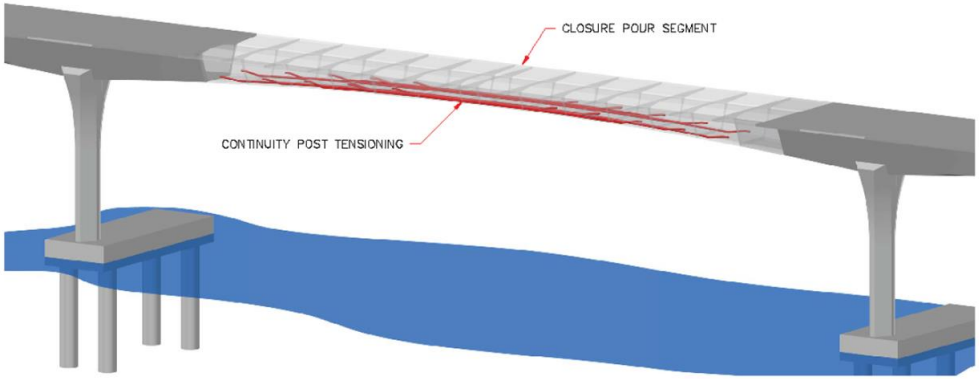
LONGITUDINAL TENDONS

SPAN TENDONS

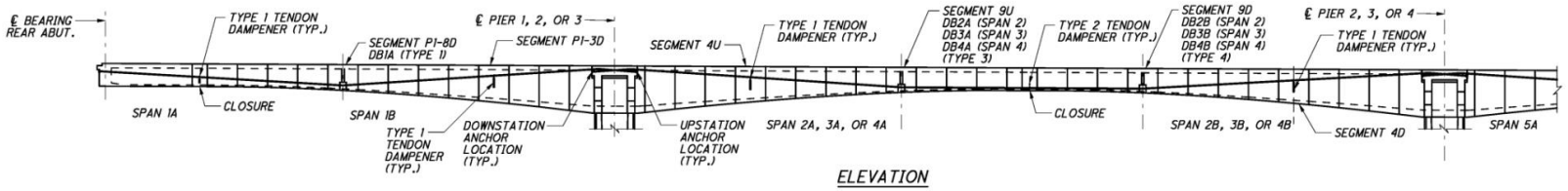
- Installed in Bottom Blisters after Closure Segment
- 19 Strands per Tendon
- 2 Tendon per Segment
- 395 Kips-835 Kips



SPAN TENDONS

EXTERNAL TENDONS

- 2 Tendons in Spans 1 & 6
- 4 Tendons in Spans 2-5
- 22 strands per Tendon
- 965 Kips per strand



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EXTERNAL TENDONS

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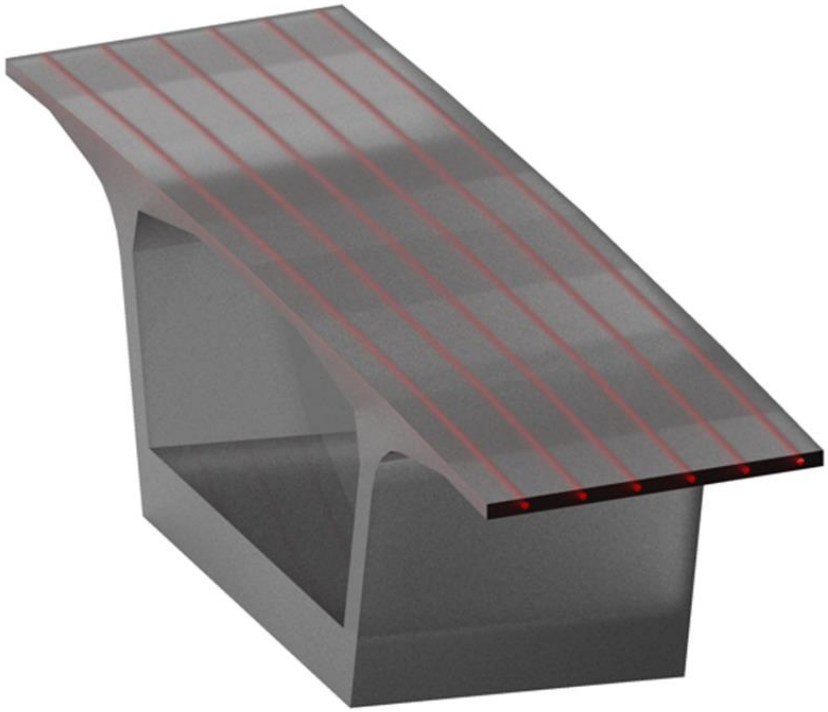
TRANSVERSE DECK TENDONS

- 6 Tendons per Segment
- 4 Strands per Tendon
- 45 Kips per Strand
- 180 Kips Total per Tendon



DIFFERENT TYPES OF CONCRETE USED

- QSC1 (4000 psi)=8785.78 CY
- QSC2 (4500 psi)=713.7 CY
- QSC3 (6000 psi)=39541.54 CY
- Class S (4500 psi)= 2406.13 CY
- Latex Modified Overlay=1081.3 CY
- Job Total: 52528.45 CY
- Total number of 8 CY concrete trucks: 6566 Trucks

*20% Fly Ash Specified for QSC2 & QSC3 concrete used on this project.

EVER WONDER WHY SOME CONCRETE AGES LIKE THIS:

AND SOME AGES LIKE THIS:

A LONG LASTING BRIDGE

- How long a bridge will last depends on:
  - How well it is built from the very start of its construction
  - How well it is maintained over the years

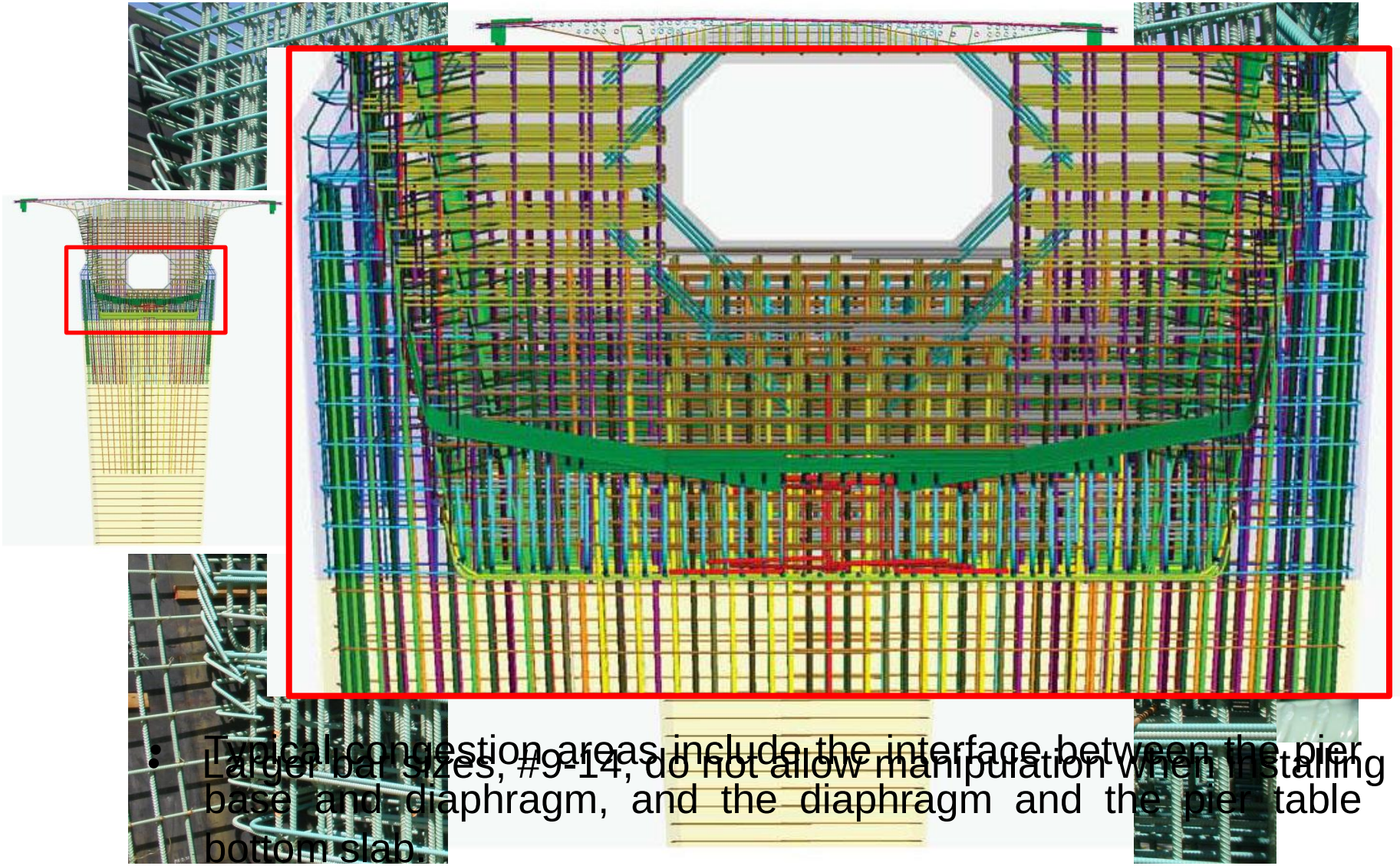
BASICS FOR LONG LASTING CONCRETE

- To build long lasting concrete you must:
  - Properly place formwork and reinforcing steel
  - Use the correct mix design with proper testing techniques
  - Place the concrete correctly
  - Properly cure the placed concrete

FORMWORK AND REINFORCING PLACEMENT

- Forms properly assembled/anchored
- Proper reinforcement placement, spacing, lap lengths
- Secure reinforcement with tie wires
- Avoid moving the reinforcement during placement

FORMWORK AND REINFORCING PLACEMENT



- Typical congestion areas include the interface between the pier base and diaphragm, and the diaphragm and the pier table bottom slab.
- Larger bar sizes, #9-14, do not allow manipulation when installing

FORMWORK AND REINFORCING PLACEMENT

IMPROPER REINFORCEMENT SPACING CONSEQUENCES

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