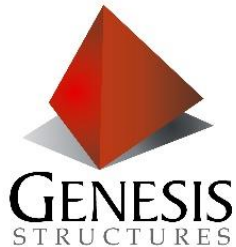




# Repairs to the Historic Tombigbee River Hwy 182 Bridge

Joe Knapp, P.E. Genesis Structures, Kansas City, MO  
Steve Bowen, P.E. Malouf Construction, Greenville, MS  
Randy Boudreaux, P.E. Neel-Schaffer, Jackson, MS  
IBC 25-10





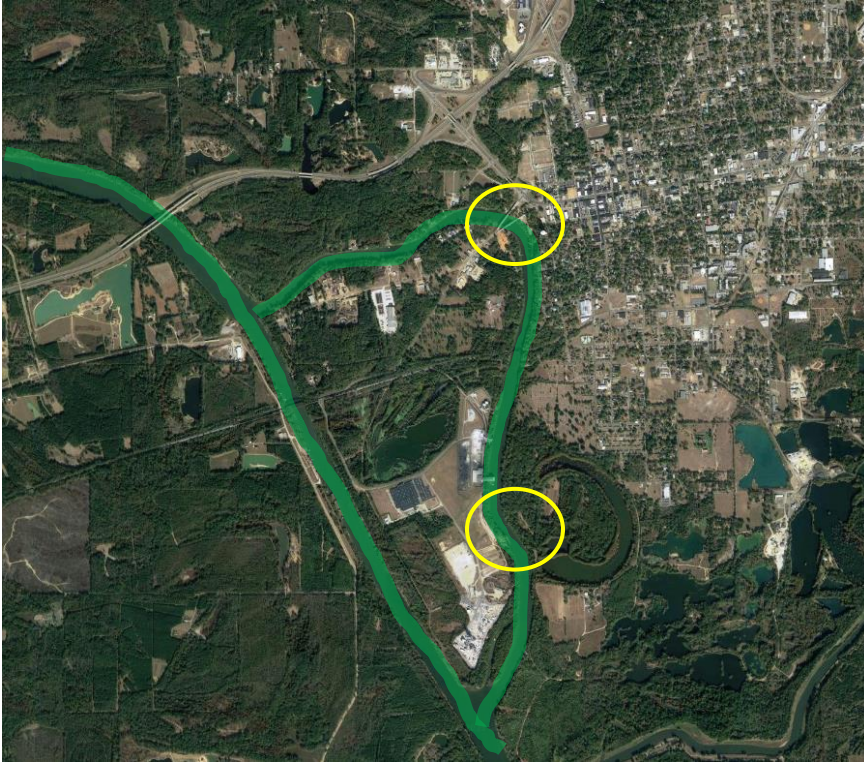
# Presentation Goals



- Project Overview
- Bridge History and Construction
- Hybrid Design-Build
- Construction Operations

# Project Overview

# Project Overview



# Project Overview



# Project Overview

- Pier 2 was struck by a runaway barge in February 2020
- The top of the pier displaced 11”
- The bottom of pier was separated from foundation
- There was cracking throughout the column web-wall near point of impact



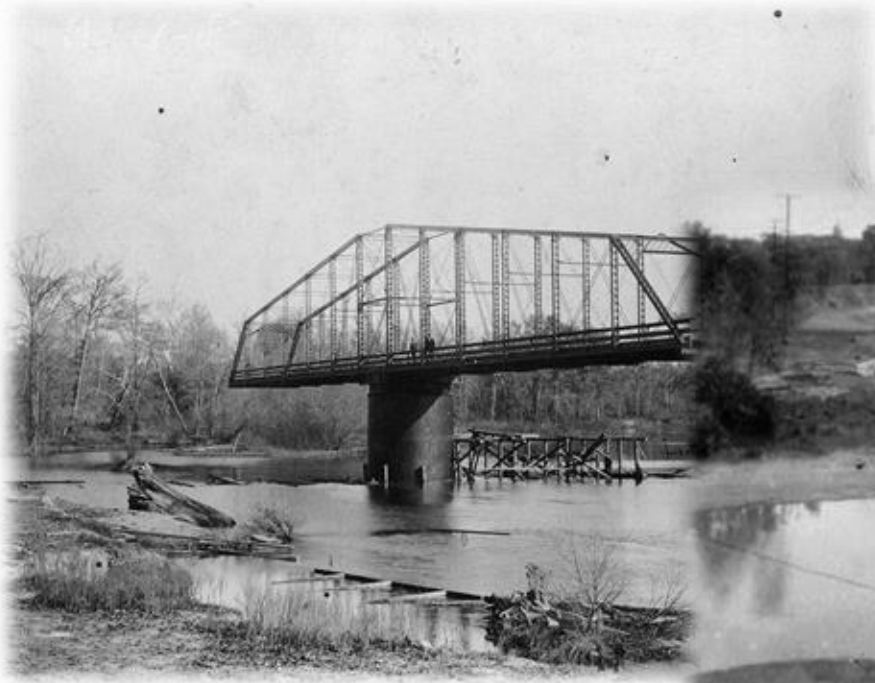
# Bridge History

# Bridge History



- Opened to traffic in 1927
- 604' total bridge length
- 220' concrete T-beam approach spans
- 90'-102'-102'-90' riveted steel truss river spans
- The two center truss spans were designed to pivot on center pier
- The river piers were constructed on spread footings
- The bridge was added to the National Register of Historic Places in 1988

# Bridge History



# Bridge History



# Bridge History – Pre 2013 Rehab

- A 1989 under water inspection found scour under the center pier which led to the construction of new bridge to the north in 1993
- The bridge was closed to traffic after new bridge opened
- Funds were raised to rehabilitate the bridge for pedestrian use



# Bridge History – Pre 2013 Rehab



# Bridge History – 2013 Rehab

- Repaired center pier scour
- Replaced timber-asphalt deck with concrete
- Replaced timber sidewalks
- Repaired truss and rails
- Repaired concrete spalls
- Painted
- Added LED lighting
- Malouf Construction, LLC was the general contractor



# Bridge History – 2020 Barge Impact



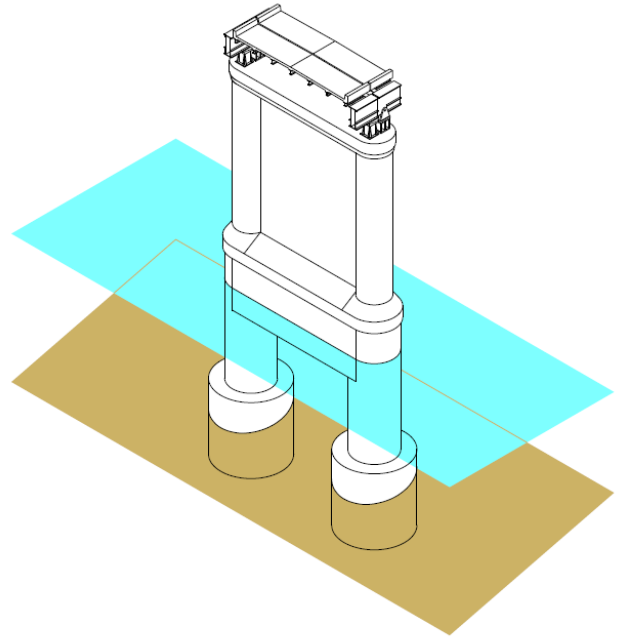
# Hybrid Design-Build

# Hybrid Design-Build

- The City of Columbus allowed Neel-Schaffer to work with Malouf Construction in a hybrid Design-Build process to develop a repair procedure
- Malouf Construction brings unique skills and experience in Bridge Construction, Bridge Rehabilitation and Marine Construction techniques.
- Neel-Schaffer collaborated with Malouf Construction to tailor the design to the equipment and experience and capabilities provided by Malouf Construction.

# Hybrid Design-Build

- River piers are supported by 11'Ø spread footings socketed into the hard chalk foundation soil
- The pier has very little reinforcement by today's standards
- 20' water depth
- The Department of Archives and History required that all parts of the pier repair visible above the water must match the existing pier



# Repair Concept 1

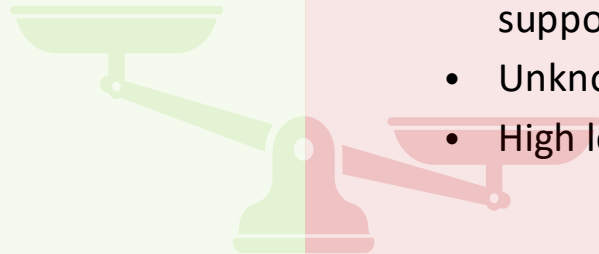
## Plumb existing pier and reconnect to the foundation

### Pros:

- Keep existing historic pier
- Minimize new construction

### Cons:

- Requires a full cofferdam to perform work in the dry
- Expensive cofferdam - hard chalk soil and low headroom makes driving sheetpile difficult; would require trenching and grouting in place; requires a lot of diver time
- Requires separate deep foundations for shoring to support the bridge spans
- Unknown strength of existing concrete
- High level of risk



# Repair Concept 2

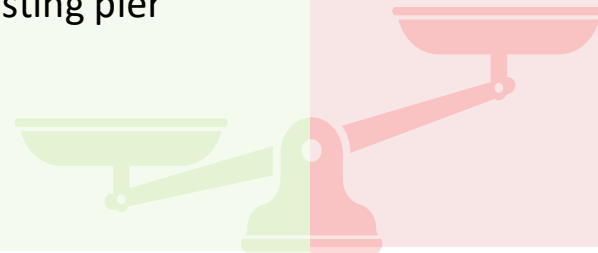
## Rebuild the pier on drilled shaft foundations outside of bridge

### Pros:

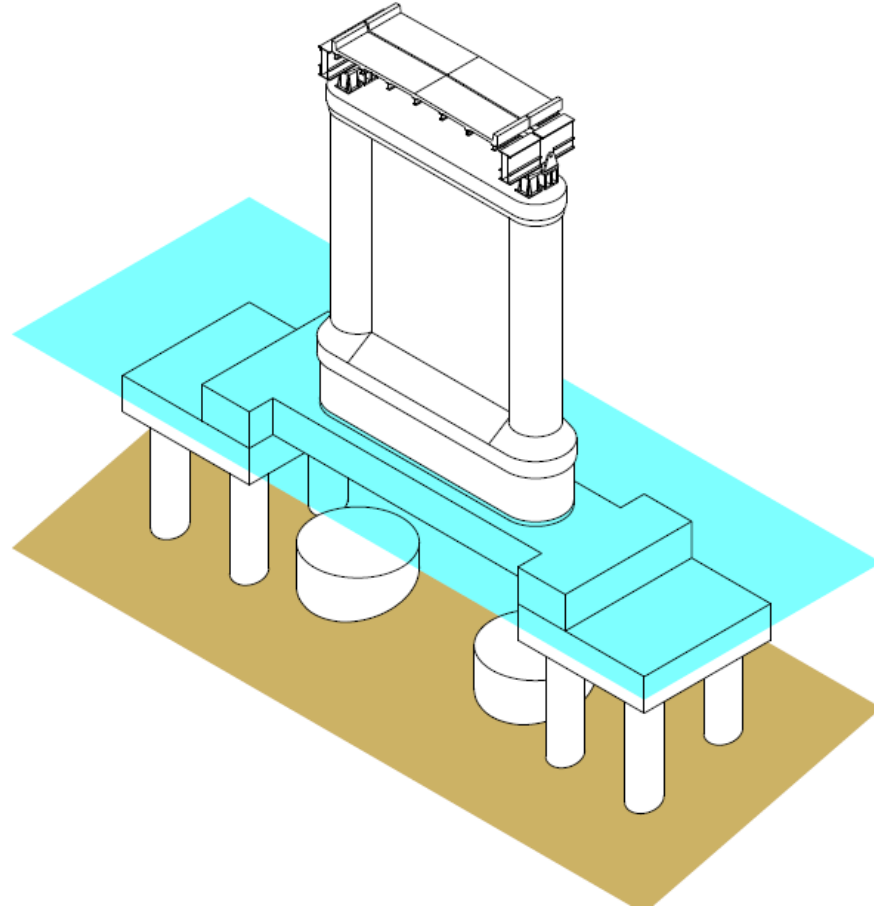
- Drilled shafts will support the shoring towers and the new pier
- Can use precast foundation elements with grout holes at drilled shafts to bring construction out of the water – no full cofferdam
- Can use pipe cofferdams over each grout hole to minimize dewatering
- Portion of pier above the water would match the existing pier
- Minimum diver time required
- Strength of new pier is known

### Cons:

- Moving large precast components into position can be expensive



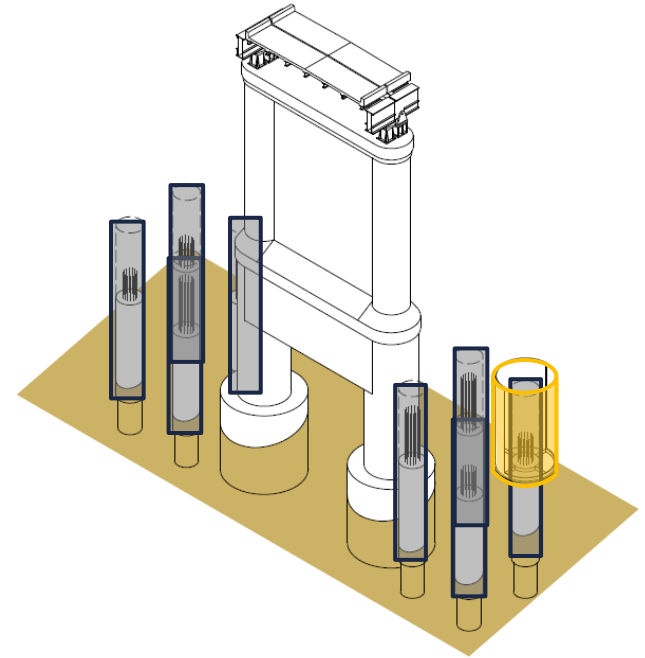
# Final Design



# Construction Operations

# Drilled Shaft Installation

- 4~36"Ø x 40' drilled shafts on each side of the existing pier
- 42"Ø steel pipe casing embedded 10' into chalk
- 90"Ø pipe with "donut" shape base plate used for cofferdam
- An inflatable bladder connected cofferdam to casing pipe and sealed gaps
- Pipe was dewatered so workers could cut casing pipe and prep top of drilled shaft for caps

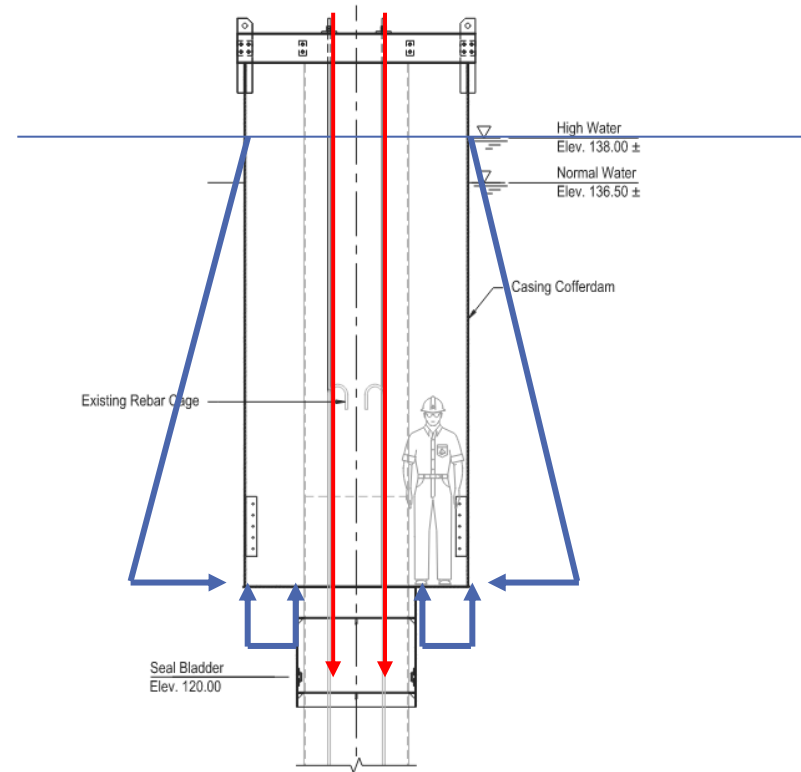


# Drilled Shaft Installation



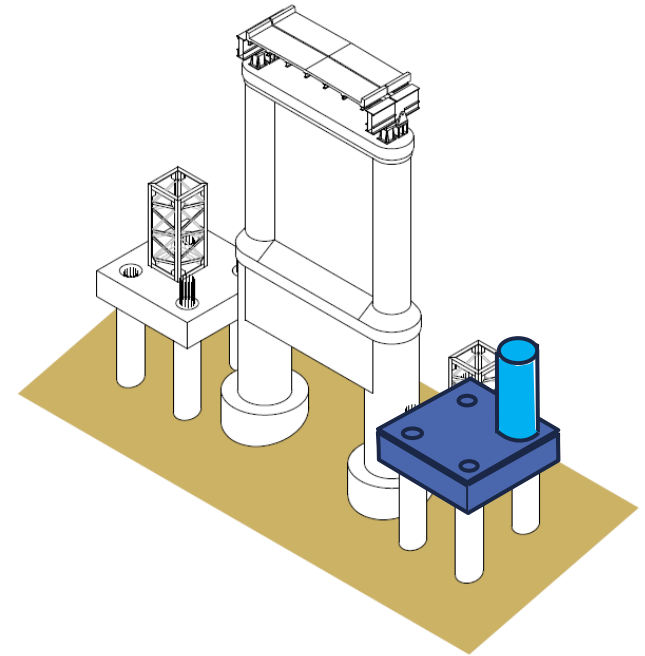
# Drilled Shaft Installation

- 18 ft of hydraulic head
- Produces 40,000 lbs uplift once dewatered
- Needed 2- 1" Dia Hold Down Rods



# Precast Shaft Cap Installation

- 16' x 16' x 4' precast drilled shaft caps
- Grout holes constructed over each shaft
- Interior drilled shaft reinforcing extends into second precast component (not shown yet)
- 54"Ø cofferdam pipe used over each grout hole
- Required minimum dewatering to eliminate flotation concerns on cap.
- Cofferdam pipes and first section of shoring towers were installed prior to installation
- Divers guided cap into position and sealed junction
- Grout pockets were dewatered and filled

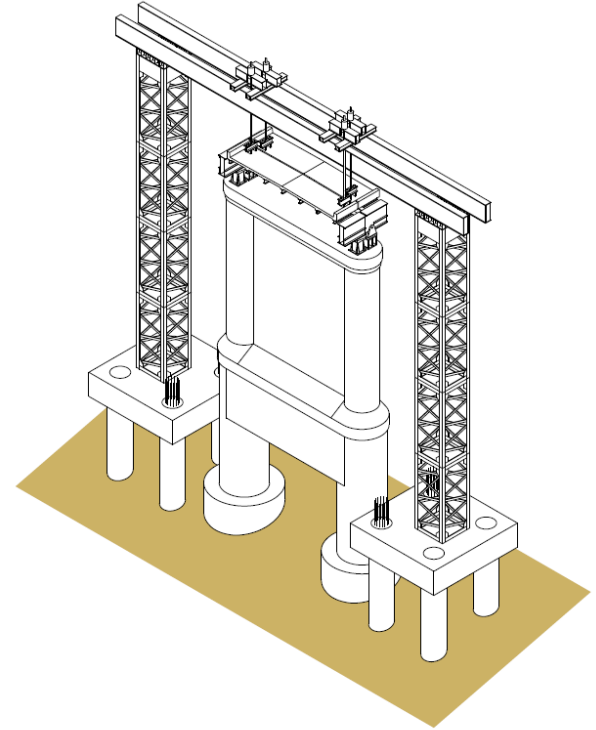


# Precast Shaft Cap Installation



# Shoring Tower Installation

- Shoring tower erection was completed
- Hanger rods were attached around truss end floor beams
- Strand jacks lifted truss spans off pier about 1/2"
- Bearings were removed

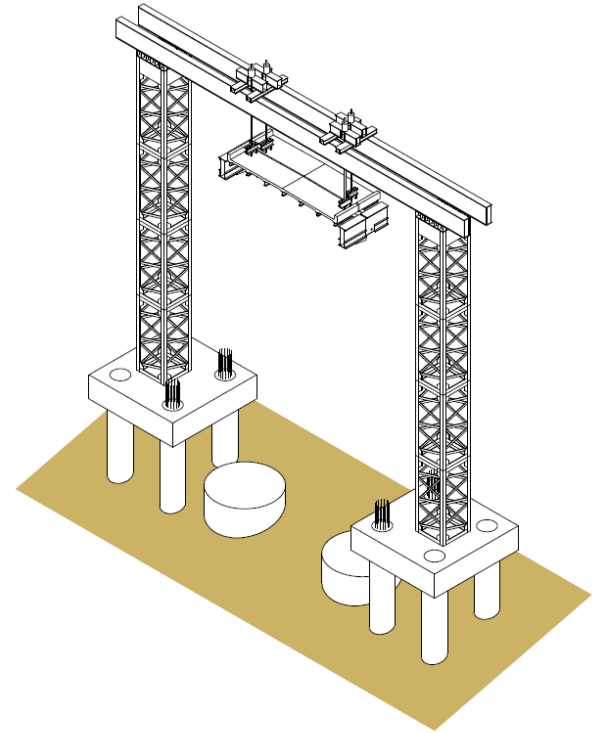


# Shoring Tower Installation



# Existing Pier Demolition

- Existing pier was demolished to top of footing
- Shoring towers supporting the truss spans
- Existing pier demo near completion

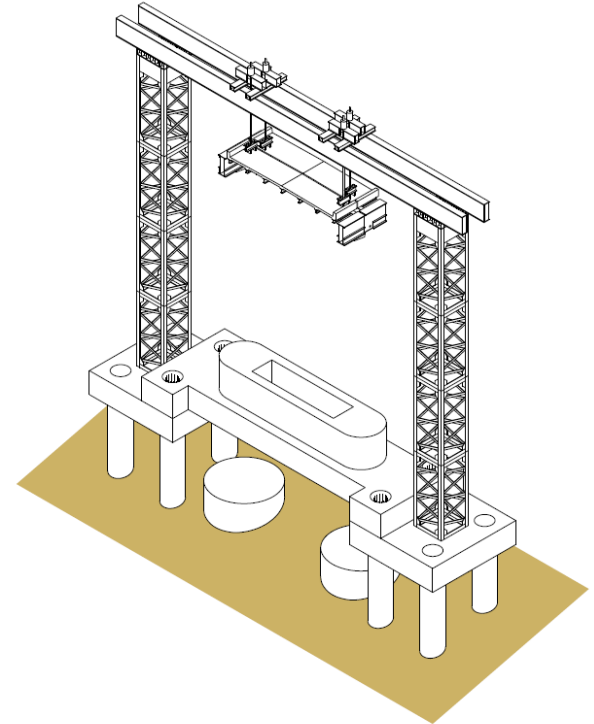


# Existing Pier Demolition



# Precast Riser Installation

- Precast riser was installed between caps over the interior drilled shafts to get construction out of the water
- Top of riser base sits about 1' below normal water surface
- Riser was cast with a center void to reduce weight, yes please!
- Lifting weight was 190 tons





# Precast Riser Installation





# Precast Riser Installation

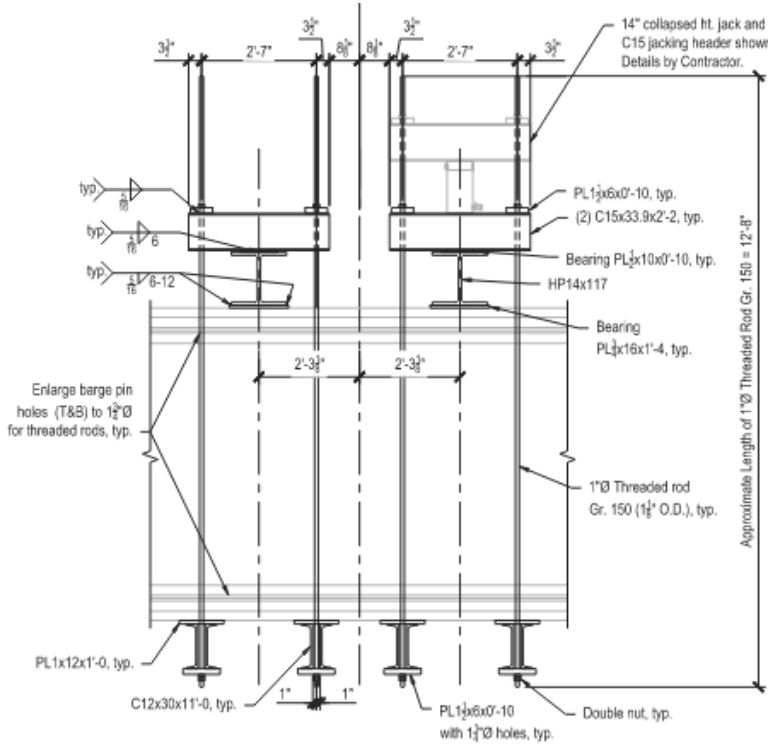
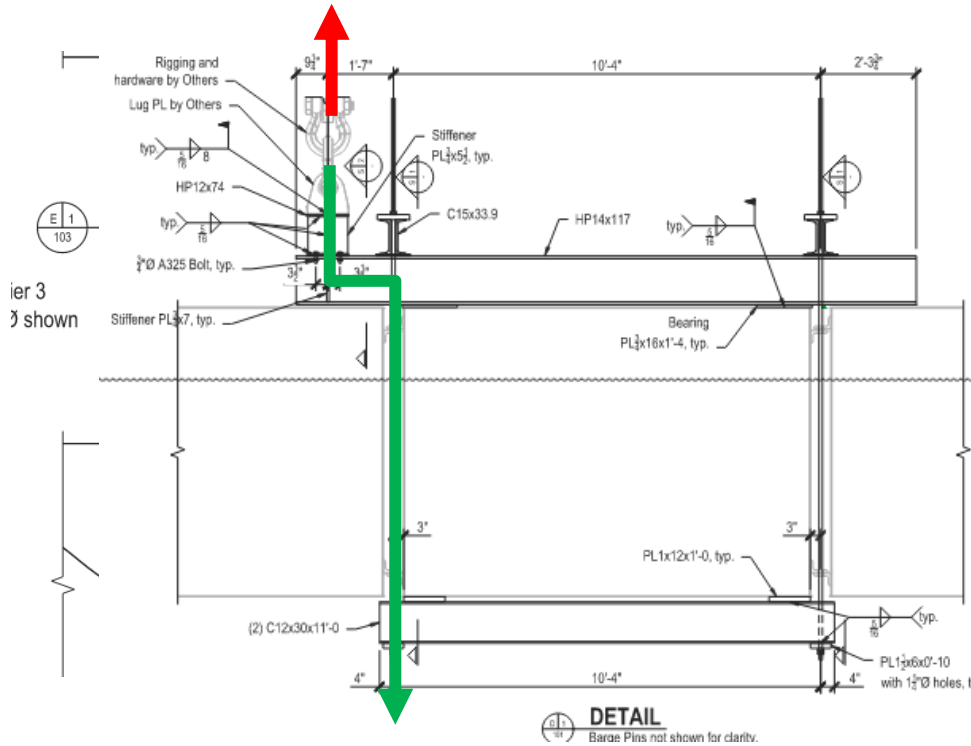


# Precast Riser Installation

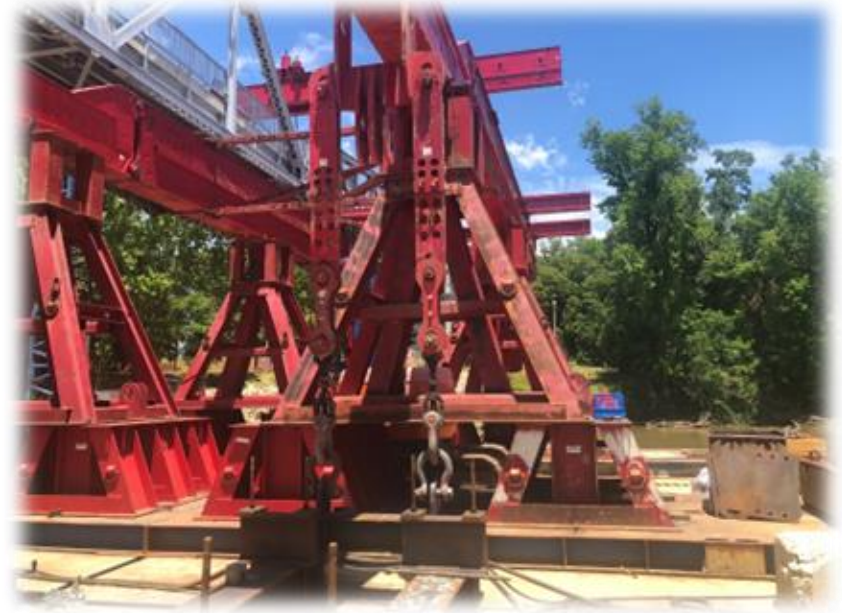




# Precast Riser Installation



# Precast Riser Installation



# Precast Riser Installation





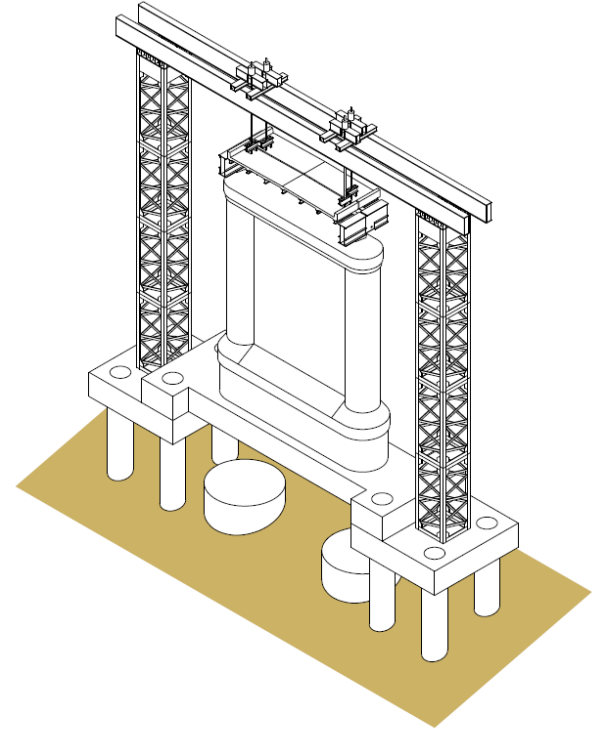
# Precast Riser Installation





# Cast-In-Place Pier Construction

- Portion of pier above water was cast-in-place using conventional methods
- Bearings were reinstalled
- Truss spans were lowered onto new pier
- Shoring towers were disassembled
- Minor steel repairs, painting and lighting repairs were completed

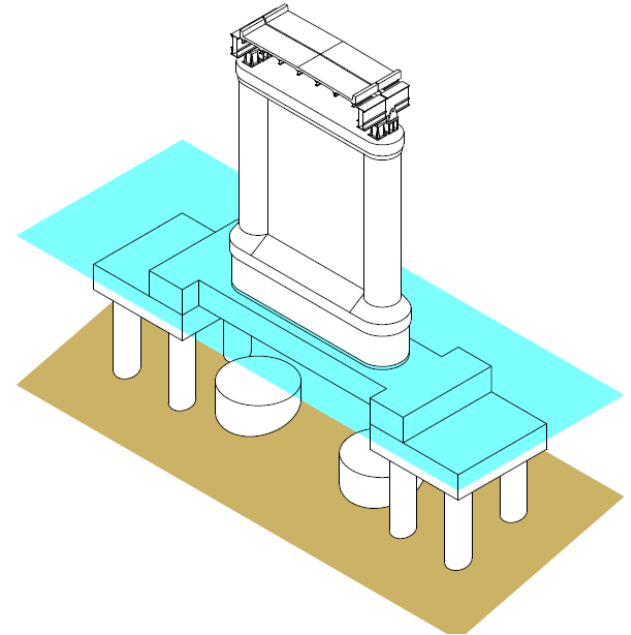


# Cast-In-Place Pier Construction



# Completed Pier 2 Reconstruction

- Bridge reopened to the public September 2024



# Completed Reconstruction





# Cost Summary

- Original bridge construction cost: \$ 165,000
- 2013 Bridge Rehab: \$2,300,000
- 2024 Pier 2 Replacement: \$4,000,000



# Thank You

- City of Columbus Mississippi
- Barnhart Crane and Rigging
- The fine people of Columbus