# Rapid Replacement of CSX's Bayou Sara Bridge Swing Span in Alabama

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Kevin Kane, PE, Project Manager

## ABC-UTC Monthly Webinar

November 12, 2020

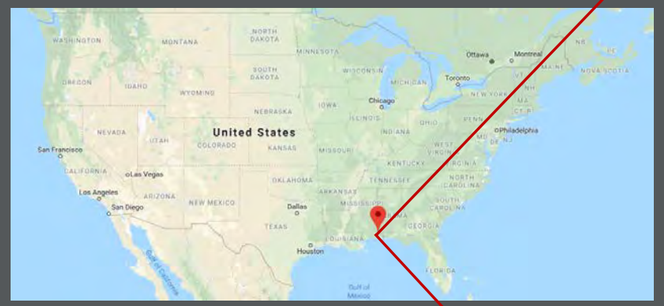
CSX HDR BRASFIELD & GORRIE GENERAL CONTRACTORS

# Agenda

- Introduction
- Project Challenges
- Design Approach
- Construction Planning
- Pre-Float-In
- Float-In
- Post-Float-In
- Conclusions

# Introduction

- Single Track Rail Bridge – 376 ft. Total Length
- 9-13 Trains per Day
- 162-ft Through-girder Swing Span
- Rehabilitated Pre-stressed Concrete Box-girder Approach Spans
- Over 100 Years Old at Replacement
- Complete Replacement of the Swing Span was the Right Solution for the Long Term



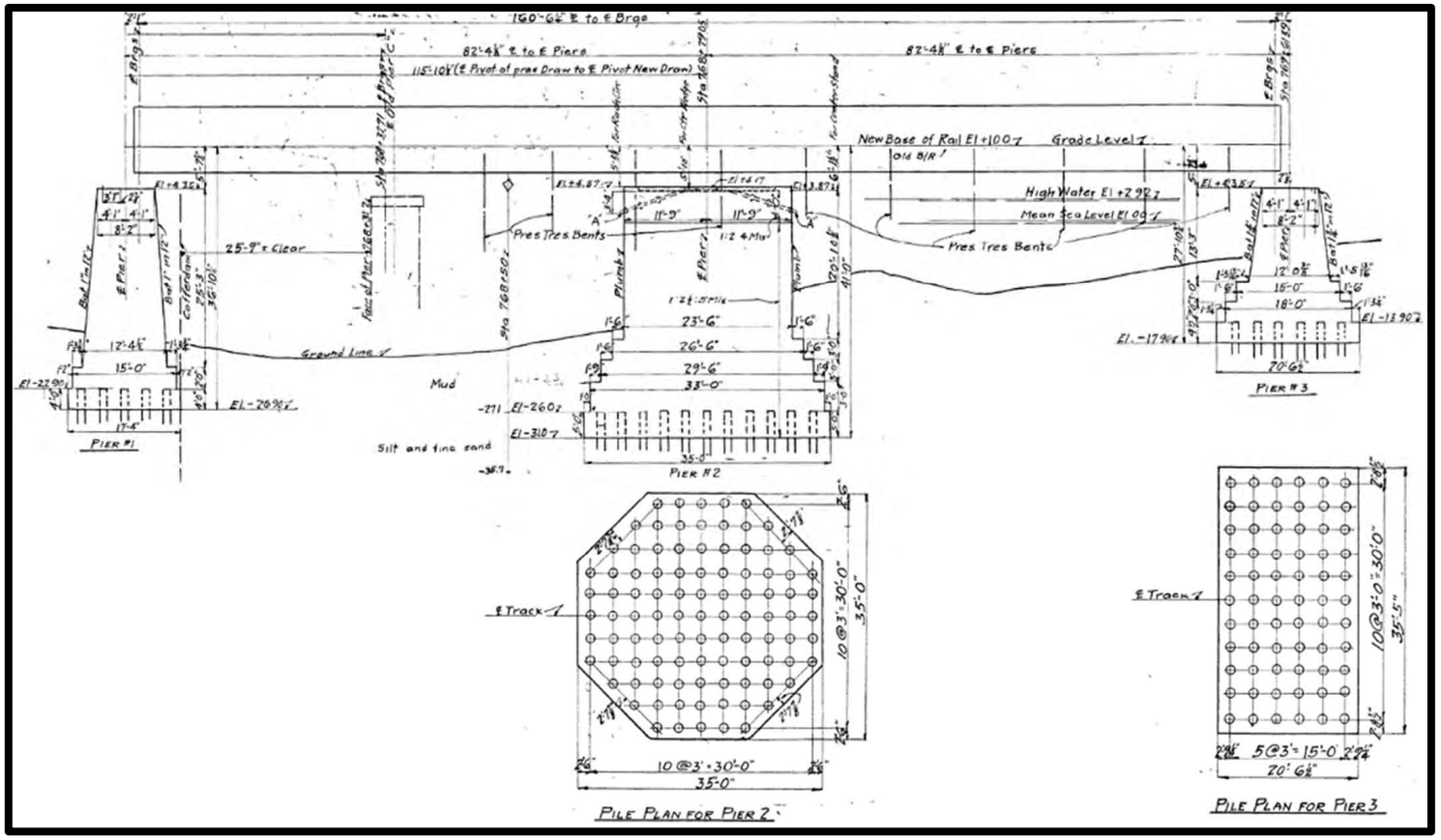

# Project Challenges

- Permitting
  - Potential significant wetland impacts
  - Potential significant mitigation efforts
- In-Water Construction
- Harsh Environment/Low Clearance over Water
- Limited Rail Outage Time for In-Line Replacement
  - Original installation window of 48 hours
  - Installation window later reduced to 14 hours

# Project Challenges

- Project Site Accessibility
  - No Roadway
  - Access only via rail or boat
  - 5.5 miles from contractor's yard and CSX rail yard

# Project Challenges




- Install Replacement Swing Span Superstructure onto Existing Substructure

# Design

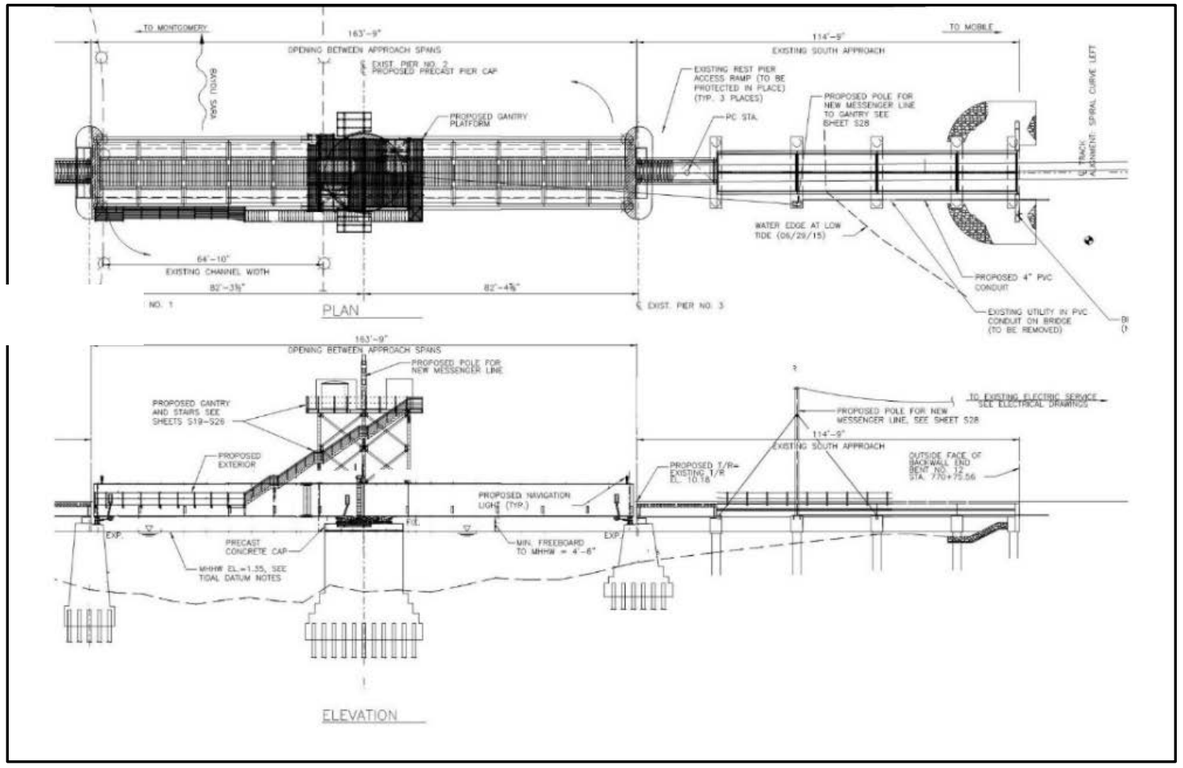
Summary of AREMA Design Loads Cases and Combinations for Swing Spans.

| Case | Support Condition | Applicable Loads | Notes |
|---|---|---|---|
| I | 1* : Ends Unsupported | 1.2*DL + 2*MF + W | Two-Span Continuous |
| II | 2* : Span Closed, End Down | DL + LL + IM + W | Focus: One Arm as Simple Span |
| III | 2* : Span Closed, Ends Unsupported for DL | DL + LL + IM +W | Focus: Two-Span Cont. for LL |
| IV | 3**: Span Closed, Ends Lifted | DL + LL + IM +W + OL | Two-Span Cont. for All Loads |

DL = Dead Load; MF = Machinery Forces; W = Wind; LL = Live Load; IM = Live Load Impact; OL = Other Loads

* – 25% Overstress allowed for Cases 1, 2, and 3

** – Fatigue analyzed on Support Condition 3 only




- Cooper E80 Live Load
- Fatigue
- Two-span continuous superstructure
- End lift reaction
  - Exceed LL-induced uplift ‘restraint’ by 50%
- Minimize span weight
- Resilience
  - protective coating; elevated equipment
- Remote-controlled operation

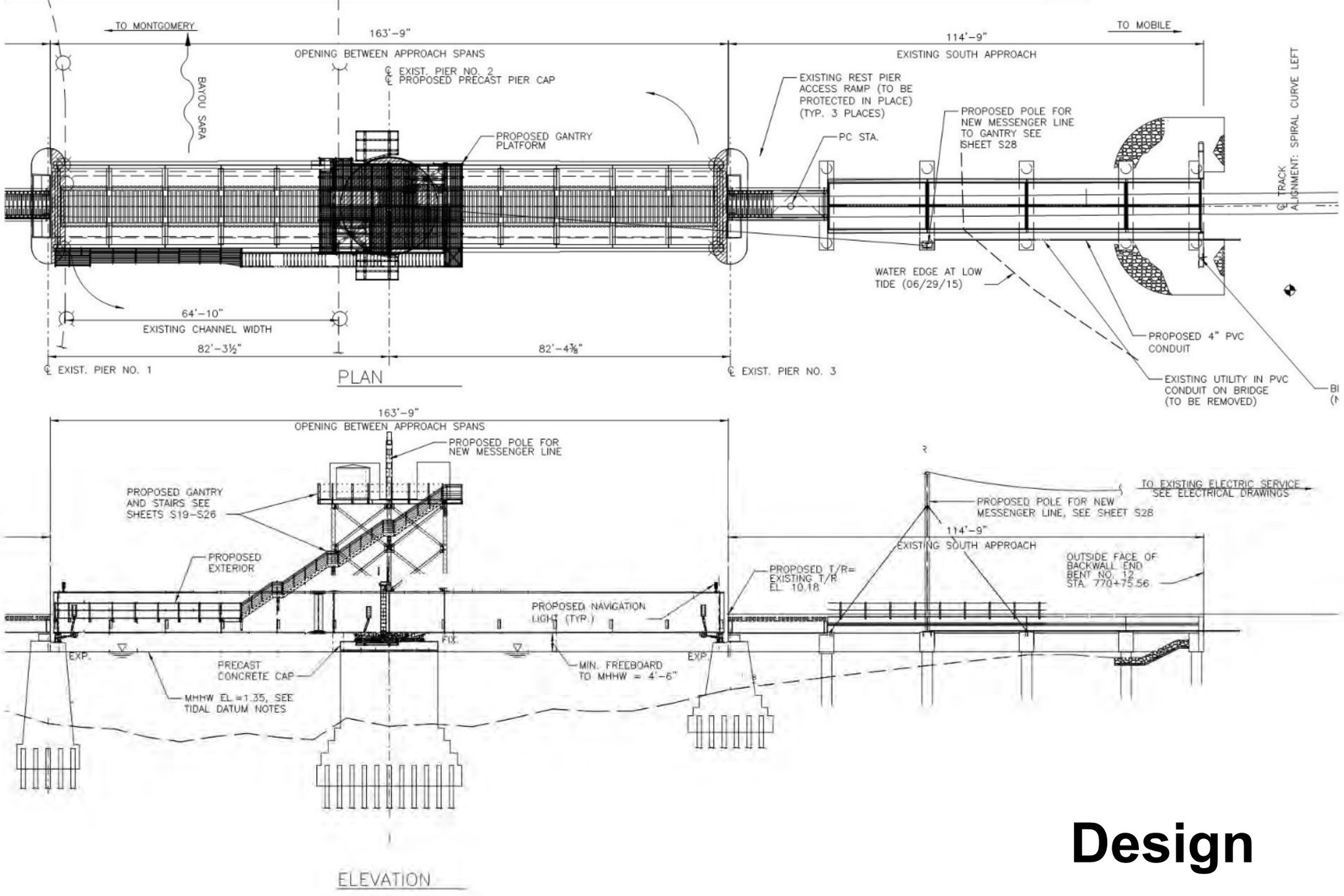
# Design

- Equipment Gantry
  - Elevated Equipment
  - Weight Reduction
    - 20,000# Counterweight reduction

# Design

Remote Operation

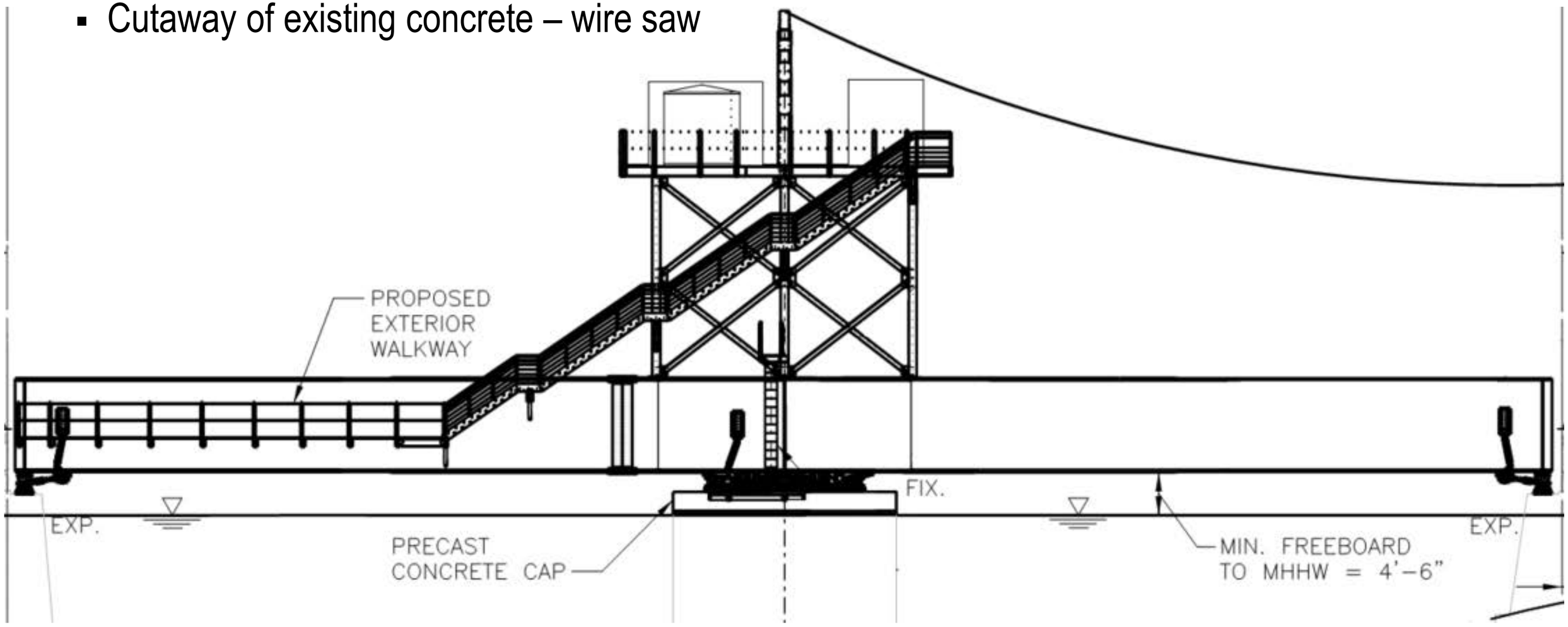
- Feedback Sensors
- Machinery Redundancy
- Control System Redundancy
- Enhanced Communications
- Cameras


TO MONTGOMERY
163'-9"
OPENING BETWEEN APPROACH SPANS
℄ EXIST. PIER NO. 2
℄ PROPOSED PRECAST PIER CAP
BAYOU SARA
PROPOSED GANTRY PLATFORM
114'-9"
EXISTING SOUTH APPROACH
TO MOBILE
EXISTING REST PIER ACCESS RAMP (TO BE PROTECTED IN PLACE) (TYP. 3 PLACES)
PC STA.
PROPOSED POLE FOR NEW MESSENGER LINE TO GANTRY SEE SHEET S28
℄ TRACK ALIGNMENT: SPIRAL CURVE LEFT
WATER EDGE AT LOW TIDE (06/29/15)
64'-10"
EXISTING CHANNEL WIDTH
82'-3½"
82'-4⅜"
℄ EXIST. PIER NO. 1
℄ EXIST. PIER NO. 3
PROPOSED 4" PVC CONDUIT
EXISTING UTILITY IN PVC CONDUIT ON BRIDGE (TO BE REMOVED)
PLAN
163'-9"
OPENING BETWEEN APPROACH SPANS
PROPOSED POLE FOR NEW MESSENGER LINE
PROPOSED GANTRY AND STAIRS SEE SHEETS S19-S26
PROPOSED EXTERIOR
TO EXISTING ELECTRIC SERVICE SEE ELECTRICAL DRAWINGS
PROPOSED POLE FOR NEW MESSENGER LINE, SEE SHEET S28
114'-9"
EXISTING SOUTH APPROACH
PROPOSED T/R= EXISTING T/R EL. 10.18'
OUTSIDE FACE OF BACKWALL END BENT NO. 12 STA. 770+75.56
PROPOSED NAVIGATION LIGHT (TYP.)
EXP.
FIX.
EXP.
PRECAST CONCRETE CAP
MIN. FREEBOARD TO MHHW = 4'-6"
MHHW EL.=1.35, SEE TIDAL DATUM NOTES
ELEVATION

# Design

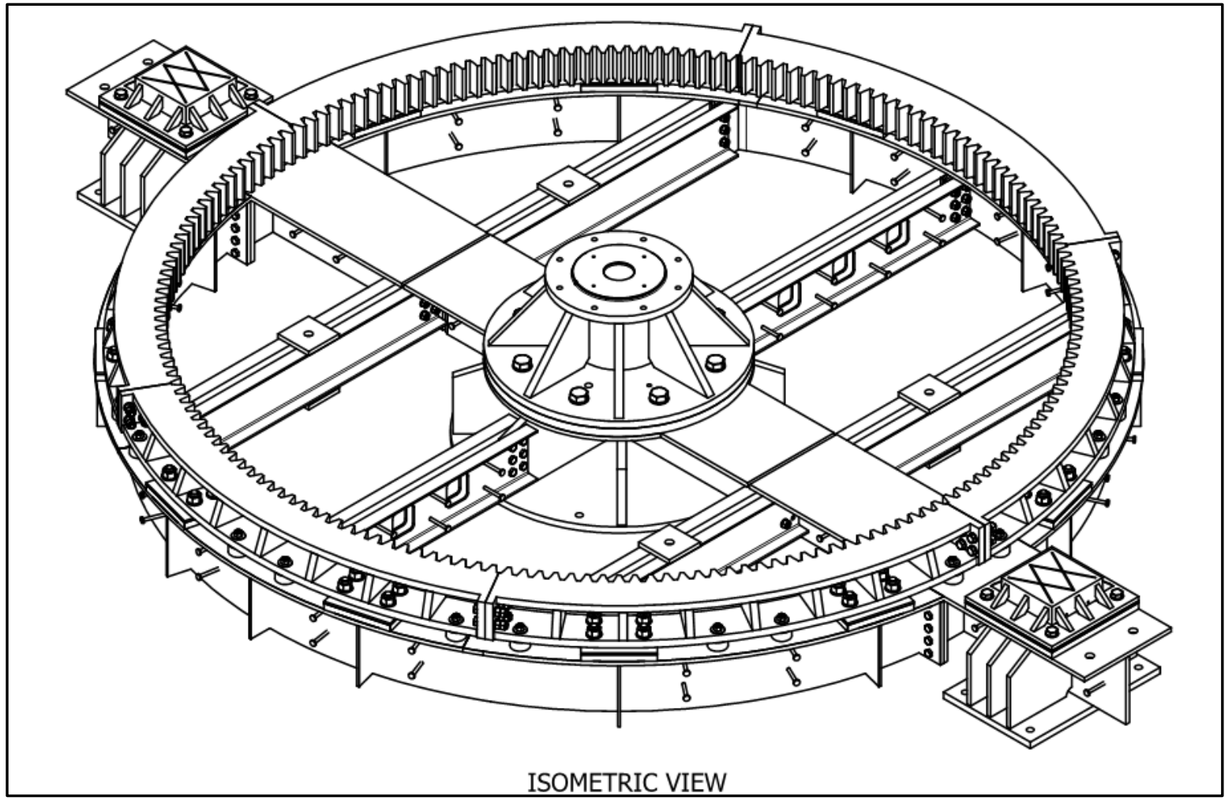
# Design

- Replacement Precast Concrete Cap
- Cutaway of existing concrete – wire saw



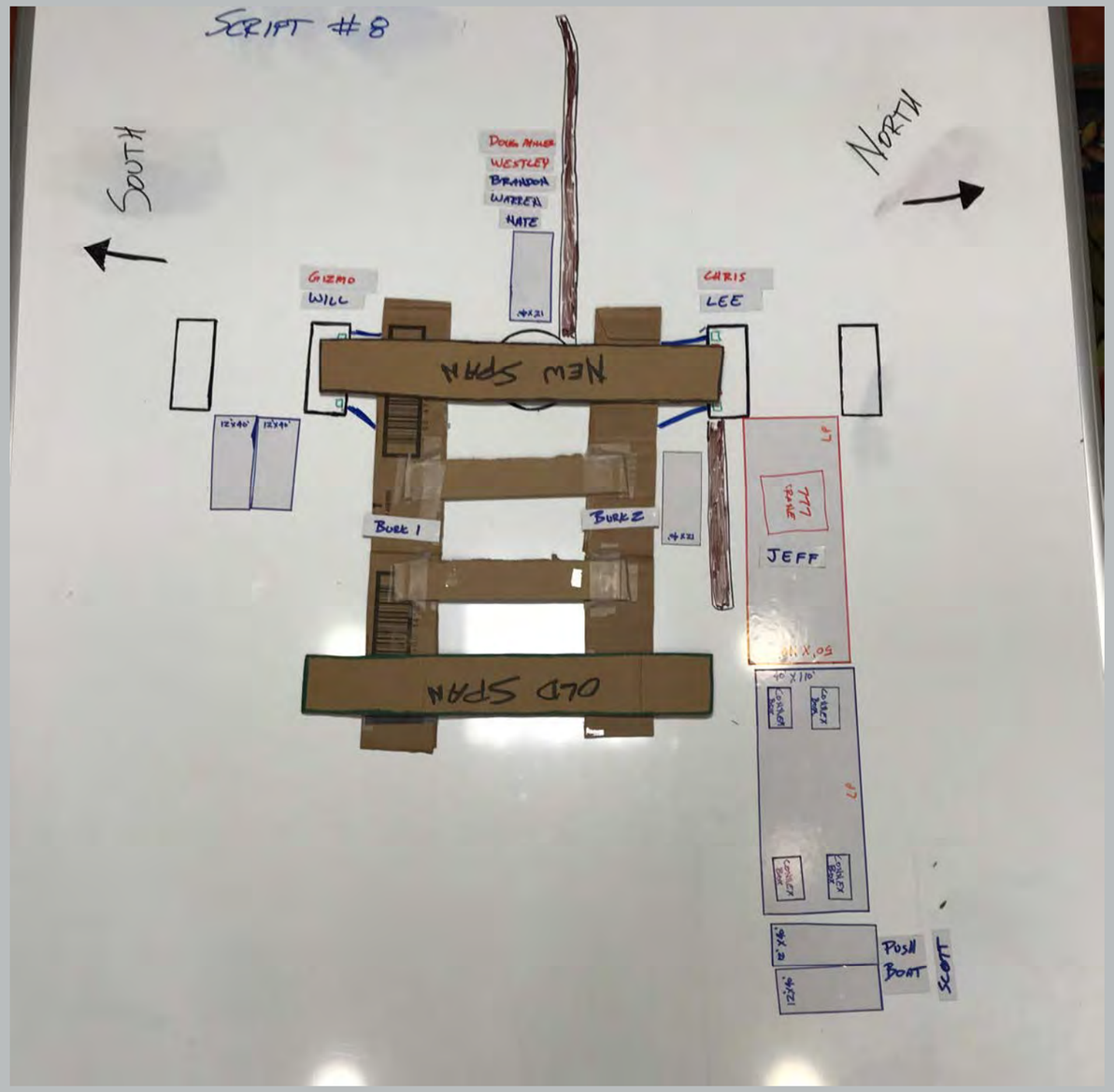
# Design Change During Construction

- Outage Duration Reduced from 48 hours to 14 hours
- Solution: Structural Steel Grillage Replaced Precast Concrete
  - Suspended Directly from the New Swing Span During Float-in
  - Placed on Steel Plate Stacks on Pivot Pier

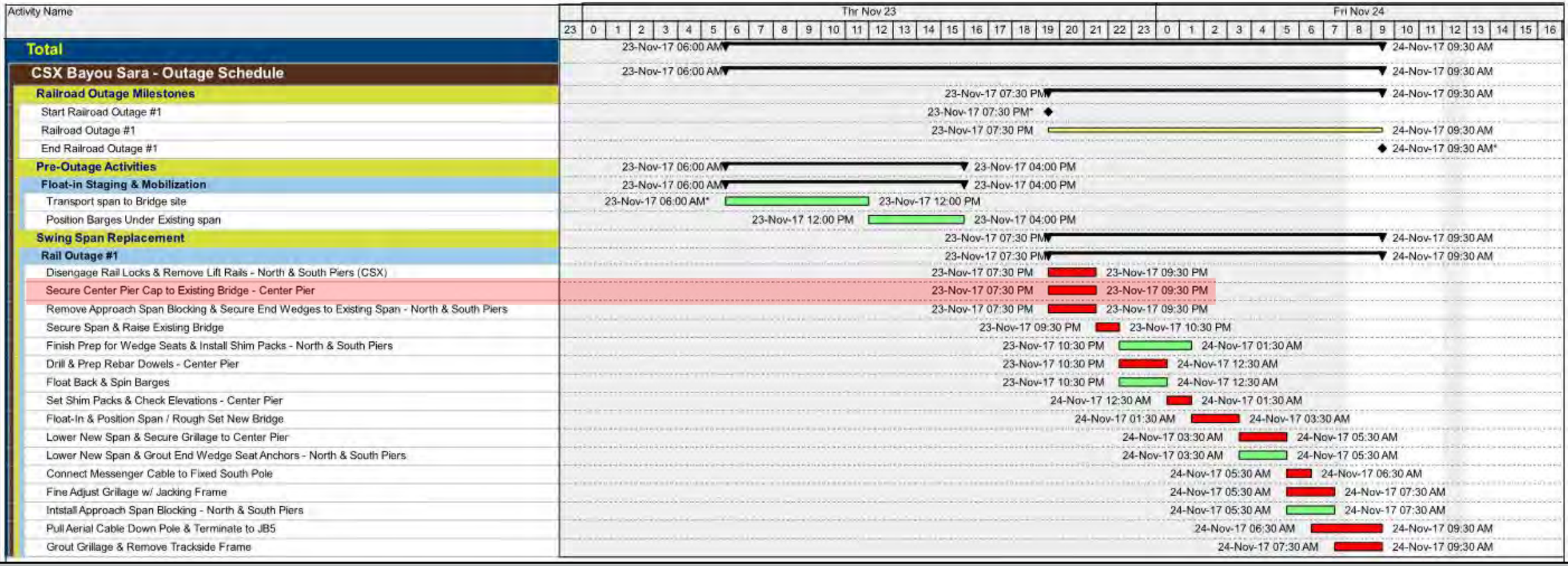



# Construction Planning

- Site Logistics
- Outage Schedule
- Activity Scripts
- Center Pier Prep
- Machinery Prep
- Bridge Transport
- Bridge Float In



# Outage Schedule




** Critical Path runs through the center pier **

# Activity Scripts

BRASFIELD & GORRIE
GENERAL CONTRACTORS

**Swing Span Float-in Work Activity Plans/Script**

| | | |
|---|---|---|
| **Work Type (Structural. Elec, Etc.)** | Float-In | SCRIPT #2 |
| **Activity** | Secure Center Pier Cap to Existing Bridge | |
| **Float-in HR (0 to 14)** | 0-2.0 | 11/23/17 19:30 |
| **Scheduled Duration** | 2 | 11/23/17 21:30 |
| **Supervisor** | Brandon Speegle | |
| **Project Manager** | Kevin Kane | |

**Micro-Activities**

| | |
|---|---|
| 1 | **Layout steel and prep for welds on girders** |
| 2 | **Pre-build and fly scaffold platform in place for girder support steel install** |
| 3 | **Feed rods through timber ties** |
| 4 | **Weld tube steel support steel to girders** |
| 5 | **Couple rods together** |
| 6 | **Set plates over top of rods** |
| 7 | **Thread on bevel nut & washer** |
| 8 | **Tighten nuts & tack weld** |

| Concurrent Outage Activities | Supervisor |
|---|---|
| **Disengage Rail Lifters** | Giz / Chris |
| **Secure End Wedges** | Giz / Chris |

| Permanent Material Requirements | QTY |
|---|---|
| Dywidag Rods 20ft length | 20 |
| Couplers | 26 |
| Bevel nuts | 26 |
| Washer plates | 26 |
| Steel beams | 4 |
| Steel plates | 20 |

| QC/QA Requirements |
|---|
| Verify coupler is evenly spaced on rod |

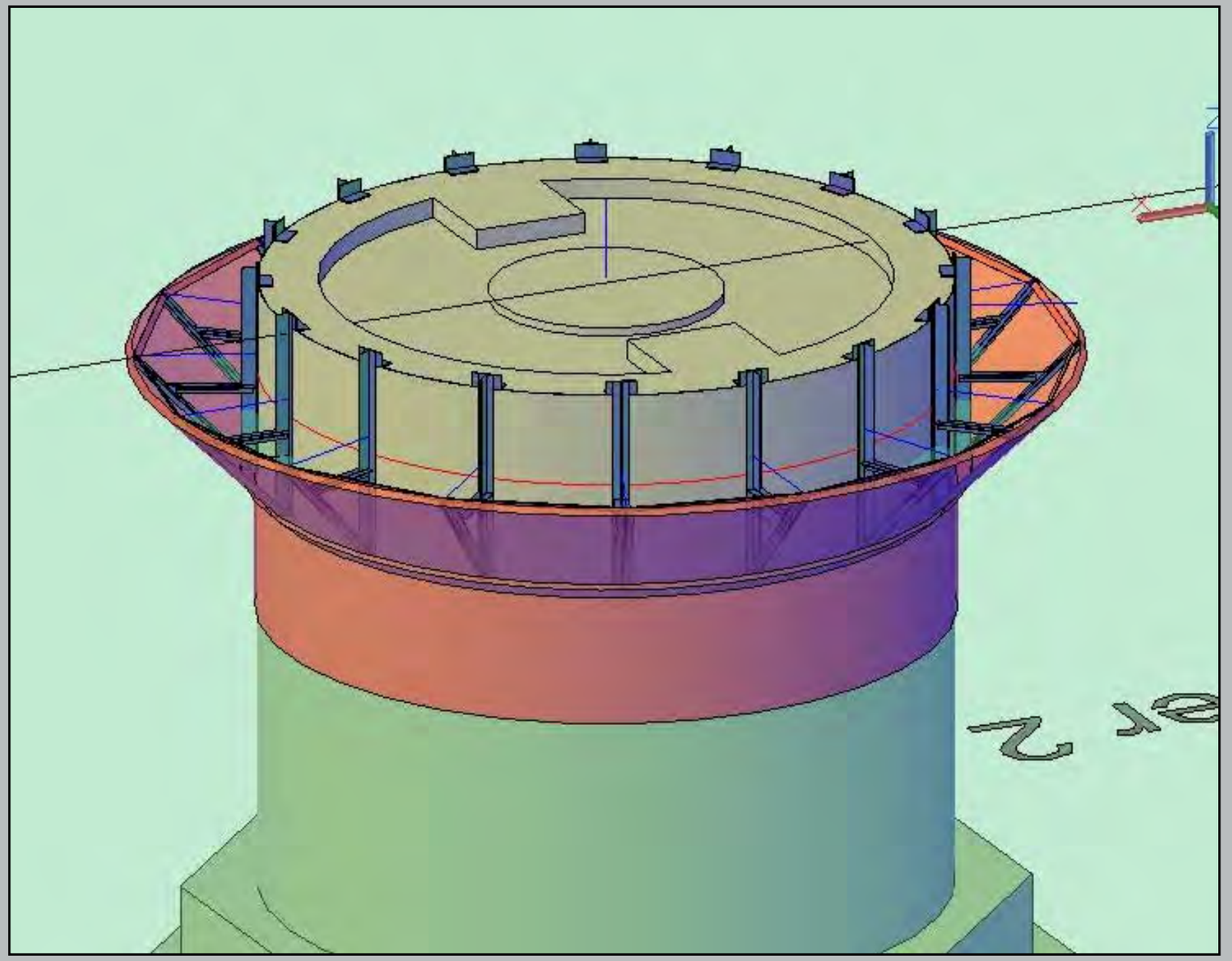
| Crew | 5 |
|---|---|
| Center | 5 |
| Doug, Nate, Westley, Warren, Brandon R. | |

| Major Equipment Requirements | QTY |
|---|---|
| Welding machine & leads | 1 |
| Generator | 1 |
| Scaffold Buck | 2 |

| Small Tools Requirements | QTY |
|---|---|
| Grinder | 2 |
| Grinding discs | Box |
| Face shield | 2 |
| Cords | 2 |
| Wrenches (Verify Size) | 4 |
| Welding Rods | Box |

# Center Pier Prep

- Install Cofferdam



# Center Pier Prep

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- Install Cofferdam
- Core Pilot Holes
- Wire Saw Outer Thirds of Cap
- Selective Demolition
- Jack and Block Swing Span

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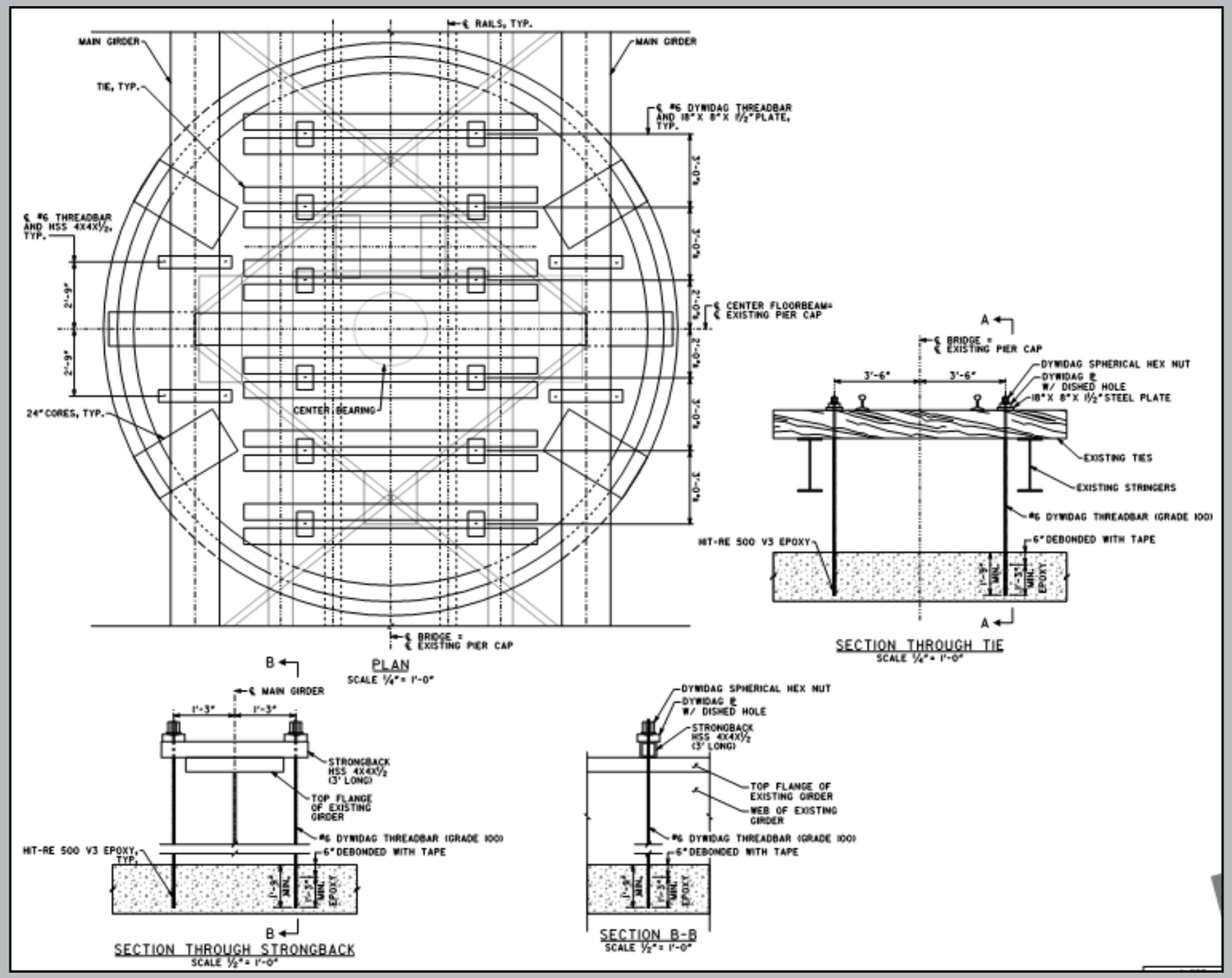
- Install Threaded Dowels



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# Machinery Prep

- Grillage Frame Jacking/Installation

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- Grillage Frame Jacking/Installation
- Initial Alignment
- Securing Grillage

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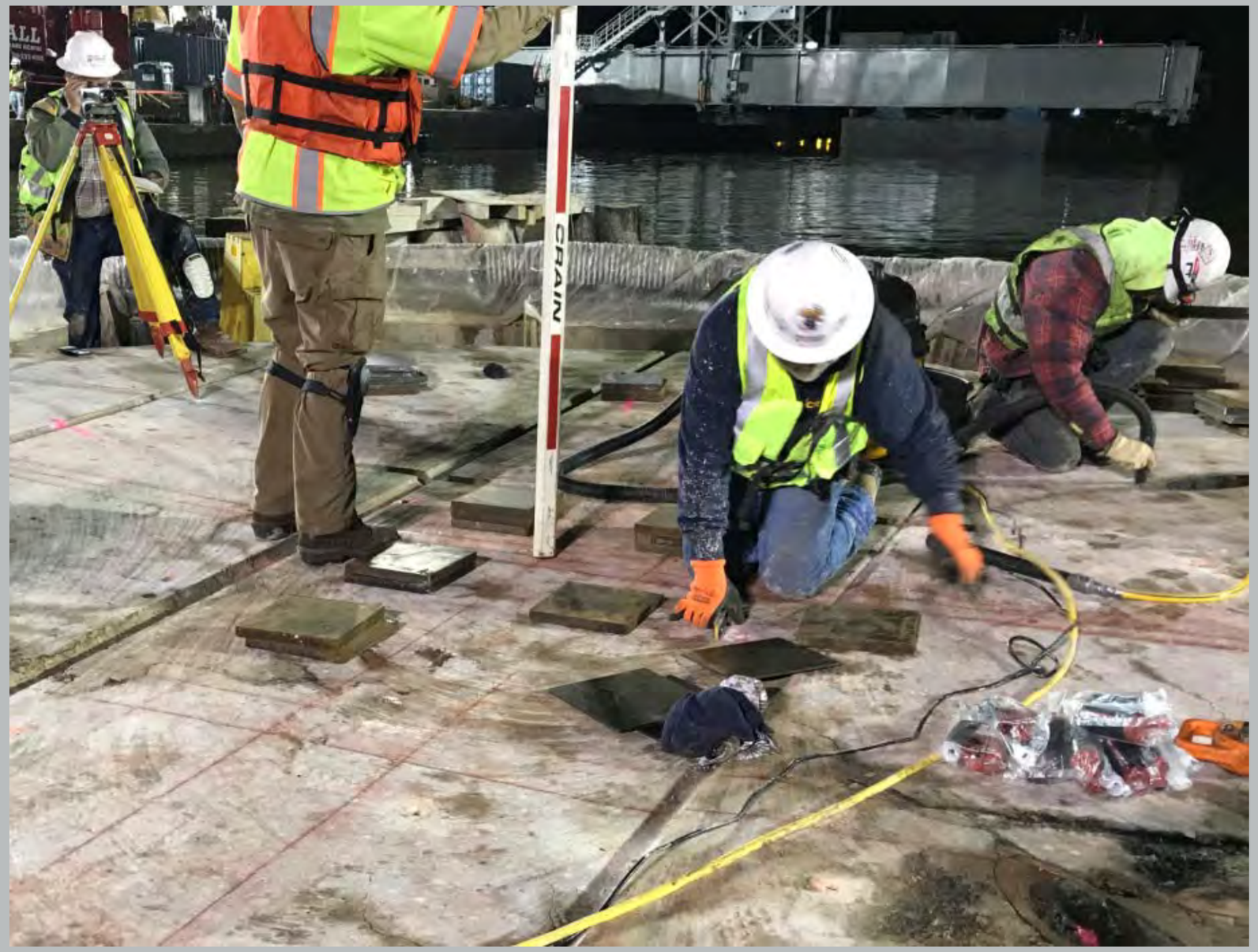
- Grillage Frame Jacking/Installation
- Initial Alignment
- Securing Grillage
- End Wedge Seat Installation

# Bridge Transport

# Bridge Transport

# Bridge Float In

- Clean & Prep Center Pier Cap Surface
- Layout & Build Shim Stacks for Grillage
- Drill and Epoxy Rebar Dowels



# Bridge Float In

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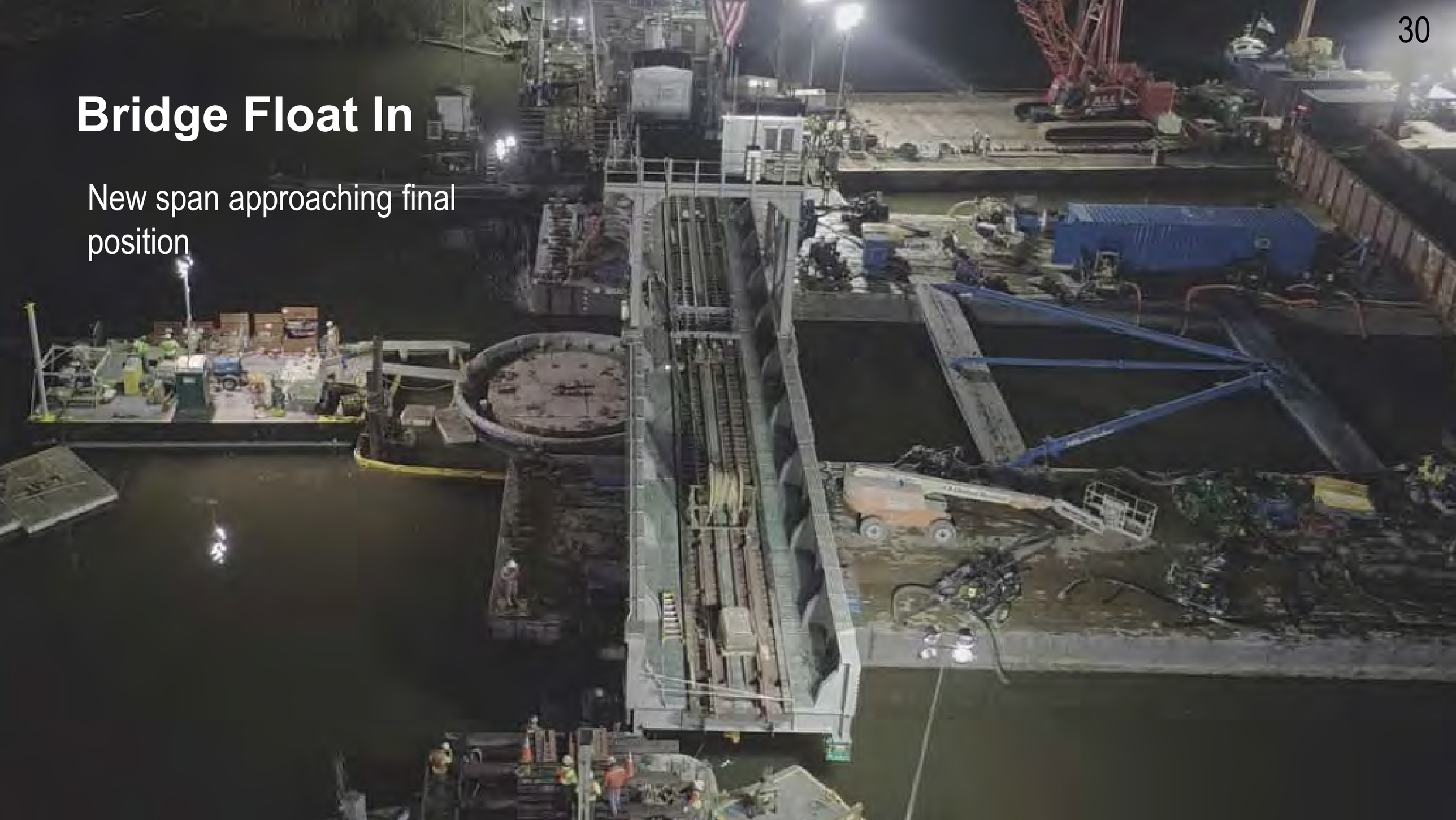
New span approaching final position



# Bridge Float In

Global Alignment

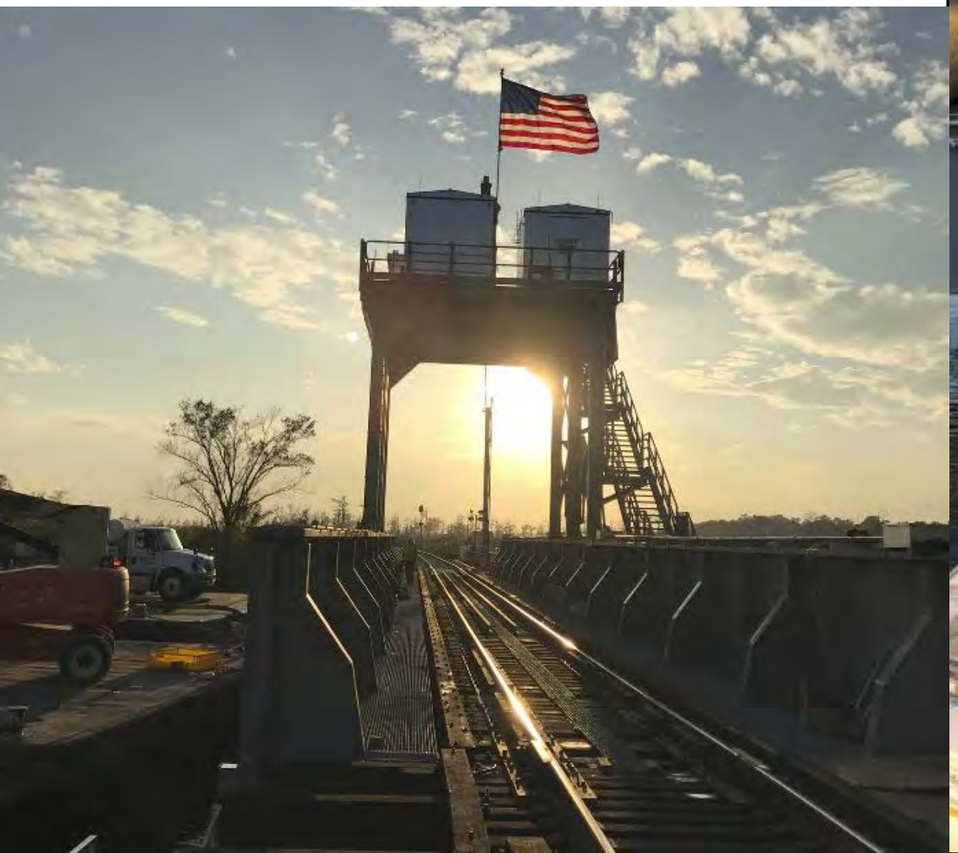
# Bridge Float In

Lower New Span On Shim Stacks

# Bridge Float In

Rail Back In Service

# Pivot Pier Completion



# Bridge Open

# Conclusions

- Service Needs/Outages Drive the Approach
- Repurposing Existing Foundations Saves Time and Cost
- Gantry Platform Minimizes Weight; Promotes Resiliency
- Pre-installed Machinery Speeds Installation
- Owner/Engineer/Contractor Collaboration Yields Best Results
- Detailed Planning of Outage Construction Schedule is Imperative

# Acknowledgements

# Presenter Contact Information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