



# LEO FRIGO

## I-43 Bridge Repair

**Scot Becker, Wisconsin Department of  
Transportation, State Bridge Engineer**  
**Kent Zinn, Michael Baker Inc, Vice President**

March 25, 2014



# Presentation Rundown

- **Leo Frigo Bridge Incident**
- **Preliminary Investigation and Findings**
- **Stability and Emergency Contract**
- **Permanent Repair**



# “Sagging Bridge Deck”

**September 25, 2013**

- Early morning hours
- Drivers Call 911





# Leo Frigo Memorial bridge

Green Bay

Fox River



\* MAP NOT TO SCALE



**Leo Frigo Memorial Bridge  
CLOSED**



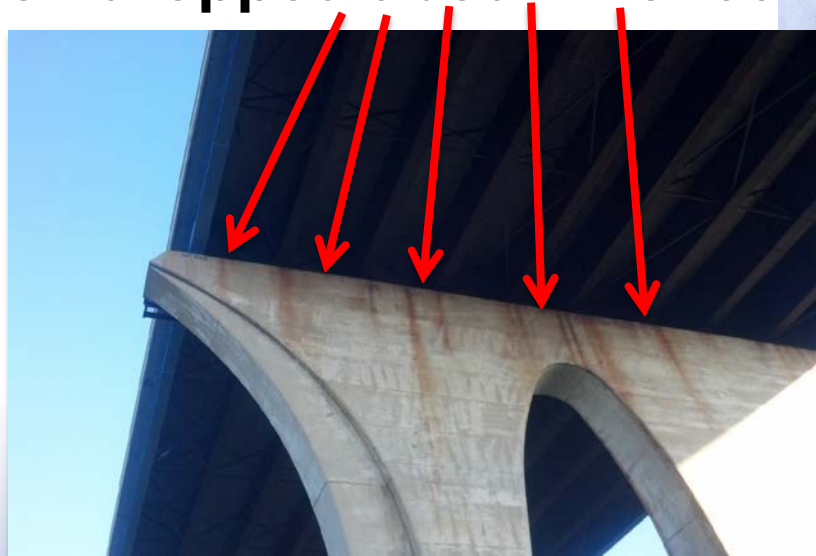
**WIS 172 and local detour routes**



# “Pier 22 Problems”

**September 25, 2013**

- Pier 22 sank 22 and 27 inches overnight
- Settling of Pier 22 caused sagging of bridge deck
- Deck dropped about two feet



# “Pier 22 Location”



Location of sag



# “Get The Word Out Fast”



**September 25, 2013**

- News conference at 2:30
- Gov. Walker and Secretary Gottlieb flew to Green Bay

- 40 Reporters from across Wisconsin
- Carried live on TV, radio and internet
- International media interest



# Executive Order

- Sept 27
  - Proclamation of emergency
    - First step in the application for emergency relief funds
  - Emergency relief: Program for the repair of Federal-Aid highways damaged by:
    - Natural disaster
    - Sudden catastrophic failures



OFFICE OF THE GOVERNOR

EXECUTIVE ORDER #114

Relating to a Proclamation Declaring a State of Emergency in Response to a Transportation Emergency in Brown County

WHEREAS, the health, welfare, and economic well-being of the citizens of Wisconsin depend on a safe and efficient transportation infrastructure; and

WHEREAS, the Leo Frigo Memorial Bridge that crosses the Fox River in the City of Green Bay and the County of Brown suffered a failure from an external cause as defined in 23 C.F.R. § 668.103 on September 25, 2013, resulting in the sagging of a major bridge segment; and

WHEREAS, the Leo Frigo Memorial Bridge has been closed because of this failure from an external cause; and

WHEREAS, the immediate repair and reconstruction of the Leo Frigo Memorial Bridge, as well as mitigation of potential damage caused by failure of a major bridge segment, are vital to the health, welfare, and economic well-being of the citizens of Wisconsin; and

WHEREAS, the Leo Frigo Memorial Bridge is a part of Interstate Highway 43, a federal-aid highway.

NOW, THEREFORE I, SCOTT WALKER, Governor of the State of Wisconsin, by virtue of the authority vested in me by the Constitution and the Laws of Wisconsin and by section 323.10 of the Wisconsin Statutes and 23 U.S.C. § 125, hereby declare the failure of the Leo Frigo Memorial Bridge due to the sagging of a major bridge segment to be a disaster, and hereby order the entire County of Brown to be in a state of emergency for a period of 60 days, unless extended by a joint resolution of the legislature.



IN TESTIMONY WHEREOF, I have hereunto set my hand and caused the Great Seal of the State of Wisconsin to be affixed. Done at the Capitol in the City of Madison this twenty-seventh day of September, in the year two thousand thirteen.

SCOTT WALKER  
Governor

By the Governor:

*Douglas La Follette*  
DOUGLAS LA FOLLETTE  
Secretary of State

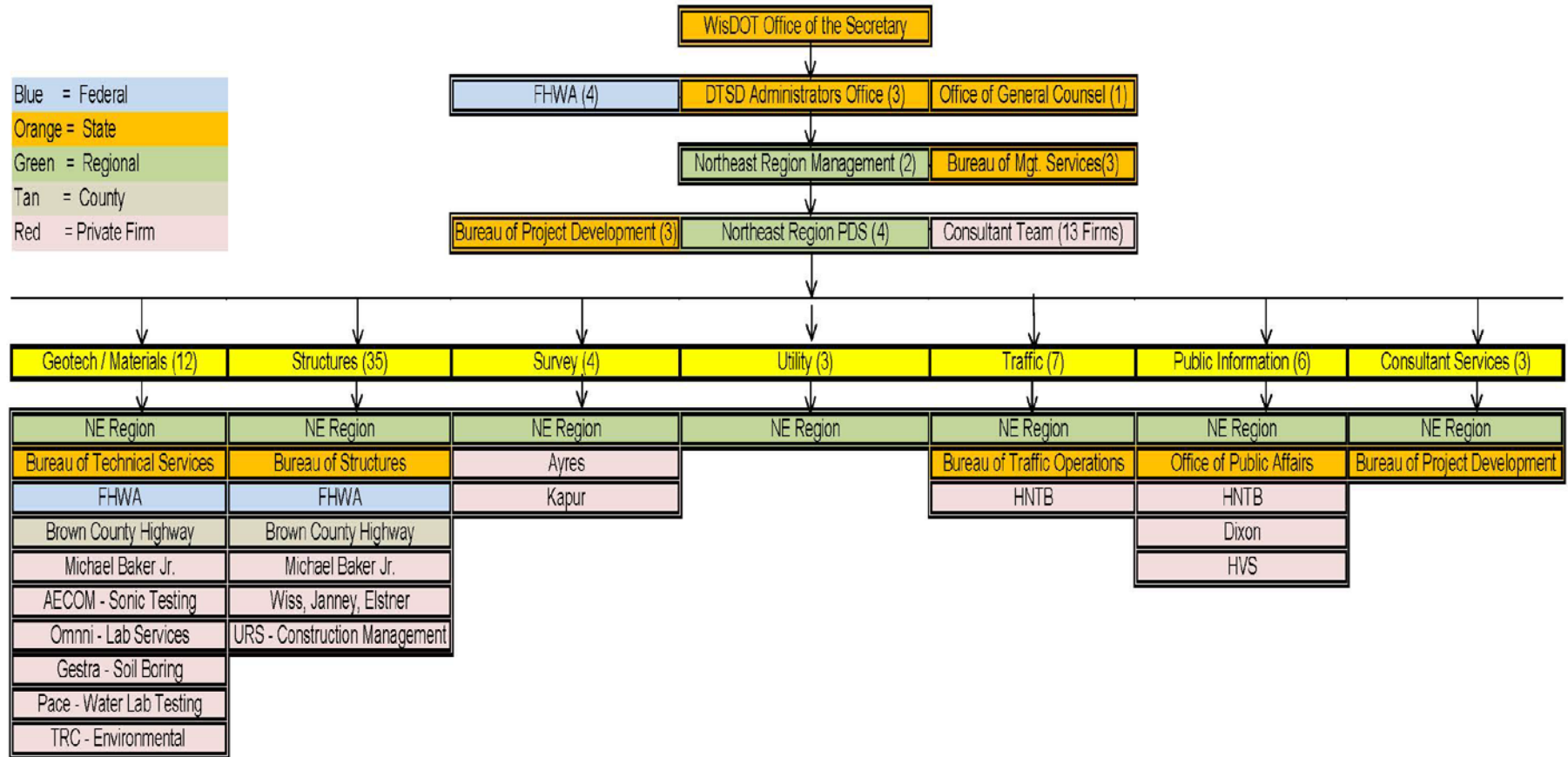
# Quick Collaboration





# Resources Assemble & State of Emergency

Blue = Federal  
 Orange = State  
 Green = Regional  
 Tan = County  
 Red = Private Firm



# “Why Did This Happen?”

## Looking for Clues



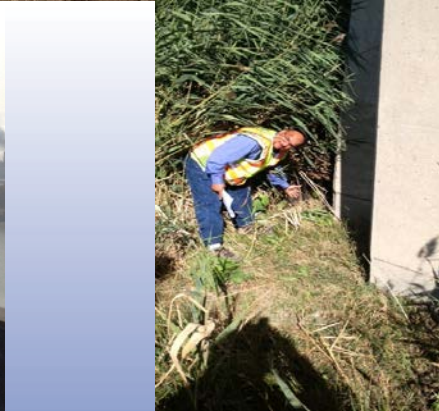


# Investigation begins with safety: Robotic Monitoring





# Visual Inspection



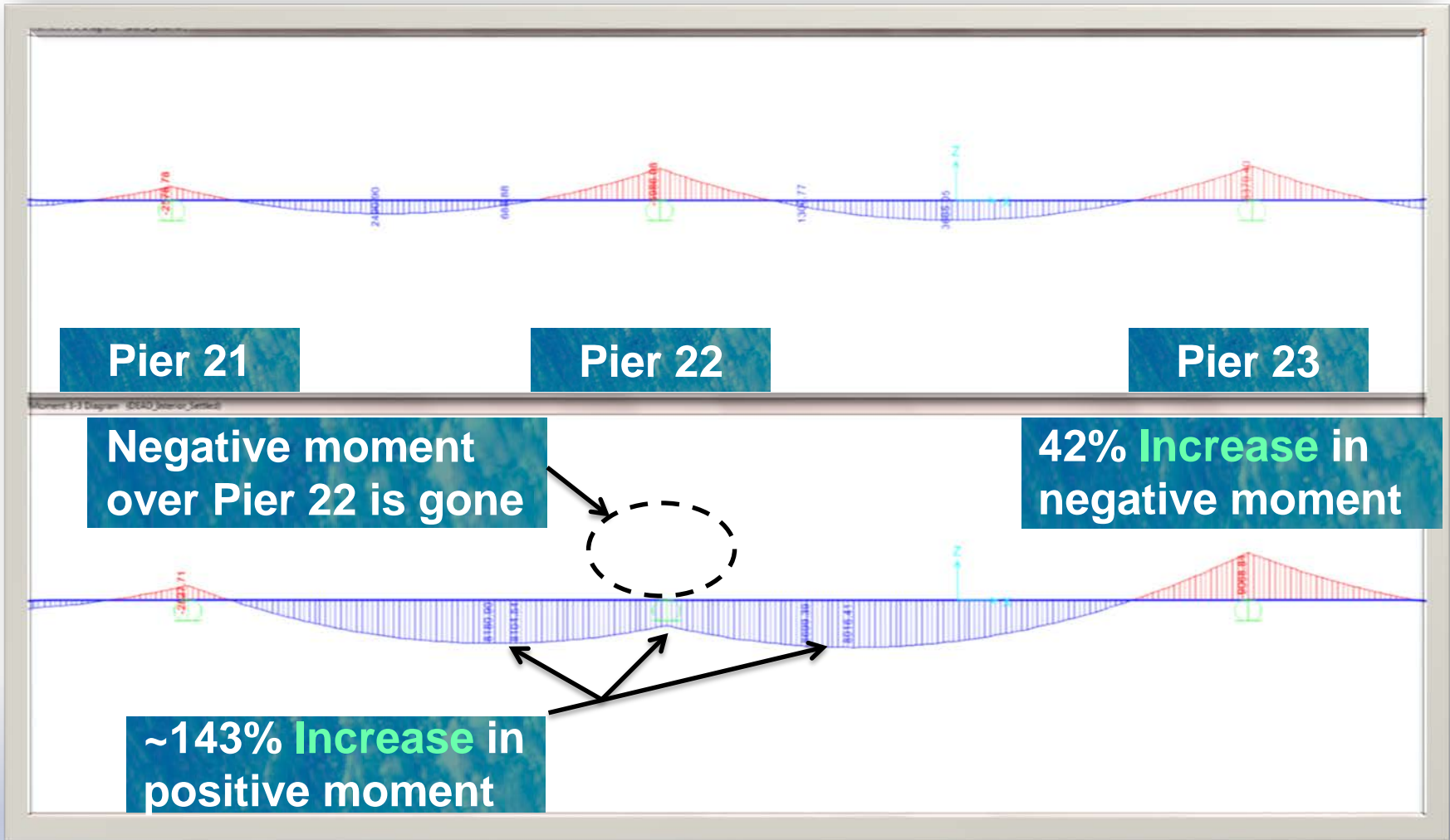
# Visual Inspection

- Superstructure: No unusual distress such as:
  - Bearing rotation
  - Plastic member deformation
  - Paint cracking
- Good condition despite sag
- No immediate concerns regarding safety and serviceability



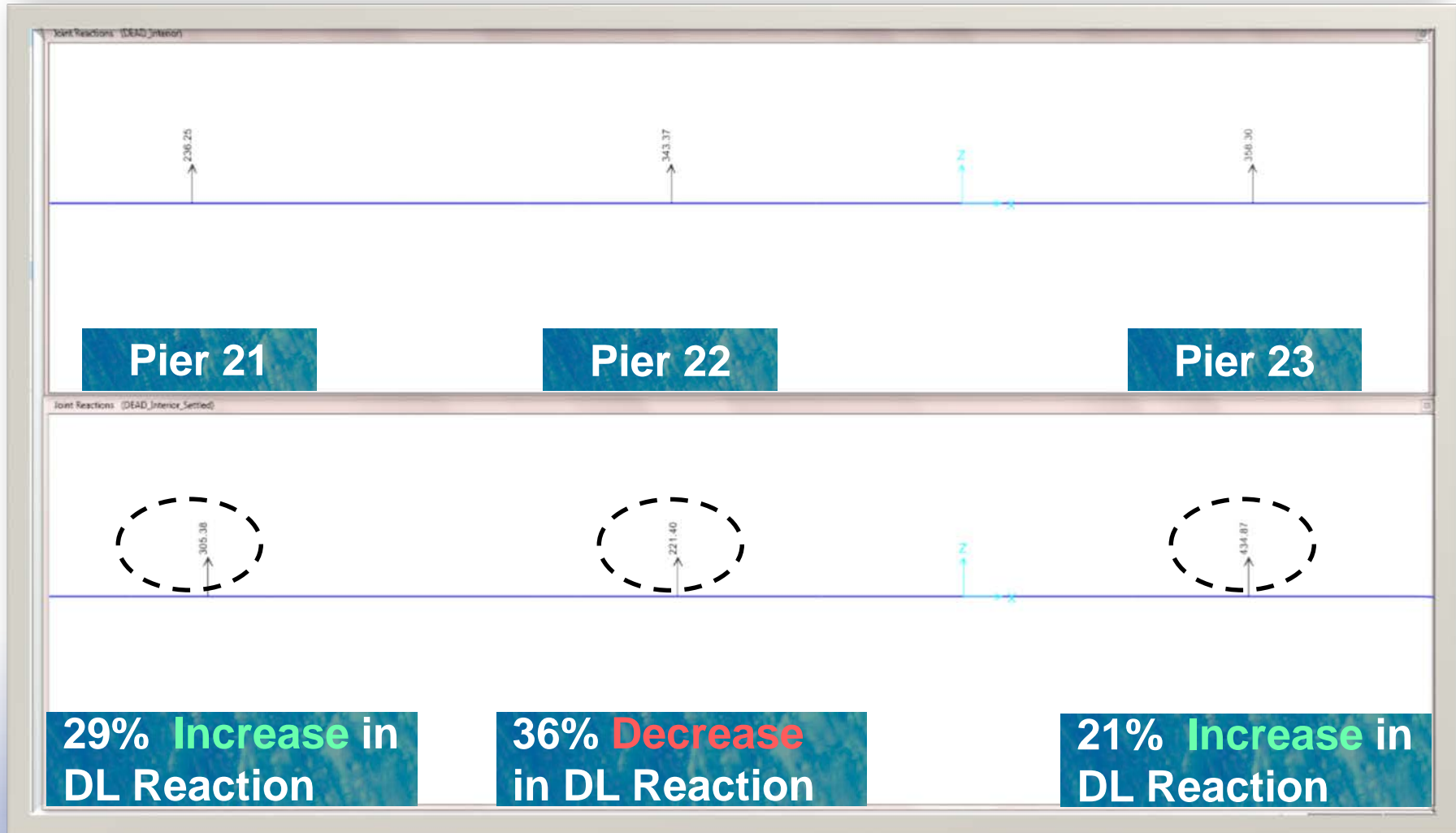


# Structure Analysis - Superstructure DL Moment





# Structure Analysis - Superstructure DL Reaction





## – Structural Analysis Results

- All force effects are within capacities
- Superstructure is within elastic stress range
- No permanent (plastic) deformation
- Superstructure could be jacked back to its original position
- Additional settlement greater than ~12 inches would cause permanent, plastic deformations

# Test Pit Investigation



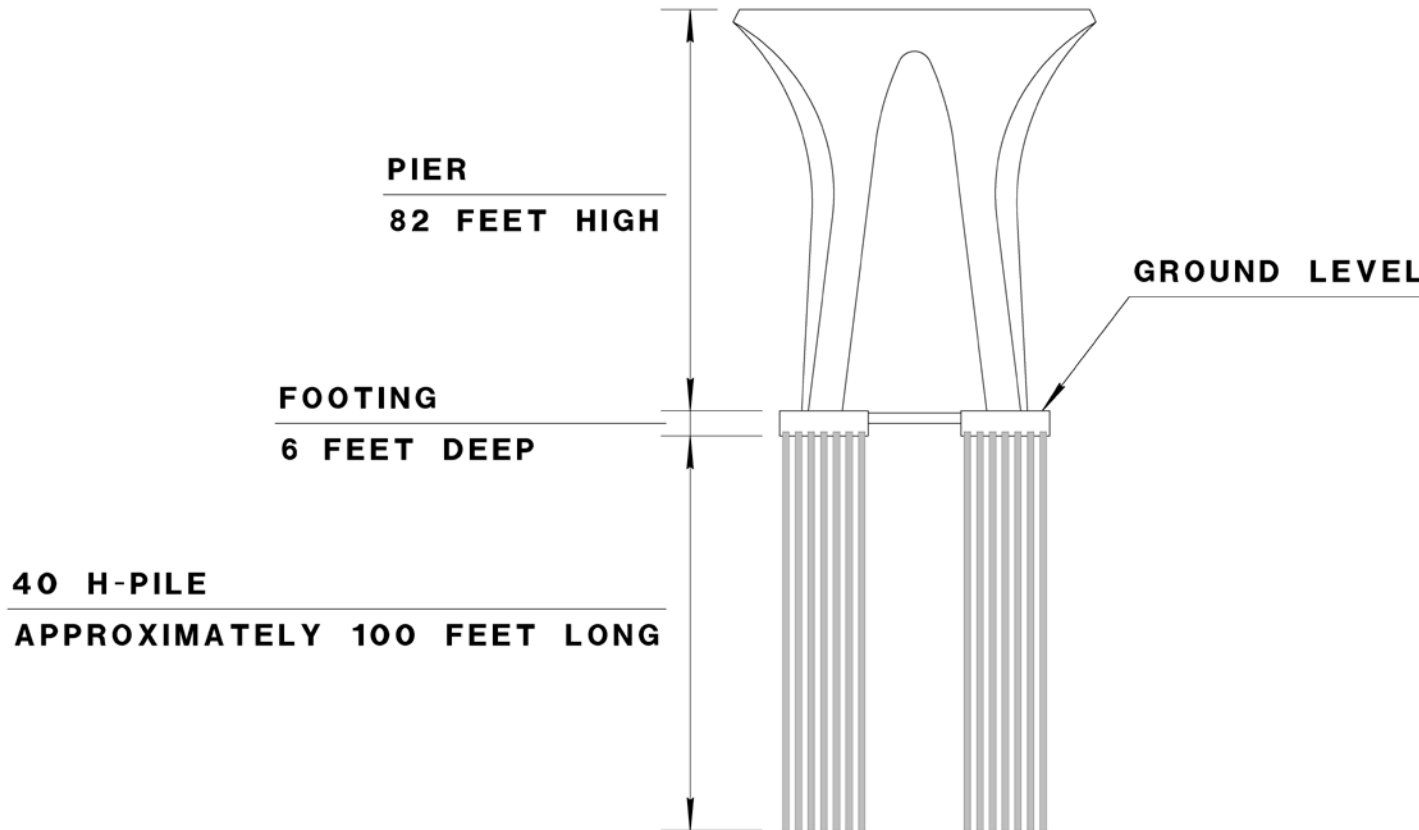


# Deep Soil Borings and Soil Sampling



# What we found

- Discovered piling buckled under the bottom of footing
- 1 pile in northwest corner
- 2 pile in southwest corner





# Piling Failure at Pier 22

- Pier 22 Knifing

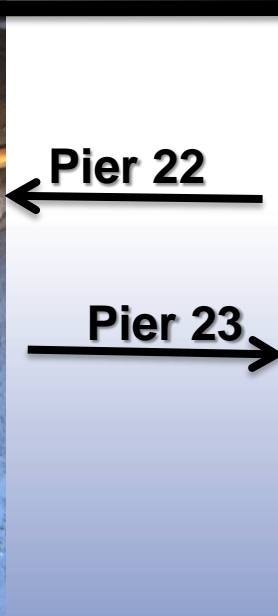


- Pier 22 Buckling





# Corroded Pilings

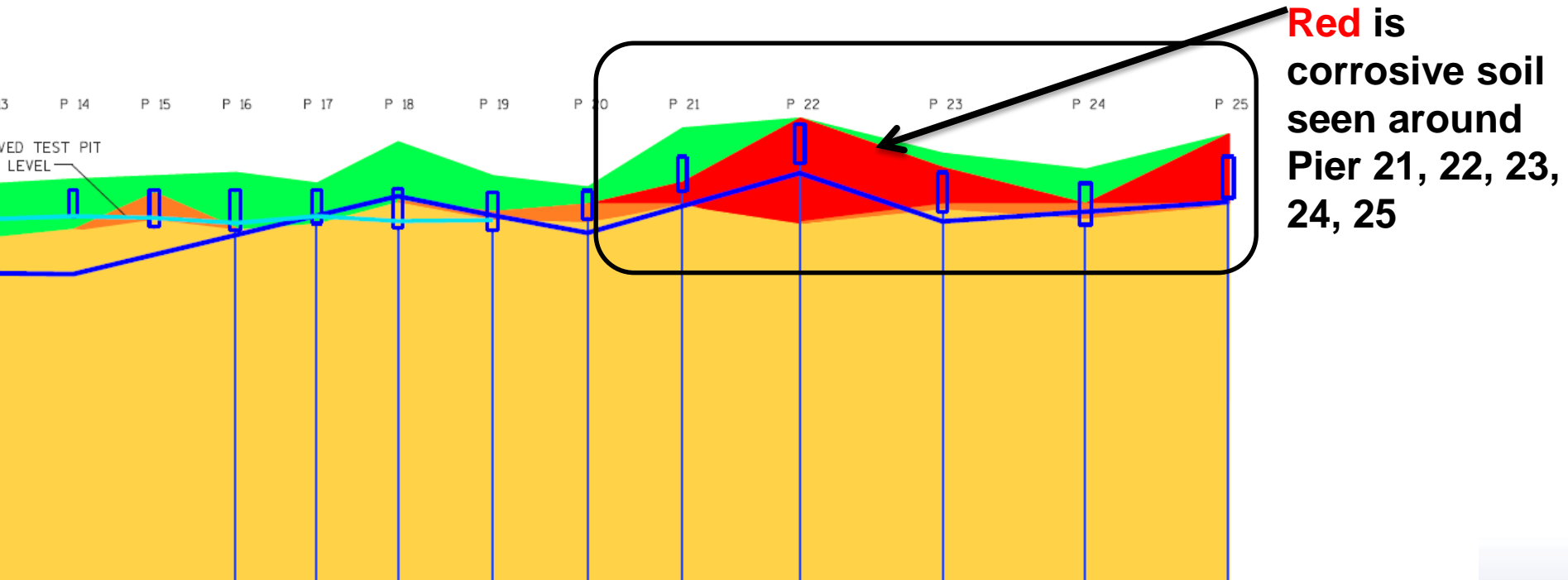


# Investigation Phase

- **Test Pits continued with numerous piers on entire structure east and west of river**
- **Soil borings completed at every pier and abutments**
- **Monitoring wells installed**
- **Finished all test pits on Friday, October 18th**
- **Completed all soil borings on Wednesday, October 23**
- **Confident in our findings as to what caused corrosion**

# Corrosive soil

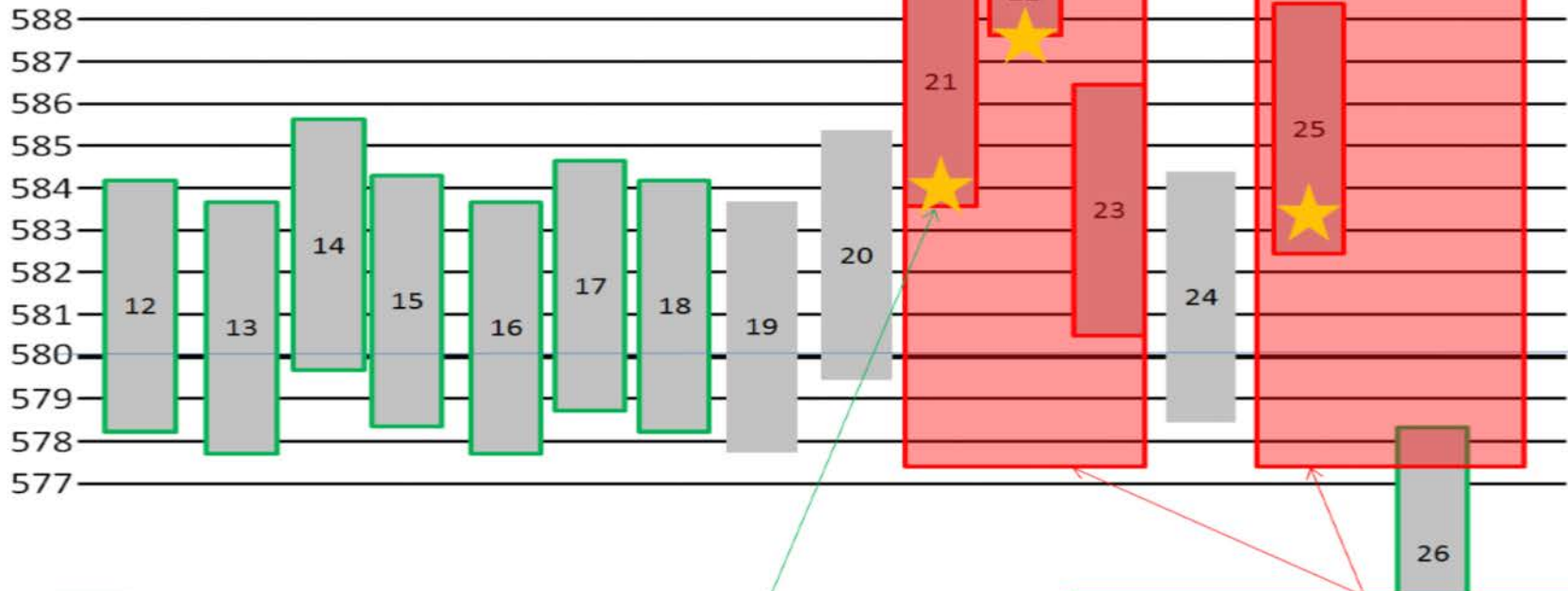
- Industrial Fill – Caused Severe Corrosion
- Industrial waste from 30s, 40s, 50s
- The fill was highly corrosive





# Footing Elevation

Elevation (orig. drwgs show WT at 580 ft)



Red rectangles show flyash zones per MB draft report

Only piers where substantial section loss was observed (i.e., knife edge; perforation) shown with gold star ★

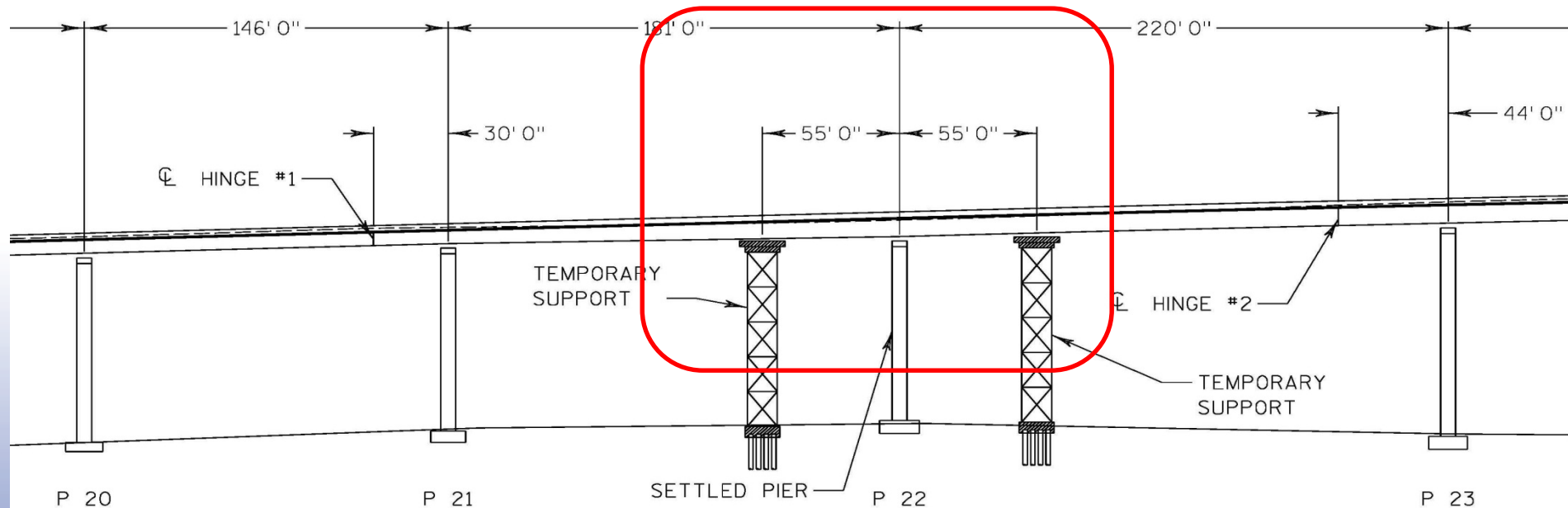
# Corrosive Soil

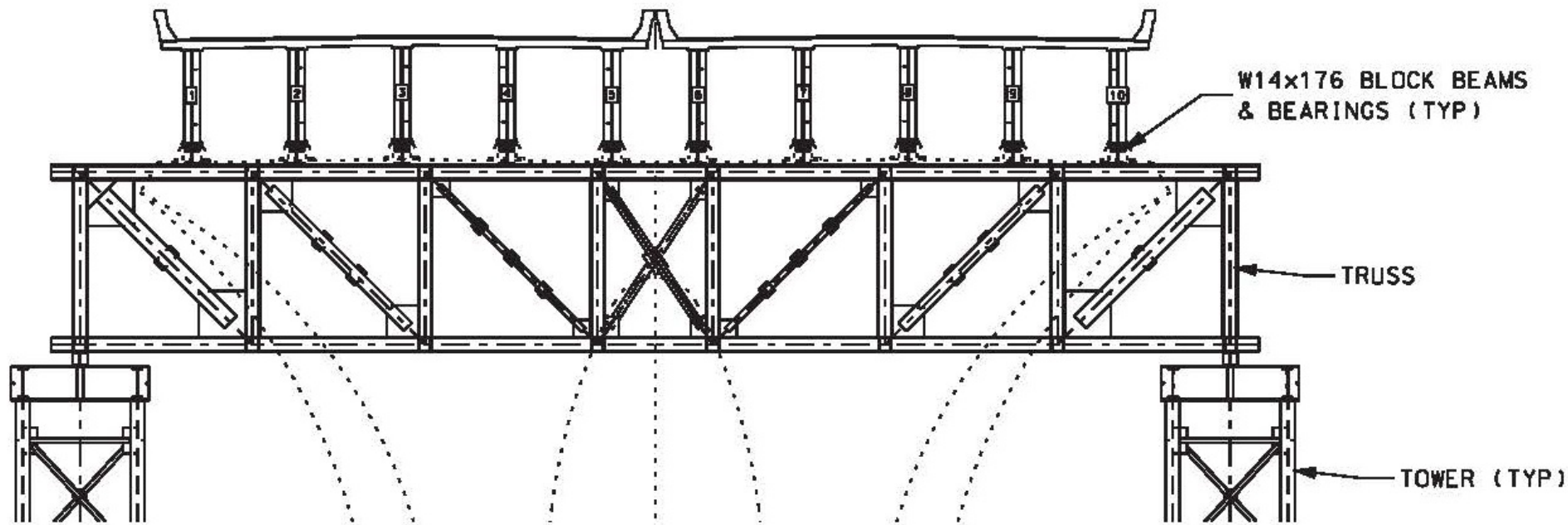




# Emergency Stabilization Project

- **Temporary shoring for safety**
  - Safety of workers, first and foremost
  - \$1.57 million – Lunda Construction won bid
  - Preserve investment in bridge





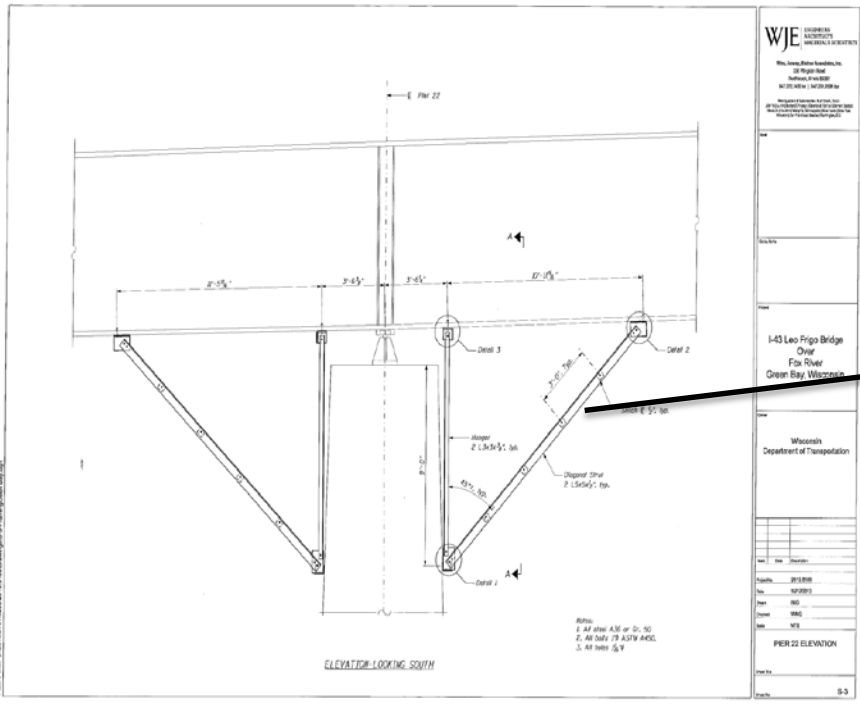
- Remove 25% of superstructure load from Pier 22
- Reduce load to adjacent piers
- Protect Pier 22 from vibrations
- Oct 3: Decision on towers
- Oct 4: Contractor meeting
- Oct 5: Send to contractors
- Oct 7: Receive bids



# Time to fix Leo Frigo Bridge

## Temporary shoring for safety

- Stability bracing on Pier 22



# Emergency Stabilization





# Day 36: Setting east truss



- West truss: 314,000 lbs
- East truss: 264,000 lbs
- Towers: 57,000 lbs

# Emergency Stabilization finished

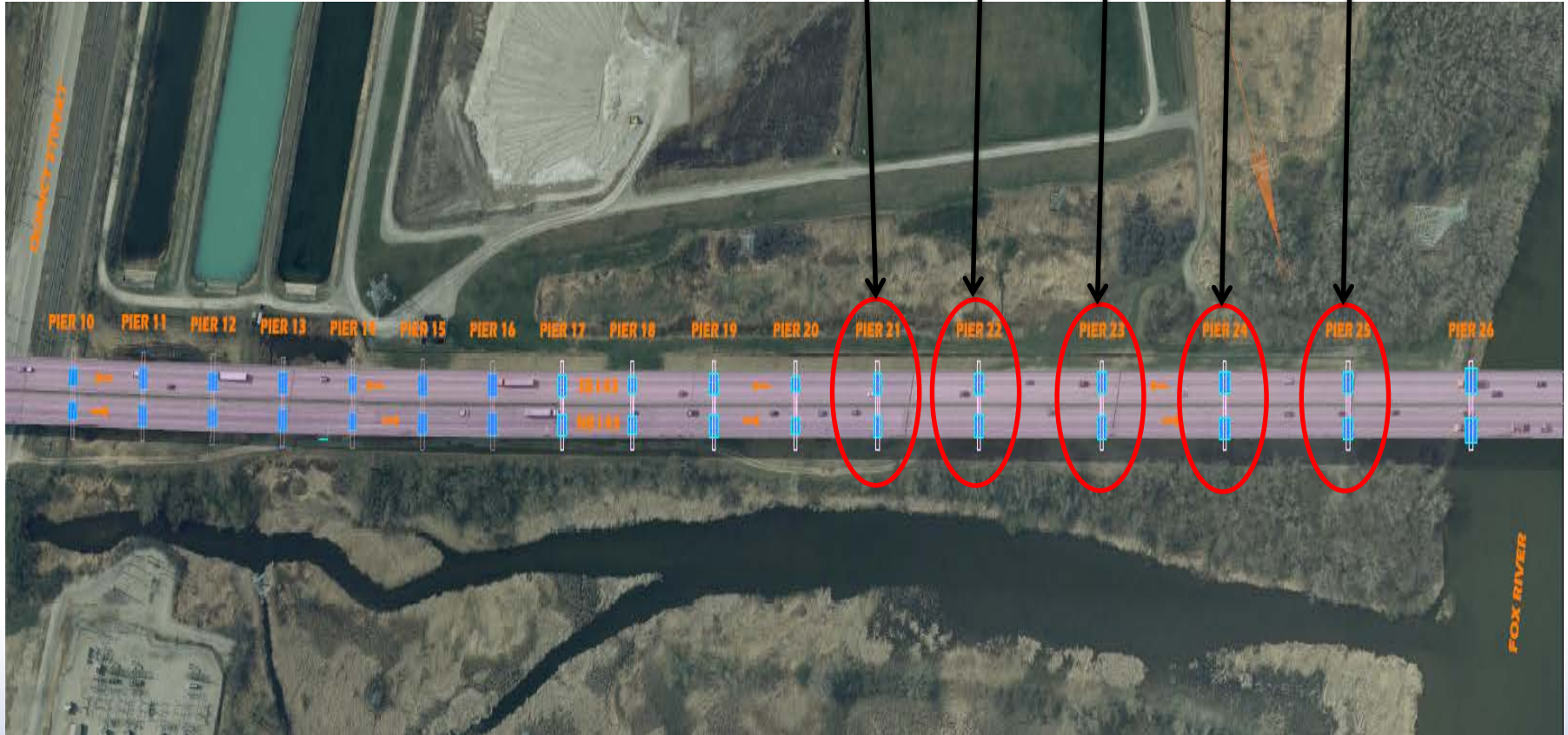


- Work began October 14<sup>th</sup>
- One support truss installed October 31<sup>st</sup>
- Second truss installed November 6<sup>th</sup>

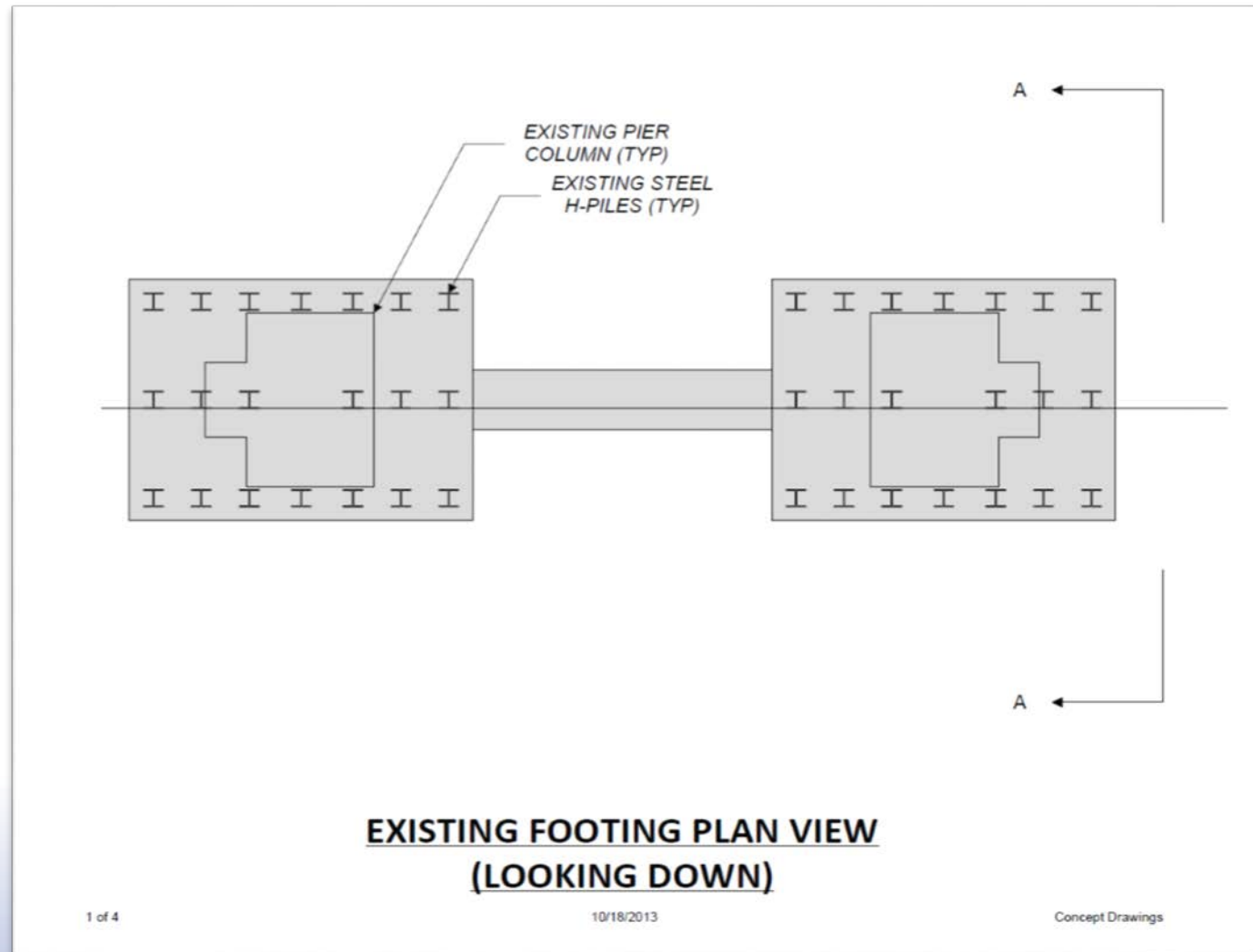


# The Big Fix!

Piers undergoing fix: 21, 22, 23, 24, 25

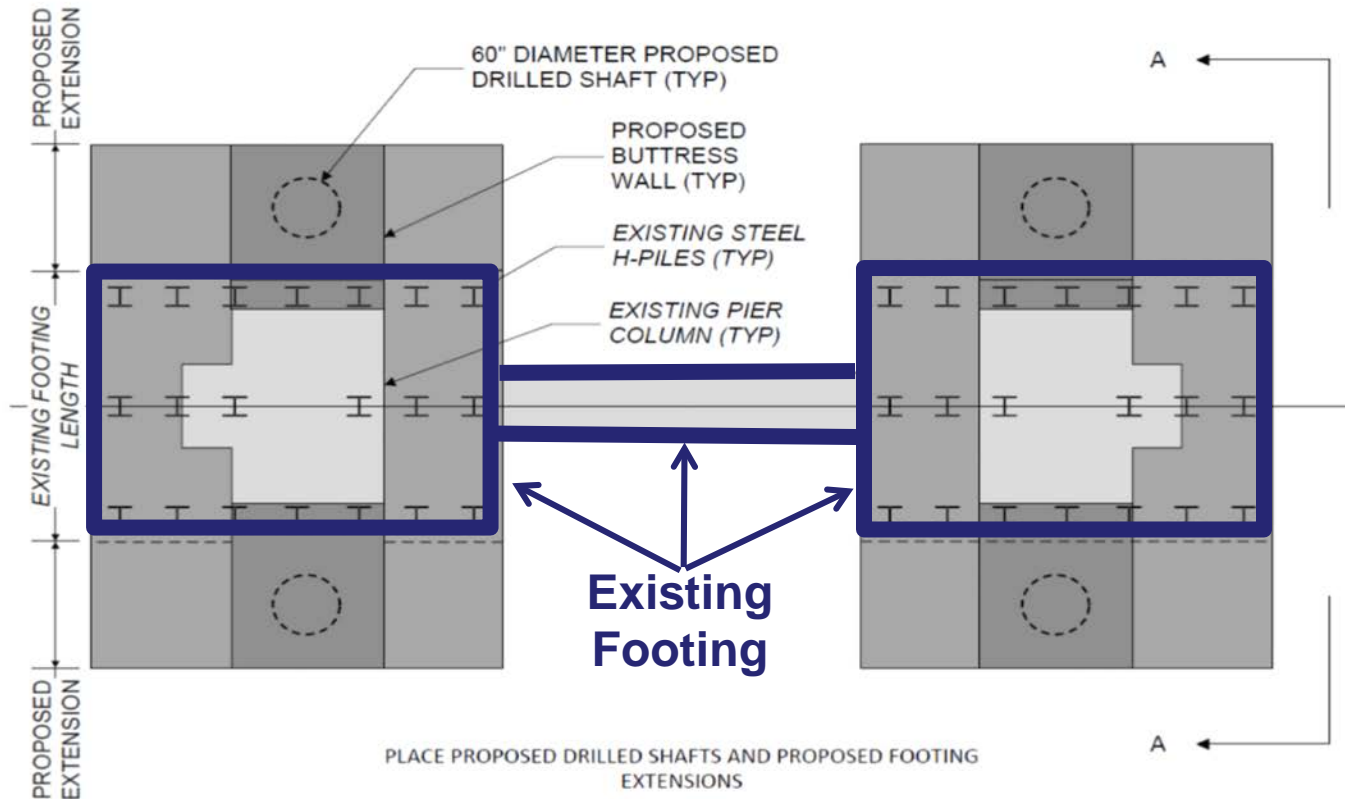


# Existing Pier Footing





# Proposed Footing (looking down)



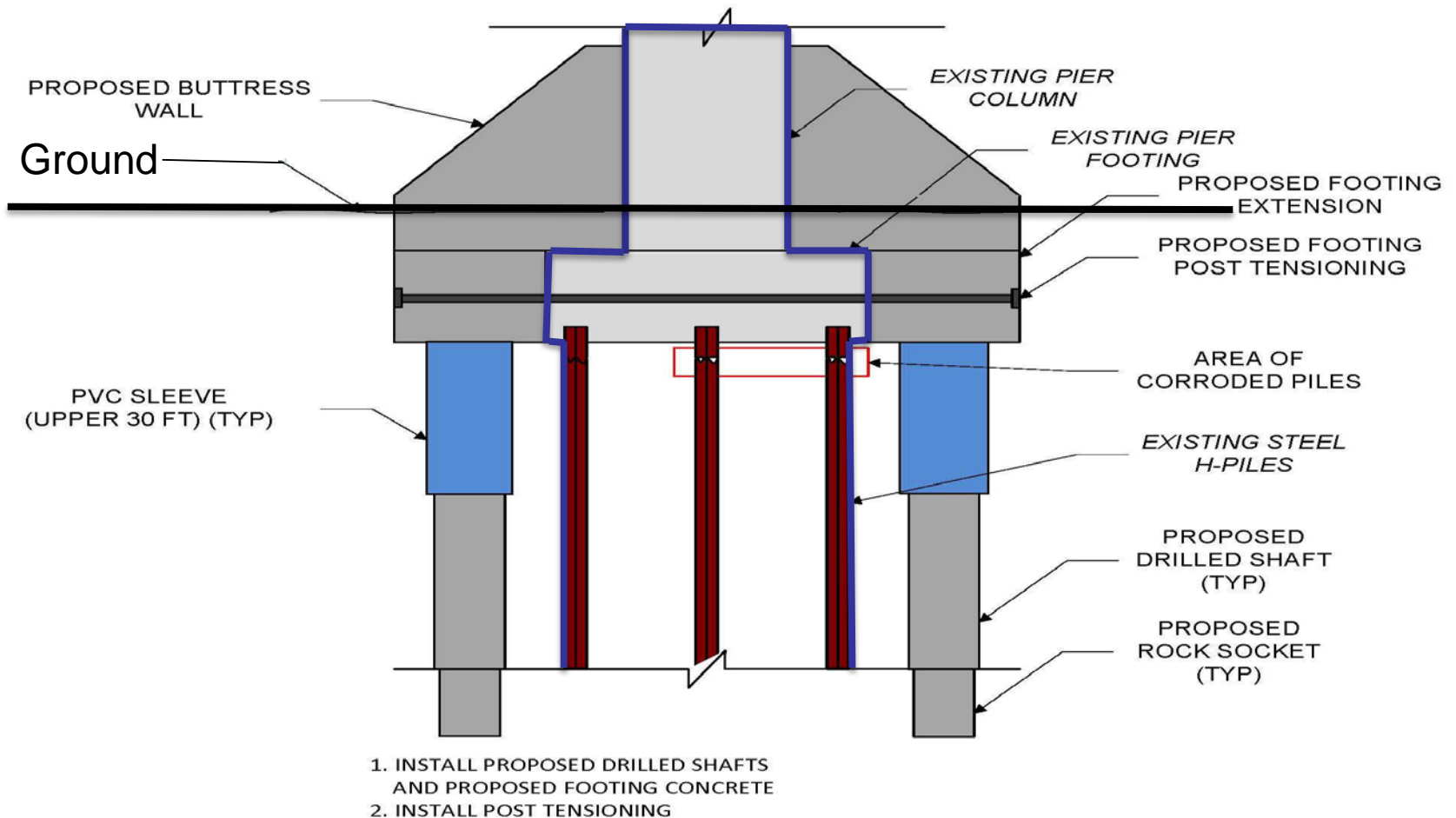
**PROPOSED PIER FOOTING PLAN VIEW  
(LOOKING DOWN)**

2 of 4

10/18/2013

Concept Drawings

# Future Pier Support on 21-25



**PROPOSED PIER SECTION A-A**

4 of 4

Concept Drawings



# Staging for Permanent Repairs

Prime Contractor: Zenith Tech





# Working 24/7

## Night Work



## Zero Degree Temperatures





# Drilled Shaft Work

Rock Auger at Pier 22 →



← Excavation at Pier 22



# Sleeve installation at Pier 24





# Drilled Shaft Cages





# Air hammer and drill bits



- 7' Rock Socket
- Drill Bit: 58"
- Titanium balls on each hammer.



# Preparing the footing for reinforcement





# Preparing the footing for reinforcement



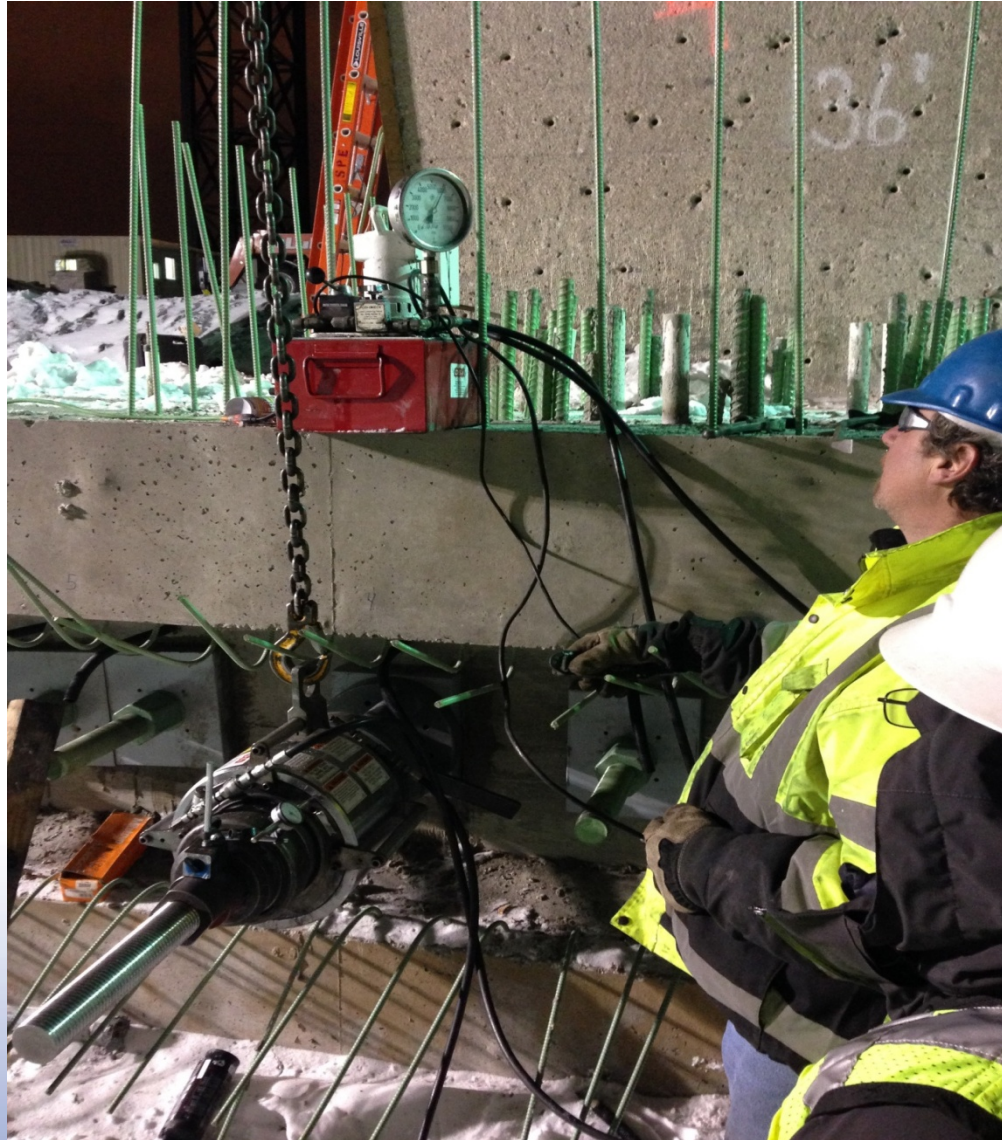


# Post-Tensioning Set-up at Pier 22





# Post-Tensioning





# Forming footing at Pier 22



# New footing and rebar for buttress

## Pier 22

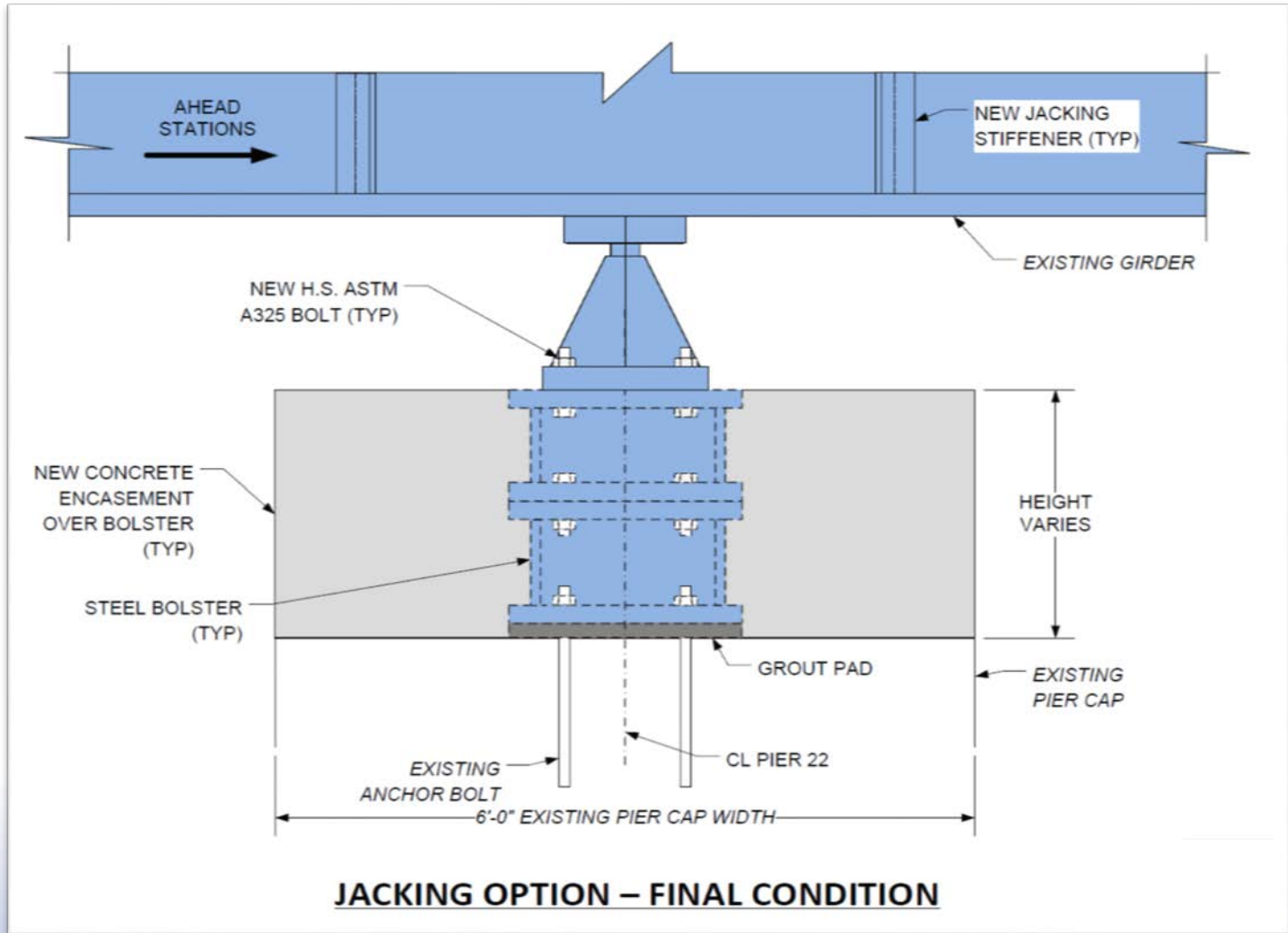




# Finished Buttress

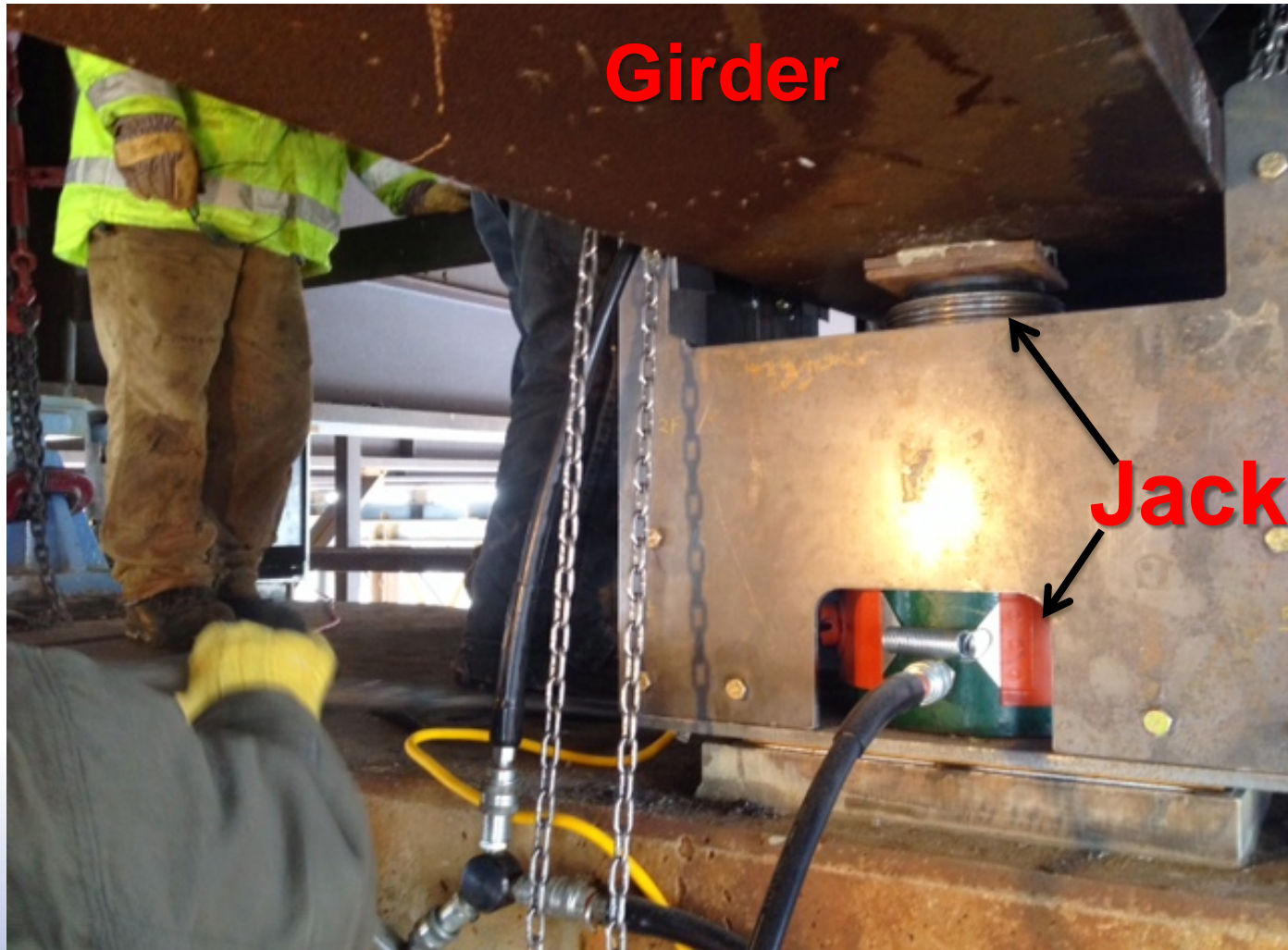


# Jacking up Pier 22





# Jacking under Pier 22



# Jacking under Pier 22





# Girder 6 in final position



# Jacking Complete Dec. 23, 2013





# Northbound jacking completed



12.20.2013 14:38

# Welding bolster

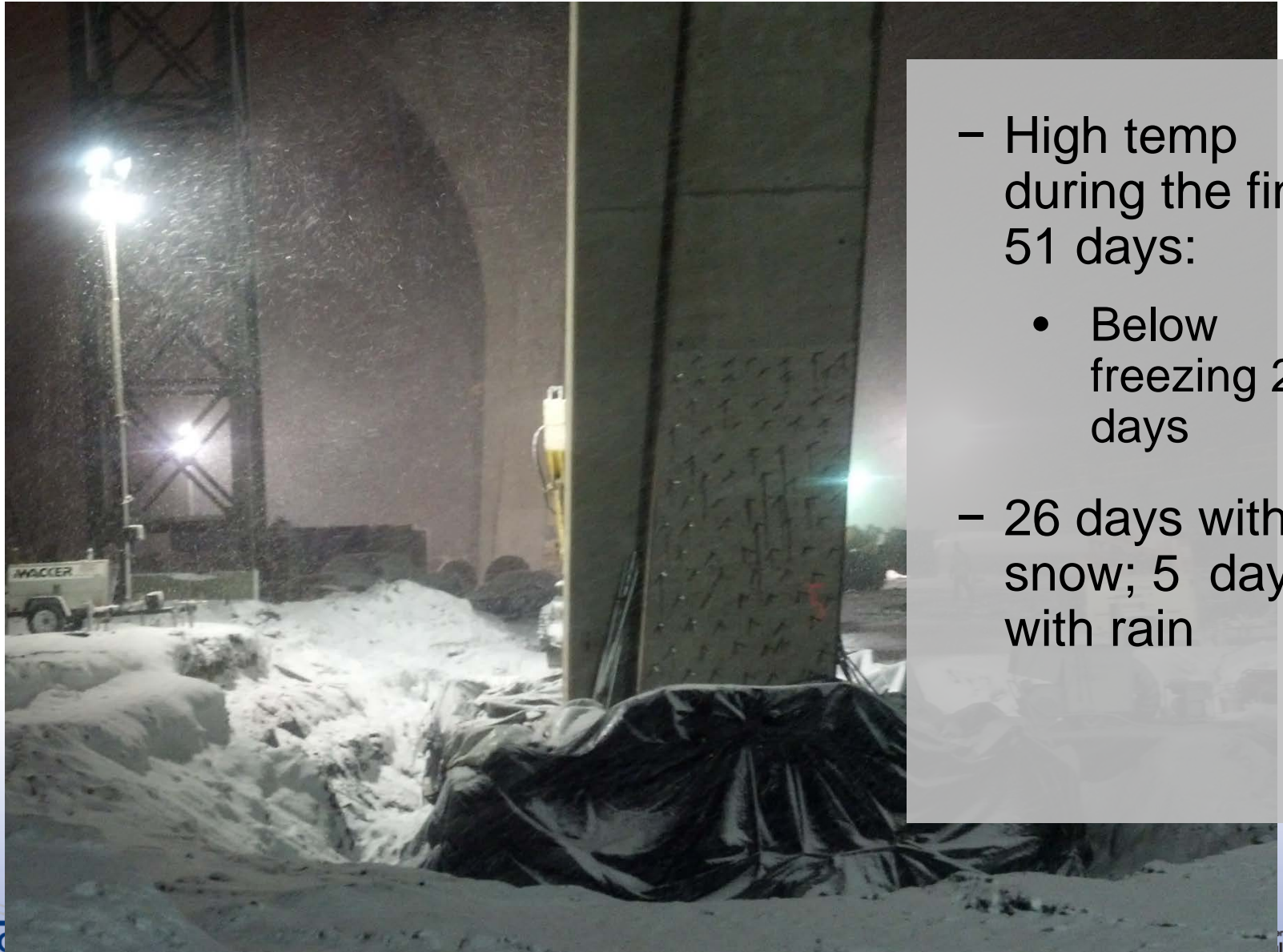




# Completed pier cap



# Challenges related to the cold

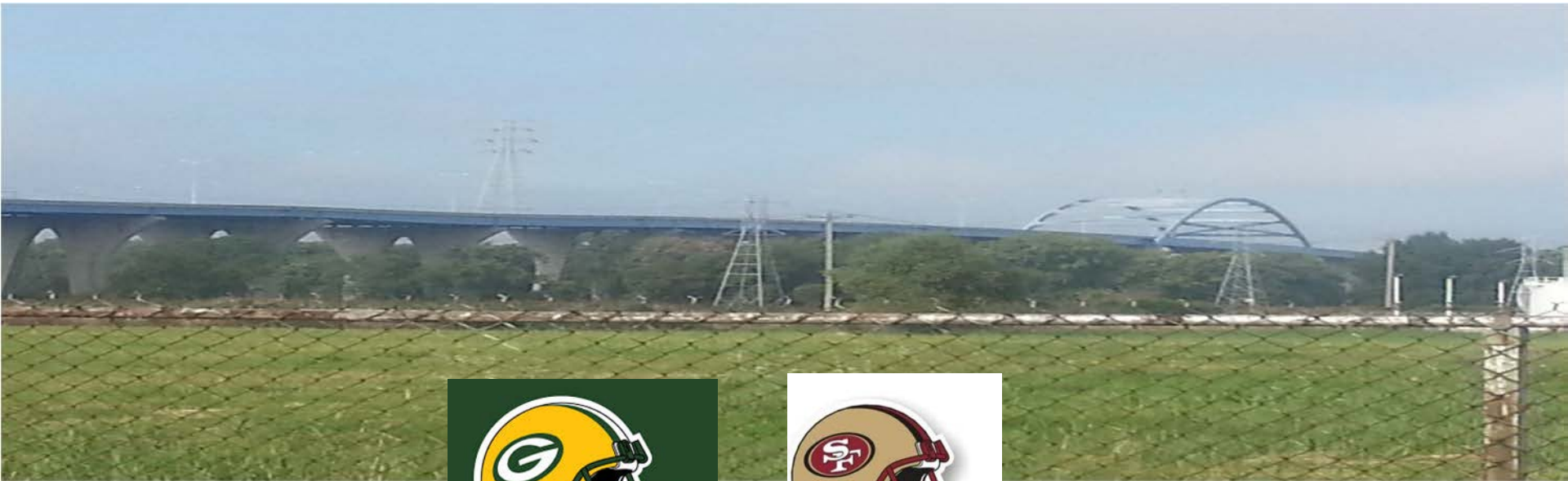


- High temp during the final 51 days:
  - Below freezing 27 days
- 26 days with snow; 5 days with rain



# Cost and Completion

- **Bridge Open – January 5, 2014**
- **Cost – 7.7 million; 20 million total:**  
Investigation, temporary stabilizer, permanent fix
- **Incentive / Disincentive \$50,000 a day**
- **Capped at 15 days for incentive**



# Public and Media Outreach

WEDNESDAY, OCTOBER 23, 2013 ★

www.greenbaypressgazette.com » (920) 435-4411

OUR VIEW BRIDGE REPAIR

## Good news for Leo Frigo bridge fix

**Gov. Walker hopes for federal funds to fix bridge**

By Scott Cooper Williams  
Press-Gazette Media

Gov. Scott Walker is asking the federal government to provide emergency funding for

**COMING SUNDAY**

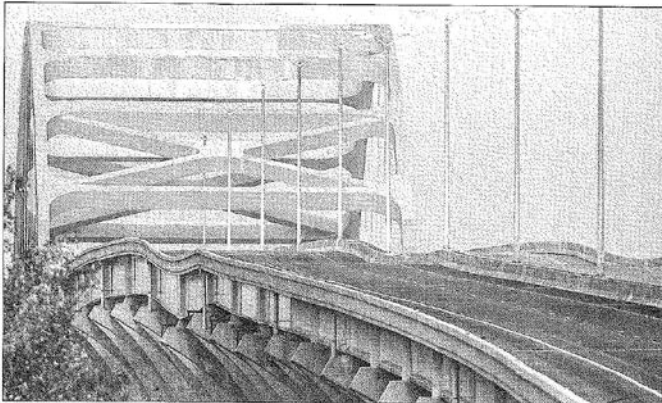
A timeline of last week's closure of the Leo Frigo Memorial Bridge, including a 911 call made hours before the original reports indicated.

**ONLINE DATABASE**

Search a database of nearly 18,000 records of bridges by National Highway Inventory number



## TAKING IT IN STRIDE



A span on the Leo Frigo Memorial Bridge in Green Bay shows signs of buckling Sept. 25 in this view looking west. The Interstate 43 bridge over the Fox River was closed indefinitely after one of its support piers sank about two feet, creating a huge sag in the roadway and raising safety concerns. JIM MATTHEWS/GANNETT WISCONSIN MEDIA

### LEO FRIGO MEMORIAL BRIDGE REPAIR

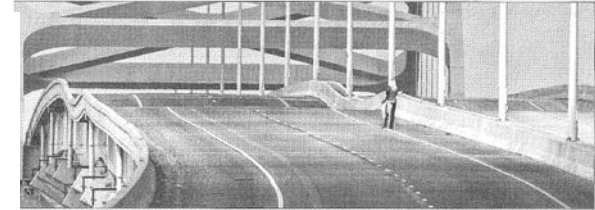
## Zenith Tech gets bridge contract

By Nathan Phelps  
Press-Gazette Media

A Waukesha-based contractor that submitted the lowest bid to repair the sagging Leo Frigo Memorial Bridge won the job and will start work early next week.

## GREEN BAY PRESS-GAZETTE

WEDNESDAY, SEPTEMBER 26, 2013 GREENBAYPRESSGAZETTE.COM A GANNETT COMPANY



Interstate 43 is closed to traffic over the Fox River in Green Bay after structural damage to a span on the Leo Frigo Bridge was discovered Wednesday. Damage is shown over four miles. © KIM HARRIS/GANNETT MEDIA

## SAGGING SUPPORT

Leo Frigo bridge closed indefinitely after support pier settles causing dip in road

Bridge had passed inspection in 2012, but officials noted 'fine vertical cracks'

Gov. Walker vows repairs will be made, but timetable uncertain

the construction site on Tuesday. PHOTOS BY LUKAS KEAPROTH/PRESS-GAZETTE MEDIA

## BRIDGE EXPECTED TO REOPEN BY JANUARY

Federal funds will help stabilize Leo Frigo for traffic



### PROPOSED PIER REPAIR DETAILS

1. Install proposed drilled shafts and proposed footing concrete
2. Install post tensioning

Proposed buttress wall Existing pier



# GREEN BAY PRESS-GAZETTE

- Positive editorials
- ‘...Hats off to everyone involved in getting the bridge repaired’
  - Witnessed federal, state and local cooperation not often seen
  - WisDOT prioritized, supported and expedited the repair
  - WisDOT kept media and public informed

## OUR VIEW BRIDGE REPAIRS

### Leo Frigo fix was quicker, cheaper than expected

When we first learned that the Leo Frigo Memorial Bridge would be closed indefinitely for repairs, the speculation began on how long it would be out of commission.

Would it take six months? A year? Could it even be fixed?

It was a problem that many hadn't heard of before. Earlier that September morning a section of the bridge that carries Interstate 43 over the Fox River in Green Bay sank about 2 feet. The bridge would sink another three-quarters of an inch in the days following.

The culprit? One of the piers that supports the bridge on the east side of the river. Its steel pilings had corroded

cover most of that cost.

» The state Department of Transportation kept the media, and in turn the public, informed on the situation and the repairs. It wisely added a \$750,000 bonus for the contractor if it finished the repairs ahead of the Jan. 17 deadline. The bridge opened 12 days early: Mission accomplished.

» The city of Green Bay and motorists dealt with the added traffic, which significantly affected the downtown during rush hour. In the evenings backed-up traffic inched along from the Dousman Street and Broadway intersection all the way to Madison and Main streets. Plus, U.S. 41 didn't provide an ideal alternate route because

# Challenges

- Light pole on bridge
  - Bound up during jacking
  - Crunching and cracking
    - Temporarily halted bridge jacking
- Surveyors: 'bridge just moved'
  - Moved ¼ inch before October 3 press conference





# Next Steps



- Final investigation report – Final Draft Delivered April 1
- Periodic inspections of Leo Frigo superstructure and install inspection probe
- Continue to research as-built plans to identify problematic soil conditions



# LEO FRIGO

## I-43 Bridge Repair

**Project Website:**

**<http://projects.511wi.gov/web/i43bridgerepair/overview>**









# Questions



U.S. Department of Transportation  
**Federal Highway  
Administration**