



Leo Frigo Bridge Investigation and Repair

March 4, 2014 Wisconsin Dells, WI







Video provided by Press-Gazette Media: http://www.greenbaypressgazette.com/VideoNetwork/2698068160001/ Image: http://www.wbay.com/category/169373/video-landing-page?clipId=9346021&autostart=true, WBAY, 9/25/13

pavarian soil preizer served spicy pepperoni, Beer Chees Large enough to share! 8.99 LEO FRIGO DIP (V) NEW! Everyone's favorite combo!



Background and impacts

Investigation and stabilization

Permanent repair

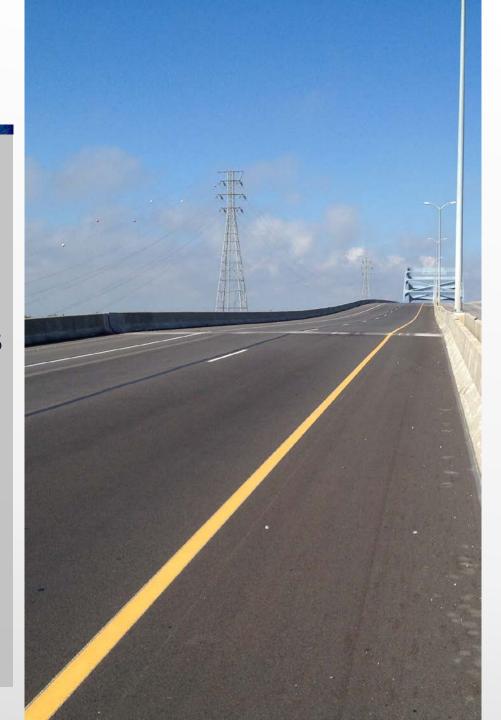
Project management and next steps

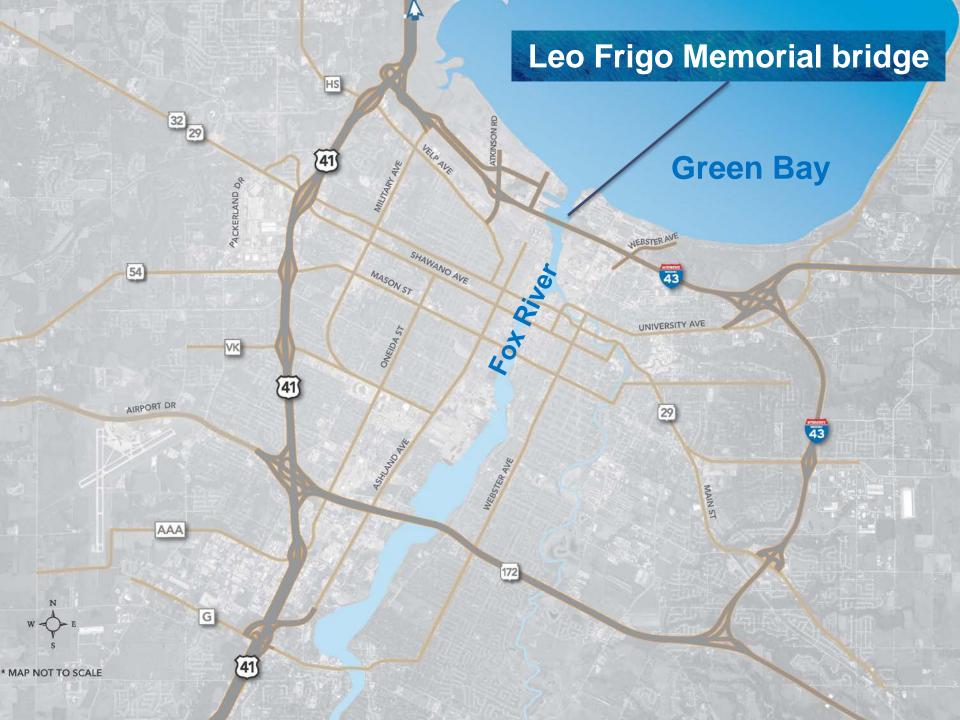


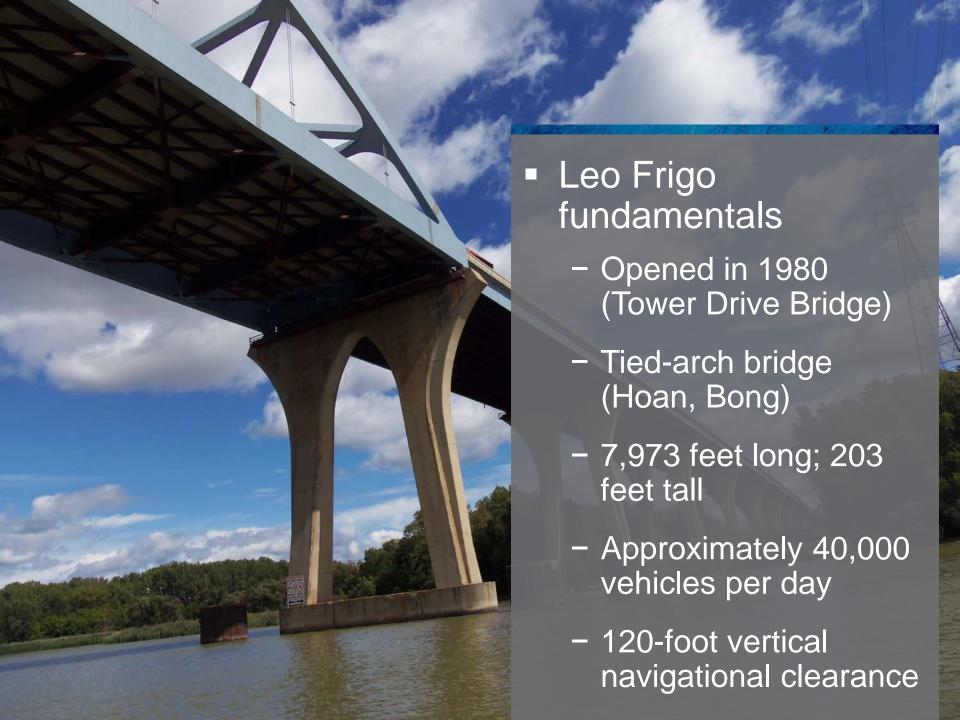
Brian Roper-WisDOT

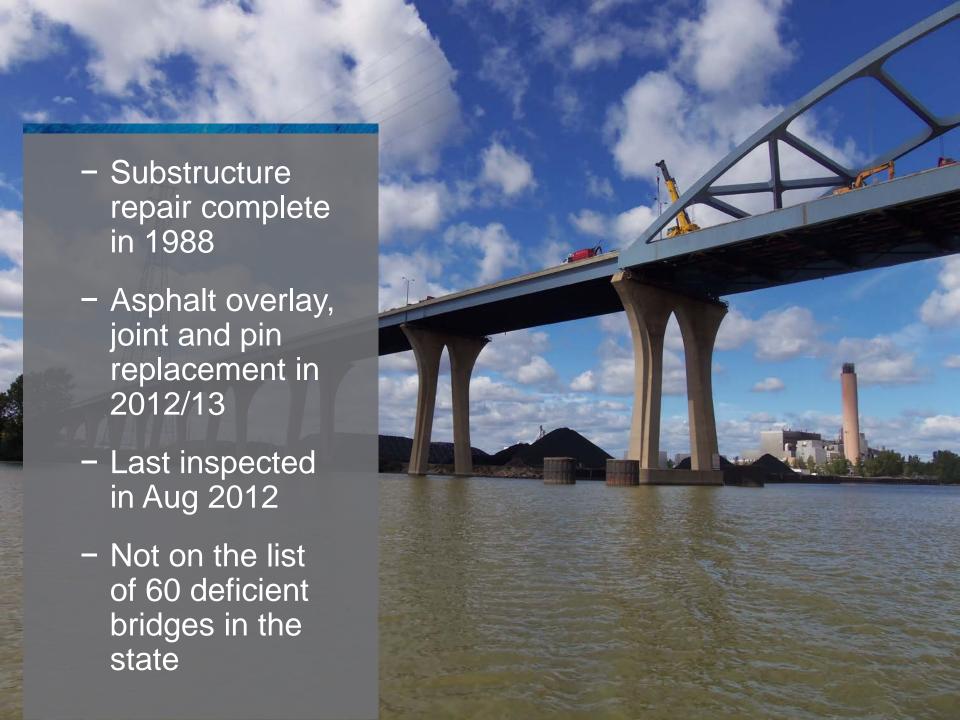
Background and impacts

- Leo Frigo fundamentals
- Day 0
- Emergency relief
- Public involvement
- Traffic impacts
- US 41 construction impacts



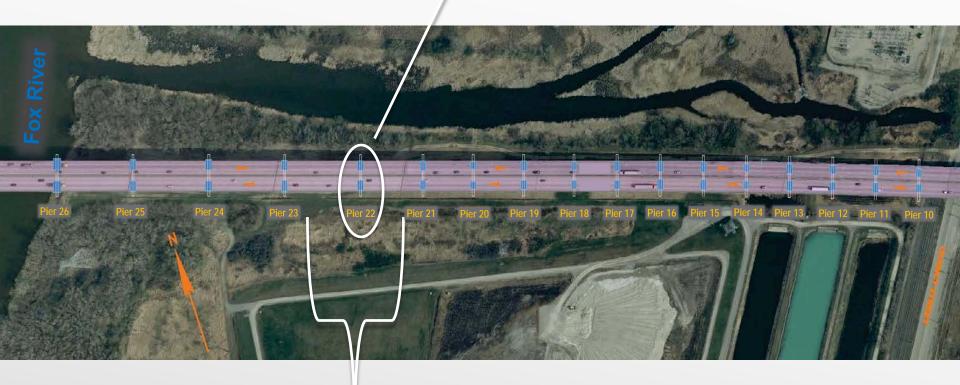








Pier 22



Location of sag

Day 0: Sept 25

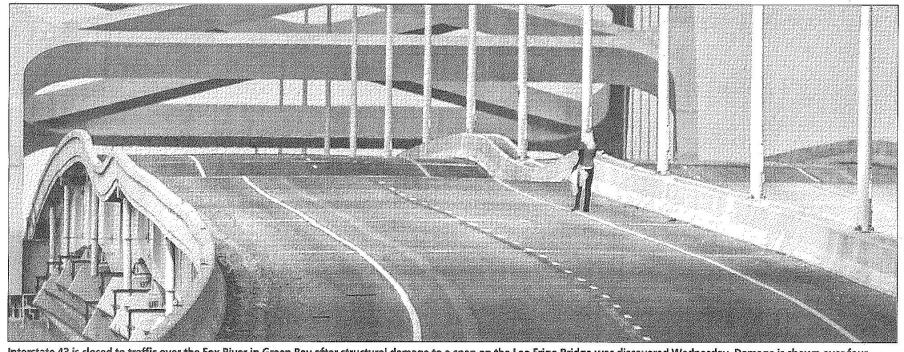
- Newsconference at 2:30 p.m.
- Governor Walker and SecretaryGottlieb flew toGreen Bay
- Carried live on TV, radio and internet
- International media interest



THURSDAY, 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 traffic lanes. H. MARC LARSON/PRESS-GAZETTE 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



- Day 2: 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 thereon.

year two trousant traiteen.

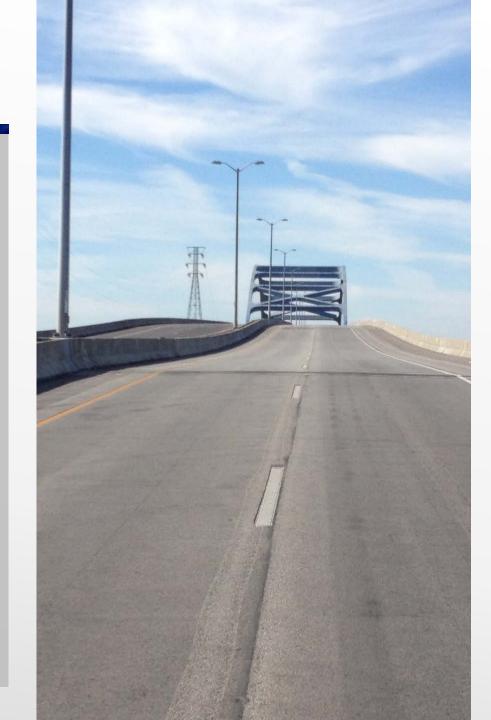
OTT WALKER

By the Governor:

DougLAS LA FOLLETTE



- Budget tracked similar to US 41 budget
 - FHWA coordination
 - \$18 \$20 million budget covers all eligible costs
- Specific items
 - Construction
 - WisDOT/consultant engineering
 - Freeway Service Team
 - Law enforcement
 - Detour route restoration
 - US 41 construction delays





Public involvement

- Days 0 5: Very intense interest and communication
 - Safety
 - Alternate routes
 - Investigation and commitment to repair



- Days 5 -102: Struck balance
 - Communicating with the media
 - Respecting the technical process
 - Arranging safe media access



- WisDOT and media: shared mission to serve public interest
 - Proactive and open
 - Provide media with information and respond to media inquiries



- By the numbers

• 5 news conferences

- 5 on-site media tours
- 4 media availabilities: Engineering/communication staff distributed and interpreted videos
- Numerous individual media interviews

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 BF

BRIDGE REPAIRS

Leo Frigo fix was quicker, cheaper than expected

hen 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.

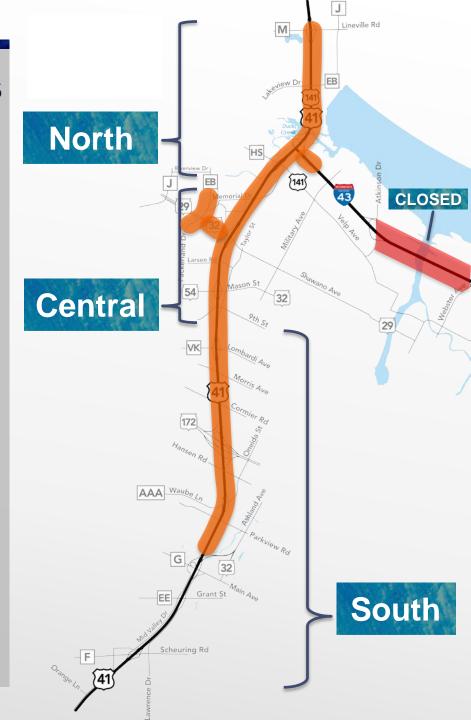
» The city of Green Bay and motorists dealt with the added traffic, which significantly affected the downtown during rush hour. In the evenings backed-up traffic inched along from the Dousman Street and Broadway intersection all the way to Madison and Main streets. Plus, U.S. 41 didn't provide an ideal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





US 41 construction impacts

- North
 - Duck Creek to Lineville Rd
 - I-43 Early structures/fills
 - Lineville Rd interchange
- Central
 - WIS 29 interchange and mainline
 - Larsen Rd to Memorial Dr
- South
 - Glory Rd to 9th St
 - Oneida St interchange
 - Hansen Rd overpass
 - WIS 172 ramps
 - Cormier Rd and Morris Ave bridges

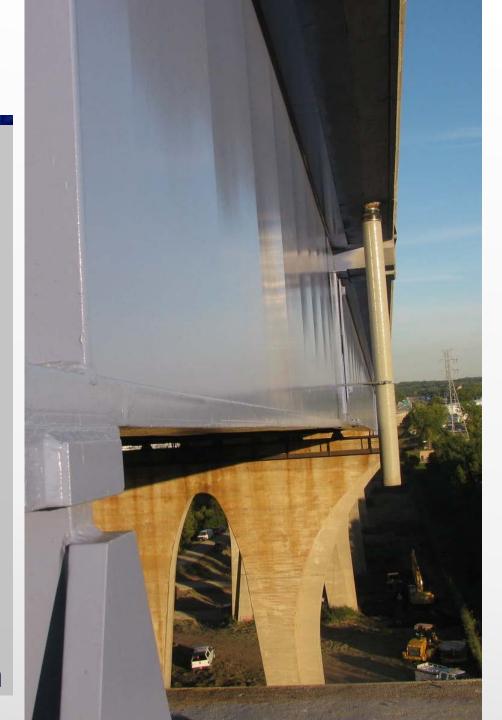


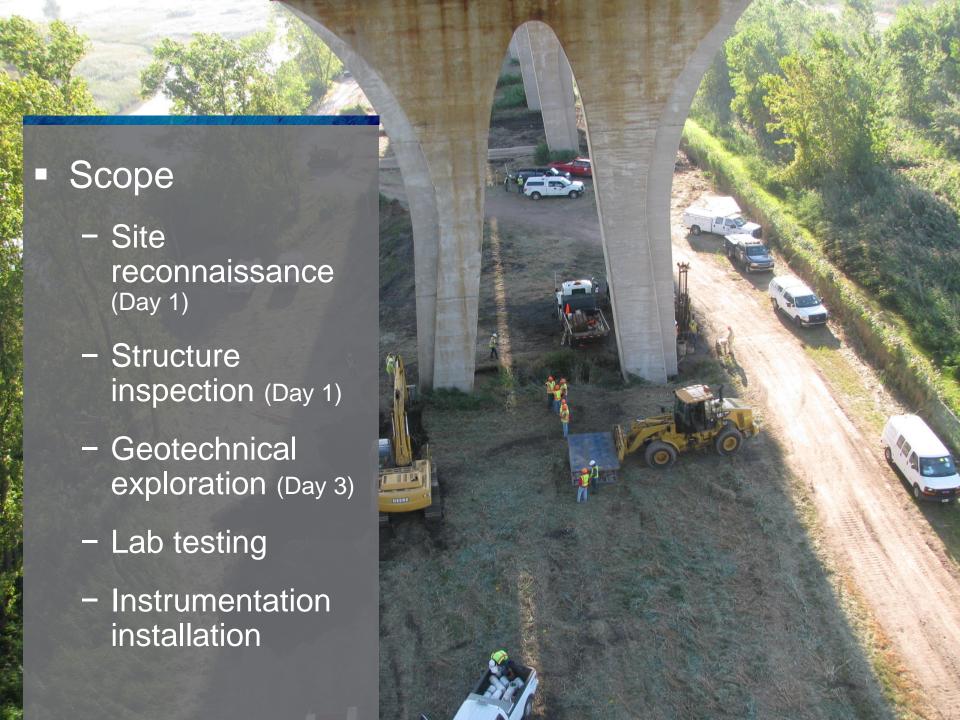


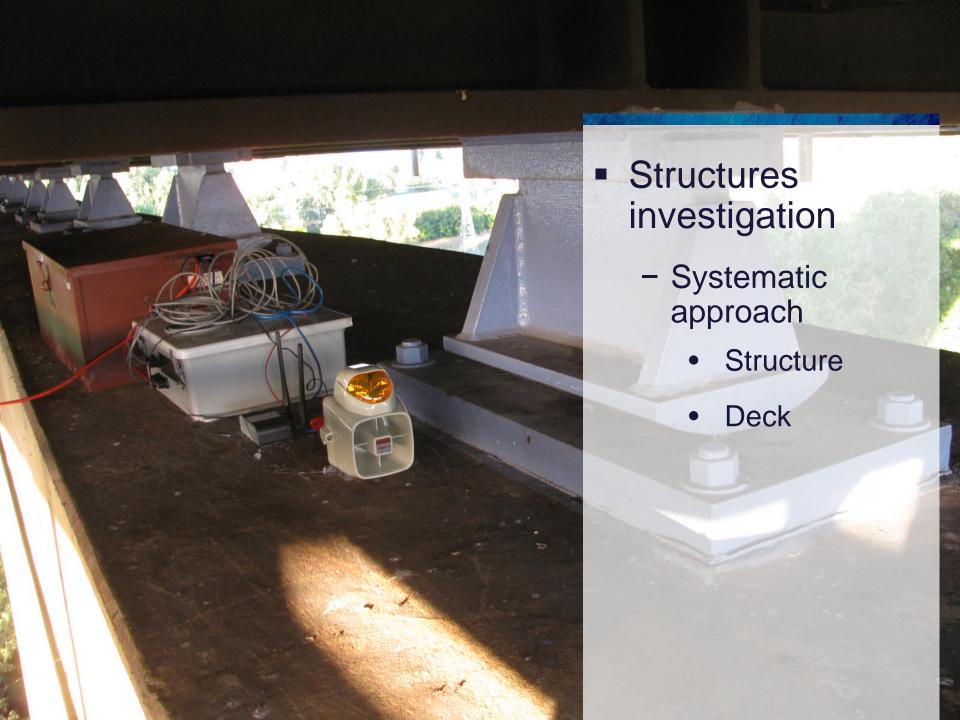
Scot Becker-WisDOT

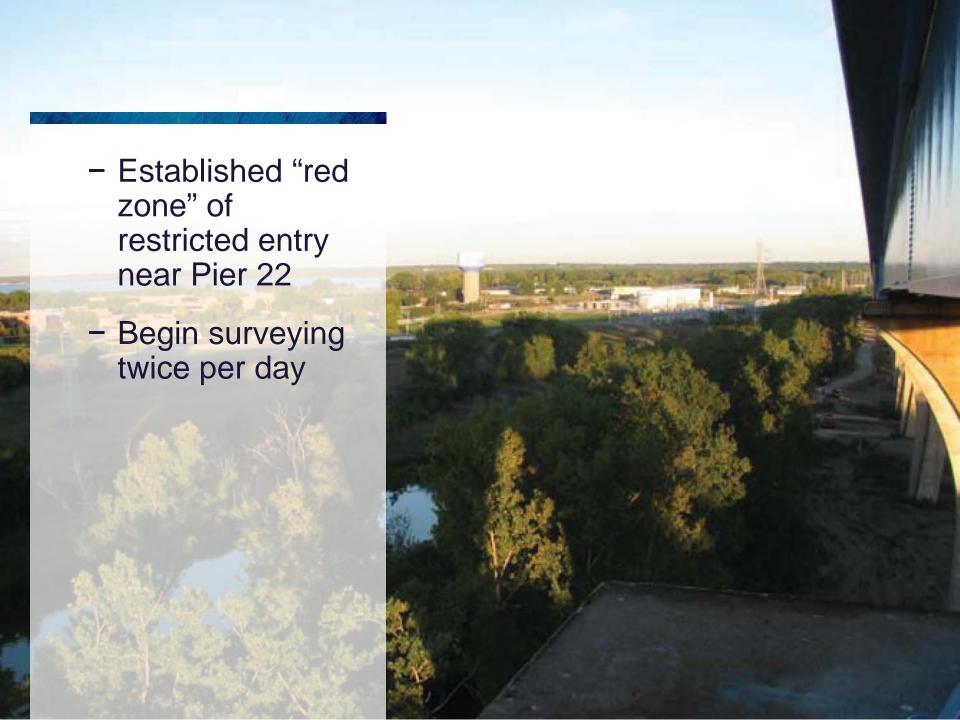
Investigation and stabilization

- Scope
- Structures and subsurface investigation
- Subsurface findings
- Support tower design
- Tower construction
- Permanent repair design









Day 4: Structure inspection challenges



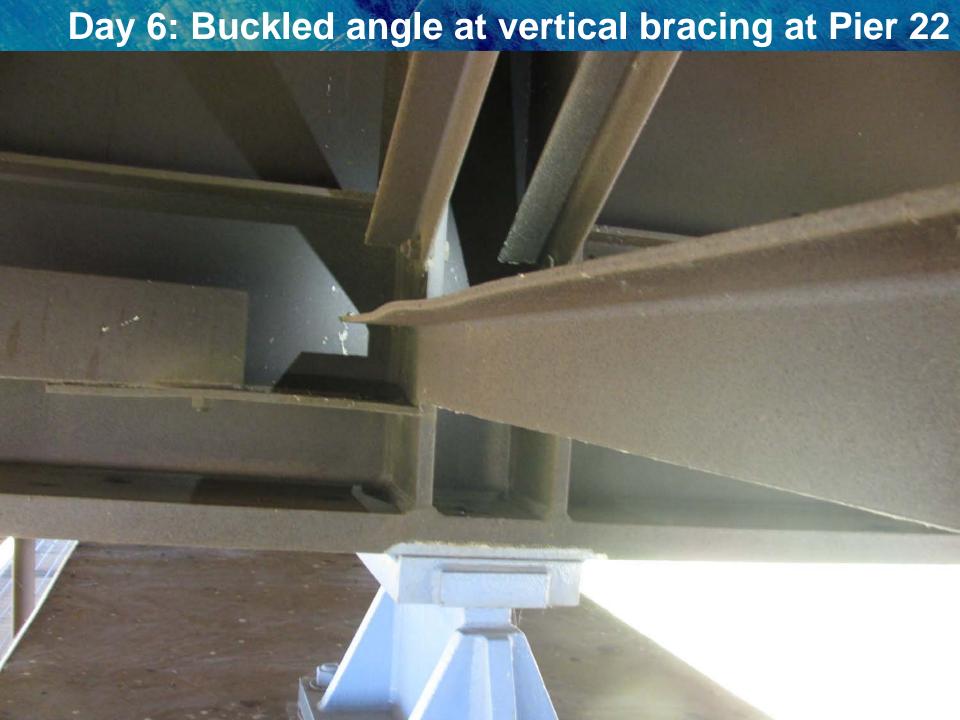


- Deck: No unusual distress such as:
 - Overlay and parapet cracking
 - Severe misalignment of joints
- Good condition
- No concerns regarding safety and serviceability



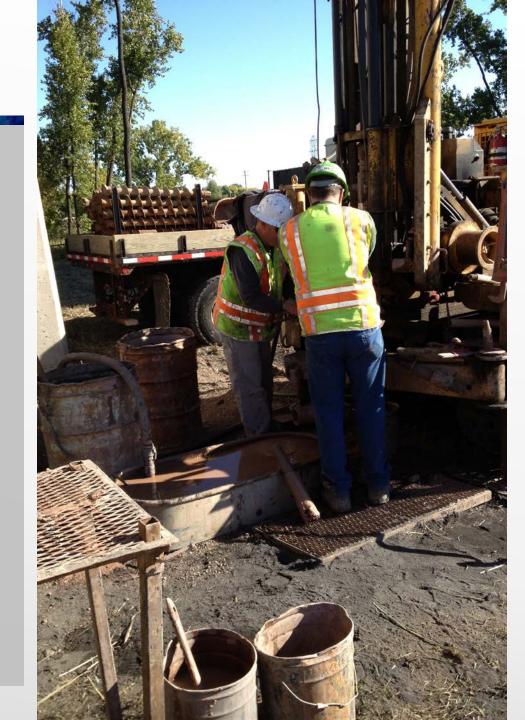
Day 5: Structure inspection







- Subsurface investigation
 - Test borings
 - Test pits
 - Groundwater wells
 - Deep borings
 - Corrosive characteristics
 - Chemical and physical properties





Pier 21: concrete core from pier cap

- Additional testing
 - Microbial analysis (anaerobic and aerobic)
 - Corrosive characteristics of fill

 - Stray current cycle

- In-situ electrical resistivity testing
- Metallurgical testing









- Day 5: Sept 30
 - Pier 21 Discovered severe corrosion with section loss on pile

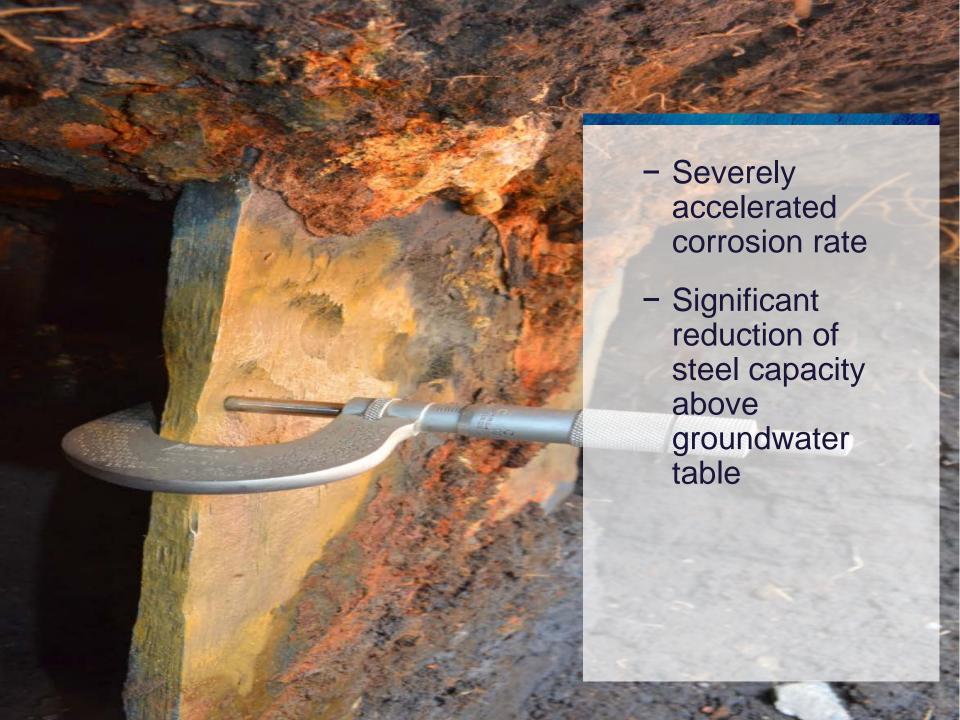


Pier 22 buckling - Day 6: Oct 1 Pier 22 - Piles failed 8 feet below bottom of footing 1 pile in northwest corner 2 pile in southwest corner

Subsurface findings

- Unique, excessive deterioration
 - Porous fly ash fill
 - Perched groundwater
 - Microbially-influenced corrosion
 - Manifested as localized pitting of steel piling at some pier locations







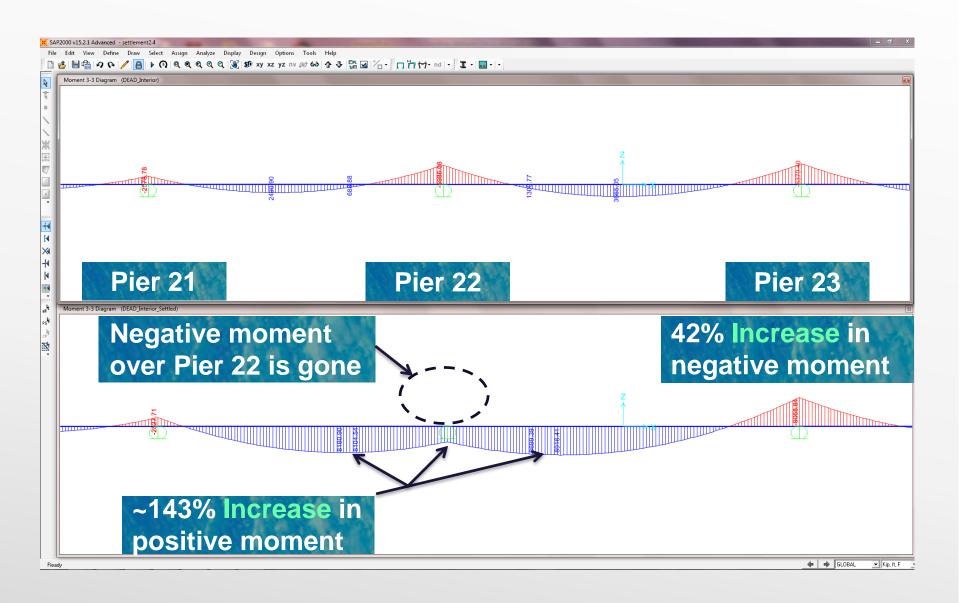


Support tower design

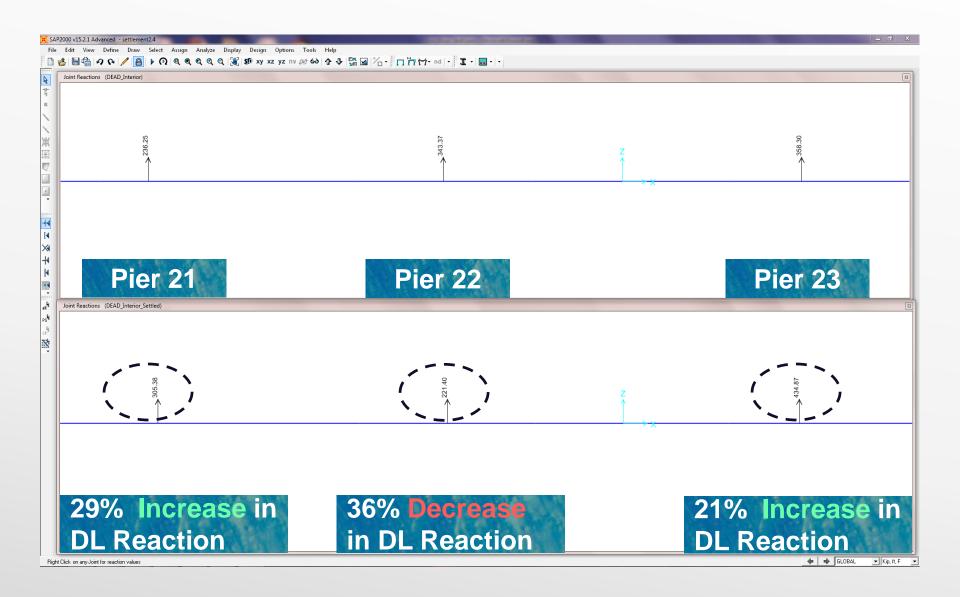
- Modeling
 - Additional loads to other piers?
 - How much can girders deflect?
 - How much more can Pier 22 move?



Superstructure DL Moment Redistribution Unsettled (top) Vs. Settled (bottom)



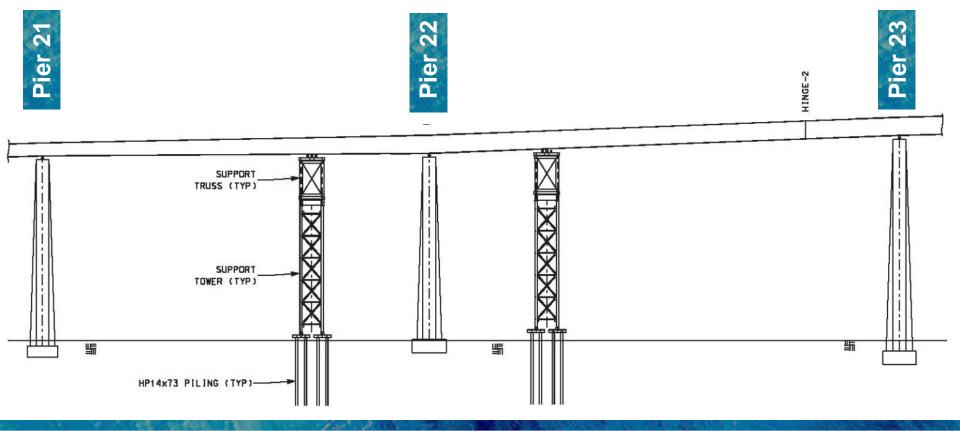
Superstructure DL Reaction Redistribution Unsettled (top) Vs. Settled (bottom)





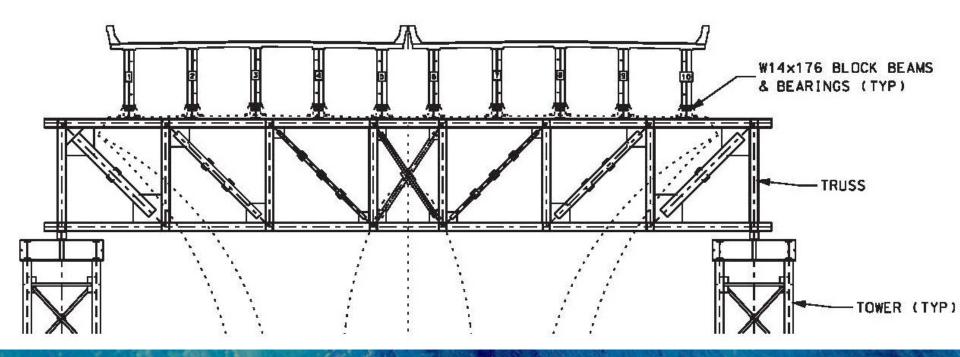
Results / findings

- 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



Concept

- Stabilize the superstructure until repaired
- Protect and preserve investment in bridge
- Ensure worker safety



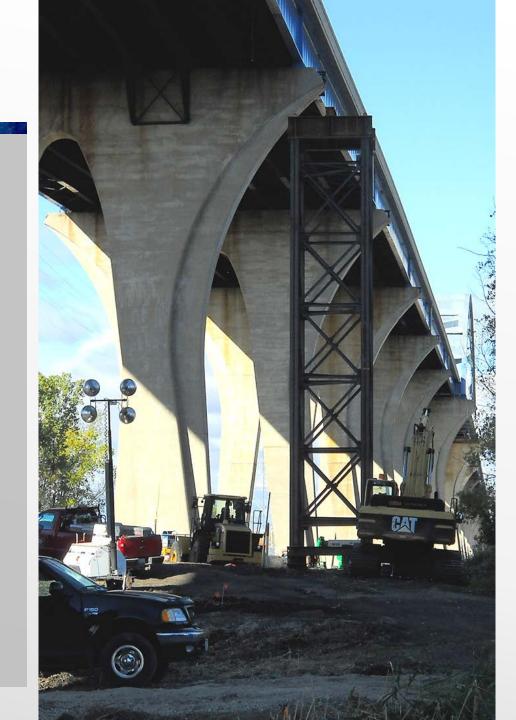
- Support entire superstructure
 - Remove 25% of superstructure load from Pier 22
 - Reduce load to adjacent piers
 - Protect Pier 22 from vibrations

- Days 8 12
 - Oct 3: Decision on towers
 - Oct 4: Contractor meeting
 - Oct 5: Send to contractors
 - Oct 7: Receive bids



Tower construction

- \$1.57 million
- Two temporary bents required (Contractor-designed)
- Days 19 42
 - Work began Oct 14
 - Trusses installed Oct
 31 and Nov 6



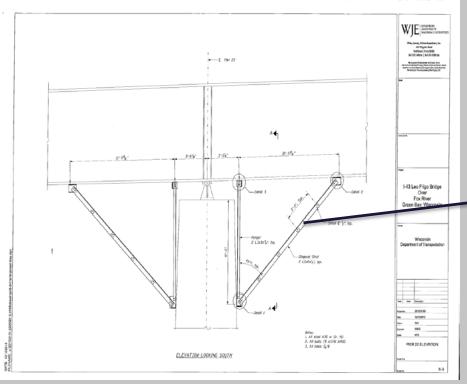




Looking east at temporary towers



- Methods and challenges
 - West Shore Pipeline (10-inch) is 15 feet from tower
 - Monitor vibration after every hammer blow
 - West truss required rental of Dawes 300-ton mobile cranes





- Lateral bracing
 - Piers 21, 22, 23, 25
 - Provide stability and ensure safety of crews



Materials transport

- Perkins Transport specialized haulers
- Haul from Hilbert Yard to the site
- Hauled from the site to Stillwater for St. Croix River bridge

Day 36: Setting east truss



• West truss: 314,000 lbs

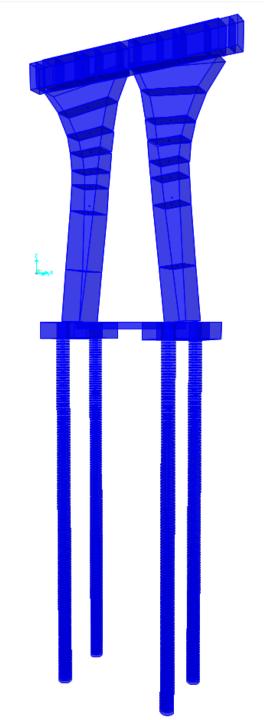
• East truss: 264,000 lbs

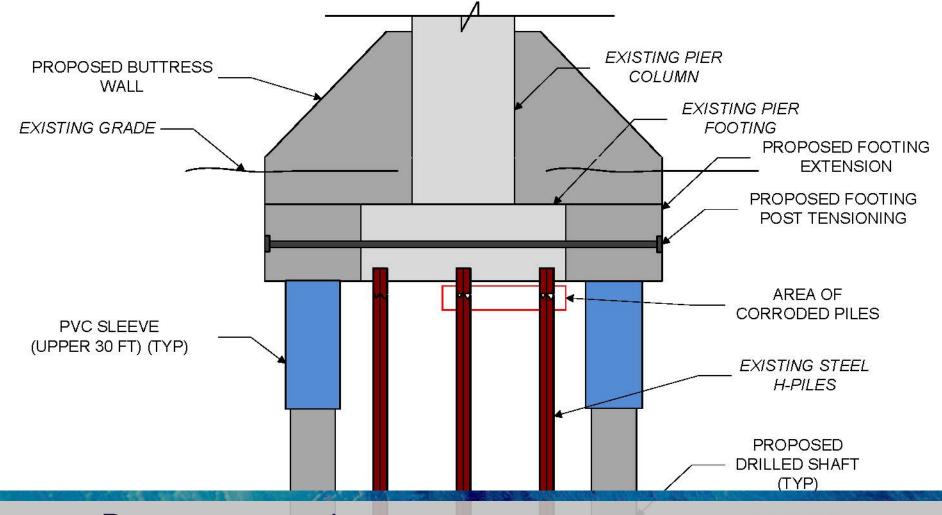
• Towers: 57,000 lbs



Permanent repair design

- Demolish and rebuild vs. repair
- New foundation system to support entire load
- Retrofit 5 piers (21 25)
- New foundation system to provide 75-year life

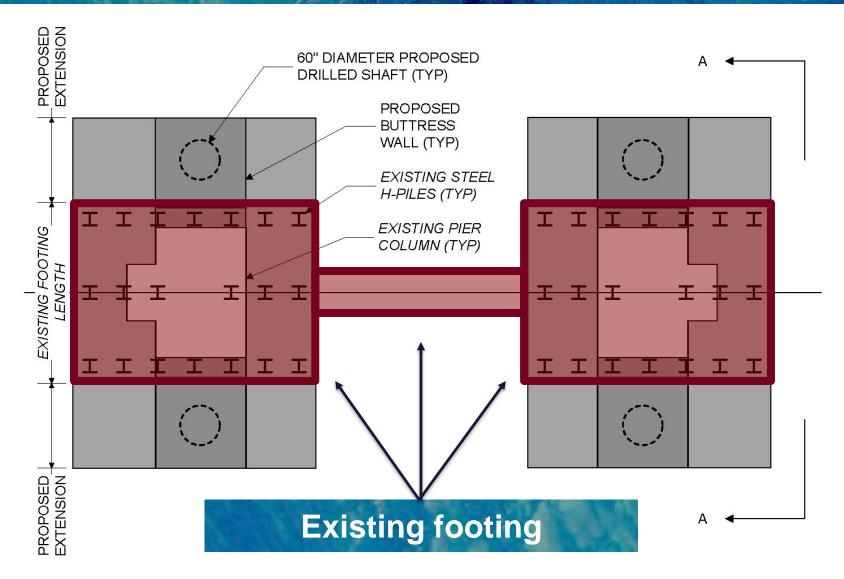




- Permanent repair
 - 4 drilled shafts capable of supporting all loads
 - 5-foot diameter shafts (120 feet)
 - 4.5-foot diameter rock sockets 7 feet into bedrock

Proposed pier footing plan view

(Looking down)

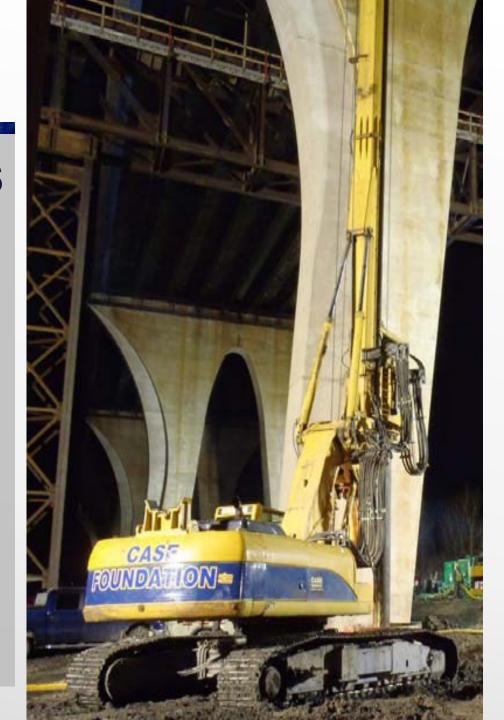




Erik Hendrickson-URS

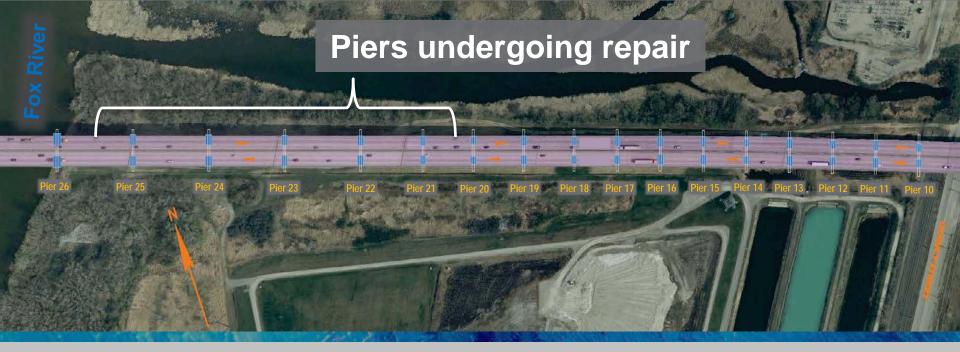
Permanent repair

- Construction scheduling
- Pier retrofit
- Drilled shaft construction
- Bridge jacking
- Challenges related to the cold

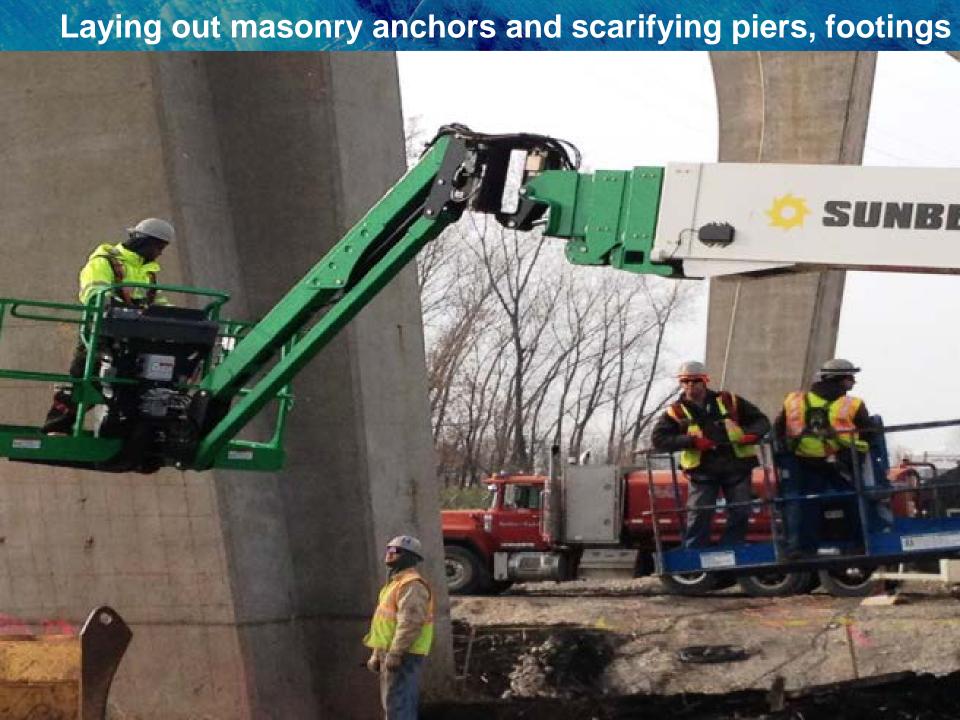


Construction scheduling

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			Past Week - Work Performed							Next Two Weeks - Work Scheduled												
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- Pier retrofit (Piers 21 thru 25)
 - Concrete drilled shafts
 - Footing extensions
 - Post-tensioning
 - Concrete buttresses
 - Bridge jacking







- Drilled shaft construction
 - Resistant to corrosion
 - Less vibration during installation

Day 50: Case Foundation installing 60 feet long, ½-inch steel casing pipe

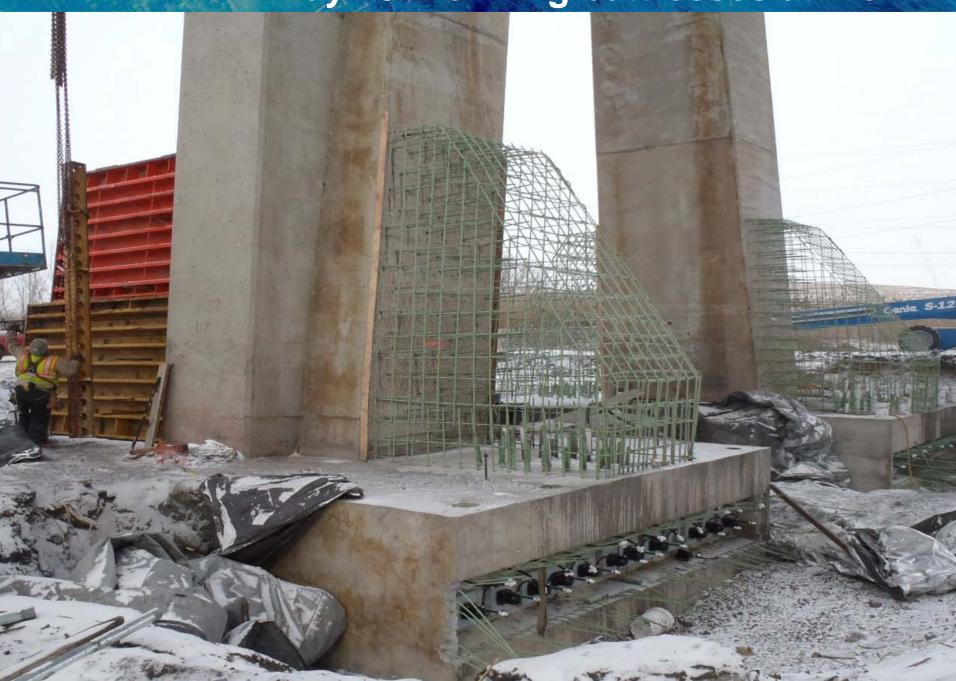


Day 68: Case installing 30-foot fiberglass liner AF 230

Day 63: Forming footing at Pier 22



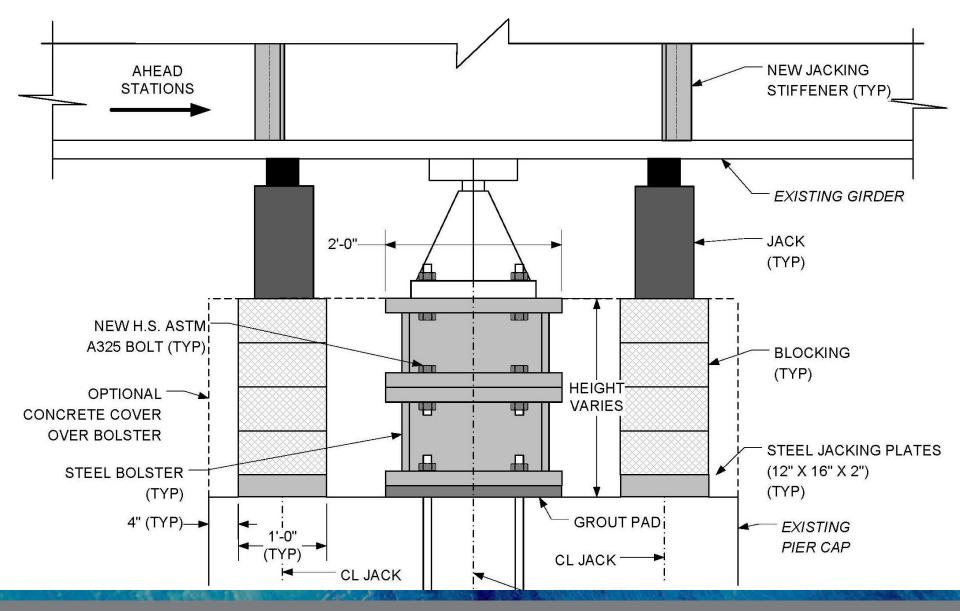
Day 75: Forming buttresses at Pier 22



Day 98: Buttress pour at Pier 24







- Bridge jacking
 - Final jacking condition

Day 84: Superstructure jacked up 2-inches

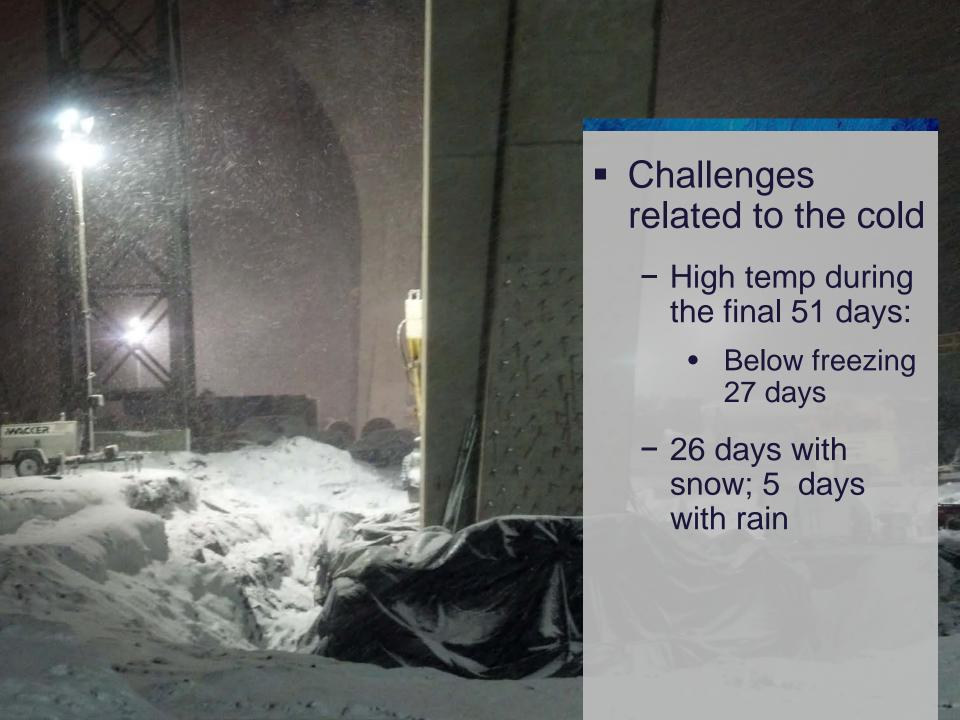




Day 86: Northbound jacking completed 12.20.2013 14:38





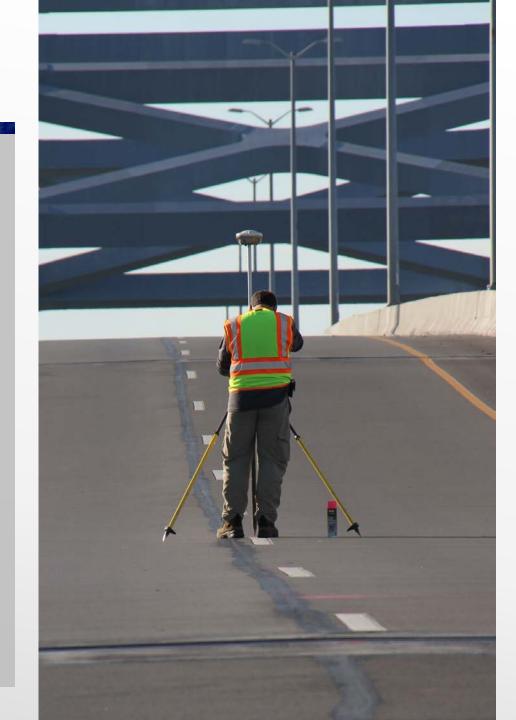


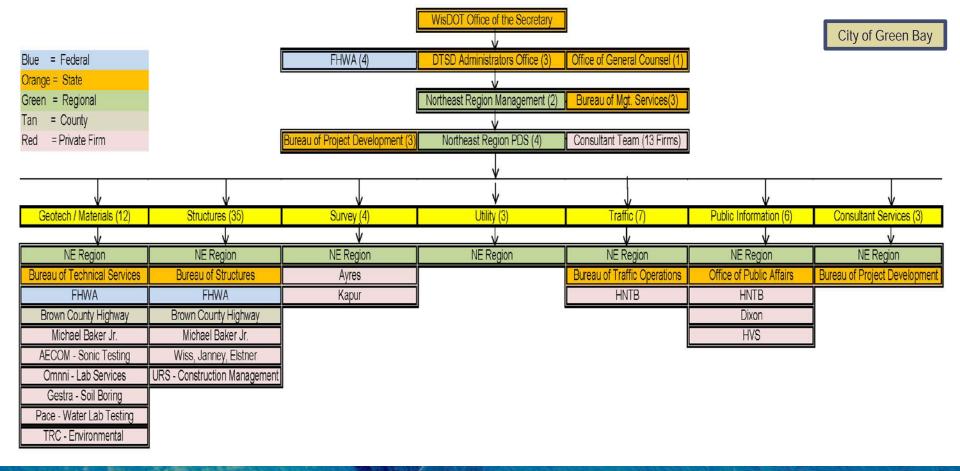


Tom Buchholz-WisDOT

Project management and next steps

- Project management
- Survey
- Bridge opening
- Next steps





Investigation and design team

- Project management
 - Coordinated team effort
 - Federal, state, regional, local and private firms
- Approximately 140 public agency employees

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OCT 2013

ORDER OF SHEETS

Section No. 2 Typical Sections and Details Section No. 3 Estimate of Quantities Section No. 3 Miscellaneous Quantities

Standard Detail Drawings

STATE OF WISCONSIN

DEPARTMENT OF TRANSPORTATION

PLAN OF BRIDGE REHABILITATION

TOTAL SHEETS = 46

CITY OF GREEN BAY, LEO FRIGO BRG

IRWIN AVENUE - ATKINSON DRIVE

IH 43

BROWN COUNTY



STATE PROJECT NUMBER 1220-19-72

STA. 849+00 NB

Days 9 – 37: Preconstruction scheduling

Oct 4: Decide on special letting

Oct 14: Complete pER, TMP, DSR

Oct 21: PSE (2 addendums)

Oct 29: Bid

Oct 30: Award and execute contract (\$7.72 million)

Nov 1: Begin work

Incentive: \$50,000/day incentive up to a maximum of 15 days (\$750,000)

Disincentive: \$50,000/day

Survey

- Monitor movement of piers
- Shoot elevations for bridge jacking
- Stake out drilled shaft locations
- Shoot elevations for Lunda's piling cap



Piling for north foundation of temporary tower





- Robotic monitoring
 - Ensure safety for crews
 - Further movement detected at Pier 22 over following weeks





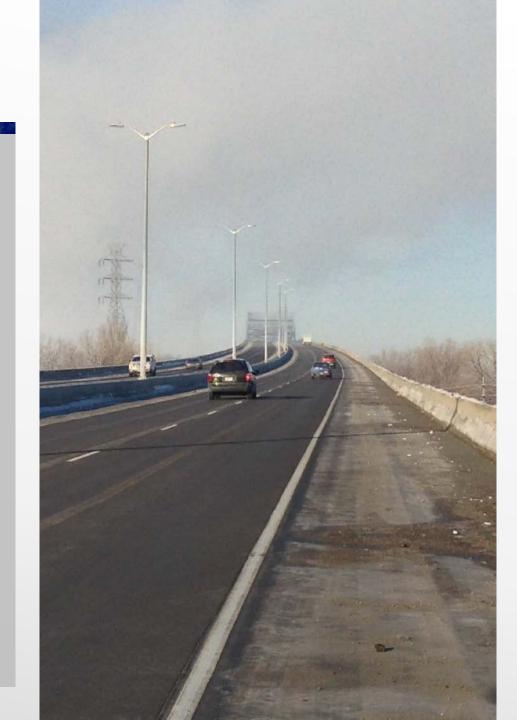
Bridge opening news conference video

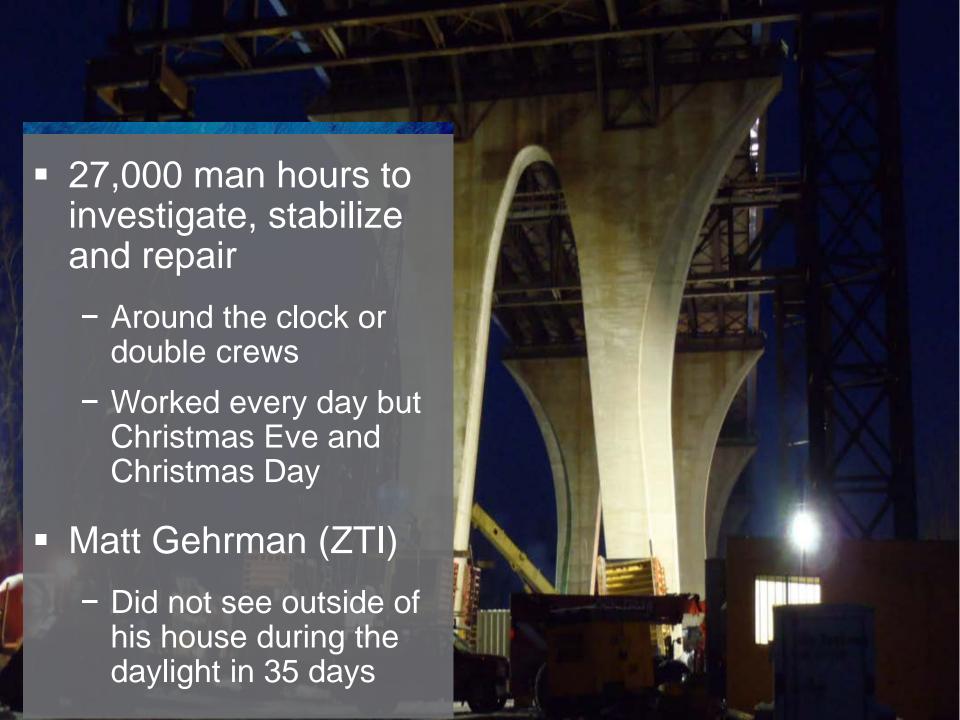




Bridge opening

- Day 102: Opened to traffic on Sunday, January 5, 2014
 - 15 days ahead of schedule
 - 102 days of investigation, design and construction







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







Lunda Construction Co.

Zenith Tech, Inc.

Con-Cor Company, Inc.

Case Foundation Co.

GeoTest, Inc.

Peters Concrete

Mega Rentals, Inc.

Hoffman Construction Co.

SPE, Inc.

Double D Landscaping, LLC

Interstate Sawing Company, Inc.

Subsurface Exploration Services, LLC



- WisDOT

- Northeast Region
- Bureau of Structures
- Bureau of Technical Services
- Bureau of Project Development

- Federal HighwayAdministration
- Department of Natural Resources



Michael Baker Jr., Inc.

Whitlock Dalyrmple Poston & Associates, Inc.

Omnni Associates

Pace Analytical Services, Inc.

Ayres Associates, Inc.

The Erlin Company (TEC)

GEI Consultants, Inc.

Wiss, Janney, Elstner Associates, Inc.

Kapur and Associates, Inc.

URS Corporation

TRC Companies, Inc.

Mears Group, Inc.

HVS Advertising and Marketing

Helen Dixon & Company, Inc.

AECOM

HNTB Corporation



Motoring public

- City of Green Bay

- Brown County

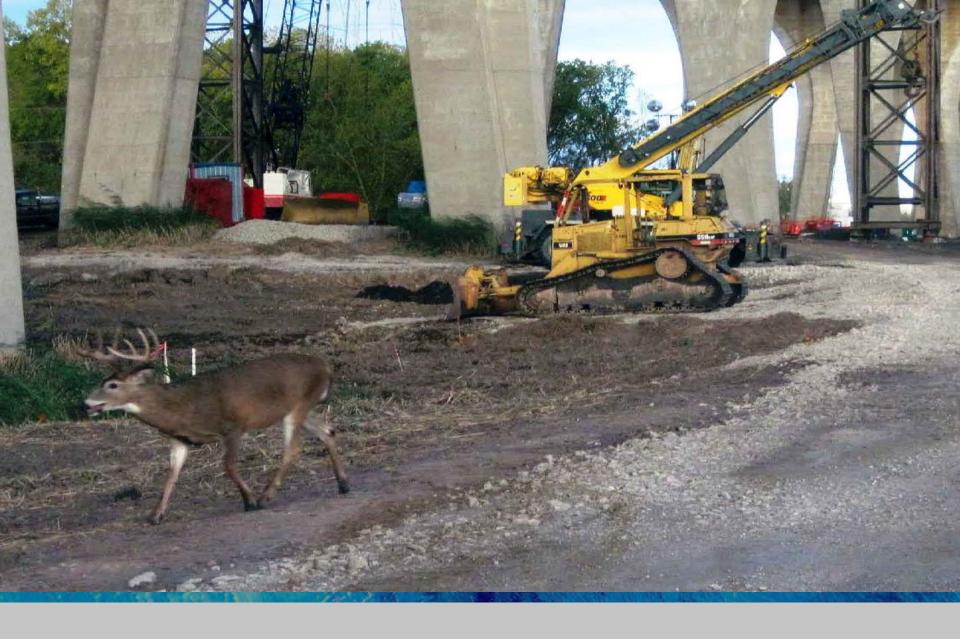
- All other team members

 Commuters, businesses, and tourists



Next steps

- Present investigation report
- Periodic inspections of Leo Frigo superstructure
- Continue to research as-built plans to identify problematic soil conditions



Questions?