LEO FRIGO
I-43 Bridge Repair

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This presentation is Dedicated to Delaware DOT !!!
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
“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
Quick Collaboration

- Federal
- County
- NE Region
- Private Firms
- Central Office
- City

Leo Frigo
“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

Negative moment over Pier 22 is gone

42% Increase in negative moment

~143% Increase in positive moment
Structure Analysis - Superstructure DL Reaction

29% Increase in DL Reaction

36% Decrease in DL Reaction

21% Increase in 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

Pier 21

Pier 22

Pier 23
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

Red is corrosive soil seen around Pier 21, 22, 23, 24, 25
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 14th
- One support truss installed October 31st
- Second truss installed November 6th
The Big Fix!

Piers undergoing fix: 21, 22, 23, 24, 25
Existing Pier Footing

EXISTING FOOTING PLAN VIEW
(LOOKING DOWN)

EXISTING PIER COLUMN (TYP)
EXISTING STEEL H-PILES (TYP)
Future Pier Support on Pier 21-25

- 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 Footing (looking down)

Existing Footing

PLACE PROPOSED DRILLED SHAFTS AND PROPOSED FOOTING EXTENSIONS

PROPOSED PIER FOOTING PLAN VIEW
(LOOKING DOWN)

2 of 4

10/19/2013

Concept Drawings
Staging for Permanent Repairs

Prime Contractor: Zenith Tech
Working 24/7

Night Work

Zero Degree Temperatures
Drilled Shafts

Rock Auger at Pier 22

Excavation at Pier 22
Drilled Shafts
Preparing the footing for reinforcement
Post-Tensioning
Buttress
Jacking - Pier 22

- NEW JACKING STIFFENER (TYP)
- EXISTING GIRDER
- JACK (TYP)
- NEW H.S. ASTM A325 BOLT (TYP)
- OPTIONAL CONCRETE COVER OVER BOLSTER
- STEEL BOLSTER (TYP)
- 4" (TYP)
- 1'-0" (TYP)
- CL JACK
- GROUT PAD
- CL JACK
- BLOCKING (TYP)
- STEEL JACKING PLATES (12" X 16" X 2") (TYP)
- EXISTING PIER CAP

AHEAD STATIONS
Jacking Complete Dec. 23, 2013
Completed pier cap
Northbound jacking completed
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
Good news for Leo Frigo bridge fix

Gov. Walker hopes for federal funds to fix bridge

By Scott Cooper Williams

Gov. Scott Walker is asking the federal government to pony up the funds needed to repair the Leo Frigo Memorial Bridge.

LEO FRIGO MEMORIAL BRIDGE REPAIR

Zenith Tech gets bridge contract

By Nathan Phelps

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.

TAKING IT IN STRIDE

A sign on the Leo Frigo Memorial Bridge in Green Bay shows signs of damage 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 gap in the roadway and raising safety concerns. (AP Photo/The Sheboygan Press 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

GREEN BAY PRESS-GAZETTE

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
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

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.

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 – Cold!

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

- Present investigation report
- Continue to research as-built plans to identify problematic soil conditions
- Install Corrosion Probes on Other Piers
Questions