

Great Lakes Waterways Conference

February 9, 2016

David Wright

U.S. Army Corps of Engineers
Chief of Operations – Detroit District



US Army Corps of Engineers
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Agenda

- **FY16/FY17 PBUD Maintenance Work**
- Recent Soo Lock Component Condition Issues
- Soo Locks Asset Renewal Status



FY16 PBUD Dredging Projects

- Duluth-Superior
- Ontonagon
- Presque Isle
- Green Bay
- Manitowoc
- St. Joseph
- Holland
- Grand Haven
- Muskegon
- Ludington
- Manistee
- Saginaw River
- Rouge River



FY16 PBUD Structure Repairs

Preventative Maintenance by Gov't Plant:

- Duluth-Superior Harbor (Superior Entry North Pier)
- Two Harbors
- Milwaukee
- St. Marys River Rock Cut

Contract Repairs:

- Muskegon Harbor (north breakwater head)



FY17 PBUD Dredging

Duluth-Superior
Channels Lake St. Clair
Detroit River
Green Bay
St. Joseph
Holland
Grand Haven
Saginaw River



Agenda

- FY16 Maintenance Dredging
- **Recent Soo Lock Component Condition Issues**
- Soo Locks Asset Renewal Status



2015 MacArthur Lock Outage

- Problems with mitering of upstream operating gates resulted in need to replace gate anchorages
- Lock taken out of service from July 29th to August 17th
- 139 Vessels Delayed With estimated 260 delay hours (all vessels had to transit the Poe Lock)
- \$865,000 Estimated Cost to Navigation Industry
- Failure to address issue could have resulted in catastrophic failure



Dewatered MacArthur Lock Chamber



- Required to facilitate repairs
- Required placement of upstream dewatering bulkheads
- Typically don't dewater until winter shut down to avoid impact to navigation



Divers Chinking Bulkheads to Reduce Seepage into Dewatered Chamber



Jacking the Gate to Remove Load from the Anchorage



Removing Old Gate Anchorage Pins



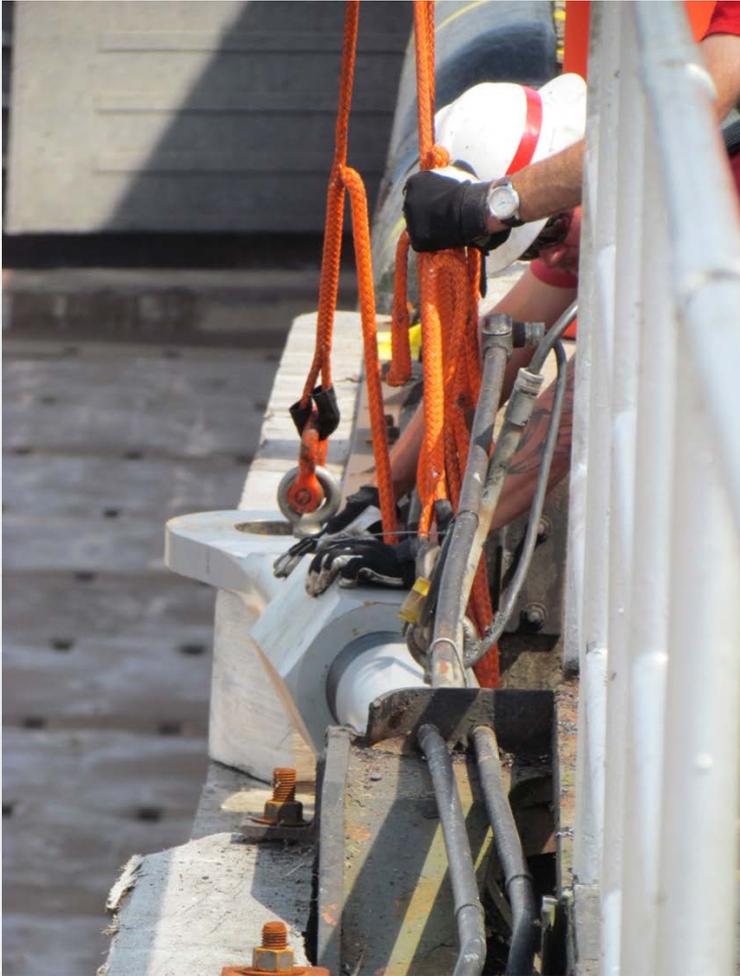
Removing Old Gate Anchorage Links



Boring Embedded Gate Anchorage & Installing New Bushings



Installing New Anchorage Link



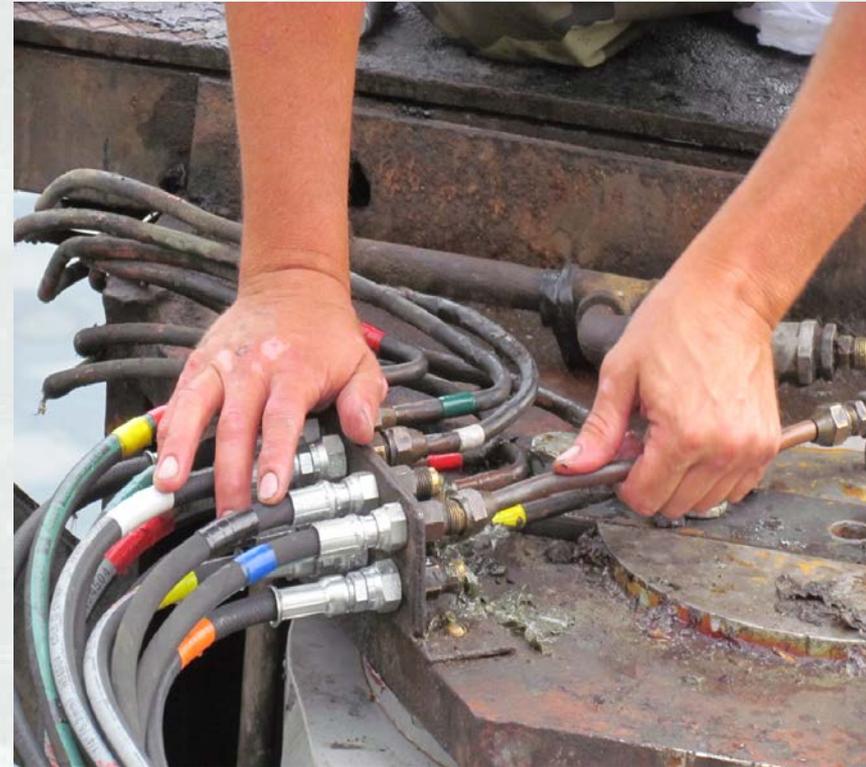
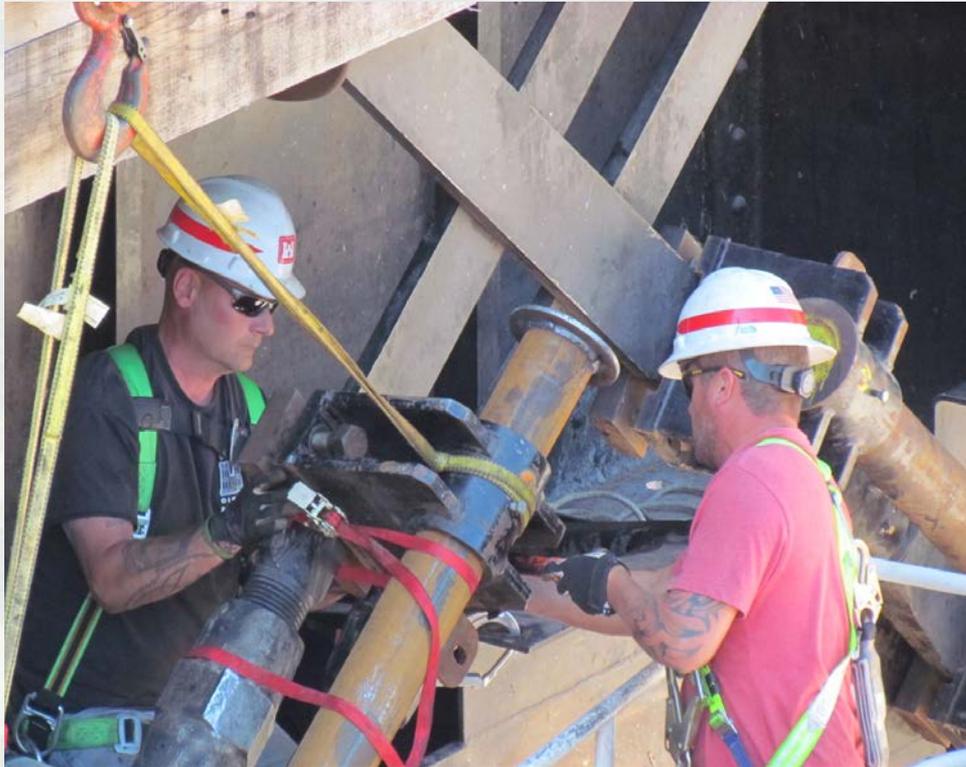
Installing New Gate Anchorage Pin



Finished Gate Anchorage Assembly



Restressing the Gate & Reattaching Grease & Electric Lines



Rewatering the Lock



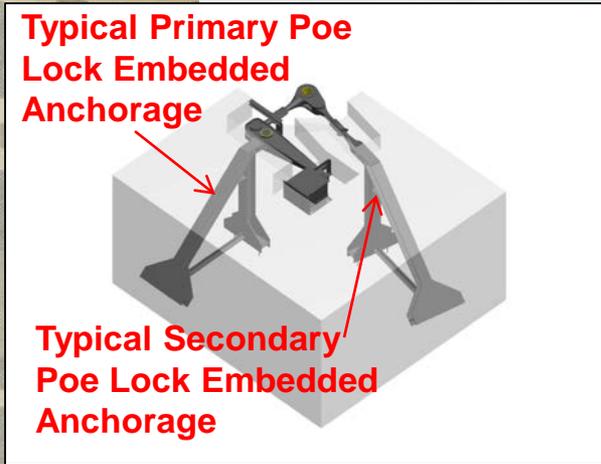
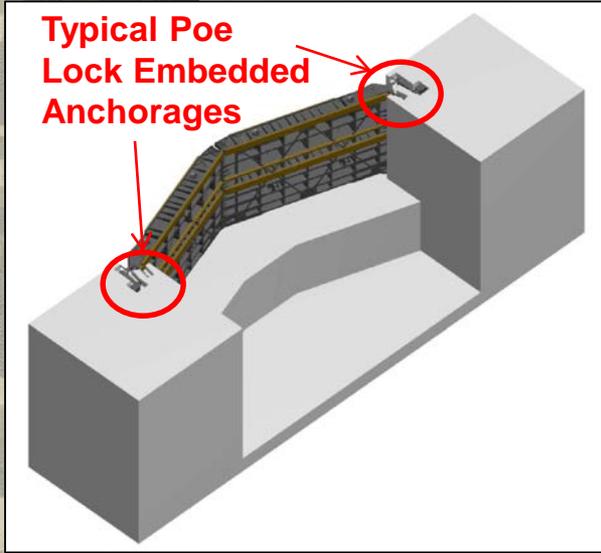
SOO LOCKS

Poe Lock Miter Gates

Embedded Anchorages



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SOO LOCKS

Miter Gate Embedded Anchorage Risk Summary

- The miter gate embedded anchorages were studied as part of ongoing Soo Locks major rehabilitation analyses
- The study has led to more detailed modelling that revealed that there is near-term risk to the Anchorages
- Strain Gauging was performed that showed actual loading to be higher than design and modeled loads
- The Life Cycle Analysis using actual loads show that the anchorages have exceeded their design life
- Poe embedded anchorages are fracture critical with no redundancy
- MacArthur Lock embedded anchorages currently being evaluated



Interim Risk Reduction Measures

- Intended to reduce risk of a failure while permanent repair is pursued
- Exposure of all embedded anchorage heads (completed)
- Visual & Non-destructive testing of welds and materials (initial completed)
- Routine visual and NDT monitoring (ongoing)
- Installation of stiffener plates (ongoing)
- Heating of pin plate (ongoing)



Gate 3S Exposed Embedded Anchorages



Gate 3S Weld Concerns: Visual Inspection, and ND Testing identified a 1.5" crack in the weld of the Gate 3S primary anchor.



Crack In Weld



Surface Pitting



Stiffener Plate Installation



Template of stiffener plate

Soo welder installing stiffener plate



Long Term/Permanent Repair

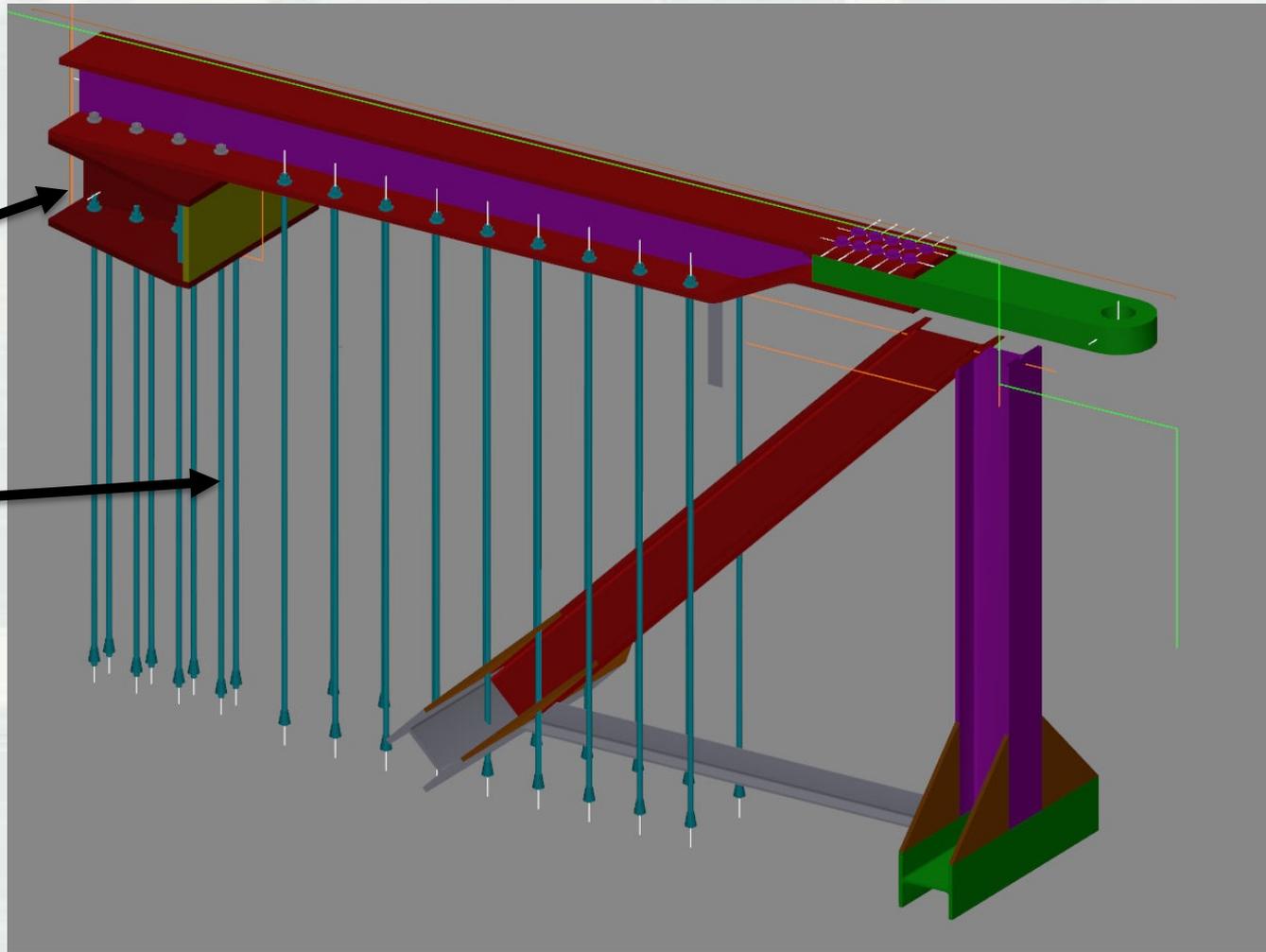
- Design Ongoing by Corps' Inland Navigation Design Center of Expertise
 - Meets current design criteria (loading, fatigue, materials)
 - Minimize impact to navigation during installation
 - Consideration of future maintenance/potential repair requirements
- Identified as Part of District's List of Critical Funding Needs for Consideration for Potential FY16 Funding Pots
- Prepared for Summer 2016 Advertisement Should Funding be Received



New Poe Anchorage

Shear key
provides shear
resistance

Anchors
provide
overturning
resistance



Agenda

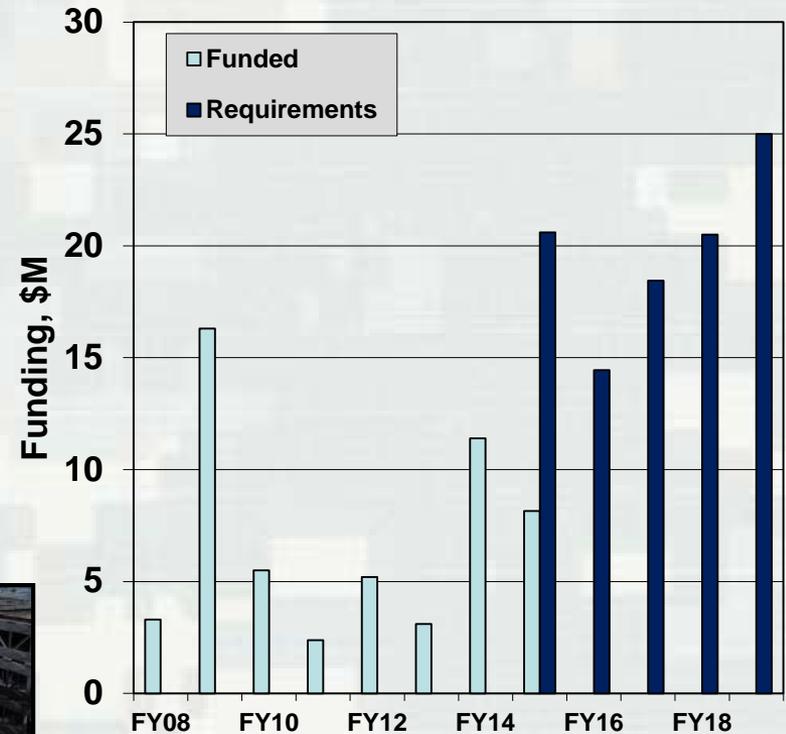
- FY16 Maintenance Dredging
- Recent Soo Lock Component Condition Issues
- **Soo Locks Asset Renewal Status**



Soo Locks Asset Renewal Long-Term Plan

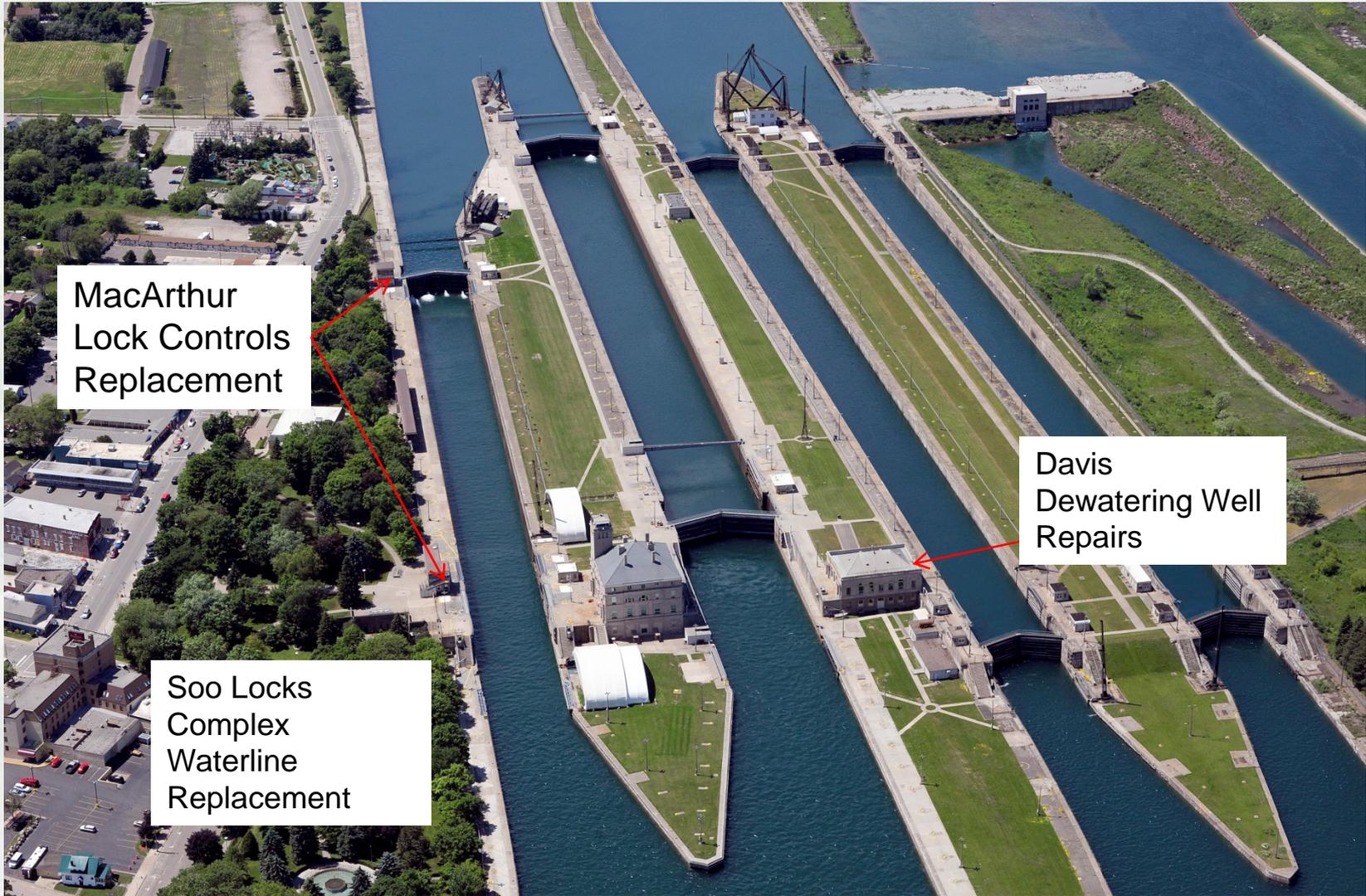
Asset Renewal Plan will maximize reliability and reduce risk through 2035

- \$55.3M funded to date through FY15
 - New hydraulics, stop logs, utilities
 - Compressed Air System
 - Gate Anchor Bar Replacement
 - Mac Lock Controls Replacement
- Remaining key priorities
 - Poe Miter and Quoin Block Replacement
 - Poe Electrical Rehabilitation
 - Poe Lock Gate 1 Replacement
 - Pier rehabilitation



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Soo Locks Asset Renewal - Ongoing



MacArthur Lock Controls Replacement

Existing controls from original construction

No longer reliable, spare parts no longer available

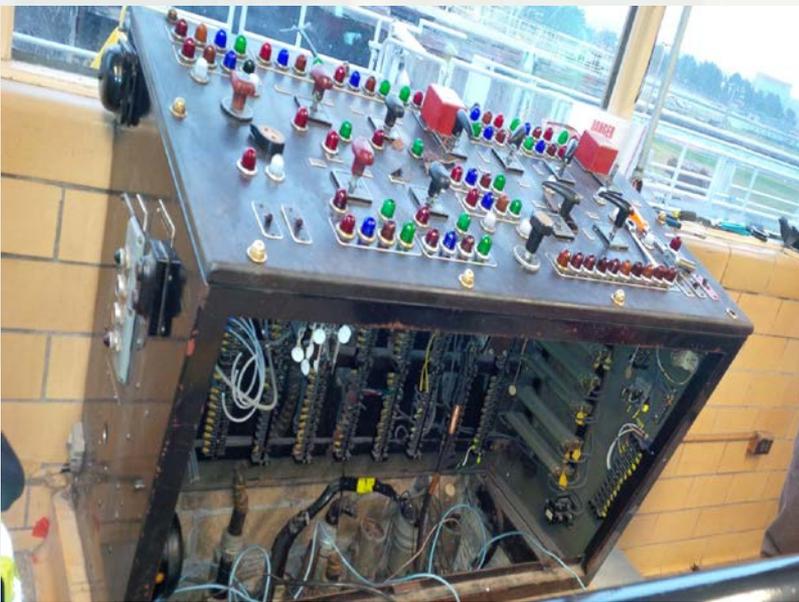
Eliminate safety hazard by replacing 480v controls

Facilitate installation of valve to gate interlocks

> Contract ongoing & scheduled to be substantially Complete Spring 2016



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Lock Dewatering Well Repairs

Existing sluice gate valves 100 years old and experiencing severe leakage

Safety concern for workers accessing the wells to perform maintenance

Impacting ability to fully dewater a lock in a timely manner (critical in winter)

- Bulkheads for Davis/Sabin Tunnels Installed
- Contract awarded for fabricating new sluice gates
- In-house install planned





Soo Locks Complex Water Line Replacement

Existing highly corroded steel water line (1943) deteriorated and experiencing leakage

Waterline co-located with high power electric feeder cables within deep service tunnel

Water line located above high voltage electrical feeder lines and natural gas lines with spot corrosion

> Contract awarded to replace water line w/ work to begin Spring 2016



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Soo Locks Asset Renewal - FY16



MacArthur Lock valve bulkheads

Poe miter gate lifting pendants

West Center Pier repairs

Poe Lock electric system rehab

Poe Lock Gates 1&3 embedded anchorage replacement

E&D for Poe Lock miter/quoin block replacement



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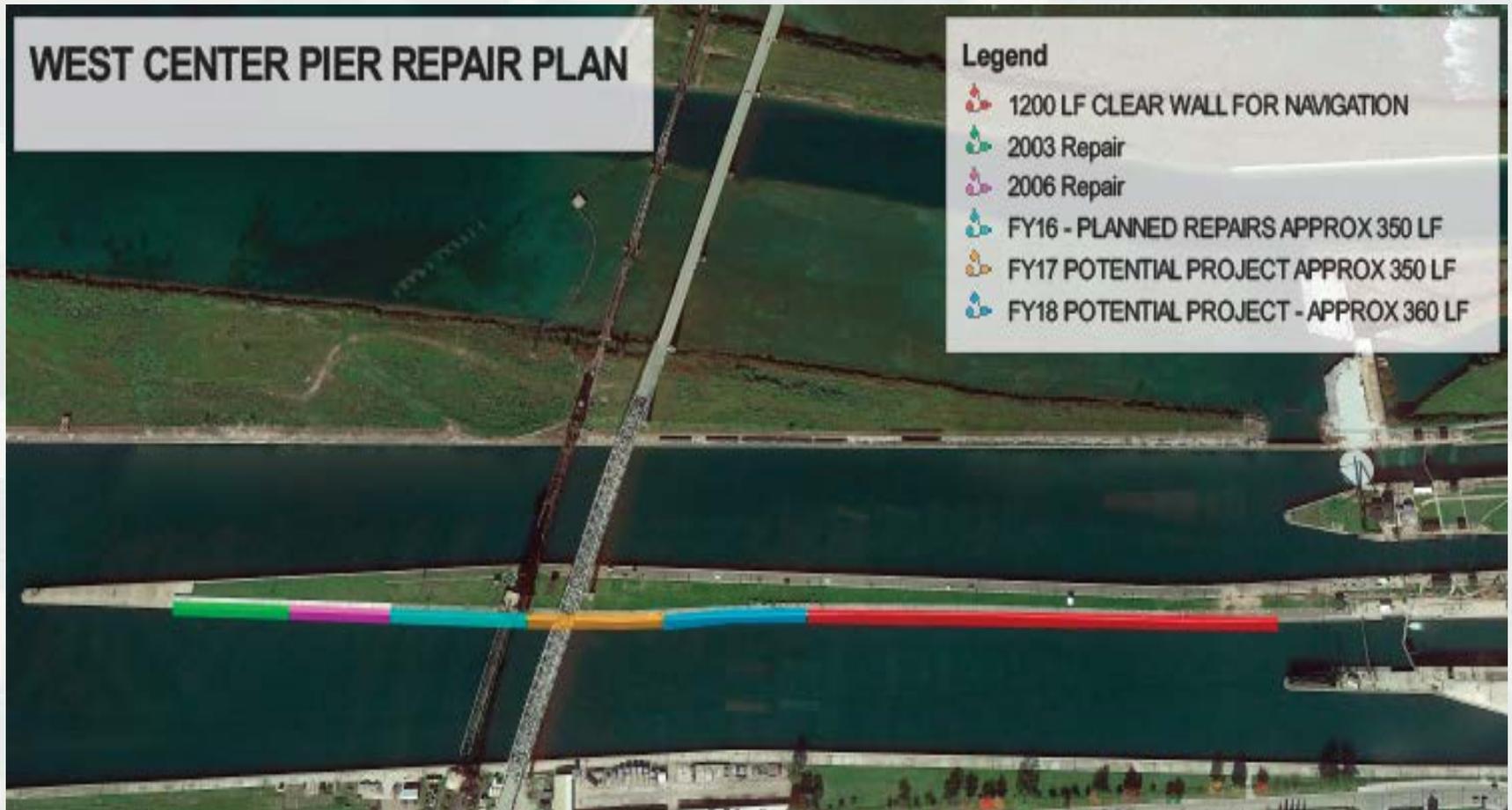
FY16 PBUD Soo Locks Asset Renewal West Center Pier Repairs



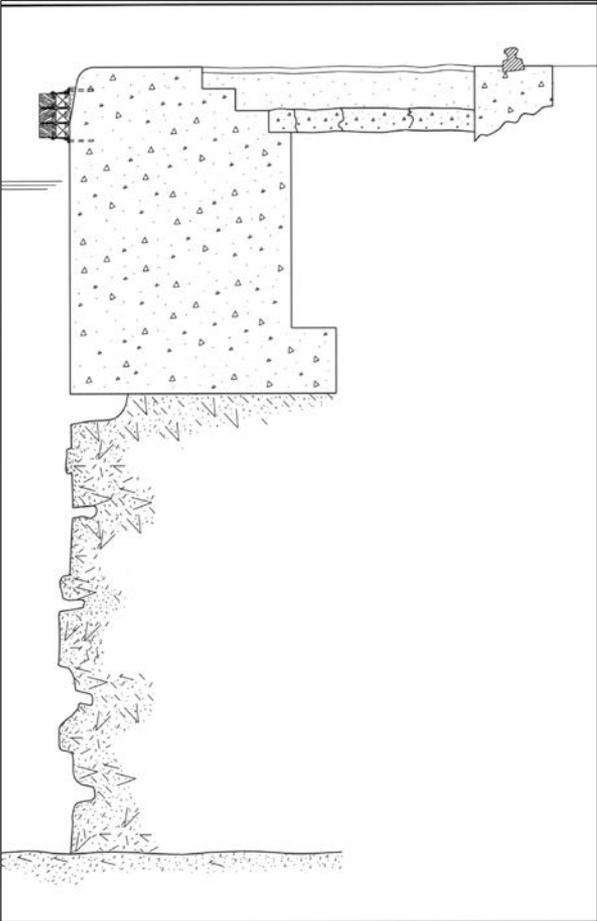
Project
Location



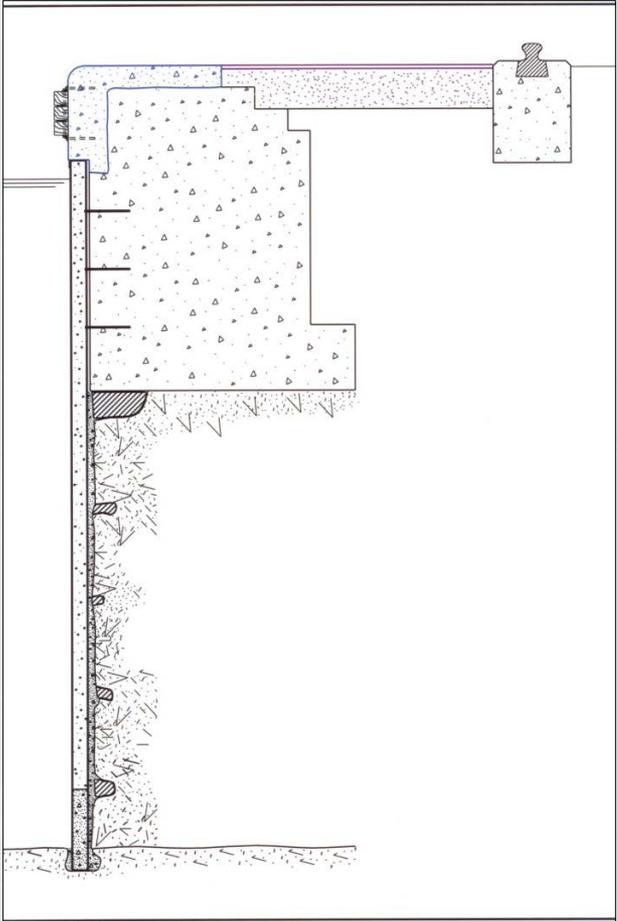
Soo Locks – West Center Pier Repairs



Soo Locks – West Center Pier Repairs



Existing Condition



Proposed Repair



Soo Locks Asset Renewal - FY17 PBUD



West Center Pier repairs

Poe Lock miter/quoin block replacement



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Key Great Lakes Contacts

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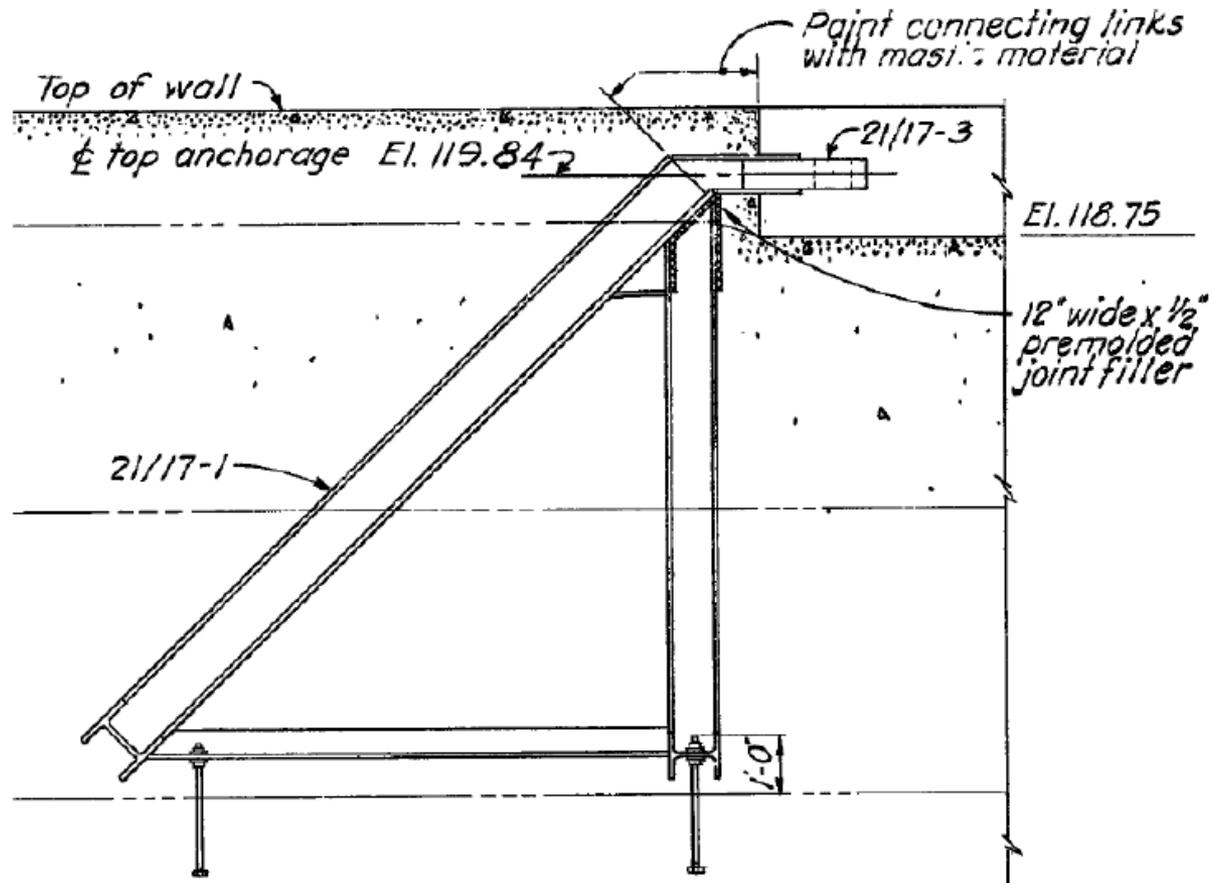
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www.lre.usace.army.mil/greatlakes/navigation



Backup Slides



FY16 Dredging Projects

- Duluth-Superior
- Ontonagon
- Presque Isle
- Green Bay x
- Manitowoc
- St. Joseph
- Holland
- Grand Haven
- Muskegon
- Ludington
- Manistee
- Saginaw River x
- Rouge River
- Manistique
- Monroe
- Alpena



FY16 PBUD Structure Repairs

Preventative Maintenance by Gov't Plant:

- Duluth-Superior (Superior Entry North Pier)
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Contract Repairs:

- Muskegon Harbor (north breakwater head)
- Grand Haven (south pier)
- Ludington (south breakwater head)



Long Term/Permanent Repair

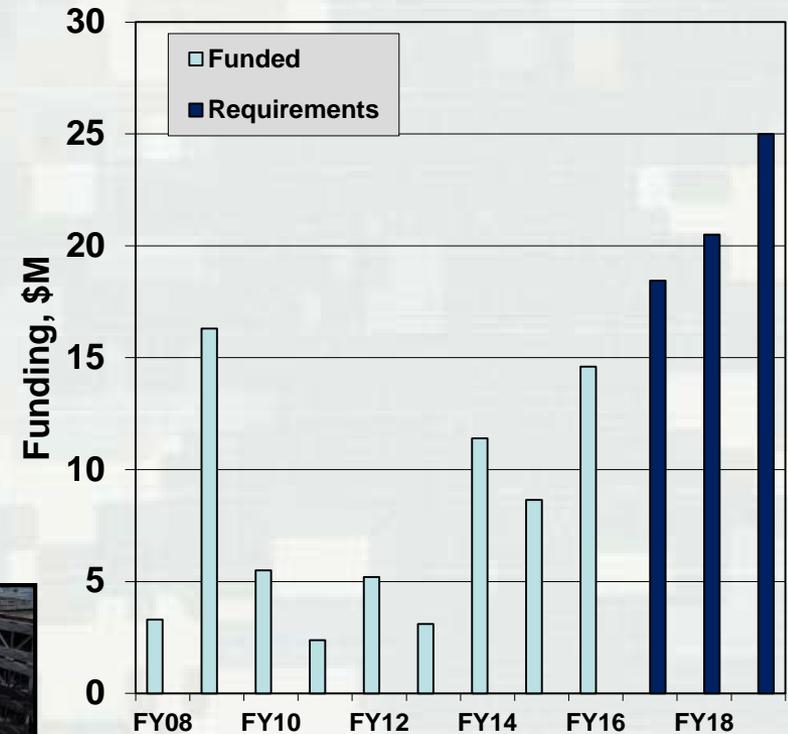
- Design Ongoing by Corps' Inland Navigation Design Center of Expertise
 - Meets current design criteria (loading, fatigue, materials)
 - Minimize impact to navigation during installation
 - Consideration of future maintenance/potential repair requirements
- Funding to implement repairs included in FY16 funding pots
- Advertise for contract repairs in Summer 2016, schedule currently calls for installation complete by March 2017



Soo Locks Asset Renewal Long-Term Plan

Asset Renewal Plan will maximize reliability and reduce risk through 2035

- \$70.5M funded to date through FY16
 - New hydraulics, stop logs, utilities
 - Compressed Air System
 - Gate Anchorage Replacement
 - Mac and Poe Electrical System Replacement
- Remaining key priorities
 - Poe Miter and Quoin Block Replacement
 - Poe Lock Gate 1 Replacement
 - Pier rehabilitation



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Strain Gauging was performed by Bridge Diagnostic Inc (BDI) to validate modeled loads. The results of the strain gauging showed actual loading to be higher than design and INDC modeled loads

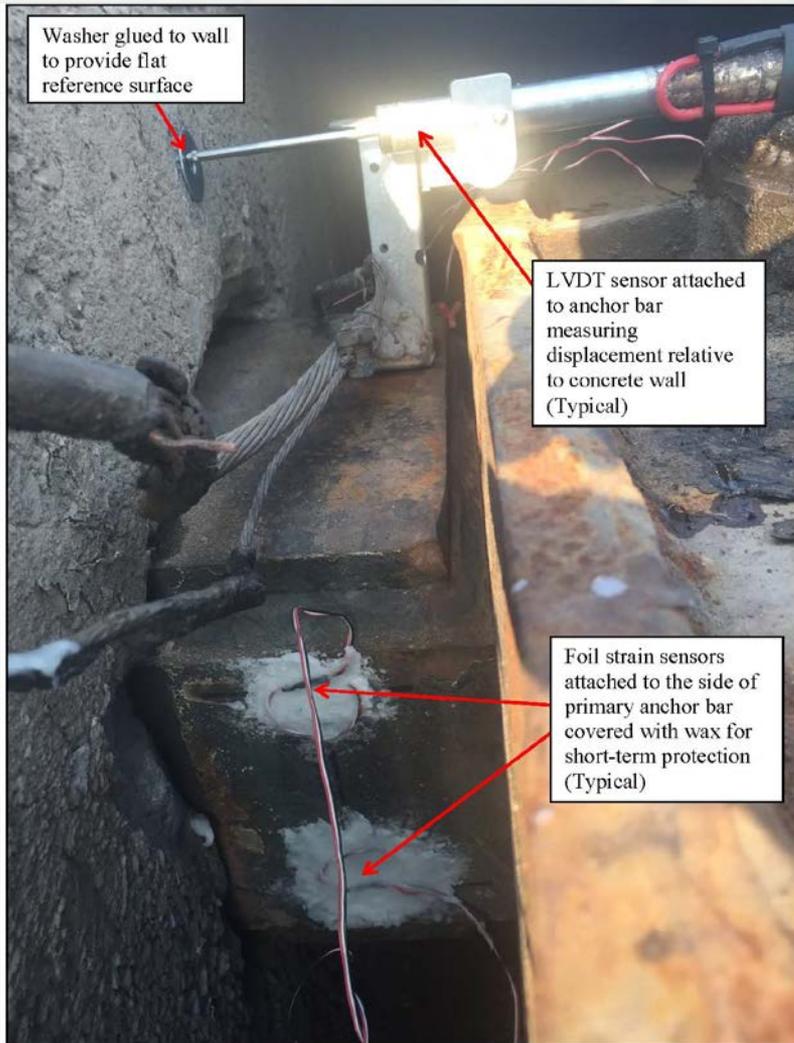


Figure 2.6 – Typical primary anchorage setup (Typical).



Figure 2.5 – Example of foil gage welded to prepared surface on anchor bar.



Gate 3S Primary Anchor Weld Grinding and NDT

Weld repair procedure prepared by INDC & implemented by Soo crew. Grinding of the existing weld resulted in the development of shallow cracks in the weld and base metal. These were sanded out and eliminated. Crack repair preparation procedures are being altered to limit shallow crack development during grinding.



Area ground for weld repair



Magnetic Particle Testing

After initial grinding, visual inspection and NDT identified crack in base metal extended further than expected

