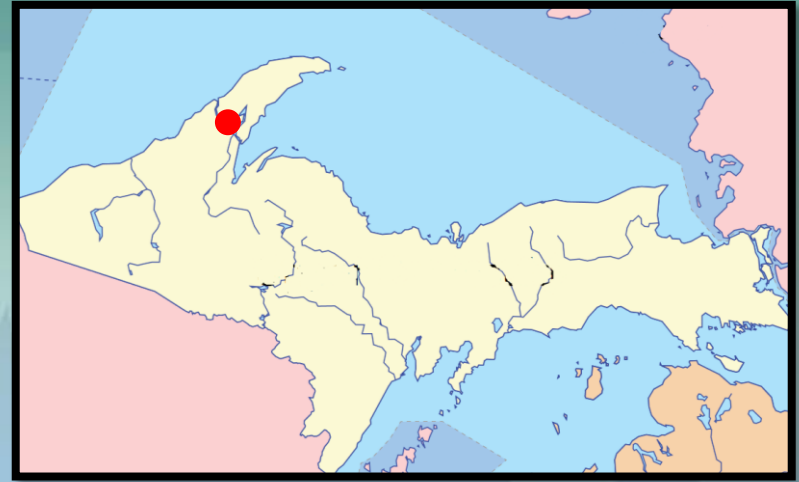


Portage Lake Lift Bridge 2014-2016 Rehabilitation



Portage Lake Lift Bridge



A Critical Link to the Keweenaw

- **“Keweenaw Island” or “Copper Island”**
 - Population 21,500 north of the bridge (44,000 on Peninsula)
 - Houghton County Airport
 - Both of area’s hospitals
 - 4 school districts on north,
3 school districts on south
 - Contains the state and county maintenance facilities (plows)
 - MTU south of Bridge

1st bridge across the Portage

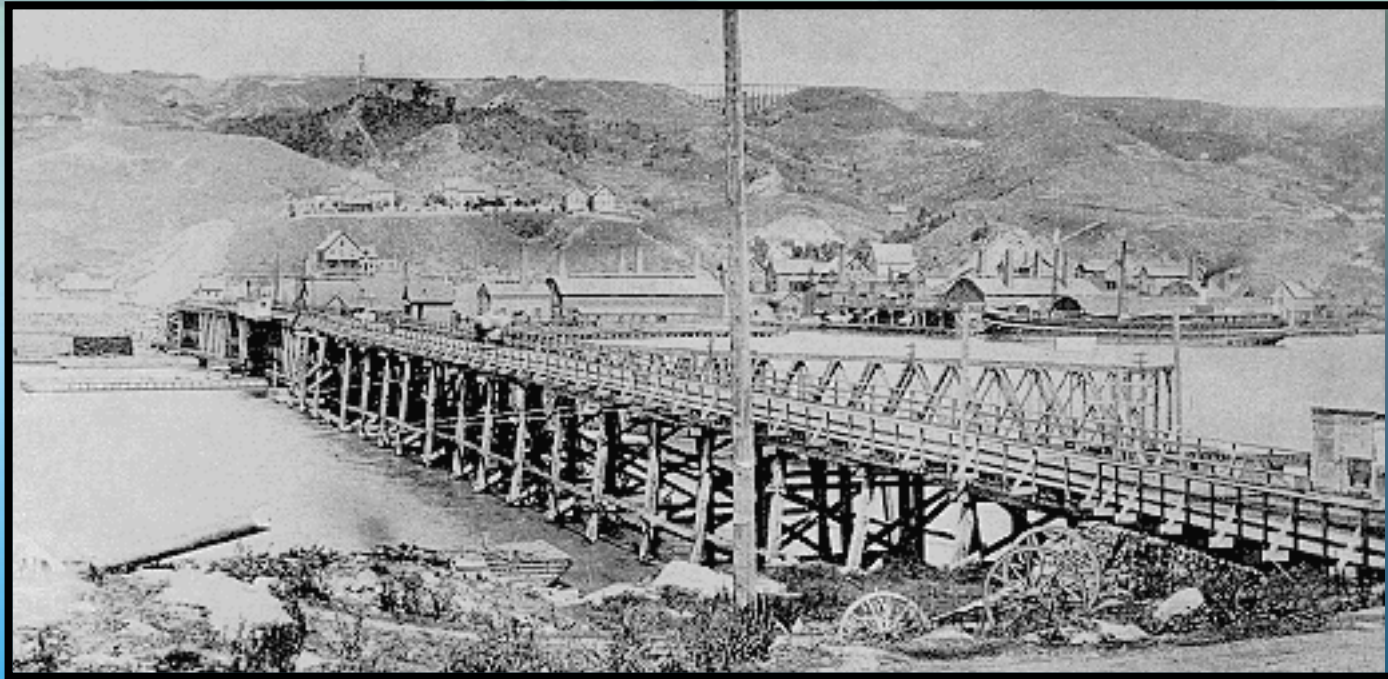


Photo Courtesy of Copperrange.org

1875-1895

2nd Span Over the Portage



1895-1959

Photo Courtesy of Copperrange.org

Portage Lake Lift Bridge



- Open winter of 1959 but officially dedicated June 25, 1960
- Built 1957-1959
- World's heaviest and widest double -decked lift bridge. The Lift Span weighs 4,500,000 lbs..
- *Cost - \$11,000,000*
- Lower spans carried rail
- Lift span designed to carry vehicular traffic on both decks
- 250' clear channel width
- Vertical clearances with water
 - 5 feet in lower position
 - 35 feet in Intermediate
 - 100 feet fully Open

MTU ties to Lift Bridge

- Engineering Staff



The Michigan State Highway Department has maintained a staff of nine, among these the three Tech graduates pictured at right. These are, as pictured from left to right, John Michels, Assistant Project Engineer from Ontonagon, class of 1952, Tom Wiseman, the project engineer from Marquette, class of 1949, and Don Kero from Palmer, class of 1958.

Mining Gazette News Clippings Courtesy of John Michels



(Mining Gazette Photo)
TERRENCE REED, left, and John J. Michels are members of the Michigan Bridge engineering group working on the Portage job. Michels is a Tech graduate in civil engineering. Reed has taken certain highway courses at the college.

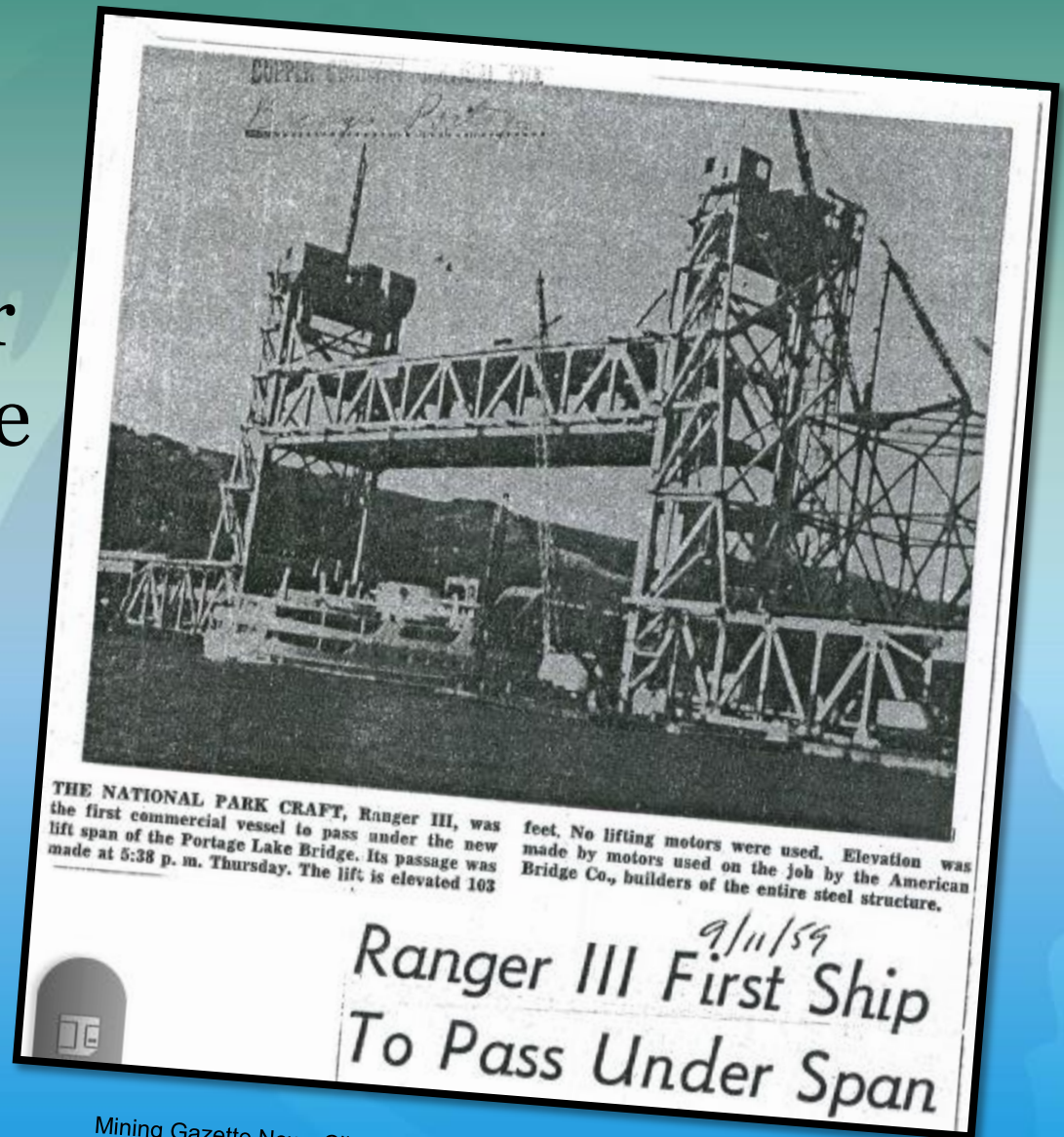
Portage Lake Lift Bridge

Floating the lift span in



Photo Courtesy of Copperrange.org

1st run of Ranger
under new bridge
1959



Mining Gazette News Clippings Courtesy of
John Michels

Portage Lake Lift Bridge

- December 20, 1959

New lift bridge lowers curtain on decade

By DAVID MAKI

The Daily Mining Gazette

HOUGHTON — The Portage Lake Lift Bridge, which replaced a bridge built in the 1890s, opened for business the morning of Dec. 20, 1959, and Hubert Peterson of Houghton Canal remembers it well.

Peterson drove the first car to cross the new bridge that morning, and while it might seem he'd have to race to be first in line, that wasn't the case.

"I didn't have to wait long, because the (police officer directing traffic) just told me to go," he said. "I just happened to get there at the right time. I didn't even know it was going to be open."

Peterson, now 74, said he and his wife had crossed the old swing bridge that morning to get to Hancock, where they were going to pick up his brother-in-law from the bus station. While they were in Hancock, they decided to eat breakfast at the then-Suomi Cafe downtown. As they finished their meal, a soldier on his way home

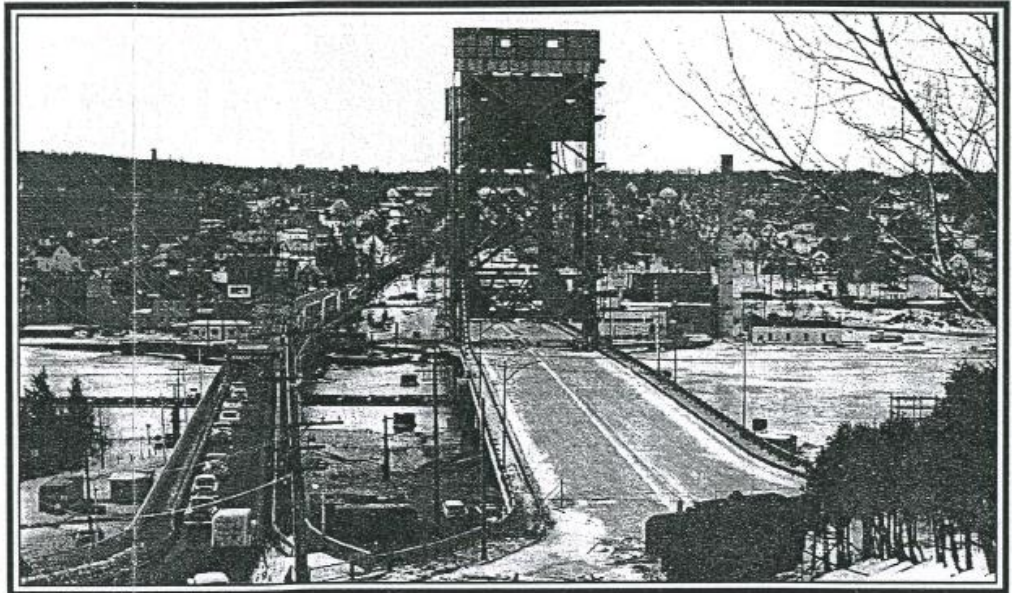
1950-59
LANDMARKS 20th
Century

I was looking forward (because) I didn't even know the bridge was going to be open.

"That was a surprise for me and my wife."

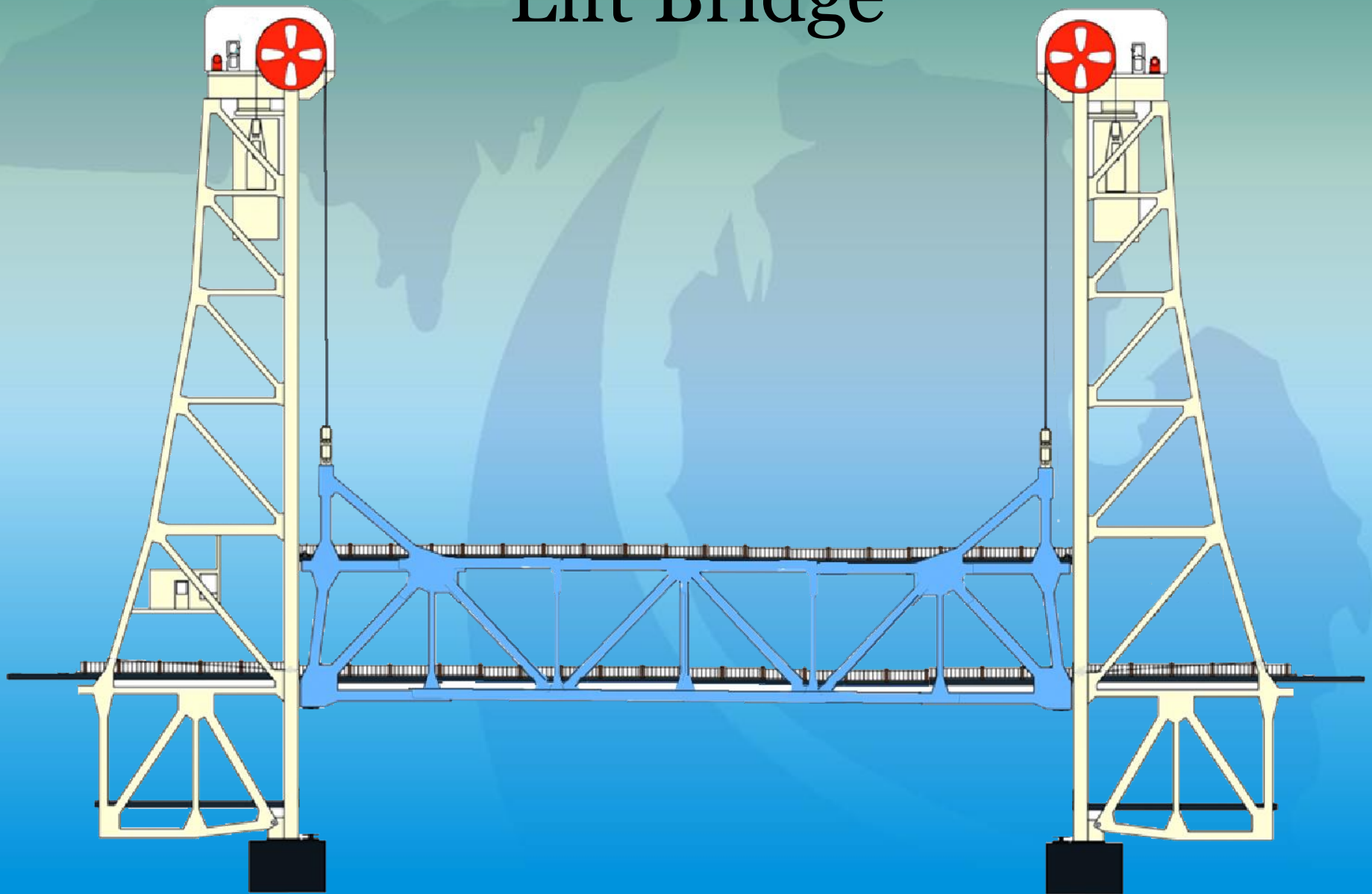
At least 14,000 cars traversed the 188-foot tall, quarter-mile long structure during the first half of that day, making life difficult for police officers like Matt Kobe of the Hancock City Police Department. Kobe, now deceased, was the officer who directed traffic that day. According to Kobe's wife, Catherine, there was no honor involved; he was just lucky enough to be scheduled for day shift that morning.

Strangely, the bridge's opening drew nary a story in the Dec. 19 Daily Mining Gazette. One day earlier, however, the Gazette announced the opening with a brief



The Portage Lake Lift Bridge sits vacant to the right of the swing bridge it was built to replace. The barricades were lifted Dec. 20, 1959 and more than 12,000 vehicles crossed the canal on the first day of operation. (Photo courtesy of Michigan Tech University Archives)

Portage Lake Lift Bridge



Rehabilitation Projects

- 1978 – Mechanical and Electrical
- 1994 – Complete Paint
- 1998 – Deck Overlay , Electrical upgrade
- 2015 – Mechanical, Electrical, Structural upgrade

Incredible Record of Reliability

Outages that affected traffic Between 1980 and 2014

- **Spring 1983** -1 1/2 hour outage due to loss of power during a lift
- **Fall 1988** - 1 1/2 hour outage when scaffolding on the bridge tripped a limit switch during high winds while lifting
- **November 1994**- 3 hour closure due to portions of the containment falling onto the bridge deck during painting project. Closed to re-secure the containment.
- **August 2010**-4 hour closure when a syncro tie relay failed during lift allowing bridge to get out of skew and stuck

Mechanical/Electrical Rehabilitation and Upgrade

Duration: December 2014-April 2016

Cost: \$8.39 million

Designer: Modjesky and Masters Inc.

Contractor: Zenith Tech Inc.

Anticipated Fix Life

20-50-year fix



Contractor Team

- Zenith Tech, Inc – Prime Contractor
- Stafford Bandlow Engineering – Engineering Expert in Movable bridges.
- SPE, Inc – Iron Workers
- Calacci Construction – Mill Wrights
- Faith Technologies – Electrical
- Link Controls – Motor Drives, System Integration
- Calumet Machine – Balance Chains, Pinions, Shafts, Hydraulic Cylinders, Misc Fabricated parts
- Dan R. Dalton, Inc. – Heat Straightening
- Civil Coatings and Construction- Painting

Project details

- Lift cable replacement
- Balance chain rehabilitation
- Electrical and mechanical upgrades
- Lift motor drive replacements
- Spot painting
- Deck repairs
- Structural steel repairs
- New warning and barrier gates



Early Procurement Contract

- Procured long lead time items
 - Pinion Forgings
 - Index couplings
 - Wire Ropes
 - Balance Chain Bushings

Replacing Lift Cables

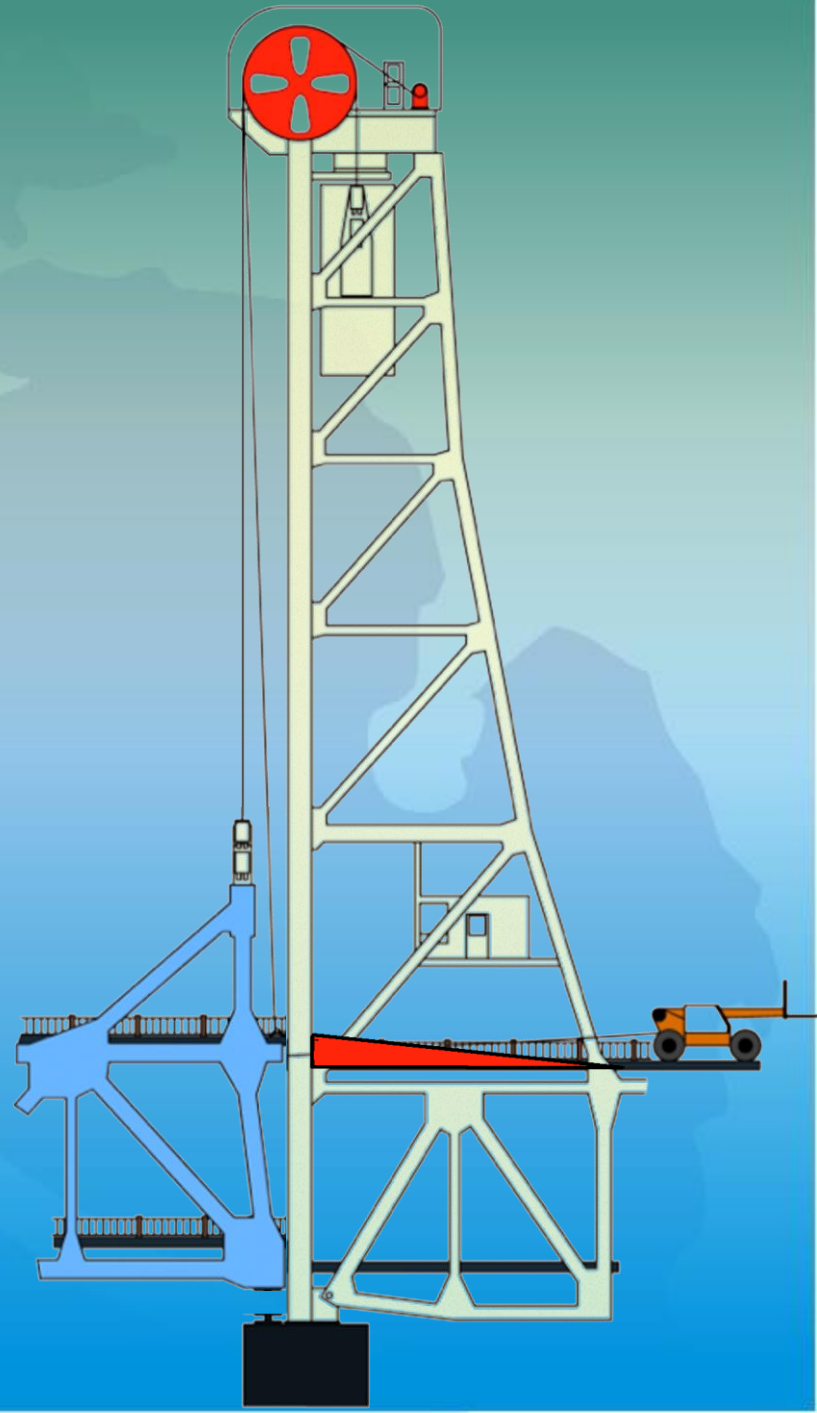
**Replace lift
cables**



- Mid-January to Late March

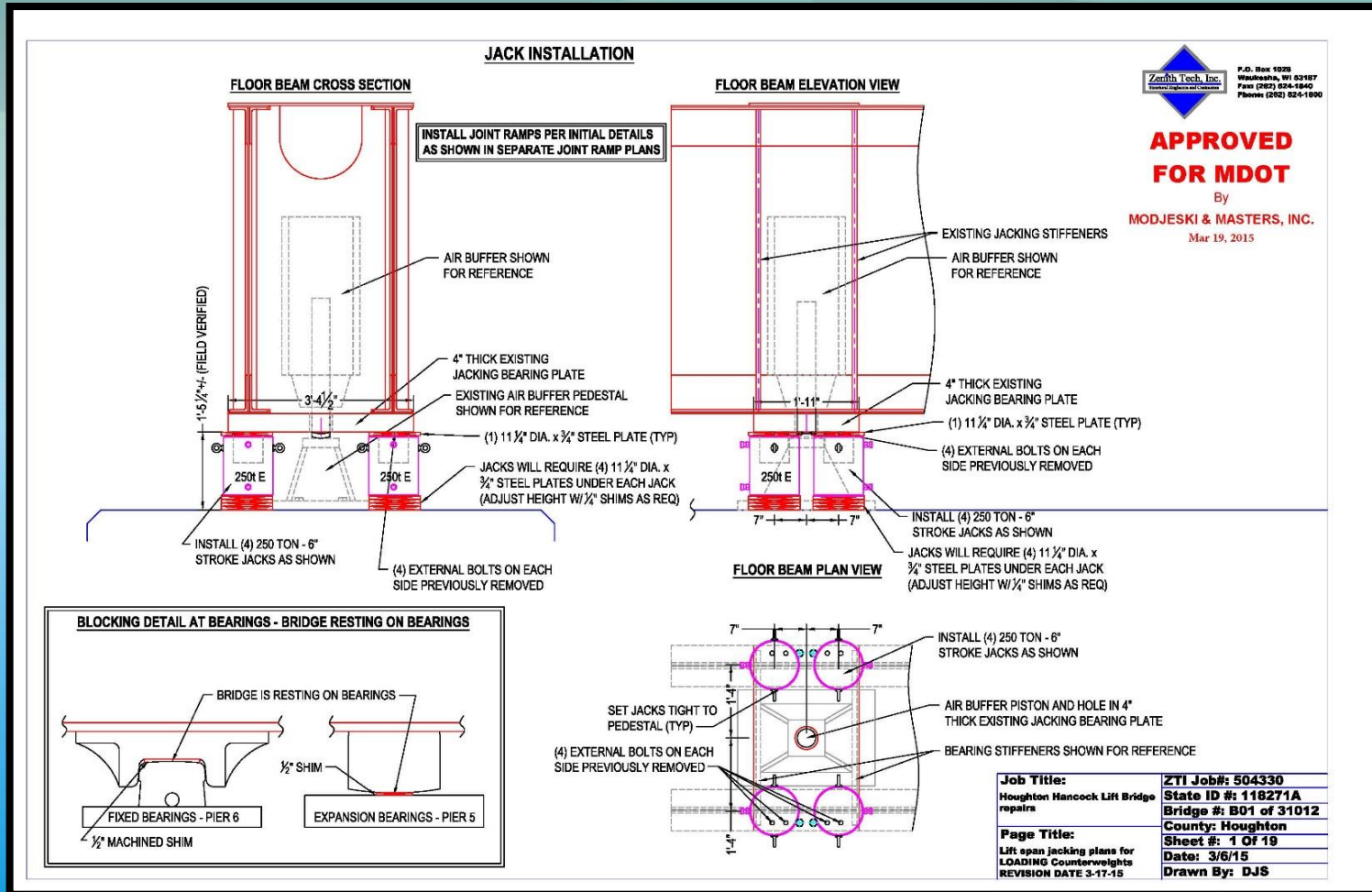
Replacing Lift Cables

- Disconnection (10 hours)
January 17
 - Pin Counterweight
 - Jack Lift Span approx. 2'
 - Place temporary ramp for emergency vehicles to pass during this time
 - Disconnect all old cables
 - Lower lift span to bridge seats for winter



Portage Lake Lift Bridge

• Jacking Plan



Replacing Lift Cables

Jacking

- Jacks – for raising the lift span

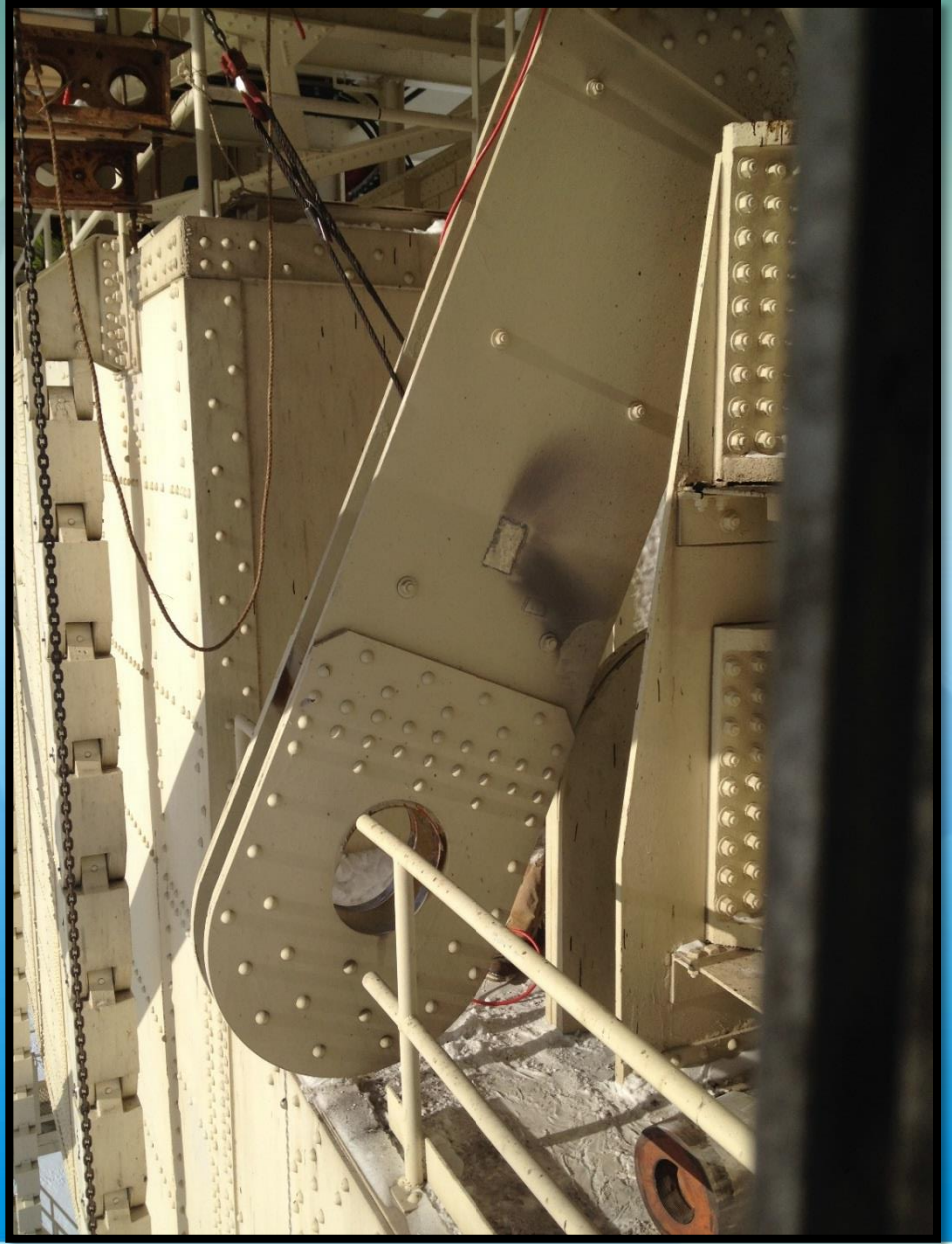


Replacing Lift Cables

- Jacking



Counterweight hangers



Portage Lake Lift Bridge

- Pinning Counterweight





Lift Cables
Disconnected

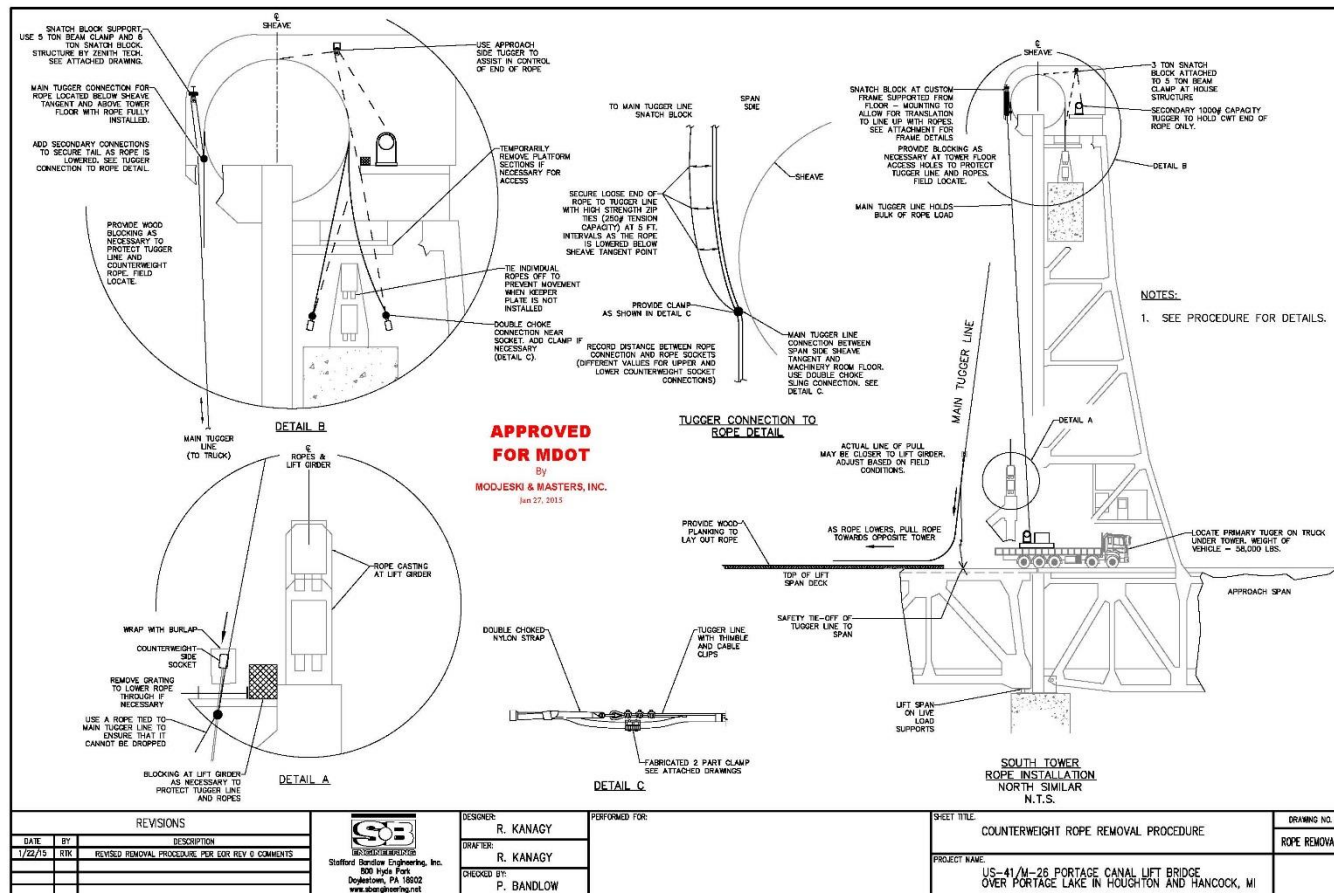
Replacing Lift Cables

- Replace all 84 2-3/8" cables - one at a time
 - 20-minute closures throughout winter (night work)

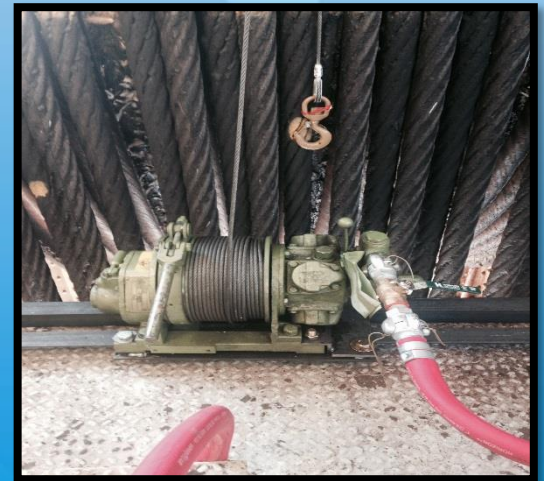


Portage Lake Lift Bridge

• Wire Rope Removal Plan



- Wire rope replacement
Equipment and rigging



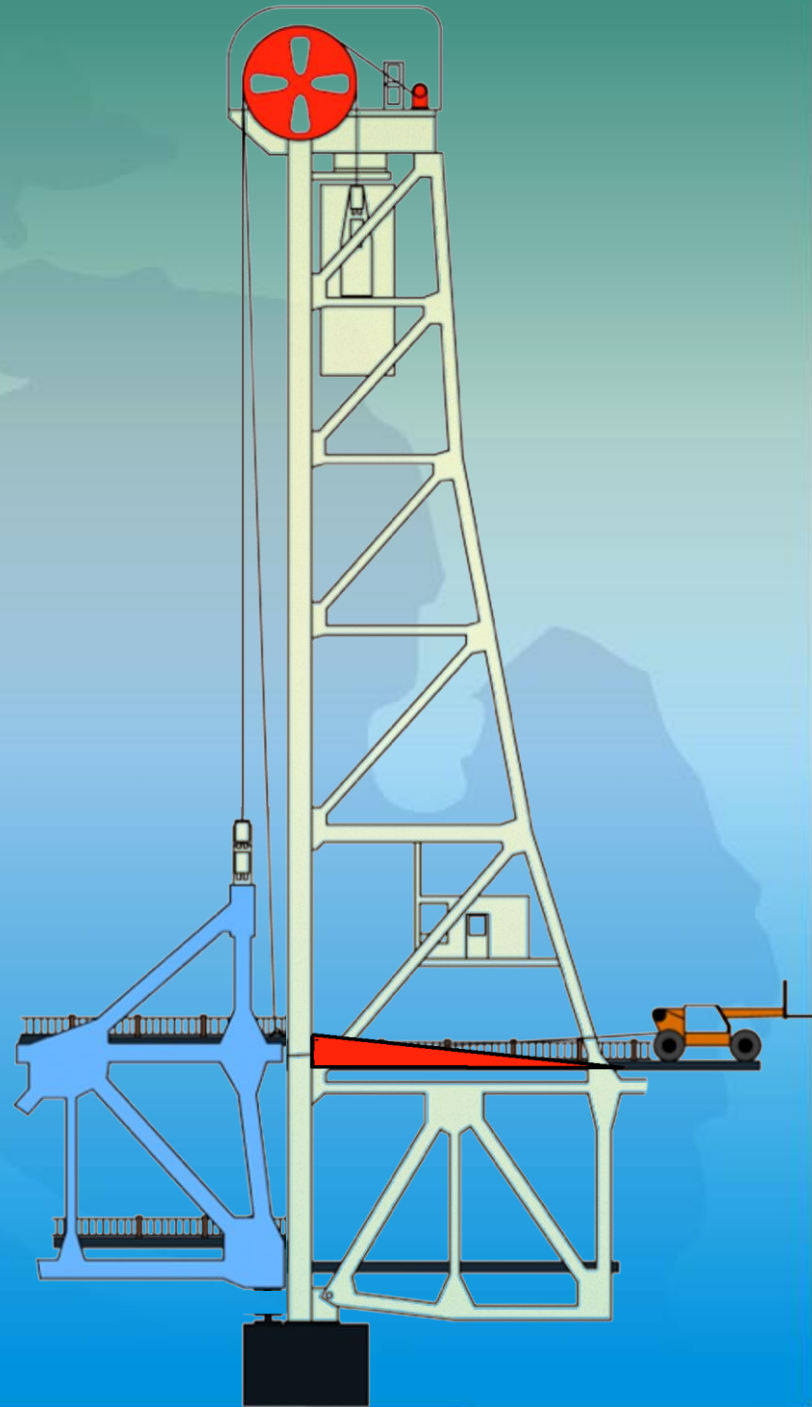
Portage Lake Lift Bridge

- Wire ropes

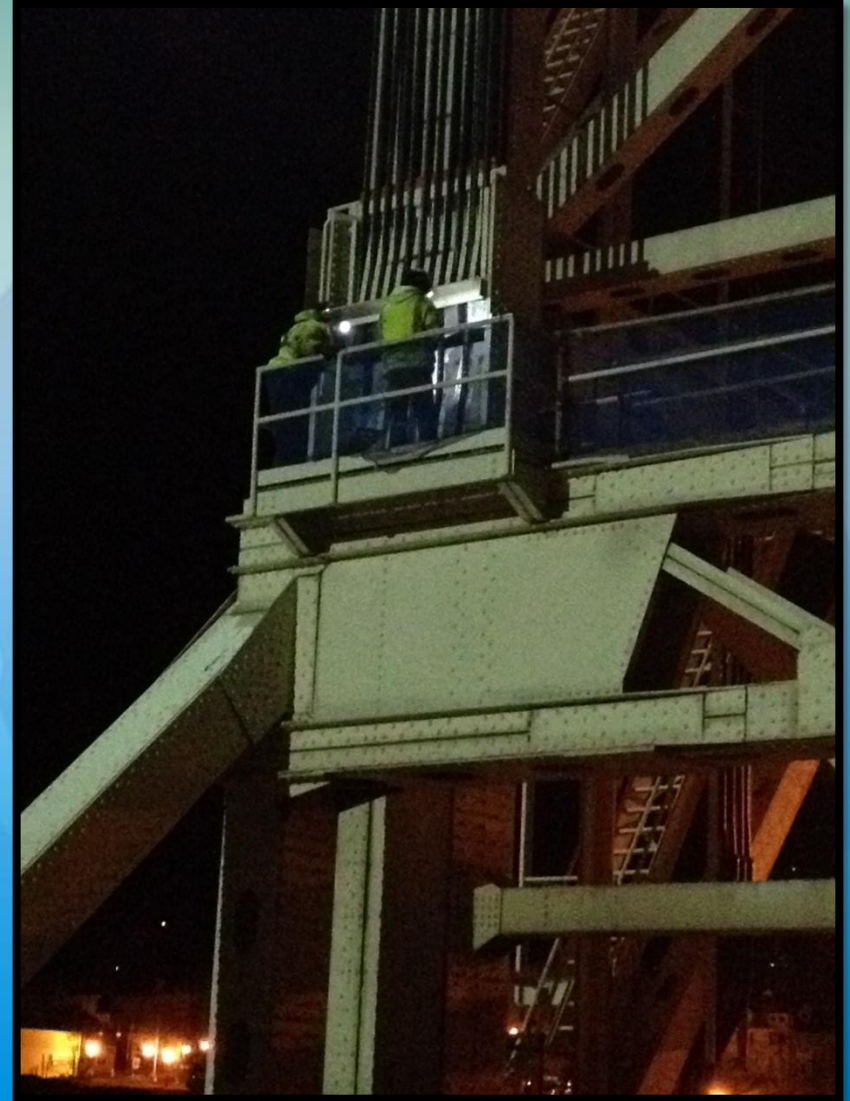


Replacing Lift Cables

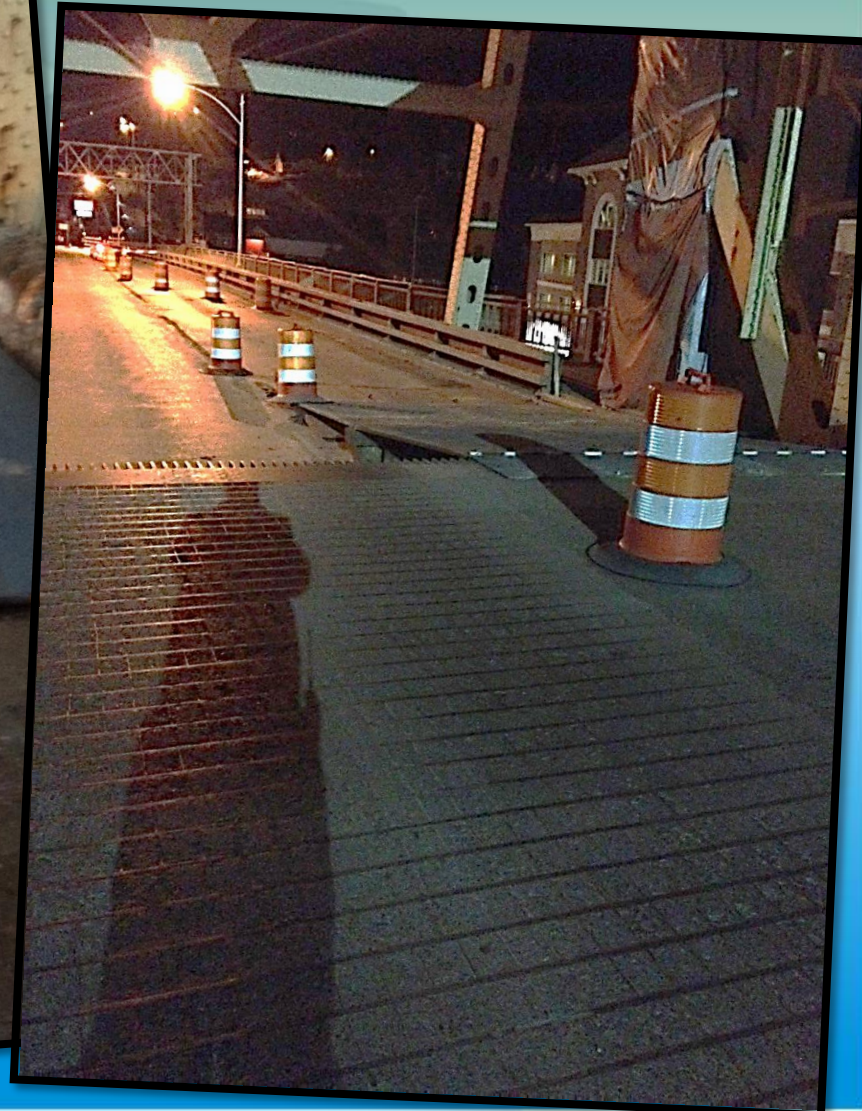
- Reconnect New cables to lift span (11.5-hour closure) March 21
 - Jack the liftspan approx. 3'
 - Position emergency ramp
 - Connect new cables
 - Lower the liftspan a distance to relieve pressure on counterweight hangers
 - Unpin counterweight and lower lift span with bridge machinery.



Reconnecting Lift Cables



Emergency ramps

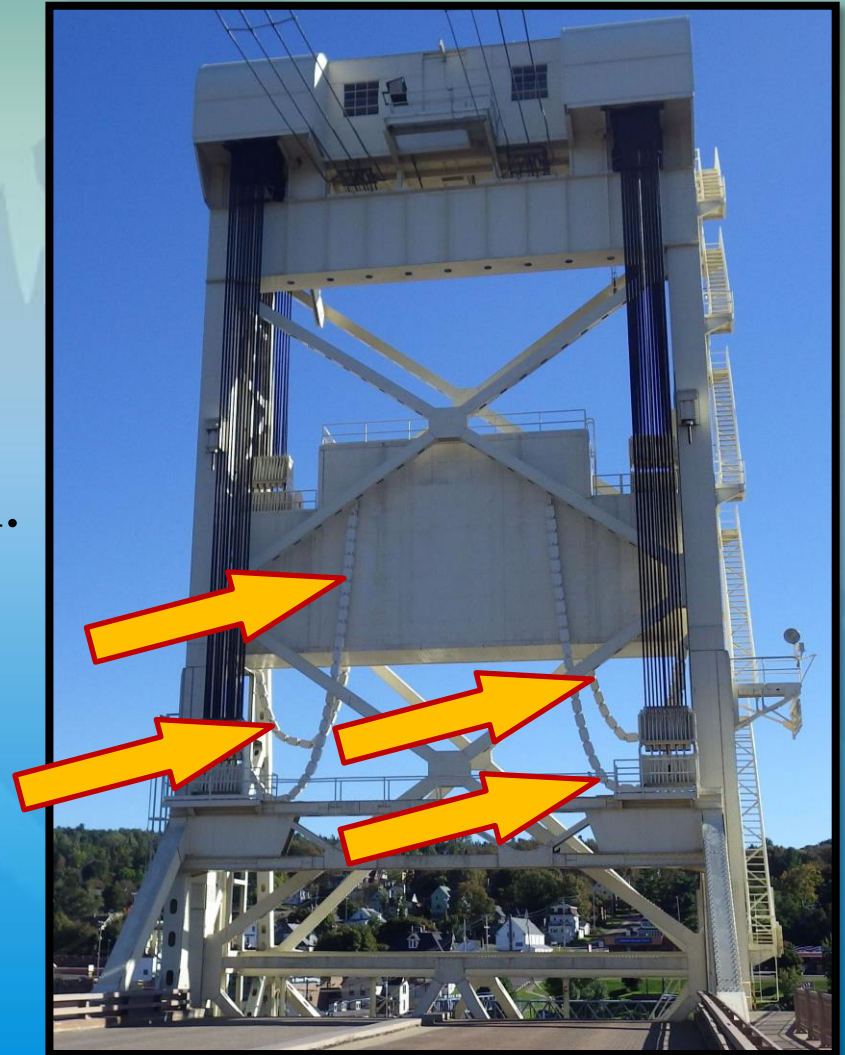


Ambulance crossing on ramps



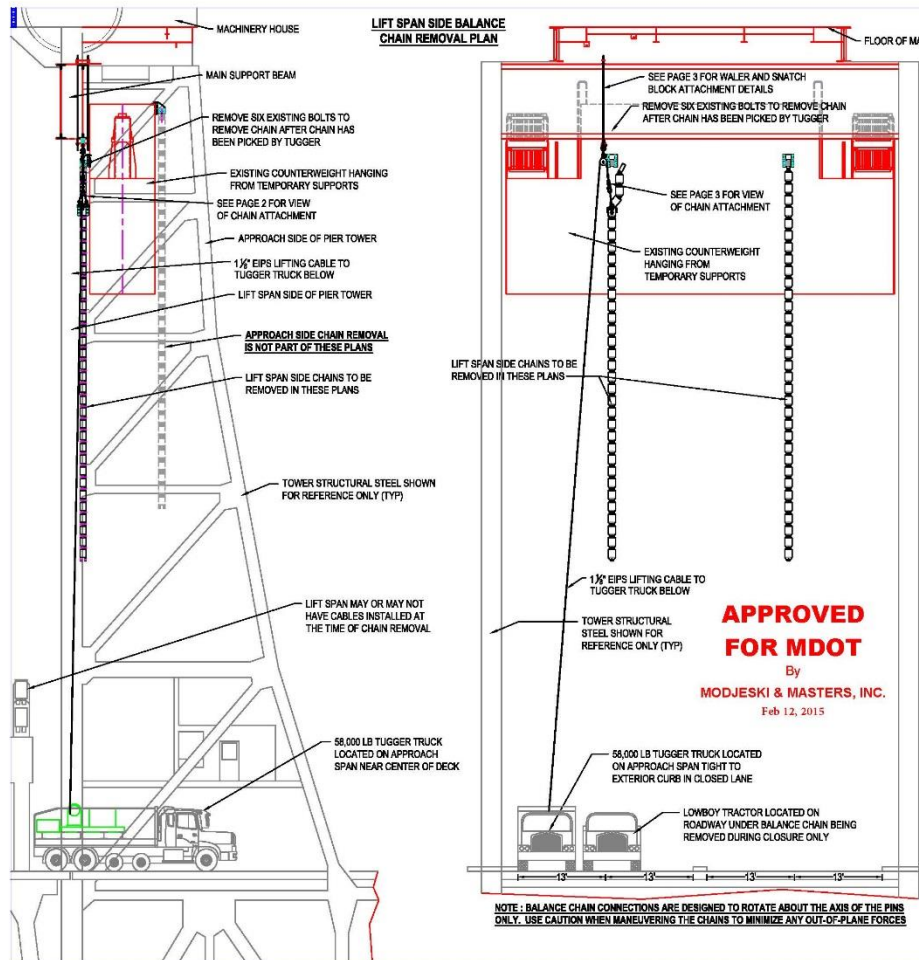
Balance Chain Replacement

- During Winter
- Shift traffic to inside lanes
- Set up rigging/equipment
- Close bridge 2 hours to lower/raise chains
- 8 chains – 2 closures per chain.



Portage Lake Lift Bridge

• Balance Chain Removal Plan



Zenith Tech, Inc.
Structural Engineers and Constructors
P.O. Box 1028
Wausau, WI 53487
Fax (762) 824-1840
Phone (762) 824-1800

US-41/M26 Portage Canal Lift bridge over Portage Lake to Houghton and Hancock, MI Lift Span side balance chain removal procedure

General
The purpose of this procedure is to outline the steps to remove the existing lift span side balance chains at the US-41/M26 over Portage Lake lift bridge in Houghton and Hancock, Michigan. This procedure only covers the removal of the (4) lift span side chains and NOT the (4) approach span side chains. The (4) approach span side chain removals are covered in a separate procedure.

Traffic Considerations
The preparation for this procedure will be performed with a single lane outage for road traffic. The actual lifting procedure will be performed during a 2 hour long full bridge closure. The closure will begin after the brackens and attachment hardware has all been assembled but PRIOR to removing the (6) 1/8" diameter attachment bolts located at the upper mounting bracket at the top of the counterweight. Stowmobile traffic on the lower deck will be permitted at all times.

- Required tools**
- An air tugger with the capacity to lower the entire length of the balance chain and tugger line (approximate weight of the balance chains = 24,000 lbs on the West side and 22,000 lbs on the East side - note that up to 800 lbs of additional snow load may be encountered depending on field conditions) and a line length approximately three times the tower height. The tugger provided will be a 22k tugger with 500 ft of 1.125" diameter EIPS cable. The as-provided rated lifting capacity of the tugger with 500 ft of cable will be = 27,123 lbs with a steel line pull = 38,619 lbs. Single line pull has been chosen for limited headroom and system simplicity. Adequate FOS is supplied by this combination of winch and cable for actual lifting loads.
 - A second, 1,000 lb. capacity air tugger to be mounted by the machinery room floor or top of the existing counterweight to assist in lifting the 1.125" diameter lifting cable from the roadway up over the 22 ton snatch block onto the mounting brackets located on the 4th balance chain link from the top of the chain.
 - A 22 ton snatch block hanging from a custom steel water attached to the bottom of the main structural beam below the machinery room. The steel water is hung using Dayton Superior 1 1/2" diameter B-12 coil rod with related hardware. The hanging of this water will require drilling a 1 9/16" diameter hole in the lower and upper cover plates on the main structural beam as well as one hole in the lateral brace attachment plate at the top of the main structural beam. The holes will be filled with 1 1/2" diameter A-325 bolts after the new chains are installed.
 - A 15 ton Crosby or equal swivel as shown on pages 2&3 of the drawings
 - DOT provided balance chain lifting brackets that have been inspected and analyzed by ZTI and determined to be of adequate capacity. All hardware has been replaced with new grade 8 hardware.

- Prior to chain removal**
- Lock the lift span and disconnect the lifting cables as outlined in separate plans
 - Remove the lower balance chain mounting brackets using 6-tin cone-s-log hooked to structural tower legs and allow the balance chains to hang vertically from the top mounting brackets. See standard calculations
 - Install steel water as detailed on pages 2&3 of the drawings.
 - Install the 22 ton snatch block as detailed on pages 2&3 of the drawings.
 - Install the DOT provided balance chain lifting bracket on the 4th link from the top of the balance chain to be removed.
 - Locate the 58,000 lb tugger truck (see separate COG calculation sheet) with attached 22k air tugger on the roadway below the balance chain to be removed in the closed lane tight to the face of the curb on the sidewalk side. The center of the tugger should be roughly centered with the balance chain in the North-South direction.
 - Stage a lowboy tractor with stretch trailer in closed lane so that it is prepared to be moved into lane 1 during the actual closure to receive the chain.
 - Remove 1.125" diameter EIPS lifting cable from the tugger truck up through the snatch block and attach it to the lifting bracket as detailed on pages 2&3 by using the 1,000 lb tugger located on the machinery room floor or the top of the counterweight. Stray the 1.125" diameter cable using the 22k tugger.
 - Install 6-ton chain cable as needed to assist in removal of the top tube from the top mounting bracket.
 - Remove and retained run from the 6 top bracket mounting bolts one at a time to ensure the hardware can be removed during the 2-hour window.

- Chain removal procedure**
- Close roadway as outlined in the traffic control plans.
 - Move the lowboy and stretch trailer into lane one so that the back of the trailer is located directly under the balance chain to be removed.
 - Slightly lift the balance chain using the 22k truck mounted tugger to relieve the chain load from the top mounting bracket.
 - Remove the 6 existing top bracket mounting bolts and use the 6-ton chain cable as needed to allow the chain to hang plumb from the 22 ton snatch block.
 - Pay out the 22k truck mounted tugger cable to start lowering the balance chain. Stop the lowering procedure as soon as the mounting nuts at the top of the chain are lowered enough to clear the top mounting bracket.
 - Lash the top 3 links of the balance chain back to the 1.125" diameter lifting cable and rewire with a minimum of (2) 1/2" high strength 250 lb capacity zip tie per section of balance chain.
 - Pay out the 22k truck mounted tugger to lower the balance chain to the lowboy tractor and attached stretch trailer waiting on roadway below chain.
 - Rigid bottom end of chain to back end of the beam cradle on the trailer and back the tractor and trailer as required to completely lower the chain onto the trailer. Ensure that the chain does not interfere with the structural steel as it is being lowered to the roadway below.
 - Once the chain is completely lowered, use a secondary safety line to secure the 22k tugger line to the span to prevent it from traveling through the snatch block and falling.
 - Rig the 1,000 lb tugger located at the top of the tower to the 1.125" diameter cable using a double choked nylon strap per the DOT provided detail in the approved lifting cable plan near the snatch block.
 - Slightly lift the 1.125" diameter cable using the 1,000 lb tugger to allow the 22 ton snatch block to be split and remove the 1.125" diameter lifting cable and lower it to the roadway. The weight of the 1.125" diameter lifting cable = 700 lbs.
 - Rigid balance chain into beam cradle on stretch trailer and remove tractor and trailer from roadway.
 - Once the main lifting cable has been lowered to the roadway and pulled back into the tugger truck, single lane vehicular traffic can pass over the bridge.
 - Remove all hardware from bottom of machinery room area and move to next location
 - Repeat procedure until all 4 lift span side balance chains have been removed.

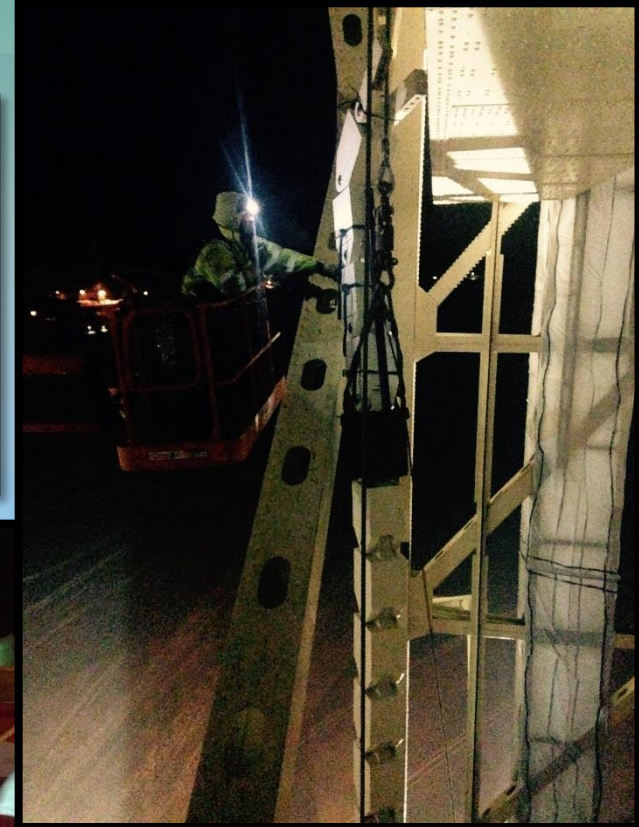
Job Title:	ZTI Job #: 504330
Houghton Hancock Lift Bridge repairs	State ID #: 118271A
	Bridge #: B01 of 31012
Page Title:	County: Houghton
Lift span side Chain removal details REVISED 2-11-15	Sheet #: 1 Of 4
	Date: 2/5/15
	Drawn By: DJS



Balance Chains Coming Down

Portage Lake Lift Bridge

- Balance Chain Removal



Portage Lake Lift Bridge

- Balance Chains Removal



Portage Lake Lift Bridge

- Balance Chains Reinstallation



Portage Lake Lift Bridge

- Upper machinery room - upgrades

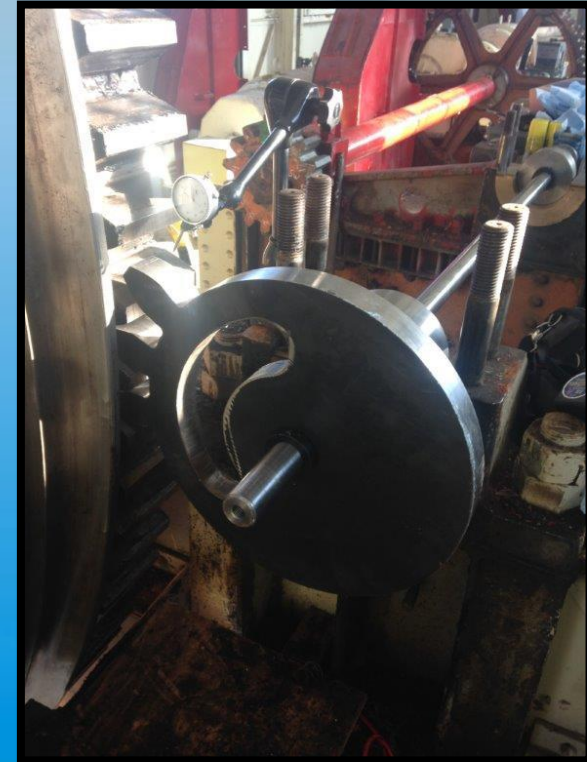
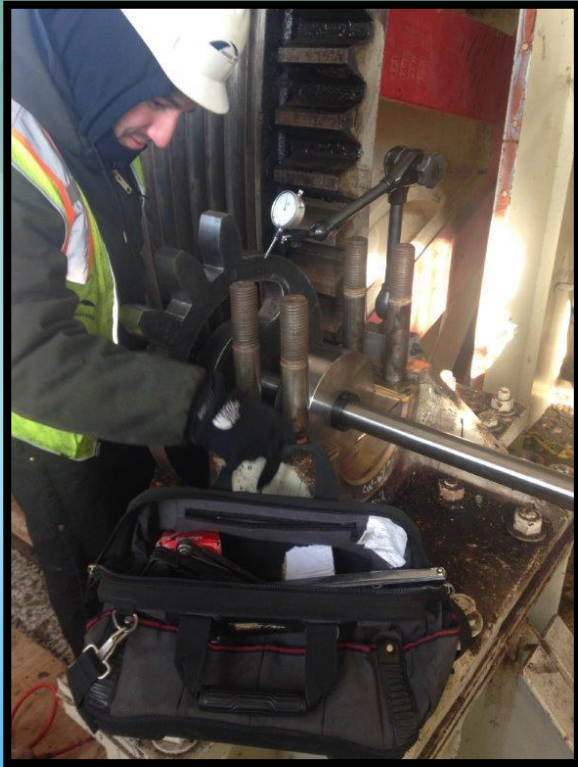


Portage Lake Lift Bridge

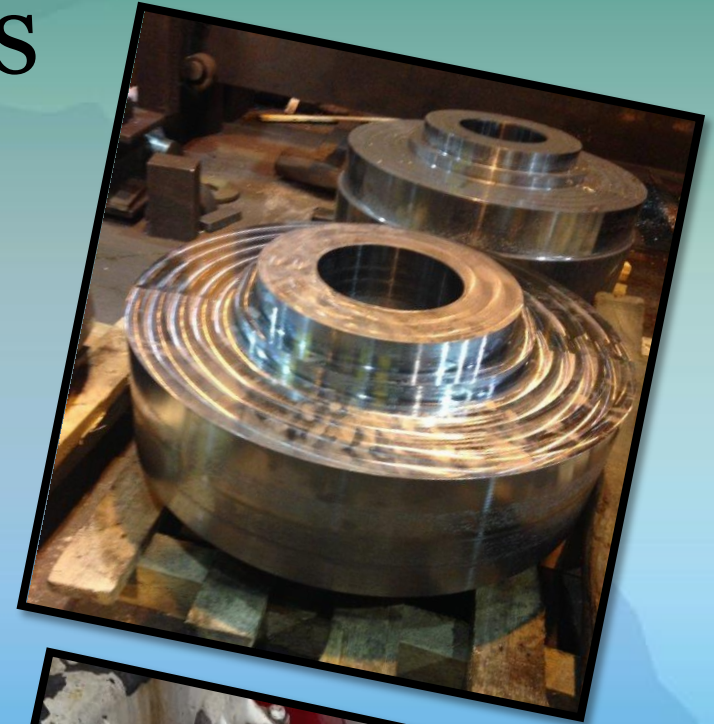
- Pinion gear and sheave



Backlash measurements



Upper machinery room - upgrades

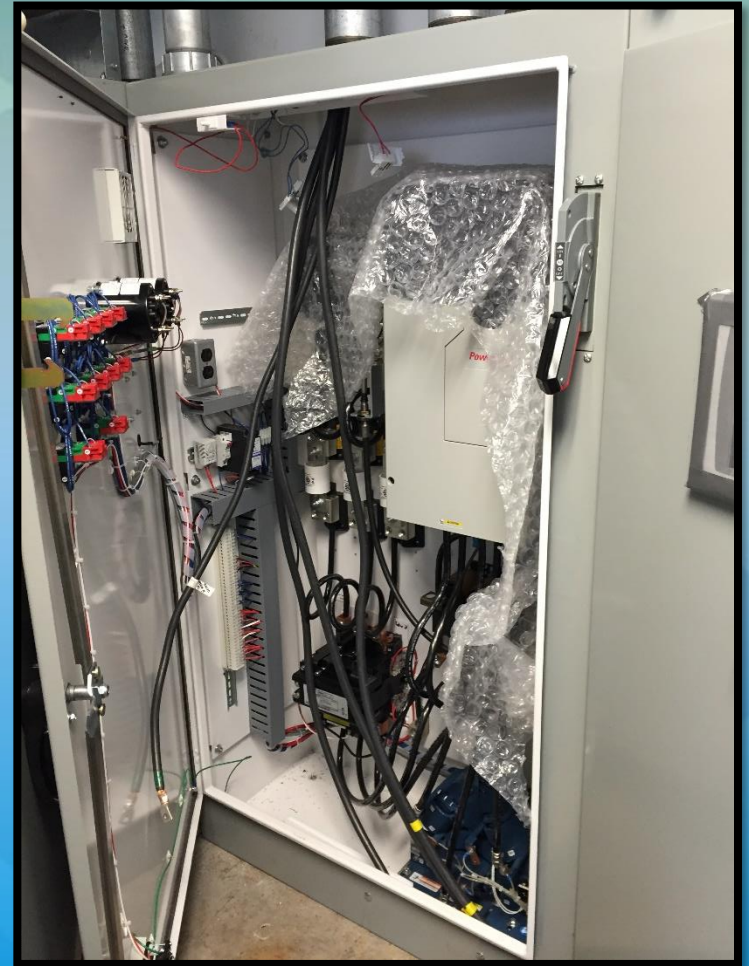
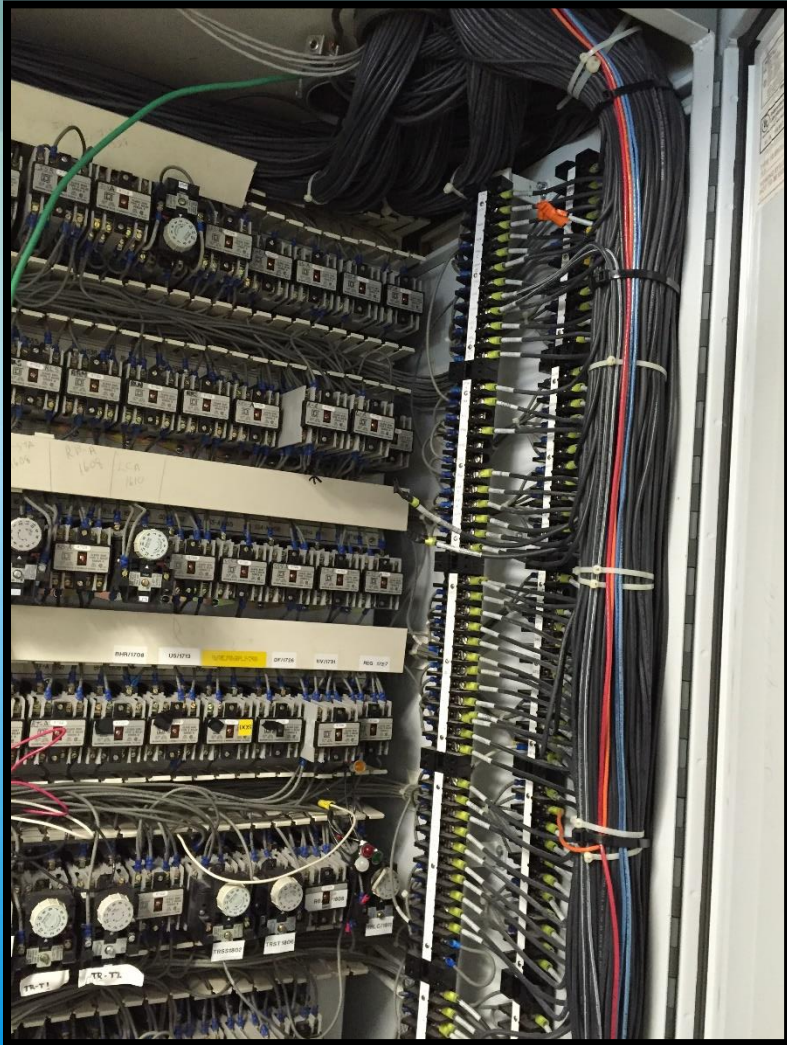


Portage Lake Lift Bridge

- Upper machinery room - upgrades



Motor Drive Replacements



Span Position and Speed Sensors



Shimming of Bridge Seats



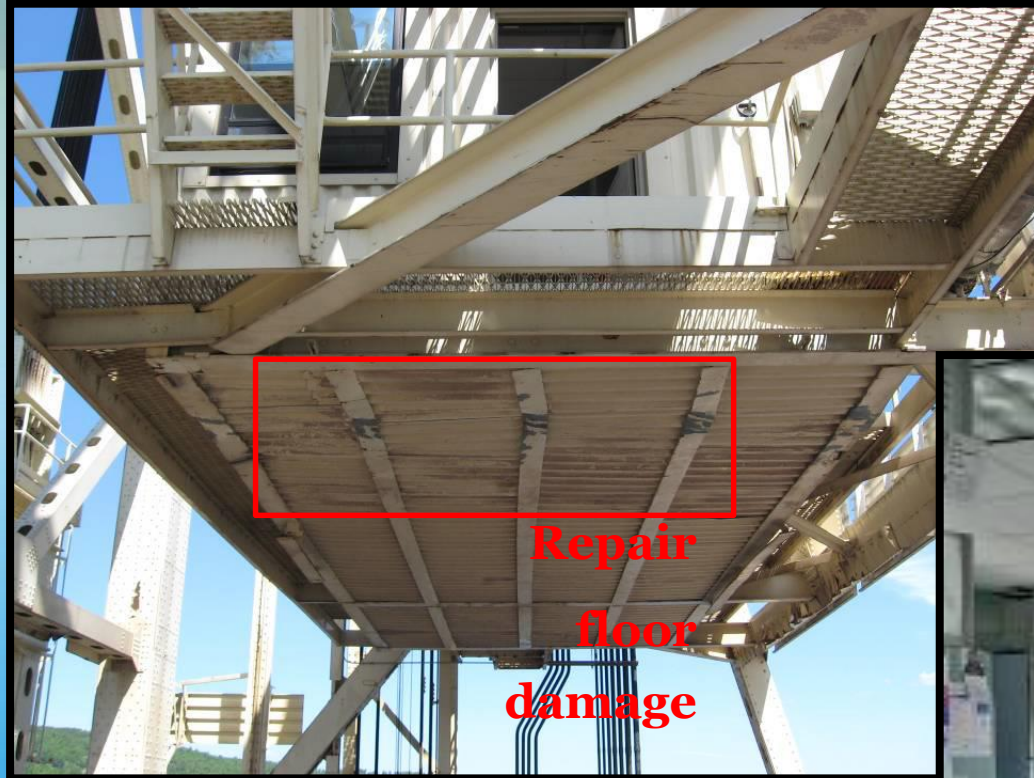
Final Adjustments

- Indexing adjustments
- Lower and Intermediate Bridge Seat shimming
- Adjustment of cable tensions (within each corner)
- Achieve equal load sharing
- Allow all corners to seat at same time
- Ensure automatic Skew control of Span during operation

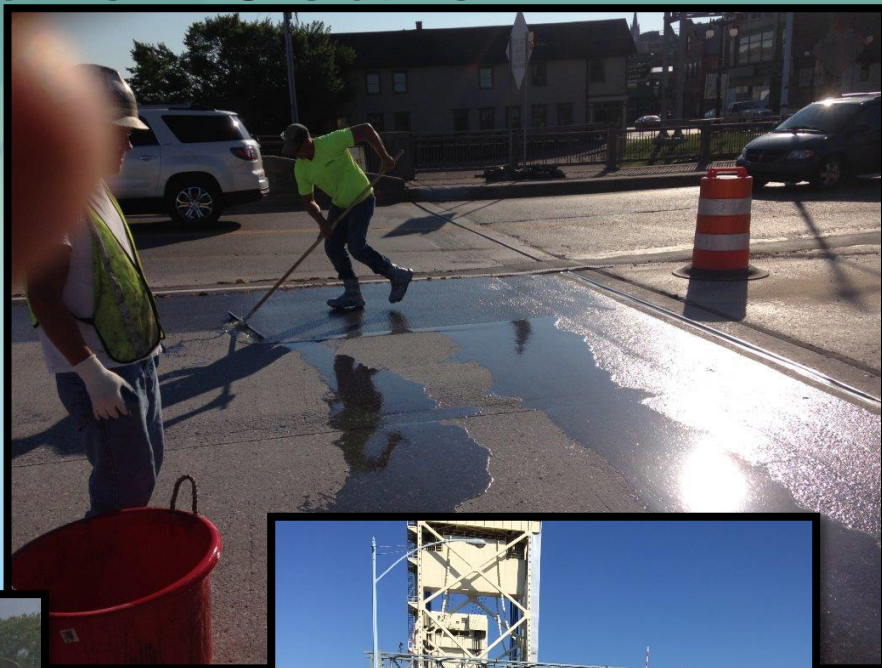
Barrier Gates



Operator House Repairs



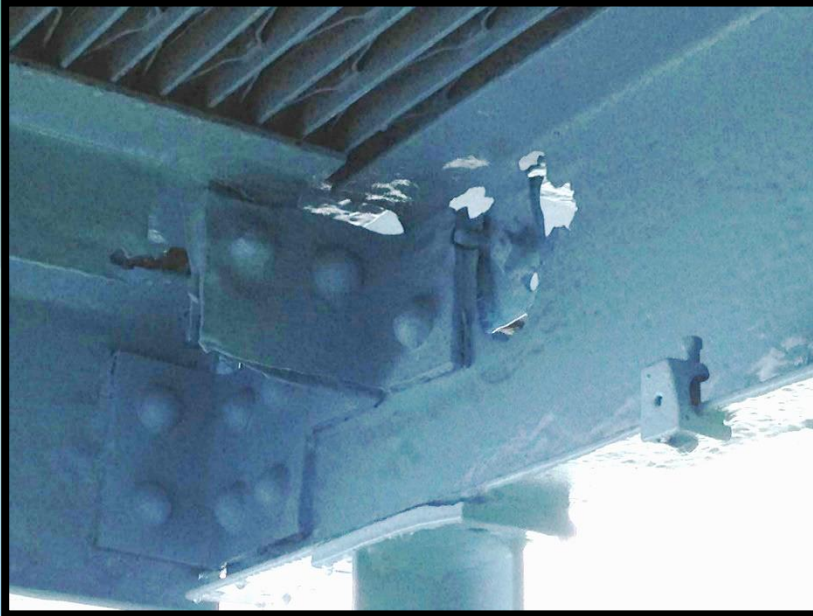
Deck Healer Sealer



Substructure Patching



Steel Repairs



Portage Lake Lift Bridge

- **Mobility challenge: bridge closures**
 - Two all-night closures: Jan. 17, 2015 and March 21, 2015.
 - Eight 2-hour closures: (2 AM-4 AM) February 2015
 - 168 intermittent 15-20-minute closures :
January-March 2015 , nighttime (7 PM-6 AM)
 - Eight 2-hour closures : March 2015,
(2 AM-4 AM)



Average Daily Traffic

- **Portage Lake Lift Bridge – 24,900**
- Ambassador Bridge – 19,500
- Blue Water Bridge – 15,400
- Mackinac Bridge – 10,100
- International Bridge – 5,800



Imagine if you couldn't get home
to your kids ...



... or if your kids couldn't get home to you.



Communications challenge

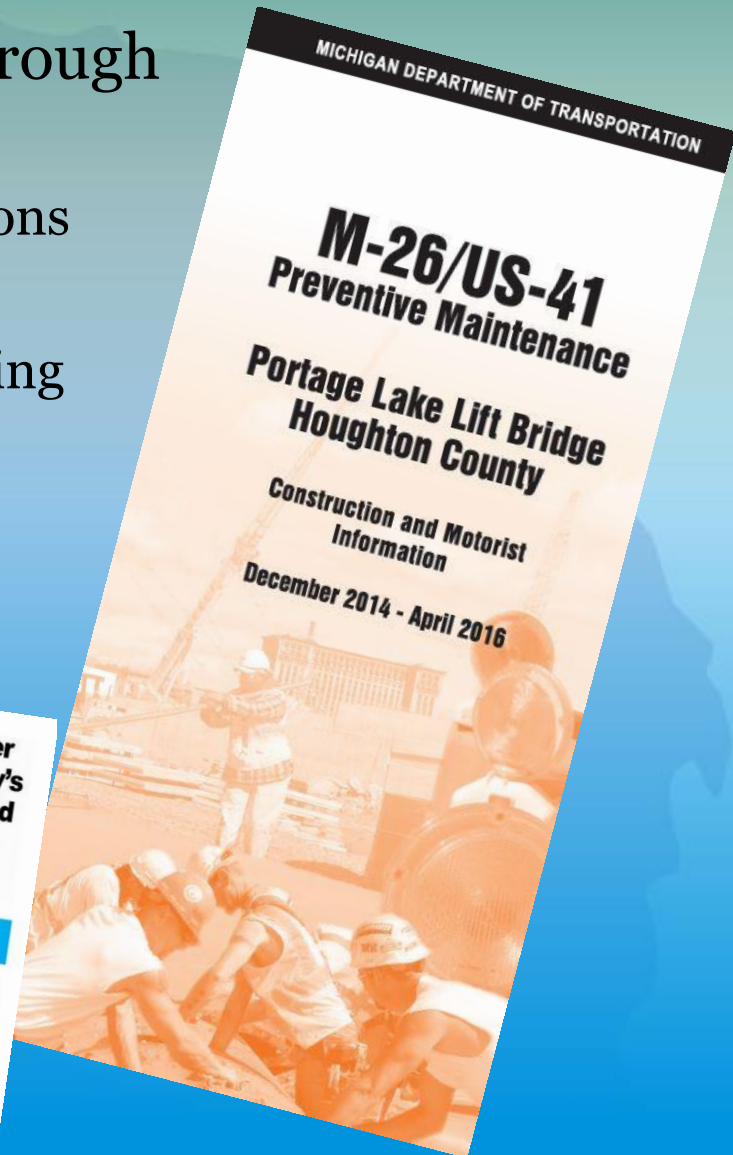
- **Issues surrounding bridge closures:**
 - Police, fire and ambulance access
 - Airport and bus schedules
 - Universities and schools – academic and sports calendars
 - Busy winter tourism season
 - Snowmobile access
 - Road maintenance and Emergency utility crew staging
 - Logging
- **How do we engage all of the stakeholder groups to coordinate bridge closures?**
- **How do we make sure all of them stay informed during the project?**

Communications challenge

- Stakeholder Engagement
 - Communications working group organized very early on – in May, 2014 – to discuss issues. Ongoing monthly meetings with:
 - Area emergency personnel
 - Law enforcement
 - Hospitals
 - Utility companies
 - Airport and transit officials
 - Schools
 - Sports organizations
 - Local units of government
 - Businesses
 - Researched area events calendars to identify quietest time periods

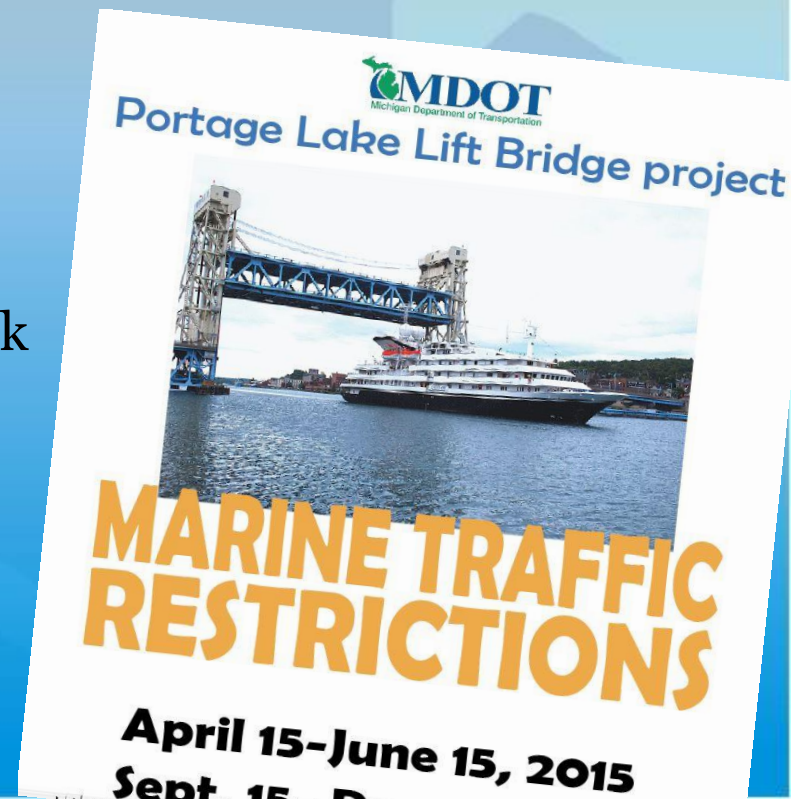
Communications Solutions

- We got the message out through traditional means:
 - Newspapers, TV, radio stations
 - Public meetings
 - Presentation to a joint meeting of the Hancock and Houghton city councils
 - Project Brochures



Communications Solutions

- We also used many other methods:
 - Digital message boards
 - 16 total DMS boards
 - Blanketed area around bridge
 - Even placed signs on snowmobile trails
 - Posters at marinas for maritime traffic info
 - Animated presentation at Houghton County Fair kiosk



Communications Solutions

- Short-range AM radio for closure alerts
- Social media: MDOT_UP twitter feed and statewide Facebook posts



Communications Solutions

- Project specific email list:
 - About 130 people from our working group, area schools, hospitals, government officials, transit organizations, businesses, interested citizens
 - Gathered names from working group, but also at public meetings
 - Sent them all official press releases and notices
 - Targeted high-level people in each organization who then spread the word internally

Communications Outcomes

- **Things we did:**
 - Developed 911 procedures
 - Coordinated all-night closures with area events
 - Scheduled 2 AM- 4 AM closures based on communications with key players
 - Provided for emergency ramps
 - Arranged hospitality rooms for motorists

Communications Outcomes

- **Things others did: Exceptional buy-in from many stakeholders**
 - MTU did its own poster and information campaign
 - Airlines made flight adjustments
 - MTU Hockey game times were adjusted
 - Cities provided extra police coverage at bridge during closures



Communications successes

- Message has been delivered

And so it begins: Massive bridge project starts today

January 5, 2015

By KURT HAUGLIE (khauglie@mininggazette.com) , The Daily Mining Gazette

Save | Post a comment |     

HANCOCK/HOUGHTON - Although a few baseline measurements were taken in mid-December, the main work for the maintenance project on the Portage Lake Lift Bridge began today.

Al Anderson, Michigan Department of Transportation project manager, said workers from contractor Waukesha, Wis.-based Zenith Tech worked on getting the bridge ready for the removal of the lift cables.

The workers were setting closure of the southbound lanes on the bridge to allow access to the lift cables.

Article Photos



Kurt Hauglie/Daily Mining Gazette

"They have to do some modifications where cables connect to the lift span," he said.

Workers will also be preparing to jack up the lift span, which will be required for the project.

No problem

Portage Lake Lift Bridge closure goes off without incident

January 19, 2015

Dan Roblee (droblee@mininggazette.com) , The Daily Mining Gazette

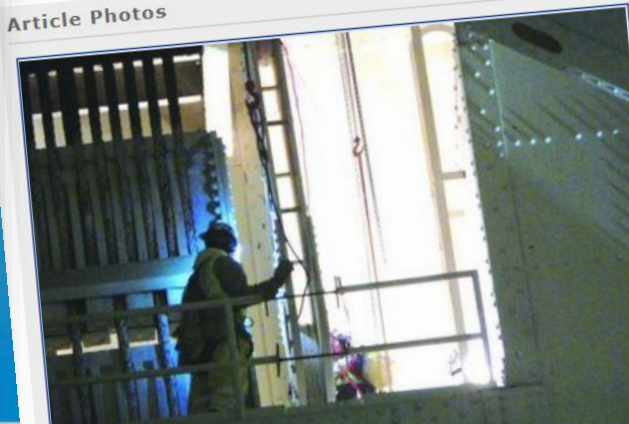
Save | Post a comment |     

HOUGHTON/HANCOCK - The Copper Country made it through Saturday night's planned closure of the Portage Lake Lift Bridge without any major incidents, and only a handful of people were trapped on the wrong side of the Portage Waterway.

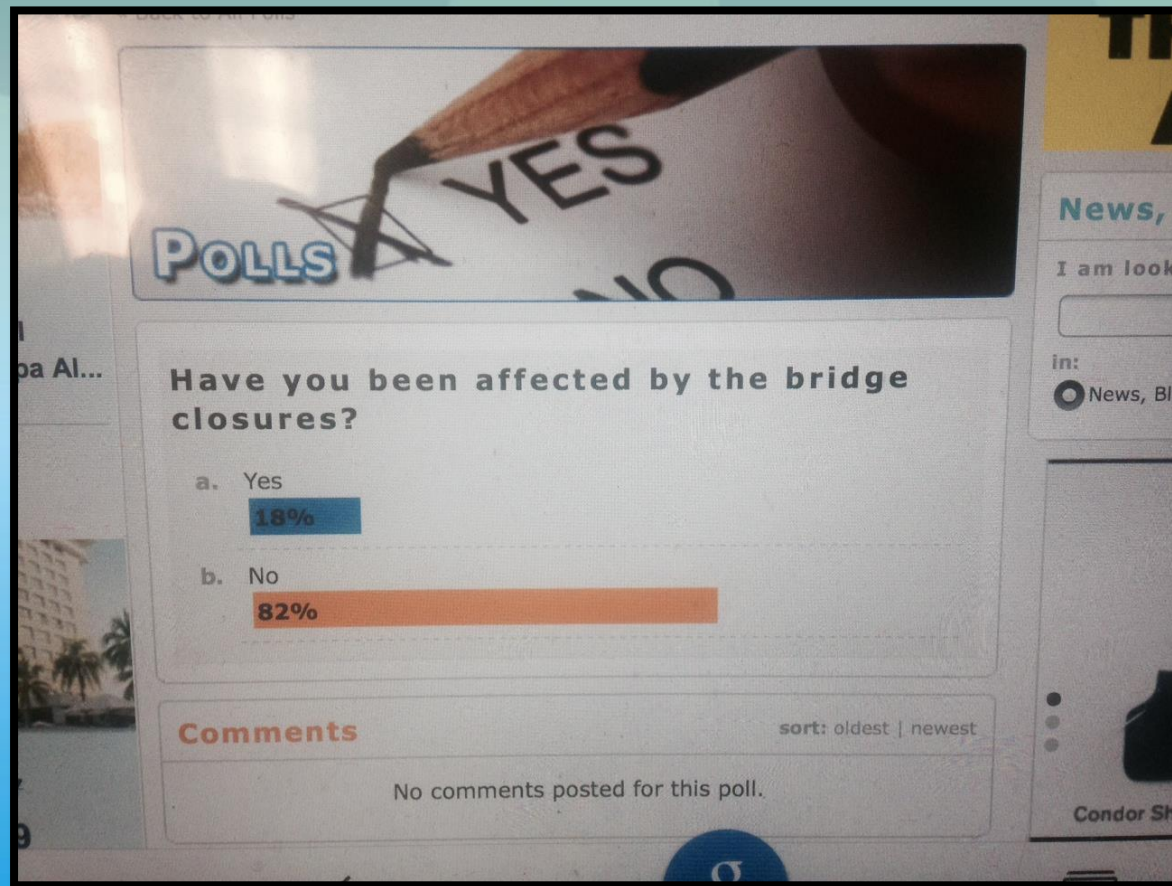
Despite blustery winds and some snow, all planned work was completed and the bridge reopened over an hour ahead of schedule.

"The main goal was to release the lift cables from the span and they did that," said Michigan Department of Transportation Project Engineer Al Anderson. "The wind didn't cause any issues - we didn't know if it would or wouldn't."

Article Photos



Happy Customers!



Portage Lake Lift Bridge

QUESTIONS?

