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US Army Corps of Engineers
Detroit District

Great Lakes Update

Winter Work at the Soo Locks

The world-famous Soo Locks (Figure 1) have a rich history spanning 150 years. Ever since the steamer Illinois first passed through on June 18, 1855, the locks have played an important role in America's growth. Today the Soo Locks are one of the busiest and largest lock complexes in the world, able to handle 1,000-foot freighters and well over 7,000 vessels per year.

Much needed maintenance was performed at the Lock Complex this year, including major work on the Poe Navigation Lock. This effort is part of a dedicated six year plan to recapitalize and modernize the lock system at the Soo. Upon completion, these efforts will enable the lock to continue its long history of serving navigation and commerce on the Great Lakes.

Figure 1: The World Famous Soo Locks

The St. Marys River is the only water link between Lake Superior and the other Great Lakes. There is a section of the river known as the St. Marys Rapids where the water falls about 21 feet from the level of Lake Superior to the level of Lakes Michigan-Huron. The rapids form a natural barrier making navigation in the area impossible without the locks.

As the United States grew in the early 1800s, the state of Michigan lobbied the Federal Government to support building a canal and locks at Sault Ste. Marie. The state did not receive support right away. In fact, one southern senator said that Michigan's Upper Peninsula (U.P.) was "beyond the remotest settlement of the United States" and building a canal there would be like placing one on the "moon." Minds quickly changed upon the discovery of iron ore and copper in the western U.P. The raw minerals needed to be shipped to industrial centers in the southern Great Lakes but because of the rapids, they needed to be portaged, costing companies both time and money.

Currently the Soo Lock complex is made up of 4 navigation locks, the unused Sabin, the seldom used Davis and the heavily used MacArthur and Poe Locks. The MacArthur is the smaller of the two measuring 800 feet long and 80 feet wide. The larger Poe Lock is 1200 feet long, 110 feet

wide and has a water depth of 32 feet. It is the only lock on the Great Lakes able to accommodate a 1000-foot freighter.

Each year, on or around January 15, navigation on the Great Lakes comes to a halt, largely due to the closing of the Soo Locks. It is necessary to combat problems associated with ice cover and for environmental concerns in the St. Marys Rapids. This closure time is used to inspect and perform rehabilitation on the navigation locks.

On January 16, 2007, an extensive rehabilitation project began on the Poe Lock. Major repairs were made to one of the lock gates, which had been "jumping" when returning to its recessed position. Divers were called in on several occasions during the year to grease the mechanism the gate rotates on. The grease seemed to only temporarily ease the severity of the jump and it was determined that more extensive work needed to be done. Other work included repair of the filling and emptying valves and many other routine inspections.

Preliminary Work

In order to get the needed heavy equipment over to the Poe Lock center pier, a bridge barge was put in place to create a temporary road over the canal just upstream of the MacArthur Lock. Once installed, the bridge accommodated heavy equipment such as cranes and trucks.

A large temporary tent (Figure 2) was installed this year to create a climate controlled environment for workers. It turned out to be very beneficial as temperatures plunged to sub-zero readings during much of the work. Blizzard conditions also would have made much of the work impossible without the tent.

Figure 2: Tent enclosing the upper gates on the Poe Lock.

Dewatering the Massive Lock

Before much of the work began on the lock, it was dewatered. This is accomplished by installing a temporary wall just upstream of the upper lock gates to stop the flow of water into the lock. This wall is made up of several large steel structures called stop logs (Figure 3). When stacked, the stop logs act as a temporary dam, preventing water from passing. The stop logs were installed using permanent cranes located at the upper end of the lock complex.

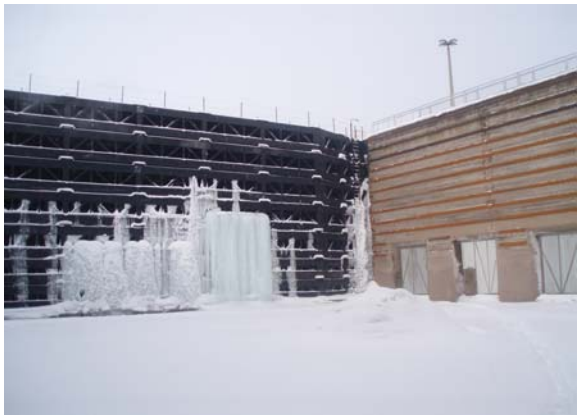

Figure 3: View of the stop logs from the bottom of the dewatered Poe Lock. The stop log structure is approx. 60 feet in height.

Pumps and gravity were used to empty the lock chamber and the guard gates on the downstream end of the chamber were closed to keep water from entering. Divers (Figure 4) then "oakum" the stop logs and guard gates. Oakum is a fibrous material that is fed into gaps that may allow water to spill into the empty chamber. Once the gaps were filled with the oakum, two nearly water tight seals were formed at each end of the lock.

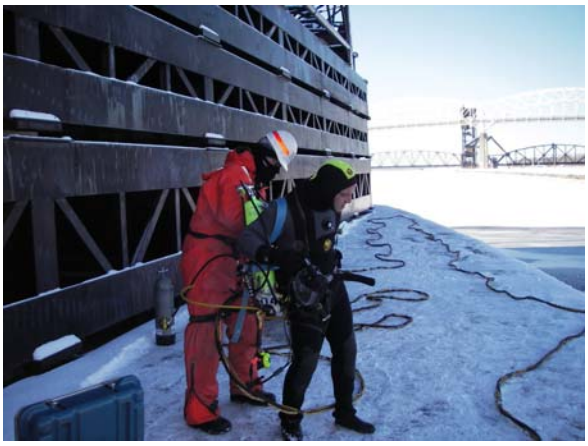

Figure 4: Diver preparing to enter the water
Note the massive stop logs behind the men.

Repairing the Gate

After dewatering, the work on the gate began. One of the first tasks was to lift the gate in order to inspect and remove the mechanisms that operate it. The gate opens and closes by rotating on a pintle. A pintle can best be described as an upright pin or bolt used as a pivot. The cause of the gate "jumping" was damage to the pintle system. To lift the massive gate, a special set of jacks was used to slowly elevate it. Once the gate was high enough, the parts of the pintle system that could be removed were taken out for inspection (Figure 5). Permanent parts were inspected in the tent structure.

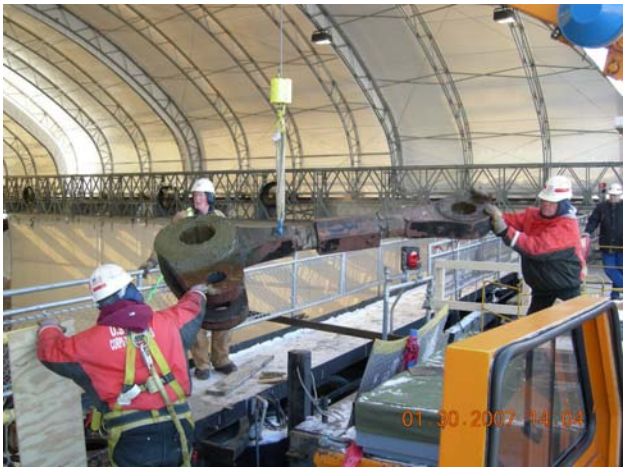

Figure 5: Workers removing part of the gate pintle mechanism in the tent structure

The base of the pintle is permanently embedded in the concrete making up the lock. It was found that parts of this base had considerable wear. This wear was the main cause of the gate "jumping." The excess wear allowed the gate to move more than it should. Weld was applied to the areas in question. The parts of the pintle that were removed for inspection were found to have many cracks. These cracks were repaired and the parts were reinstalled (Figure 6).

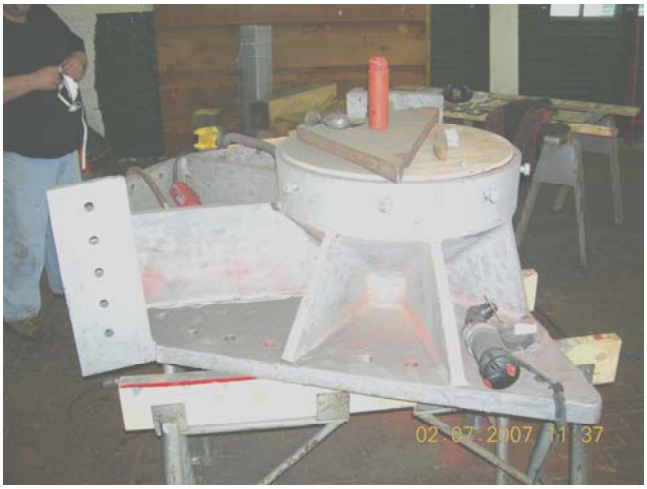

Figure 6: Pintle mechanism in the weld shop

One of the most important tasks involved in getting the gate back in working order is stressing it. This process confirms that the gate components are correctly installed and that the

gate swings properly. After proper stressing the gates can be returned to working order.

Repairs were made to sections of concrete around the lock gate. A number of bolts were tightened and replaced and routine welding was performed. The hydraulic components used to open and close the gates were inspected and the hydraulic fluid was filtered.

Repairing the Valves

The Poe lock is filled and emptied using four large valves, operated using hydraulic systems. Repairs to the valves included the replacement of holding bolts and bracing of the trunnion arms. A trunnion is the pin on which the valve cover rotates. The hydraulic systems were inspected the hydraulic fluid was filtered. No other major maintenance was needed on the filling or emptying valves.

Return to Business

After the work on the Poe Lock was completed, the task of removing the heavy equipment via the bridge barge commenced. The tent and support structure was removed and the stop log structure was pulled from the canal. The stop logs were removed on March 15, 2007 and the Poe Lock chamber was flooded and made ready for vessel traffic. Navigation season opened at the Soo Locks on March 25, 2007 at 12:01 AM.

The first vessel through the refurbished Poe Lock was the bulk carrier Roger Blough of the U.S. Fleet. The Blough was down bound for Gary, Indiana with a load of taconite pellets. It is estimated that approximately two dozen vessels utilized the Poe during the first few days of the navigation season (Figure 7).

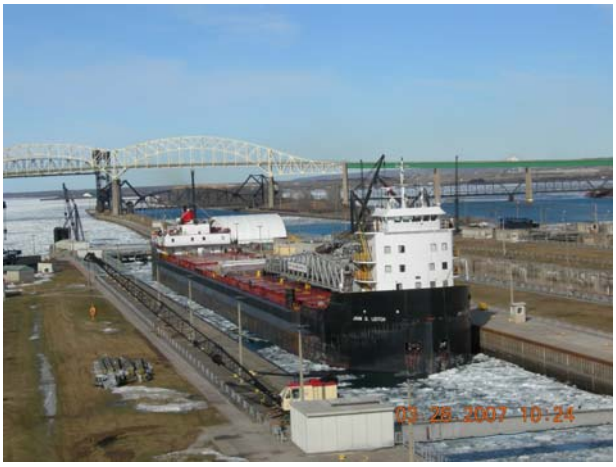

Figure 7: Vessel John D. Leitch downbound in the Poe Lock, March 28, 2007.
Photo Credit to Carmen Paris SAO

Public Meetings

The Lake Superior Board of Control will hold its annual public meeting in July in Sault Ste. Marie, MI. Details on the location and times have not been finalized and can be obtained from John Kangas at (312) 353-4333 or David Fay at (613) 938-5725.

The International St. Lawrence River Board of Control will hold its annual public meeting the evening of June 19 in the Brockville, Ontario area. Details on the location and times have not been finalized and can be obtained from John Kangas at (312) 353-4333 or George Cotroneo at (716) 879-4278.

The International Niagara Board of Control will hold its annual meeting with the public the evening of September 12 in the Fort Erie, Ontario area. Details on the location and times have not been finalized and can be obtained from John Kangas at (312) 353-4333 or Len Falkiner at (905) 336-4947.