Belleville Locks & Dam
Main Chamber Dewatering

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BUILDING STRONG®

Project Background

- Location: Huntington District, Ohio River mile 204 from Pittsburgh
- Operational Dates: Locks 1965 and dam 1968.
- Normal Lift: 22’
- Locks: Two parallel locks, main lock 110ft by 1,200ft, auxiliary lock 110ft by 600ft, miter service gates, bulkhead emergency closure.
- Dam: Non-navigable, high-lift, gated dam, top length 1,206ft, including 8 tainter gates and 189-foot fixed weir with 130-foot open crest.
- 2012 Commercial Cargo Lockages: 3,553. National Rank: 40.
- 2012 Tonnage: 42 M ton. National Rank: 16.

Project Layout

Scope of Work

- Dewater & inspect main chamber gates
- Replace upper & lower miter & quoin contact blocks.
- Install & weld stiffeners for miter gate bay windows.
- Repair air lines and j-seal as required.

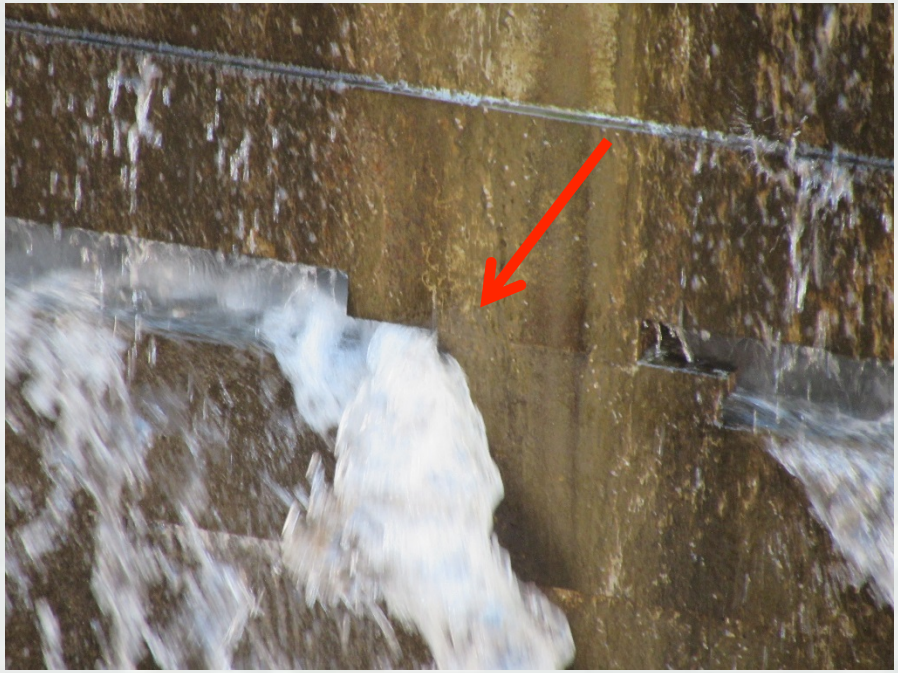
Setting Bulkheads

- LRH divers and dive supervisors were utilized in setting the bulkheads due to dive procedure differences between the two districts.

Pump Out

- The chamber took a little longer than normal to pump out because of unforeseen shore power issues causing pump malfunctions and the new bulkheads had leakage.

Olmsted Bulkhead Leakage

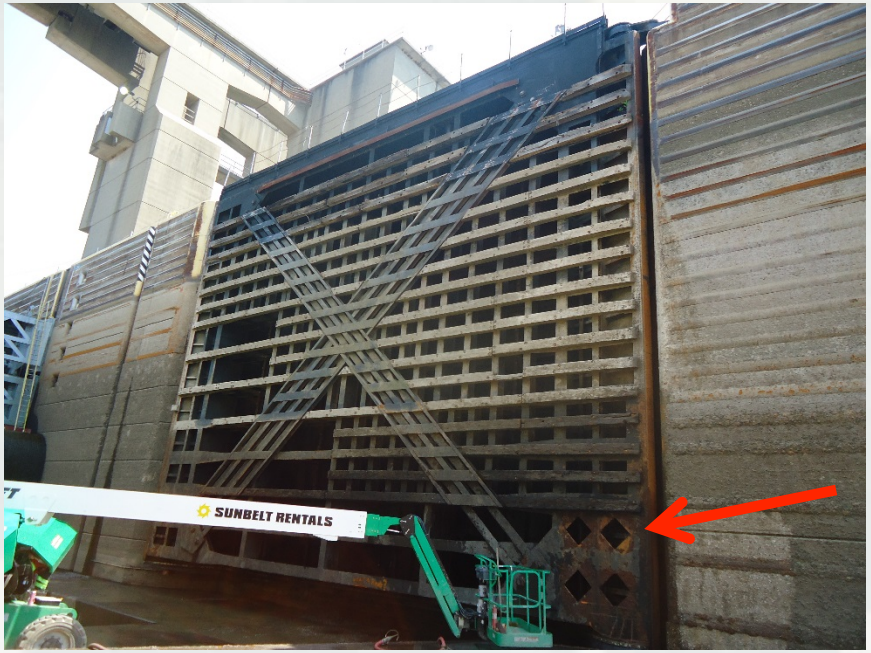


- The new bulkheads had a design oversight and they need to be lined up within a couple inches from the rest of the stack.
- The Contractor at Olmsted found out the hard way and spent quite some time trying to dewater.
- Leakage at Belleville was manageable.

Olmsted Leakage Solution

- Olmsted contractor sealed the area with plywood.
- It is possible to stack the bulkheads tight to one wall keeping them aligned resulting in no leakage.
- This is a warning for R3F, LRL, & LRH!!

Miter Gate Window Stiffeners



- A total of 8 window stiffeners designated per gate leaf.
- 4 at the quoin on the upstream side and 4 at the quoin on the downstream side, 32 window stiffeners total.
- Stiffeners were ¾” thick with complete joint penetration welds.

Upper End Window Stiffeners

The existing window stiffeners were creating numerous cracks due to stress concentration and weld imperfections.

Upper End Window Stiffeners

- The existing window stiffeners were removed and new stiffeners were welded in.

Lower End Window Stiffeners

- The Lower End did not have existing stiffeners and there were very few cracks around the windows. This saved approximately 4 days of welder work removing stiffeners and repairing cracks.

Miter Gate Window Stiffeners

- In total there was roughly 250’ of ¾” double bevel groove weld.
- This took approximately 6 men 33 days to prep the windows, repair cracks, fit the stiffener, and weld.
- With such a time consuming process, it would be beneficial to look at other options to reduce stress in the quoin areas of the gate leafs.

Miter/Quoin Block Replacement

- Miter & Quoin Blocks were scheduled to be replaced on both the upper and lower miter gate.
- During the initial inspections of the chamber being dewatered, the upper gate pintle bushing showed signs of wear.
- Both upper gate leafs had dropped at the toe 7/8”.
- Approximately 3/16” to a 1/4” gap was between ball and bushing on the unloaded side.
- All grease would run out the unloaded side of the bushing on the upper gate leafs.

Upper End Miter/Quoin Block Replacement

- The bottom of the miter gate latching device was rubbing on the embedded latch.

Upper End Miter/Quoin Block Replacement

- The Upper River Wall quoin block had a 3/16” to 1/4” gap at the top tapering down.

Upper End Miter/Quoin Block Replacement

- The embedded & gate quoin blocks are showing wear.

Upper End Miter/Quoin Block Replacement

- Since the pintle bushings were not receiving grease on the loaded side, the bushings would continue to wear at a much quicker rate.

- The findings of the upper end were brought to the attention of LRD, the proposed fix was to jack the gates and change the pintle bushings.

- The schedule did not allow enough time to change pintle bushings so LRL would only change the blocks on the lower end.

Lower End Miter/Quoin Block Replacement

- It was determined that the lower end pintle bushings were previously replaced because the gates had jacking guide cutouts and the pintle bushings had return grease lines.

Lower End Miter/Quoin Block Replacement

- The contact blocks were out of tolerance with a large gap at the miter.
- The gates had to be adjusted further downstream to allow the gates to seal against the sill properly.

Lower End Miter/Quoin Block Replacement

- The large gap at the bottom miter was causing the gate leafs to twist under hydrostatic load causing a lack of bearing at the top.

Lower End Miter/Quoin Block Replacement

- LRH assisted LRL with equipment and personnel to pour zinc since LRL typically utilizes Nordbak or other epoxy materials to back the gate miter & quoin blocks.

Lower End Miter Block Replacement

Before

After

Additional Repairs Completed

- The diagonal protection steel was replaced along with 220’ of steel rub fender tubing.
- 20’ of buckled girder was cut out and replaced.

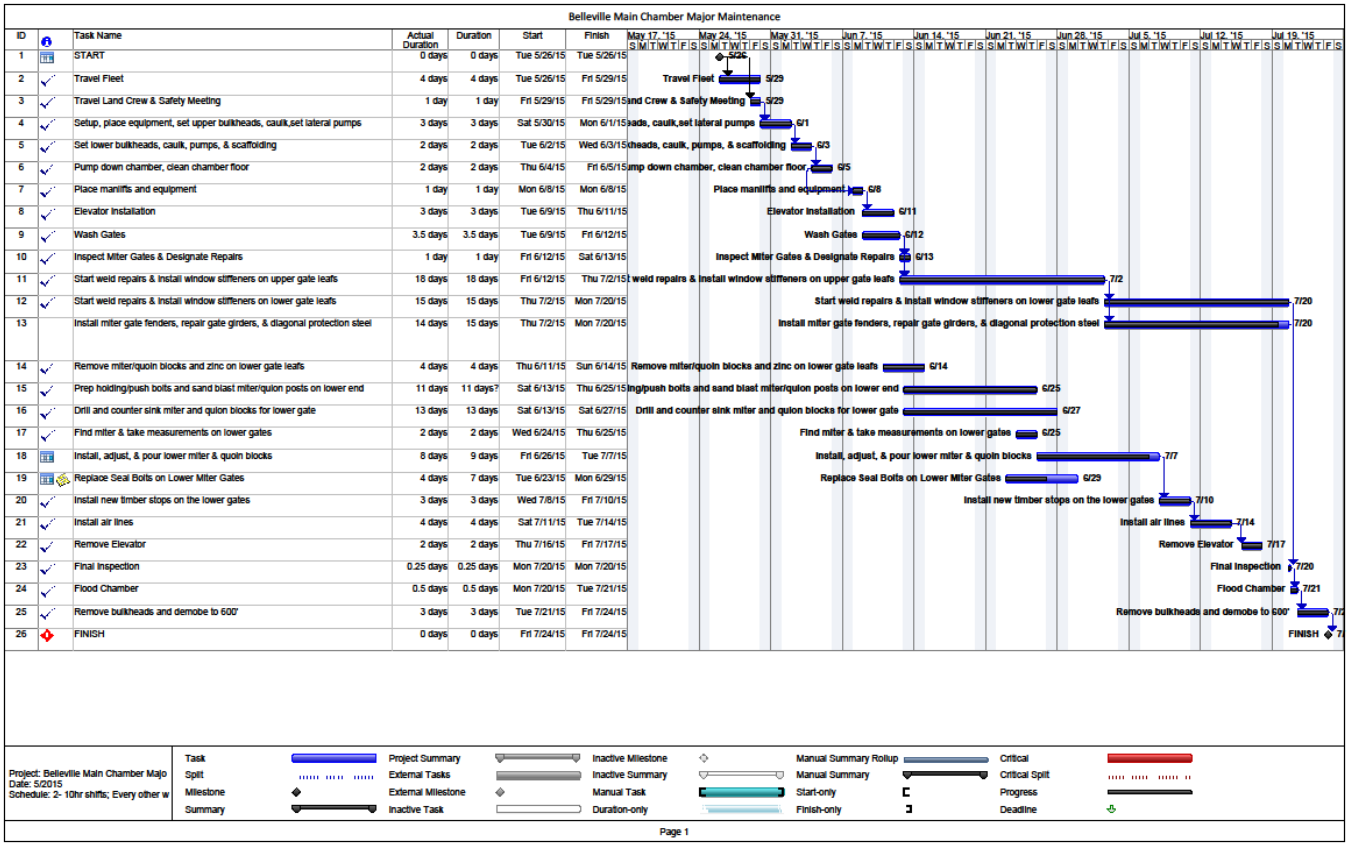
Additional Repairs Completed

- Repaired air lines at numerous locations.
- Rerouted and ran new airlines for the bubbler system behind all four gate leafs.

Additional Repairs Completed

- Replace timber bumper stops with rubber bumpers
- Repaired areas of j-seal and replaced all j-seal bolts.

Schedule & Costs



- LRL Plant and Labor: $1.9 million
- Duration: May 29th to July 24th, 56 days

After Action Review

- COMMUNICATION is KEY when working at an unfamiliar Lock & Dam project sites, and will continue to be vital during the transition to the R3F Reorganization.
- Early in the planning phase drawings & lock maintenance history should be provided for the project site.
- Prior to the arrival of the repair fleet the required HSS inspections should be completed in order to maximize maintenance time.
- Diving SOP's should be standardized and discussed during the pre-work meetings.
- Electrical Capabilities, dealing with small unforeseen issues takes time away from maintenance.
- Maintenance processes could be standardized.
  - If possible plan on changing pintle bushings when changing miter/quoin blocks.
  - Methods for minimizing stress at pintle.

Questions?