

L&D 52 Wicket Replacement

Keith Fleck

Project Engineer

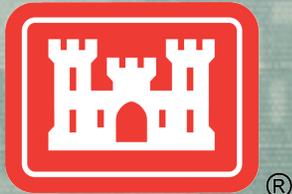
Louisville District

Presented by:

Craig Moulton

Mechanical Engineer

Louisville Repair Station



US Army Corps of Engineers
BUILDING STRONG®



Outline

- Lock History
- Missing Wicket Issue
- Options for Replacing the Wickets
- Poiree Panel Frame
- Wicket Replacement

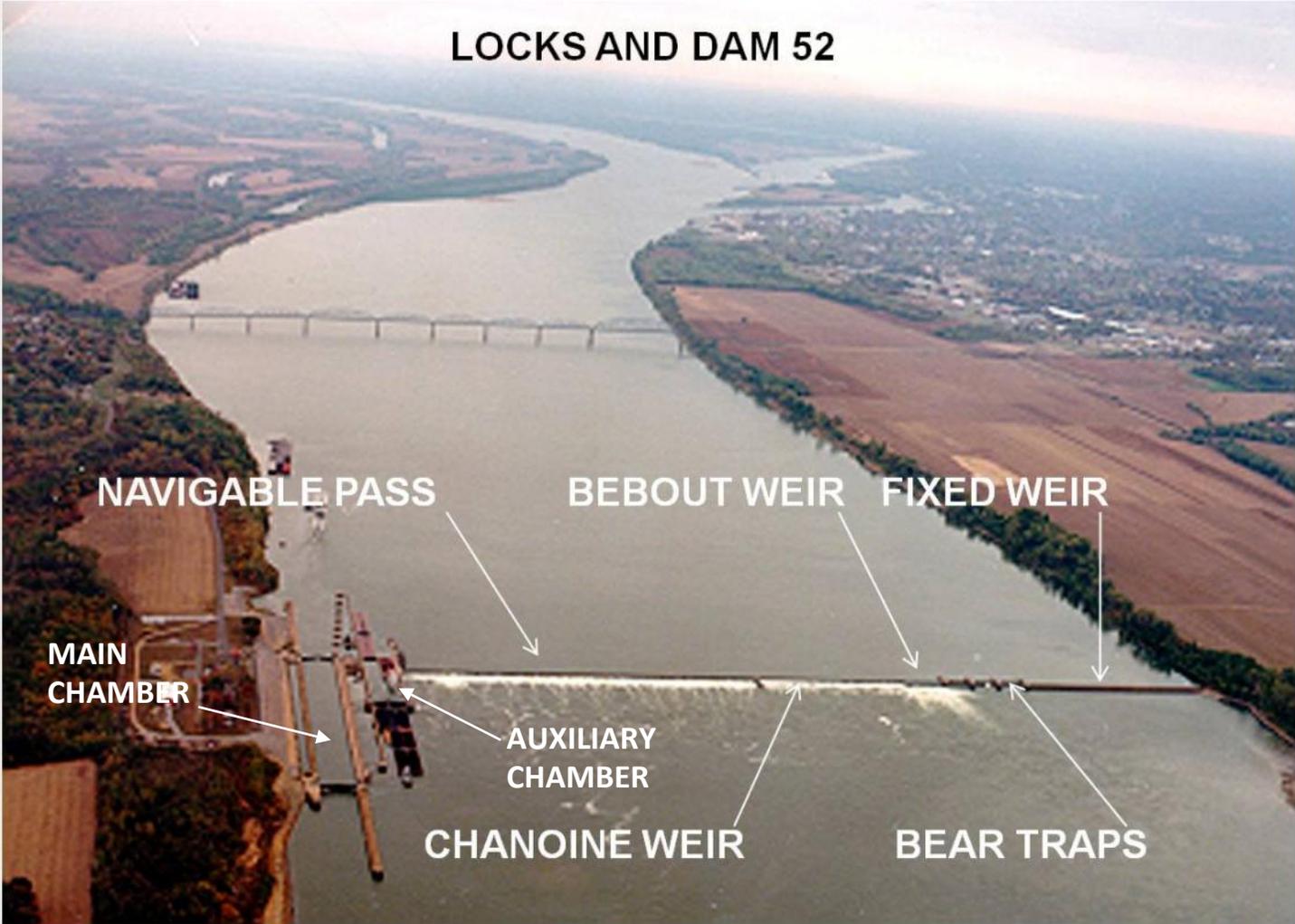


Lock & Dam 52 History and Facts

- The original 600' chamber was completed in 1929.
- The 1200' "Temporary" chamber was completed in 1969.
- The two locks operate an average of 40 percent per year due to river elevations overtopping the lock walls.
- The highest tonnage in the nation passes through L&D 52.
- The dam is constructed of navigable pass wickets, chanoine weir wickets, bebout weir wickets, 3 bear traps, and a fixed weir.
- Olmsted Lock & Dam will replace Lock & Dam 52 & 53, the last low lift locks on the Ohio River



Locks & Dam 52



52's Dam is assembled from Pass, Chanoine Weir, and Bebout Weir Wickets

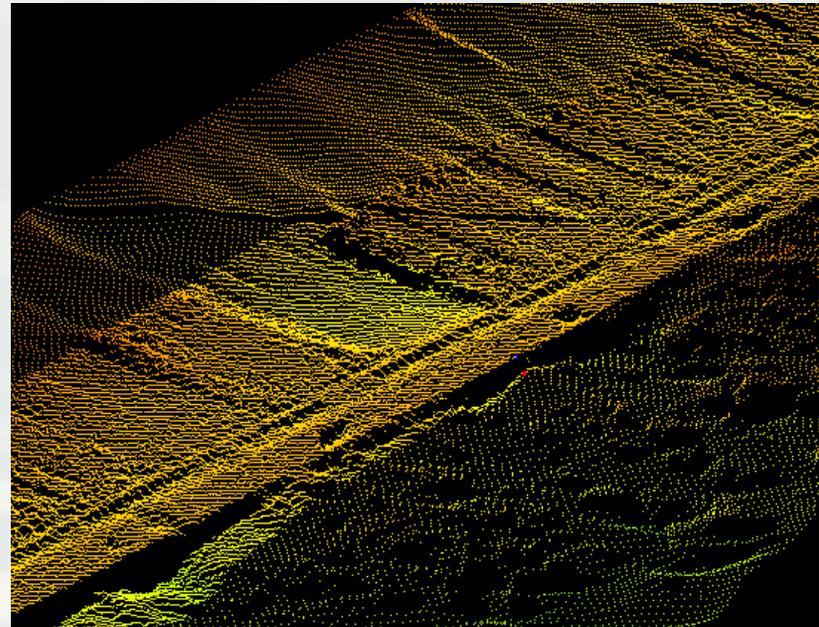
- Pass Wickets are 3'-9" wide x 19'-11¼" long x 1' thick.
- Chanoine Weir Wickets are 3'-9" wide x 11'-9" long x 1' thick.
- Wickets are made of four, 1' thick white oak timbers.
- A steam boiler winch barge and track hoe are utilized to raise and lower the dam.



BUILDING STRONG®

Missing Four Pass Wickets 244 thru 247

- When lowering the dam, two wickets came loose and floated downstream.
- This was in a location adjacent to two already missing wickets, creating a four wicket wide gap in the dam.



BUILDING STRONG®

Issues Four Missing Wickets Creates

- Lock and Dam 52 only has the capabilities to replace two wickets at a time with the dive deflector box when the dam is up.
- The Manuever Boat and Wicket Lifter can only pass across three missing wickets during raising the dam.
- This meant the wickets had to be replaced in open river before the dam has to be raised.



BUILDING STRONG®

Open River Wicket Replacement Options Considered

- Dive in open river when river velocities are very low and do not hinder the divers.
- Utilize the Olmstead Chain Curtain to slow velocities allowing the divers to replace Wickets.
- Sink a barge full of rock to create a cofferdam.
- Set Gravity Dam Blocks above the dam to slow velocities for the divers.
- Place large sand bags in the hole and wait until river velocities were low enough to replace the wickets.
- Set the Wicket Dewatering Box over the hole to allow the divers to replace the wickets from inside the box.



Wicket Dewatering Box

- It was decided to attempt to set the Wicket Dewatering Box over the 4 wicket hole.
- The LRS fleet would spud down and set the dewatering box over the hole.
- Lugs were welded on the upstream side of the box to attach mooring line leading back to the crane capstans. The mooring lines would hold the box in position from the force of the river pushing the box downstream during the setting.
- Setting the box has been performed when the dam was up, but not in open river dam down.



BUILDING STRONG®

Issues Encountered During the Attempt

- The fleet had to be positioned in a precise location close to the dam, because the crane only had the capacity to pick the box at a 70' radius.
- A total station was utilized from the bank to position the fleet and it would also have been used to position the box during setting.
- It was difficult to maneuver the fleet into position because the velocities increased greatly closer to the dam.
- The cross sectional area of the river was reduced by the dam, increasing the velocities.
- There was also a strong side current, created by the shallower weir wicket section of the dam making the river flow into the deeper pass section of the dam.
- The fleet managed to spud down twice, but as the spuds were tested by clutching in the tow boat, the spuds started to slide.
- It rained and the river rose allowing the dam to stay down for another month.



Lessons Learned & Alternative Options

- The fleet only had the capability to spud down and hold position further upstream from the dam, out of the high velocities.
- Anchors and winches would be needed to set the dewatering box at the tight radius.
- If wickets could be raised, a frame could be set on the wickets to block the flow for divers.
- The frame had to be light enough to set at least 60' upstream from the dam.



Frame Fabrication

- LRS started fabricating a frame that would be utilized with existing poiree panels.
- The T-beams and W-beams had to be utilized from materials at the repair station, since the lead time to procure the materials was too long with the short time frame.
- LRN trucked the beams from LRS to Smithland.



BUILDING STRONG®

Raising Wickets in Open River

- The LRS Fleet was spudded down upstream of the dam.
- The L&D 52 Maneuver Boat was hooked off the fleet and winched down to the dam.
- The wickets were then hooked and raised. This process is similar to raising the first 20 starter wickets.



BUILDING STRONG®

Setting Frame

- The frame was picked and leaned up against the wickets.
- Mooring lines connected to capstans were utilized in position the holding the frame from moving downstream.
- The rigging was unhooked from the frame utilizing a light boat.



BUILDING STRONG®

Setting Poiree Panels

- The poiree panes were guided with taglines and slide down in between the T-beams on the frame.
- The rigging was unhooked the same as the frame utilizing a light boat.
- A total of four poiree panels were set on the frame to close the gap between the wickets.



BUILDING STRONG®

Frame and Panels



BUILDING STRONG®

L&D 52 Replacing Wickets

- L&D 52 positioned the maneuver boat downstream of the wickets and dropped spuds.



BUILDING STRONG®

L&D 52 Replacing Wickets

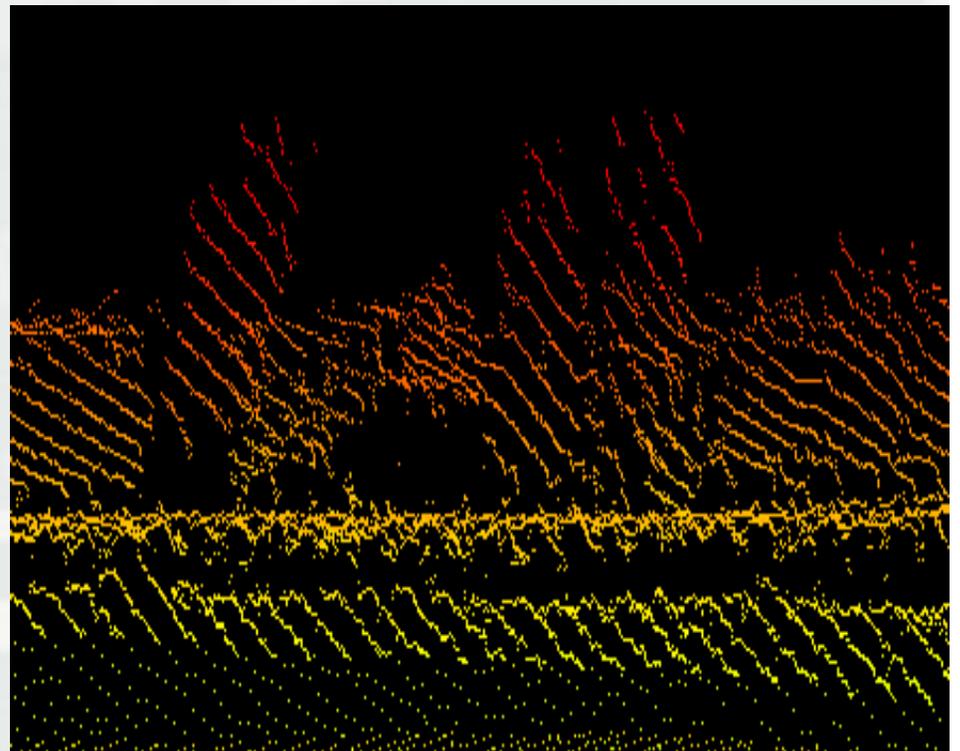
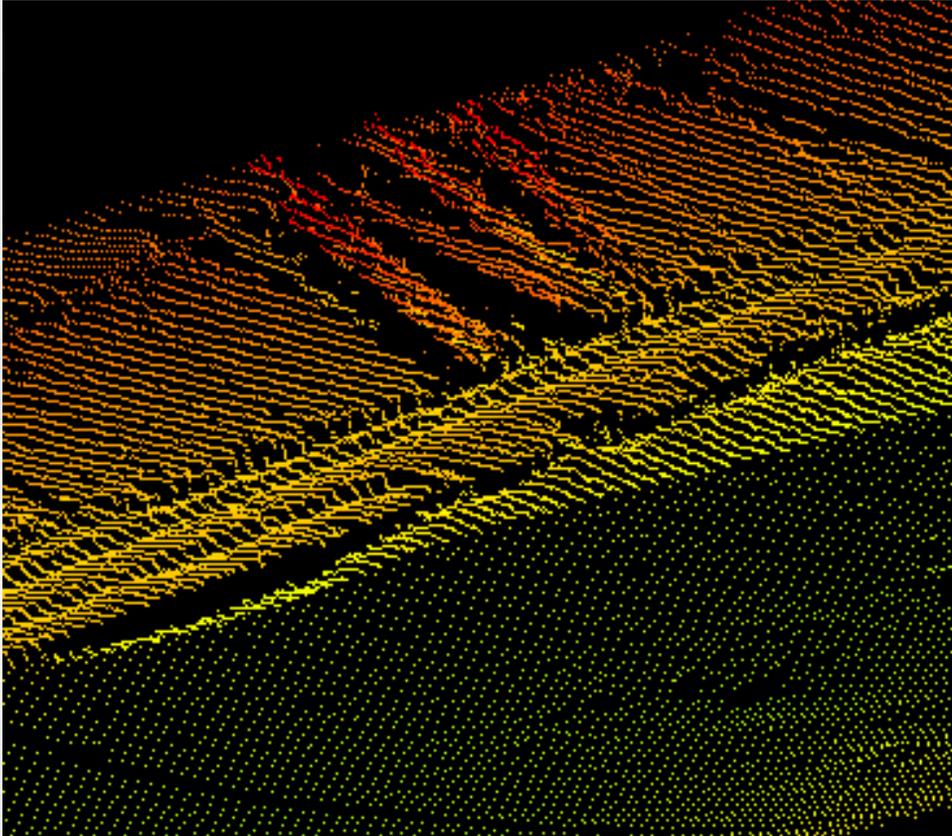
- Divers installed new horse boxes and positioned the new wickets.



BUILDING STRONG®

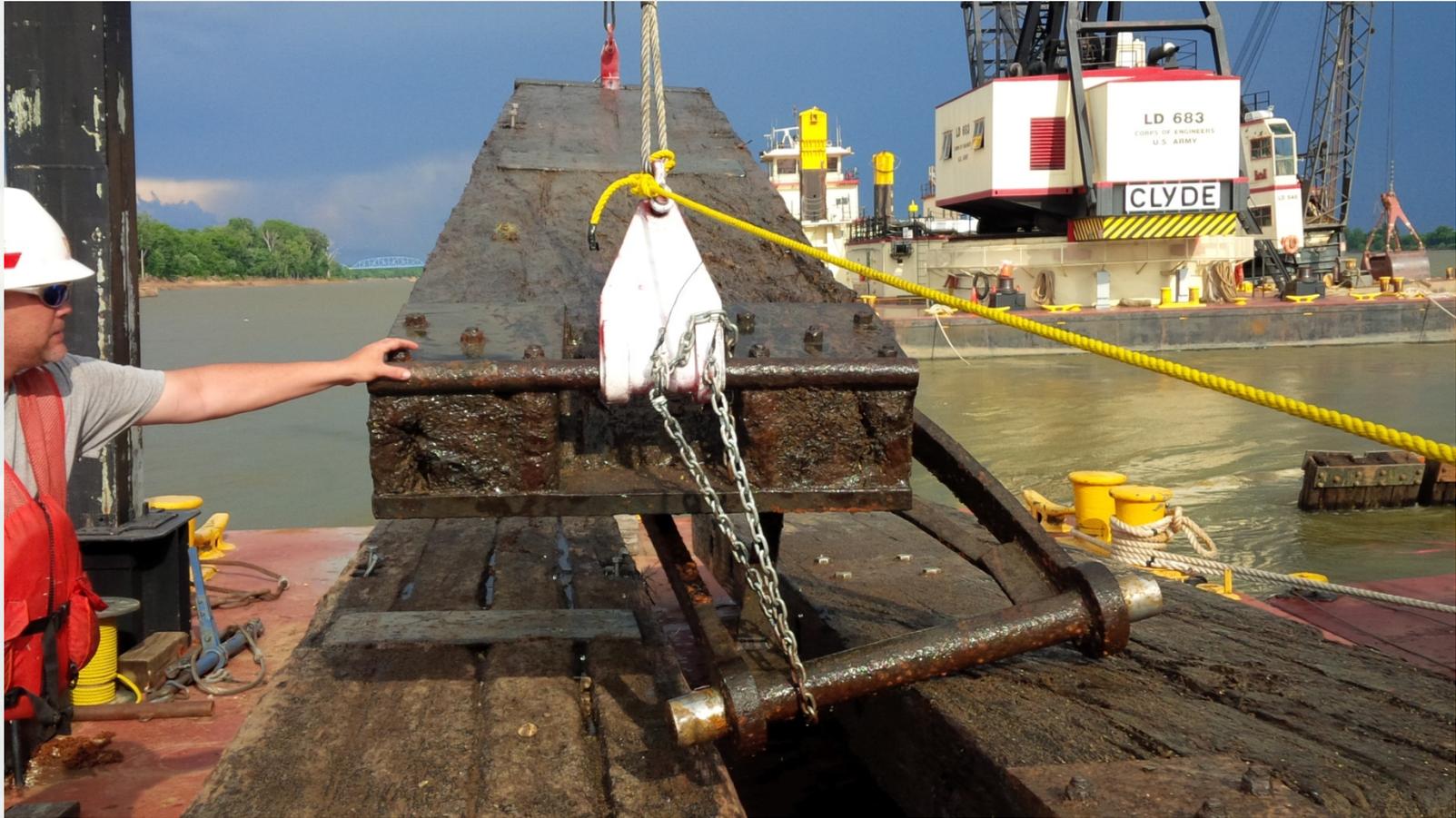
Wickets 50 thru 54

- The operation was utilized in replacing wickets in other trouble areas on the dam.
- Wickets 50 thru 54 were not missing, but they were not laying correctly and only wicket 53 was able to be raised.



BUILDING STRONG®

Wickets 50 thru 54



BUILDING STRONG®

Wickets 50 thru 54



BUILDING STRONG®

Conclusion

- Wickets 51-55, wickets 97-98, and wickets 245-248 were replaced over the length of the job.
- The frame was fairly inexpensive because excess materials were used to fabricate the frame and existing poiree panels were utilized to block the water.
- The poiree panel frame worked well because it weighed only 13,000lbs and the LD 683 could pick the frame flat out at a 160' radius. This kept the fleet back away from the dam out of the turbulent water.
- The frame has the capability to span 5 wickets if the conditions river conditions are right.
- The poiree panel frame has its limitations. It can only be deployed with a low gauge and low velocities because of rotational stability issues. The frame can not be set with the dam up, with a head pressure.



Any Questions??



BUILDING STRONG®