HYDRODEMOLITION—FORGET THE FLAT WORK

BY PATRICK WINKLER

In the world of hydrodemolition, large flat (horizontal) work projects are the bread and butter of the hydrodemolition business. Needless to say, these projects represent the primary use of hydrodemolition equipment.

Concrete removal, however, is a difficult task on structures where the removal must be performed on overhead and vertical surfaces. Typically, small chipping hammers (handheld breakers) are used to perform the concrete removal. Chipping hammers are not very productive and are tough on the operator. Vertical and overhead concrete removal is also more difficult as a result of access along with the actual location of the repair area on the structure. In addition, it is difficult to control dust when chipping concrete and with the implementation of the new silica exposure law, the need to find alternate methods to remove concrete will become more important.

A variety of hydrodemolition equipment is available to assist with overhead and vertical concrete removal. They range from hand lances for small detailed projects where access is limited to robotic equipment for large open areas such as bridge piers and dam faces. Hydrodemolition equipment can also be mounted on manlifts, capable of performing hydrodemolition at significant heights above grade.

BLANCHETTE BRIDGE REPAIRS

In 2012, a $64 million contract was awarded to restore the westbound Interstate 70 Missouri River Bridge (Blanchette Bridge) shown in Figure 1. The bridge over the Missouri River, which connects St. Louis and St. Charles counties, was built in the late 1950s and had experienced significant deterioration. Without major repairs, the bridge would continue to deteriorate, requiring emergency repairs at more frequent intervals with longer traffic closures and delays. These repairs would become increasingly more expensive.

Fig. 1: I-70 Bridge (Blanchette Bridge) over the Missouri River

The westbound I-70 Blanchette Bridge includes a total of 23 spans. Of those, the main three spans over the Missouri River consist of overhead steel trusses.

The rehabilitation of the Westbound I-70 Bridge included:

- Removal and replacement of the existing truss spans with new trusses;
- Replacement of the complete driving surface, edge barrier walls and expansion joints;

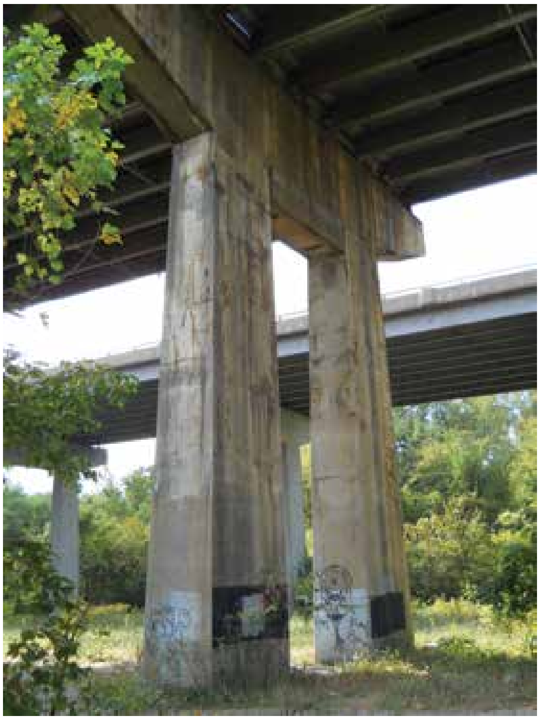


Fig. 2: Substructure pier in need of repair

- Elimination of the three spans nearest to the St. Louis County end and their conversion to roadway on embankment;
- Repair of remaining concrete substructure units including some concrete replacement (Fig. 2);
- Complete replacement of the structural steel in the first nine spans of the bridge on the St. Charles County side;
- Repair of structural steel components for the long girder spans and truss spans; and
- Repainting of existing structural steel.

The repair of the concrete substructure included the removal and replacement of approximately 44,000 square feet (4088 square meters) of pier

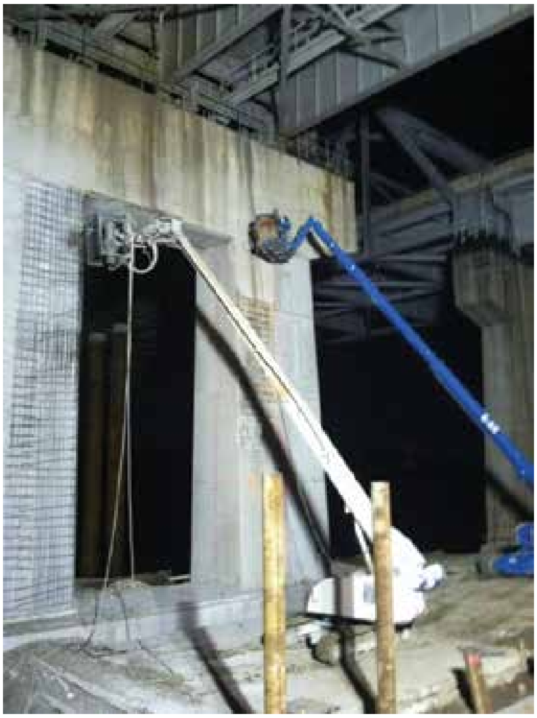


Fig. 3: Operator in manlift observing the hydrodemolition

surfaces to a depth of 3 to 5 in (76 to 127 mm). The delaminated concrete on the pier surfaces was a result of failure of the expansion joints in the roadway above the piers. Open joints allowed de-icing salts to flow down over the piers, initiating corrosion of the embedded reinforcing steel. In several areas, the entire pier surface was delaminated and required repair. Concrete that was sound, yet contained chloride levels above the threshold level to initiate corrosion, was also removed at substructure components.

Originally, the contractor planned to remove the deteriorated concrete using chipping hammers, a

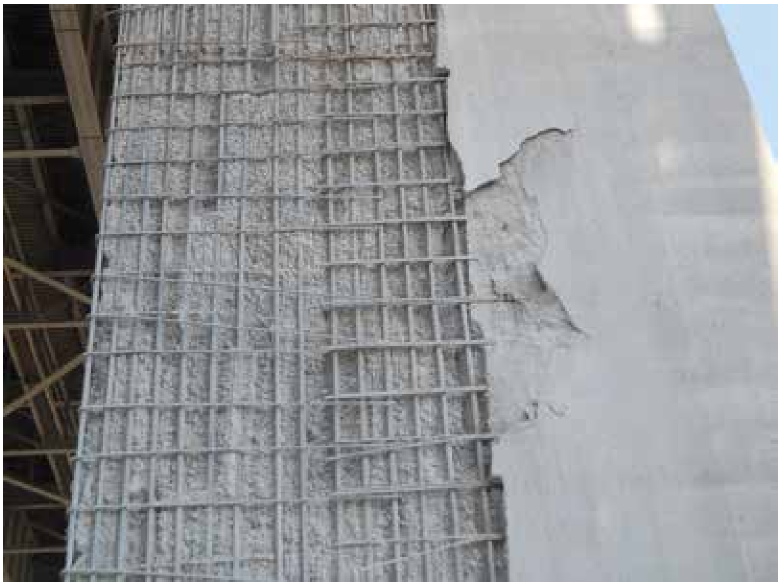


Fig. 4: Removal area adjacent to delaminated concrete

labor intensive and time consuming process. In order to accelerate the project, and minimize the wear and tear on employees, the contractor elected to use specialized hydrodemolition equipment to remove much of the deteriorated concrete. The specialized hydrodemolition unit had an x – y head mounted on the end of the boom of a manlift. The controls to operate the manlift, including travel, rotation, extension, and leveling were removed from the manlift and placed in a control box that was attached to the hydrodemolition unit using an umbilical cord. In addition to the normal functions of the manlift, the control panel also contained the controls to operate the hydrodemolition functions including traverse, index and nozzle rotation as well as pump operation and safety shutdowns. In order to observe the hydrodemolition work, the operator uses a manlift (Fig. 3). The control panel connected to the hydrodemolition unit is placed in the manlift basket with the operator. From the vantage point of the manlift, the operator can move in close to the work area and position the equipment over the area to be cut and then back away from the work as the hydrodemolition is performed. The x – y cutting head is equipped with legs to allow the frame to "touchdown" on the surface, providing a solid base. This is important to allow the cutting head to remain in place during the concrete removal (a significant amount of reactionary force is generated when the hydrodemolition unit starts the actual removals). In addition, this allows the operator to accurately control the height of the nozzle (standoff) from the work area. The x – y cutting head contains the normal two dimensional movement of a standard hydrodemolition robot allowing the cutting head to move uniformly over the concrete area to be removed (Fig. 4). During the period in

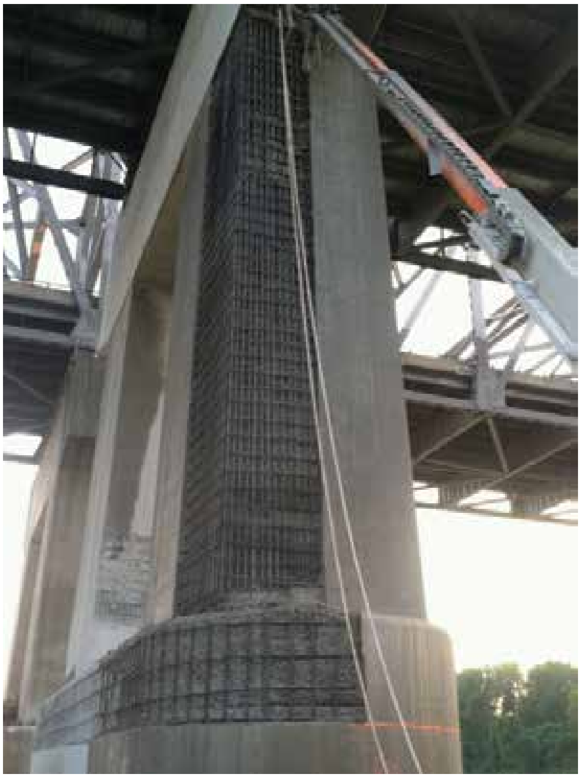


Fig. 5: Full height concrete removal on 25% of the pier

which the westbound lanes were closed and the re-decking was in progress, up to 50% of the column surface area at piers could be removed by hydrodemolition. This work continued following the completion of the decking and reopening of the lanes. Once traffic was back on the bridge, concrete removals were limited to a maximum of 25% of the pier surface (Fig. 5).

The westbound bridge closed to traffic in November 2012 and was reopened to traffic in late August 2013, more than two months ahead of schedule.

BLANCO DIVERSION DAM OGEE SPILLWAY RESURFACING

In 2012, a contract was awarded for the Blanco Diversion Dam Ogee Spillway Resurfacing Project (Fig. 6). The Blanco Dam is located on the Colorado and New Mexico borders about 60 miles (97 km) east of Durango near Pagaso Springs, Colorado and at an elevation of 7,855 ft (2394 m). The Blanco Dam is part of the San Juan/Chama project to move water from the San Juan River basin to the Rio Grande River Basin and is part of the Colorado River Storage Project.

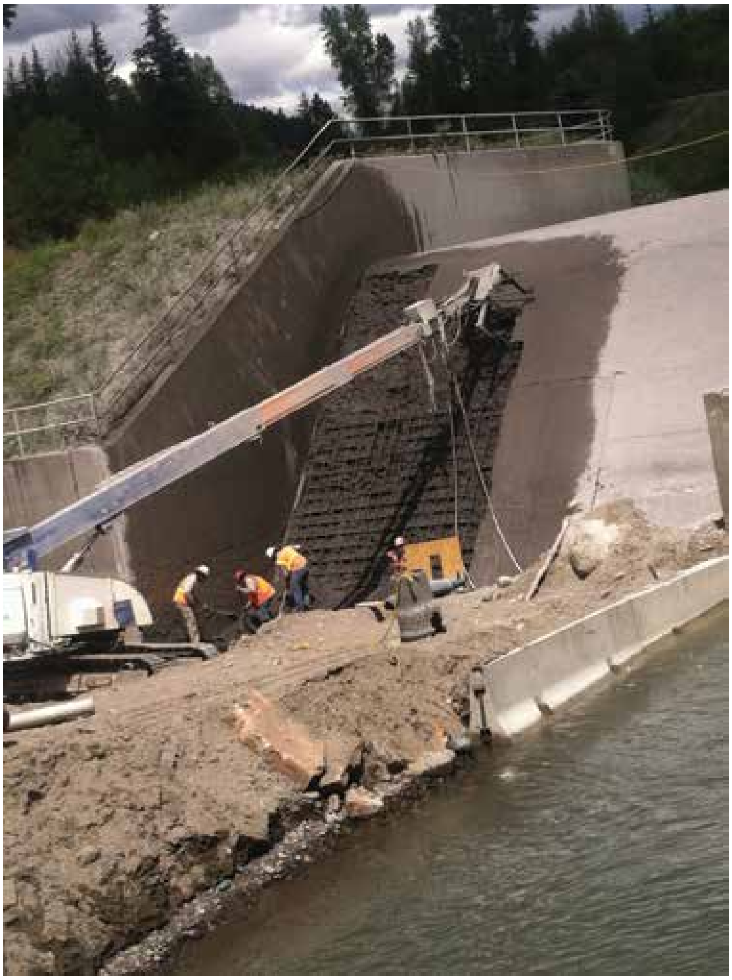


Fig. 7: Hydrodemolition unit removing concrete from the spillway face

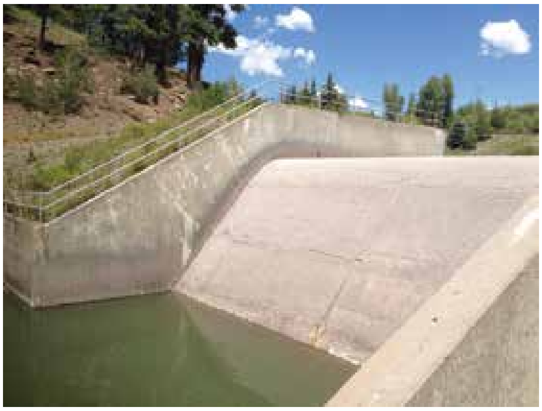


Fig. 6: Blanco Diversion Dam Ogee Spillway removal area adjacent to delaminated concrete

The specifications for the project outlined the following:

- Diversion and care of the Blanco River including maintaining a minimum bypass flow and diverting the remaining flow into the Blanco tunnel;
- Dewater and clean spillway flip-bucket;
- Hydrodemolition of Ogee Weir Spillway, Ogee Weir Spillway upstream Face at existing Construction Joint, Baffle Dissipaters, Sluiceway Wall, and area upstream of Sluiceway Entrance on Concrete Apron;

- Furnish and install new and/or replacement reinforcement where required;
- Furnish and install PVC waterstop as shown on the drawings; and
- Furnish and place Silica Fume Shotcrete (12,000 PSI).

The concrete removal performed by hydrodemolition consisted of approximately 2,750 square feet (255 square meters) of 7 in (178 mm) deep removal to expose the reinforcing steel. The work was performed from manlifts including both the concrete removal and placement of shotcrete. It was important that the work area and spillway basin could be quickly evacuated in the event of heavy rain and potential flooding.

A specialized hydrodemolition unit was used to perform the concrete removal work. Once placed in the spillway basin, the hydrodemolition unit could reach the various surfaces requiring hydrodemolition (Fig. 7). The work proceeded from the bottom of the spillway to the top allowing debris to collect in the flip bucket where it was removed. Periodic inspection of the work was performed to ensure proper clearance and to locate damaged reinforcing steel (Fig. 8).

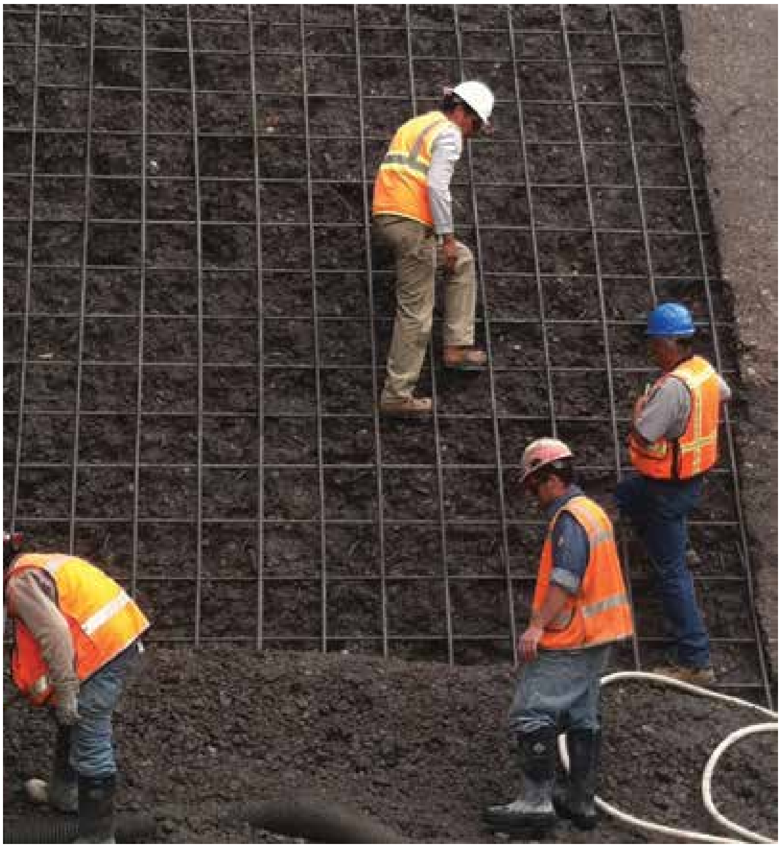


Fig. 8: Inspection of the hydrodemolition removal

The work was performed in early August 2013. As might be expected, heavy rain developed during the hydrodemolition removals, flooding the spillway basin (Fig. 9). Fortunately, there was sufficient warning and time to remove the equipment from the spillway. Several days were required to allow the water to recede and to again dewater the basin and allow the work to resume.

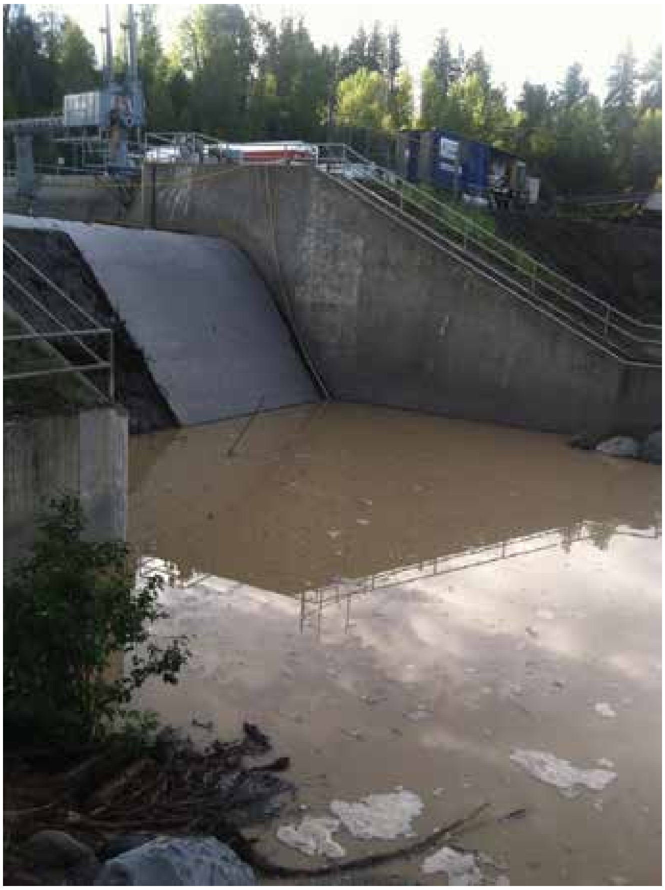


Fig. 9: Flash flooding of the spillway

The use of specialized hydrodemolition equipment allows contractors to remove concrete using hydrodemolition on vertical and overhead surfaces at significant heights above grade without installing scaffolding. This process is much faster than using chipping hammers from manlifts and minimizes wear and tear on the employees. Given that hydrodemolition is a wet process, the potential for exposure to silica dust is also eliminated.

Blanchette Bridge Restoration
St. Charles/St. Louis, MO

OWNER/ENGINEER
Missouri Dept. of Transportation (St. Louis District)
St. Louis, Missouri

REPAIR CONTRACTOR
Walsh Construction Company
Chicago, Illinois

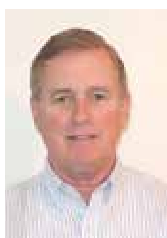
HYDRODEMOLITION SUBCONTRACTOR
Rampart Hydro Services
Coraopolis, Pennsylvania

Blanco Diversion Dam Ogee Spillway Restoration
Pagaso Springs, CO

OWNER/ENGINEER
Bureau of Reclamation
Albuquerque, New Mexico

REPAIR CONTRACTOR
AJAC Enterprises, Inc.
Albuquerque, New Mexico

HYDRODEMOLITION SUBCONTRACTOR
Rampart Hydro Services
Coraopolis, Pennsylvania



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