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FEATURE STORY

Wire Sawing Opens Up Wastewater Facility to Increased Flow

Large-Diameter Tapered Hole Links Underground Tanks

Detroit's wastewater collection system and main treatment plant serves more than 3 million people in 78 communities, making it the third largest utility in the United States. The main wastewater treatment plant processes an average of 723 million gallons of sewage per day, with peak flows exceeding 1.2 billion gallons per day.

A recent project involved connecting new primary clarifiers, numbers 17 and 18, to an existing part of the wastewater treatment facility. To allow wastewater flow between an existing shaft (tank) and a newly constructed shaft, a 14-foot-diameter opening with tapered sides needed to be cut in a 5-foot-thick concave shaft wall. This opening would create a passageway between Shaft 4 and a tunnel leading to the new Shaft 6. With this modification, wastewater would flow from Shaft 4 through the tunnel to Shaft 6 and then on to the new primary clarifiers numbers 17 and 18. These new clarifiers had been constructed to increase the plant's wastewater filtering abilities.

The engineering plan required precision openings so as not to degrade the balance of the heavily reinforced structure. The hydro-demolition method of water jet cutting, which was originally specified, was deemed too costly and would have created a large amount of secondary waste. Demolition hammers would have caused excess vibration and damaged the shaft wall. In the end, the engineers on this project learned that wire saws could cut tapered holes and they finally specified wire sawing as the most efficient and economical method to get the job done properly. To complete the job, general contractor Jay Dee Contractors, Inc. of Livonia, Michigan, enlisted the wire sawing services of CSDA member Cutting Edge Services Corporation of Cincinnati, Ohio.

Cutting Edge began work in September 2003. Before customizing a wire saw for the job, Cutting Edge reviewed the job conditions. An existing 9-foot, 6-inch-diameter concrete bulkhead formed a portion of the 14-foot-diameter plug to be removed in Shaft 4 and the connecting tunnel. Access to both sides of the plug was limited. Operators would have access on the cutting side of Shaft 4 through an 8 1/2-foot opening in the roof slab and could gain access relatively easily in a normal cage. However, in the new Shaft 6, the only opening was 3 1/2 feet wide.

After evaluating the job, Cutting Edge designed and built a

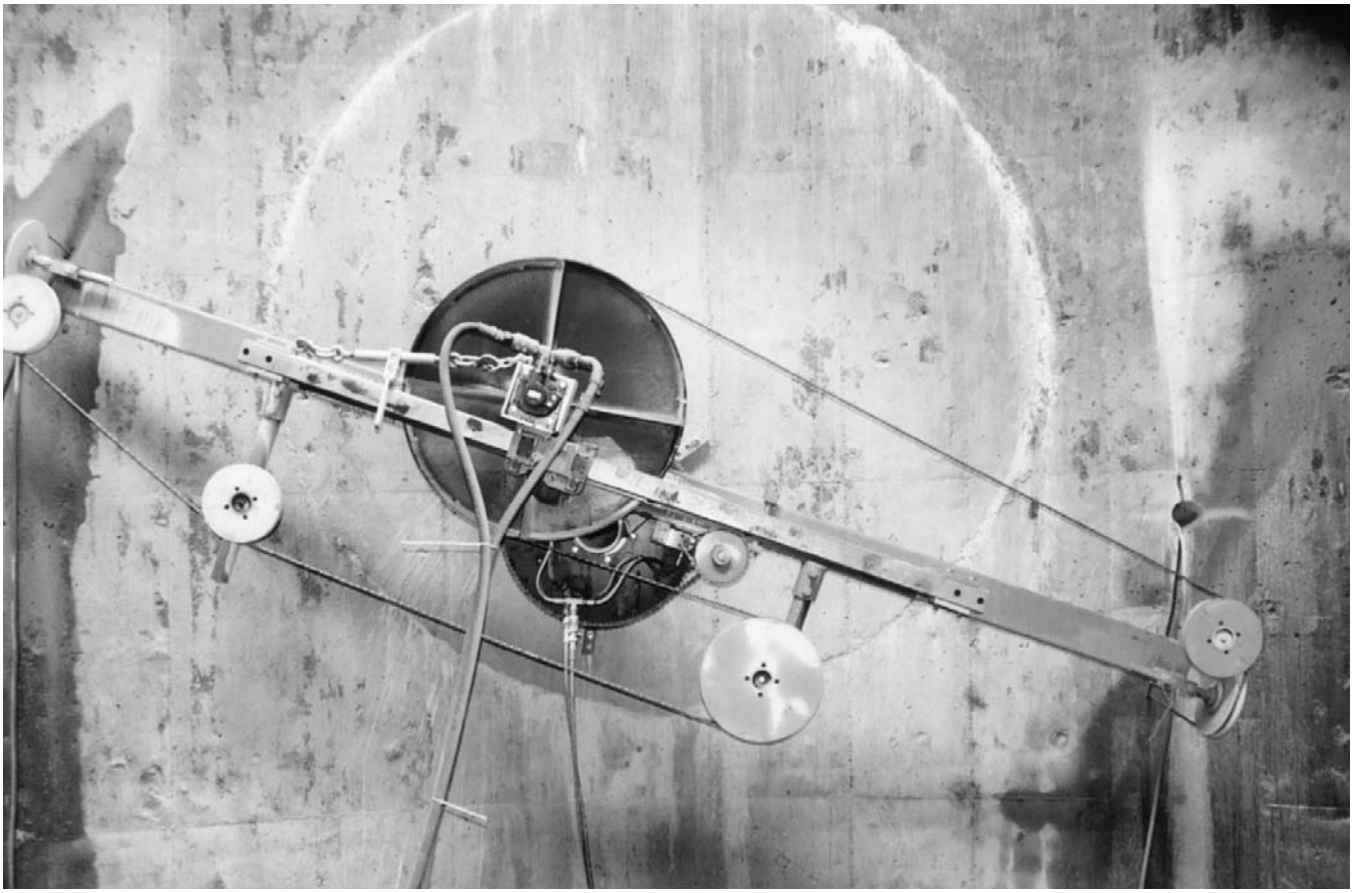
Operators cut the center pivot hole and two 4-inch-diameter wire access holes to allow set-up of the wire saw.

special wire saw with hydraulic actuated rotation. They customized equipment starting with a Diamond Products WS-25 saw and built a special hydraulic/chain mechanism to rotate the saw. (This customized rig was also used during the CSDA Wire Sawing Mega Demo at the 2004 World of Concrete.)

To begin the job, Cutting Edge set up their work platform on the Shaft 4 side of the opening where the drive side of the wire saw would be located. For Phase I of the project, operators drilled one 12-inch-diameter center pivot hole in the middle of the 14-foot-diameter plug and drilled two 4-inch-diameter wire access holes at two opposite points (at 3 o'clock and 9 o'clock) on the circumference of the plug. This allowed the wire saw assembly and the saw's rotating arm to be attached to the plug, facilitating the diamond wire cutting around the perimeter of the opening. The wire saw mechanism was set up so that the tapered opening would measure 15 feet in diameter on the Shaft 4 side and 14 feet in diameter on the tunnel side connecting to Shaft 6.

For Phase II, operators performed the perimeter cut by rotating the wire saw mechanism 180 degrees, forming a complete circle. Operators encountered unexpected heavy steel reinforcement, but no disruption to the wire sawing process occurred.

Operators began Phase III of the project after the wire sawing was complete. Using impact equipment, operators demolished the plug including the existing 9-foot, 6-inch-



Top: Wire saw set-up viewed from existing Shaft #4.
Bottom: Ninety percent of the cut is complete in the view from the existing shaft.

diameter bulkhead. The rest of the shaft was not affected by the use of impact equipment since the wire sawing had separated the plug from the shaft, preventing structural damage. The demolition of the cut concrete was performed with a Brokk 330 machine. To complete the job, operators cut back 1 inch of existing rebar within the new opening and grouted it with non-shrink grout. The resulting hole left a precise tapered 14-foot / 15-foot-diameter opening.

In all, operators drilled a 12-inch pivot hole and two 4-inch-diameter, 5-foot-long access holes for the wire and performed 250 square feet of wire sawing to create the large-diameter tapered opening. The complete circle was cut in 19 hours. Approximately 32 cubic yards of concrete were demolished with the Brokk 330 breaker in two shifts.

This job presented several challenges. Limited access to the job site for both operators and equipment presented the biggest challenge. Also, methane gas from existing tunnels was closely moni-

tored and work periods were restricted.

Safety was a major concern on this project and several precautions were taken to ensure there were no breaches in safety. Due to the confined workspace, operators were required to sign in and out and received special training concerning working in confined spaces. Gas monitors with alert signals were kept near workers at all times. Personal protective equipment included a hard hat, safety gloves and safety glasses.

The Cutting Edge team finished the job on time and within budget. "We were very satisfied, especially when considering the excess heavy steel encountered and the difficult work environment," said Tim Beckman, owner of Cutting Edge Services. "There was not a single failure or disruption of the special wire saw rig." Beckman attributed a few factors to being awarded the job. Specialty wire sawing is a major scope of Cutting Edge Services, and the price was below the originally specified method of water jet cutting.

"To my knowledge, there have been few, if any, large-scale, tapered openings created with a diamond wire saw," Beckman said. "The use of wire sawing on jobs such as this, and many other types of jobs, is likely to increase as more people begin to realize the efficiency and precision of this method."

Cutting Edge Services has been a CSDA member since 1998. They are a specialty diamond cutting contractor offering engineered field services and equipment for the nuclear, forest products, hydro, industrial, decommissioning and bridge markets. The business began in 1997 and is based in Cincinnati, Ohio. CEO and President Tim Beckman has over 30 years experience and helped commercialize wire sawing in the early 1980s. ■

RESOURCES
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Top: Access to the new side of the tunnel was limited by an opening only 3 1/2 feet wide. Bottom: Wire saw set-up viewed from the new Shaft #6 side.