

A length of clay pipe is lowered into the boring pit.

INTIMIDATING ROCK BORES

4 Bores Through Granite Beat The Odds

by Jeff Griffin, Senior Editor

Much of the work for the city of Atlanta's massive water and sewer improvement program is being accomplished by conventional open-cut construction methods. However, various trenchless construction methods are playing a key role in many projects, installing segments of new pipe where excavation is difficult or impossible.

One recently completed project is the Greensferry Sewer Separation Project, one of several projects in the \$3.9 billion Clean Water Atlanta program which constructs new sanitary or storm sewers in areas where the two systems flow through a single pipeline. A new pipeline is constructed and the existing line then serves as either a separate sanitary or storm sewer, depending on the design intent of the newly constructed sewer.

The Greensferry project involved construction of 56,700 feet of new sewers, 381 manholes, more than 900 service connections and replacement of storm water inlets with traps. The project also included 48,000 linear feet of water distribution lines and service connections.

One of the most difficult segments to

construct called for 1,000 feet of 18-inch (inside diameter) vitrified clay pipe to be installed on line and grade through solid granite. Because of subsurface conditions, project designers designated the work to be done by guided boring to precise line and grade control.

To complete the bored segment, McCowien Horizontal Directional Drilling, Pierpont, OH, made four bores for primary contractor Reynolds Inc., Orleans, IN. McCowien Drilling was assisted by Rock Drill Solutions, Thompsonville, IL.

High risk

"Before work began it was our opinion that the extreme hardness of the rock made the odds of success very unlikely," said Rick McCowien, owner of McCowien drilling. "To our knowledge, this is the first time a guided boring machine has bored through granite this hard. If boring had failed, the only option would have been to hand mine a 72-inch hole."

In order of completion, bore lengths were 297, 190, 180 and 220 feet. Installations

were made with an Akkerman 308 GBM (guided boring machine) and Halco Storm 500 air hammer with 5 1/4-inch bit for the pilot hole and specially-designed theodolite guidance system. Hardness of rock encountered ranged from 35,000 to 50,000 psi. Each pilot hole was progressively enlarged to accommodate the pipe. Pipe was provided by the Can-Clay Corp.

Considering subsurface conditions and the complexity of the bores, time was a factor from the outset with just under six months to complete the work. An immediate concern was locating materials to begin fabricating wall plates, ladders and hose brackets for the two launch pits and four receiving pits required to complete the four bores. McCowien said Reynolds personnel assisted in locating needed materials quickly. In addition, a steel snorkel had to be constructed to deflect and carry cuttings out of the shaft to a vacuum truck on the surface. Depths of the bores ranged from 25 to 40 feet. It took approximately one month to complete preparations.

Portions of the first and longest bore contained metamorphic granite and also

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mixed soil conditions which caused complications. Water was encountered at the midpoint of the bore and sand was hit near the end, causing the bore hole to cave in, and a 30-foot casing had to be designed and built on location to solve the problem. Water flooding the shafts required operation of three, 2-inch pumps 24-hours per day. Upsizing the pilot hole to 26 inches required three weeks.

The pilot hole for the second bore through rock from 34,000 to 42,000 psi was completed in eight hours. Hole enlargement required 14 hours.

Set up time for bore three was two days, and the drilling of the pilot hole was completed in four days. Because the deadline for completion was near, a 24-hour-a-day work schedule was implemented with law-enforcement officers providing security for personnel and equipment.

Unexpected complication

One hundred seventy feet into the last 220-foot bore through metamorphic granite of 50,000 psi, metal fatigue of downhole tools caused the LED target housing to crack bringing work to a halt. The target

housing was specifically designed for this project so no replacement existed. A new housing was designed and built over a seven-day period. Once work resumed, it took one day to complete the pilot bore. It then was upsized to 26 inches in 21 hours.

All four bores were completed on line and grade 12 days before the deadline.

One thing that set this project apart from other jobs is that drilling the pilot bores and enlarging the holes was done strictly with air, said McCowien. No fluid was used.

"We drilled a 5 3/4-inch hole and then reamed a 12-inch hole doing 15 feet every 30 minutes," he said. "We then reamed a 26-inch hole at 15 feet an hour. If you were to do this the conventional way with a roller cone reamer, just for the 12-inch pass it would have taken four to six hours per 15 feet. Also, using a roller cone would have required making nine reaming passes in two-inch increments. We made only three passes: 5 3/4, 12 and 26 inches."

Co-owner of McCowien Drilling is Rick McCowien's son, Derrick. The father and son team have 35 years combined experience in vertical and horizontal drilling. In addition to the Akkerman GBM, the com-

pany operates four horizontal directional drills – two Vermeer and two Tulsa Rig Iron models with pullback capacities ranging from 100,000 to 1 million pounds.

McCowien said it was very satisfying to complete the Greensferry segment in such extreme hard-rock conditions and overcoming the unexpected tool failure near the end of the final bore.

"With the assistance of other contractors and suppliers, we built all secondary tools used and finished before the city's deadline for completion," concluded McCowien.

FOR MORE INFORMATION:

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Rock Drill Solutions, (618) 627-2544

Akkerman Inc., (800) 533-0386, akkerman.com

Halco, halcoamerica.com

Can Clay Corporation, (812) 547-3461, canclay.com

Vermeer Corp. (888) 837-6337, vermeer.com

Tulsa Rig Iron, (918) 321-3330, tulsarigiron.com