



Water Mains Installed Using HDD



Contractor LA Fuller & Sons, Amarillo, TX, recently had two options for bidding a large water improvement project in nearby Plainview:

- Submit a proposal to do the job by open-cut construction, a method with which the company has many years of experience; or
- Bid the job as a mostly-trenchless project, employing horizontal directional drilling to install the pipe.

Most contractors chose the usual course of action and submitted cut-and-cover bids. It would have been easy for Fuller and Sons to do the same; the company had never installed water pipe with a directional drill. But company owners J. Mark and Mike Fuller understood the benefits of trenchless construction and saw that the Plainview job seemed well suited for directional drilling.

After thoroughly investigating the relative costs and advantages of directional drilling compared to open-cut construction for the Plainview project, Fuller & Sons submitted an approximately \$4 million bid to install more than 200,000 linear feet of restrained-joint PVC water pipe, with more than 90 percent of the work to be completed by directional drilling.

Fuller and Sons won the contract over the only other company to submit a trenchless bid, and the job is believed to be the largest water construction project ever done by horizontal directional drilling. To some, it might seem that Fuller and Sons was taking a huge risk by assuming the commitment to build so large a project with a construction method they had never used.

But brothers J. Mark and Mike Fuller, who own and manage the company their father started 65 years ago, knew exactly what they were doing; they left little to chance and were confident that thorough planning would ensure success.

Fuller and Sons has been constructing water, sanitary and storm sewer systems since the mid-1980s and knows how to build water systems. The new HDD experience provided a solid base for extending its capabilities into trenchless construction. In addition to underground utility construction, the company is one of the area's primary heavy-highway construction contractors.

Trenchless benefits

Although they had never used directional drilling on a job, the Fullers were well aware of the benefits offered by the trenchless procedure, and they had closely followed the progress of public works projects that were using the technology.

"We were reading the trade journals and talking to people who were active in directional drilling," says J. Mark Fuller, president. "We had not invested in directional equipment yet, because we were waiting for the right project."

The one in Plainview turned out to be it.

"We were looking for a job that was large enough to justify the purchase of

directional equipment," explains Fuller. "It's difficult for a water and sewer contractor to make the capital outlay necessary for a directional machine to do a small job. In Plainview, we were comfortable that if we decided we could do the work by directional drilling, the project was big enough to pay for the equipment."

Experience made it routine for the Fullers to estimate what it would cost to do the job by open-cut construction. Considering the residential areas where pipe was to be installed, it was clear that restoration costs would be a large part of a cut-and-cover project.

To compare open-cut costs with directional drilling, the Fullers had to gather the information to prepare a realistic estimate of what costs would be to install pipe by HDD.

Initially, says Fuller, the unknown factors with HDD were production capabilities and labor requirements. The Fullers had to accurately estimate how much pipe they could realistically expect to put in the ground each day and what it would cost to accomplish the necessary production.

Most of the project's pipe - 205,000 linear feet - would be four inches in diameter; six- and eight-inch pipe comprised another 5,000 feet.

"To do the job by directional drilling," says Fuller, "we determined that we needed an average of between 700 and 1,000 feet of pipe per day."

The more they considered the options, it became increasingly clear to the Fullers that directional drilling was the best choice for Plainview, and they were confident their company could do the job.

Estimator Gordon Rea played a key role in securing the project for Fuller and Sons. "Gordon has been our company's chief estimator since 1984 and was responsible for analyzing the project and putting together the successful bid package," says Fuller.

"There was very little difference between our winning bid and the other contractor who bid the job directional," Fuller continues. "We were just a little lower. But the open-cut bids ranged from \$1 million to \$1.5 million more. Directional drilling is saving Plainview taxpayers a substantial sum of money and is improving their water system without the inconvenience inherent with excavation methods."

Right equipment

Contract in hand, Fuller & Sons proceeded to buy the necessary HDD equipment. Selecting the right directional unit for the job was a critical factor in achieving necessary production.

"We wanted a machine with the power to pull in

Water Mains Installed

the larger sizes, but because most of the pipe was four inch, we didn't want to spend more money for a machine that was larger than necessary," says Fuller. "Because of the locations where we would be working, it was important that the drill unit be compact."

The Fullers researched equipment options and narrowed their choice to models made by the two leading HDD manufacturers.

"Then we talked to six or seven contractors," says Fuller. "We asked them what kind of equipment they ran and their experiences with it."

After evaluating their options, the Fullers decided that a 27,000-pound-pull-back Ditch Witch JT2720 Mach 1 unit was the best choice for the project, and that it could achieve levels of production that would enable the job to be completed cost effectively.

To manage directional drilling operations, the company hired an experienced HDD specialist, Josh Franklin, as HDD crew leader.

"Hiring Josh was an important part of the equation," says Fuller. "He is experienced in horizontal directional drilling, and he had used an earlier version of the HDD unit we purchased. With his knowledge, the learning curve for other crew members was very short, and we put together a drill crew that was productive the first week on the job."

Construction began in April. The contract calls for work to be completed in 24 months.

Directional drilling production is well ahead of early expectations, averaging between 1,100 and 1,200 feet per day for four-inch pipe, says project foreman Chris Cornell.

"We could get all drilling done in substantially less time," adds Fuller, "but making tie ins and connecting services takes additional time."

The only other excavations necessary on the project are for small holes at the entry point of the bore, receiving pits and pits at tie-in locations. Distances from the new main to meters are too short to drill; two compact excavators are used to dig the 10- to 15-foot trenches necessary to make the tie ins.

Directional drilling installations generally are being completed in one-block segments. New pipe is placed on both sides of a street and then connected to meters already in place.

The process involves drilling a pilot hole, attaching a backreamer and pipe to the drill string, and pulling pipe into the ground. Pilot bores are launched from the surface, so the only excavation necessary

usually is a small hole where the bore is initiated and a small pit at the exit point.

C-900 restrained-joint PVC pipe either is assembled in a string and pulled in or, if space is limited and it is impractical to lay out lengths of pipe, 20-foot sections of pipe are pulled in one at a time

Soil conditions & reaming

Soil in the area has heavy clay content, but contains little rock and is well-suited for drilling, says HDD crew chief Franklin.

"We are installing pipe without pre reaming," he says. "For the first runs of both four-inch and eight-inch pipe, we did pre ream, but we've found that it isn't necessary, so we enlarge the pilot hole and pull in pipe in one step."

A five-inch Ditch Witch Tuff Bit is used for pilot holes. The self-contained JT2720 Mach 1 has a 125-horsepower (93 kW) diesel engine and develops 27,000 pounds pullback, 3,200 foot pounds of spindle torque, and spindle speeds to 225 rpm. A FM13 drilling fluid mixing system is used in conjunction with the drilling unit. A FX30 vacuum excavator keeps job locations free of drilling fluid that escapes from bore holes and also is used to dig "soft" excavations for potholes to visibly verify exact locations of existing utilities before drilling begins. Much of the route for the new pipe closely parallels old two-inch water mains.

Directional drilling production is averaging more than 700 feet per day for four-inch pipe with other personnel following up to make tie ins and completing service connections, says project foreman Chris Cornell.

The suitability of the restrained-joint PVC pipe for installation by directional drilling is an important factor in making the project a success, says Cornell. The pipe, manufactured by the CertainTeed Corp, Valley Forge, PA, uses restrained joints to firmly lock pipe sections together so they do not pull apart during installation.

Fuller says work is on schedule and proceeding exactly as planned, and Plainview city officials and the public appear to be pleased with the way construction is proceeding.

The project, Fuller believes, proves that horizontal directional drilling is a viable method for installing water mains, and that it also can be used for sewer projects, as well.

"When soil conditions are right, a trained crew is operating the right equipment and work is properly planned and executed, a project can be completed by directional drilling at a lower cost than with open cut," says Fuller.

"We are going to see more and more cities going to this technology." However, he says that the directional drilling requirements for public works projects are much different than those for other markets.

"There is much more to it than simply putting pipe in the ground as fast as possible," he says. "The water and sewer construction business is highly competitive as the closeness of the trenchless bids on the Plainview project proves, and contractors have to be efficient throughout every aspect of construction in order to turn a profit."

Almost Open Cut

What may be the largest water project ever undertaken by horizontal directional drilling almost was designed as an open-cut project.

The project is replacing most of the water mains serving residential areas in the West Texas city of Plainview and construction ultimately will reach most every section of the city of 23,000. Old two-inch, cast-iron mains are nearly plugged from corrosion and almost all of them must be replaced.

"The original plan for the improvement project was for most pipe to be installed by open-cut construction and to jack and bore pipe under driveways," says Plainview City Engineer Sean Lanier. "But after looking at the project, and considering the extensive surface restoration that would be necessary, the contractor who later was awarded the contract, LA Fuller and Sons Inc. of Amarillo, suggested that the city prepare a bid package that included the option to do the work by horizontal directional drilling."

So Plainview invited bids for both methods of construction. The three open-cut bids ranged from \$1 million to \$1.5 million more than the low trenchless proposal.

Lanier says city officials are pleased with directional drilling and the progress made during the first months of construction.

"The only problems we have encountered are making tie ins to our existing system, and that is because it is so old," says Lanier. "The directional drilling part of the work is going very smoothly. Directional drilling has greatly reduced the impact of construction for the residents of Plainview. For the city, it has cut the amount of pavement replacement that would have been necessary if we were excavating to install the pipe."