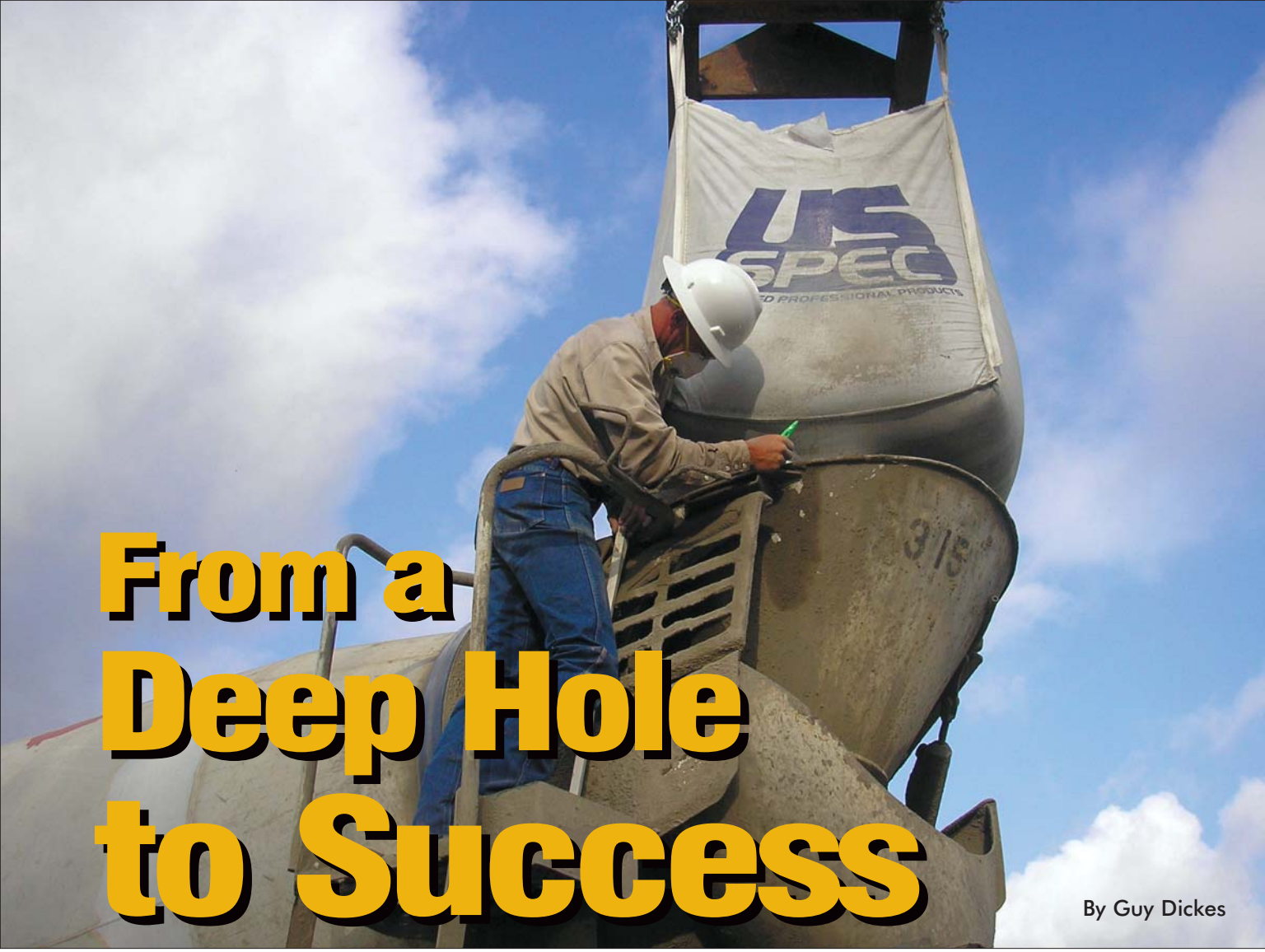

From a Deep Hole to Success

By Guy Dickes

Austin, Texas, Grouting Project Tackles Challenges

If you have been a contractor for any length of time, a subcontractor has left you high and dry at least once. You've put the winning bid together, started the paperwork and got your subcontractors under contract.

This is how it's supposed to work, except when the sub has left two thirds of his cost off his bid and disappears. This time it happened to Jim Ellis with Mears HDD. Not only was Ellis faced with a major dollar deficit and no sub, he had a technically difficult grouting job to do. Queries to grouting contractors after the bid were answered with "nobody's done that," "impossible" and "good luck."

A third party introduced Ellis to grouting and repair specialist Guy Dickes, president of Constellation Group LLC, Baltimore. A personal bond was established and a game plan was quickly set in motion.

The task was daunting. There were two 30-in. diameter pipelines, each about 2,000 ft long, filled with two 12-in. HDPE force mains and six 3-in., HDPE electric conduits. Underground Devices supplied the spacers to be set on 5-ft centers. The only space left for grout pipes were two 3-in. pipes in the center of the bundle. Approximately 180 cu yds of grout were required in each pipeline, with pumping distances of more than 1,000 ft. The spacers were modified with Underground Devices' permission to allow for extra 2-in. grout pipes.

The grout was not your regular sand/cement/water mix. This grout had an assortment of unusual requirements:

- Low thermal resistivity (less than 90), to transmit heat to the surrounding rock from the electrical transmission lines
- Low viscosity, less than 26 seconds in a standard flow cone, so the grout would flow around all the nooks and crannies and spacers and require low pumping pressures to avoid crushing the conduits
- Low heat of hydration — high cure temperatures would soften the HDPE conduits
- Long set times — it would take all day to place 50 yds of grout
- The grout had to be homogenous — it could not separate
- Low shrinkage — the engineers had to ensure complete filling of the pipeline

Constellation Group LLC undertook grout rheology (mix design), using a proprietary mix blended for Mears HDD by US Spec. Tweaking the stabilizers and admixtures produced a viable mix in Constellation Group's facility for all param-

eters. They also had to ensure meeting the thermal resistivity criteria. Test samples were sent to a specialized lab for testing, resulting in thermal resistivity under 70. Sika provided the required admixtures. Constellation Group formulated the stabilizer. A full submittal package had to be generated, from QA/QC to work plan, schedule, estimated grout takes, anticipated and maximum pumping pressures. An early morning trip — 3 a.m. — to the testing lab was necessary for official samples to be made and tested.

Dickes and Ellis spent days working out the grout operation details. Planning a task of this nature requires time and dedication. Scale pipeline profiles on a 2,000-ft pipe with a 60- to 100-ft elevation change were 12 ft long. Grout pipes were laid out according to elevation, distance and planned grouting phases. A full scale pipeline mock-up was assembled to see where extra grout pipes could be squeezed in. Planning included site logistics because there was only a small portion of a parking area of a local boat ramp facility in which to work.

Onsite batching was determined to be the best and only course of action. Ellis worked on arranging rented ready mix trucks, while US Spec started producing grout — 400 tons total in supersacks. Specialty hardware was designed and quickly fabricated.

Ellis' crew had to be brought up to speed as well. Pat and Chris Tobias, Texas cowboy pipeliners and brothers, accepted the challenge, although having never grouted before. Keeping City of Austin inspector Jim Evans up to speed at all times contributed to a smooth running operation.

A 50-ft, full-scale pipeline mock-up, required by contract documents, was assembled onsite. In addition, 1,000 ft of 3-in. HDPE pipe was placed on the ground to demonstrate that crews could pump the necessary distance.

In the middle of August, early morning temperatures hovered around 90 F. With more than 30 engineers, city inspectors, subcontractors and vendors watching, Constellation Group mixed its first batch of 7 yds of grout for the mock-up. Initial quality control testing indicated the mix was slightly tight, so 10 gal of water were added, resulting in a perfect grout.

A local equipment rental yard provided Schwing 500 concrete pumps. Into the hopper, and after about eight minutes of slow and easy pumping, crews had grout out of 1,000 ft of 3-in. HDPE pipe lying on the ground. A quick connection to the mock-up and another 4.5 yds was easily pumped, filling the 50-ft section of pipe. Then 500 ft of 2-in. HDPE (secondary grout pipes) was pumped, just to prove it could be done. Work was done by 10 a.m.

Prior to production grouting, all the conduits were pull-tested with pigs to ensure roundness. The conduits were filled with water and pressurized. If a conduit collapsed, the entire pipeline would have to be redone — not a pleasant alternative. There was only one chance to get it right; "Failure is not an option" was the motto. The worksite was situated such that the launch site of one and the receiving site of the other pipelines were within 50 yds of each other. The other ends of the pipelines were up the highway and the back end of a prestigious country club.

It's one thing to mix one ready mix truck, but production grouting required two or three trucks running all day long. The worksite at the bottom of the highway ramp was cramped, looking like a concrete plant — trucks, excavator,

grout pumps, water and dust and 100-degree Texas heat. Chris Tobias was the superintendent, Pat Tobias handled the loading, Ellis monitored the pumping and Dickes was mixmaster, QA/QC and record keeper. Each batch of grout, usually 7 cu yds at a time, was tested for temperature, flow and specific gravity, all parameters recorded. Grout records were turned in daily. Progress was recorded on a truck by truck basis on a truncated scale drawing.

In a project of this nature, being prepared, working out every detail, second-guessing and double-checking everything, saved time and money. Constellation Group required its pump supplier to have a spare pump onsite. Although this cost some money, the crew was paid back many fold when the first pump blew a seal. There was virtually no downtime, and no grout was lost. There were two grout pipes available per phase, a total of 12, only six were used.

Constellation Group has performed grouting work using HDD technology, expanding the capabilities of the pipeliner to reach areas previously unavailable.

The grouting operation was divided into six phases. In the first two, the center plugs of the pipelines were filled, each with about 50 cu yds of grout. The next two phases filled the sections of pipe closest to the work area.

It is one thing when your mix site and pump site is within 50 yds, as was with the first four phases of grouting. It's another thing when fluid grout has to be transported through a golf course to fill the other end of the pipeline. A third ready-mix truck was brought in, and shorter loads were batched to minimize splashing. The last phase was up the road on Highway 360, a heavily traveled main artery into Austin.

To undertake a project of this magnitude, planning, more planning and sticking to the plan allowed everyone to execute this operation. Having an open mind and willingness to learn allowed Constellation Group to self-perform this world-class grouting operation on schedule.

Grouting is not one process. It is a means to accomplish a goal. Grouting can be used for water control, flowing through soil, rock or concrete; support of excavation to stiffen soils from collapse; stabilization of soils, sands and gravel/broken rock seams and layers when tunneling or drilling to prevent unraveling and collapse; or fill voids in the ground or annular spaces. Grouts can be cement based, with or without aggregate; chemical based, like sodium silicate and urethanes; or flyash and lime used as admixtures and fillers.

While grouting has been more traditionally performed by the vertical drillers, Constellation Group has performed this work using HDD technology, expanding the capabilities of the pipeliner to reach areas previously unavailable. Constellation Group is participating in research in Europe to develop new grouting technologies using HDD within the tunneling industry.

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