Sand and Gravel Pipeline Connects Texas, Oklahoma

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Texas Industries was constructing a new sand and gravel mine in Bryan County, Oklahoma, along the north edge of the Red River. Their market for the product is the Dallas-Fort Worth metroplex. The mine reserves, all of which are in Oklahoma, cover 2,200 acres. The company was able to purchase 80 acres in Fannin County, Texas, across the Red River from their Oklahoma property. To ship their product from the Texas property would cut approximately 42 miles off of the distance between the mine and the distribution points. This is critical in the economic evaluation of the project. Peak production of sand and gravel is projected to be 12 million pounds per day. Shipping from the Texas property would save more than 10,000 truck miles per day.

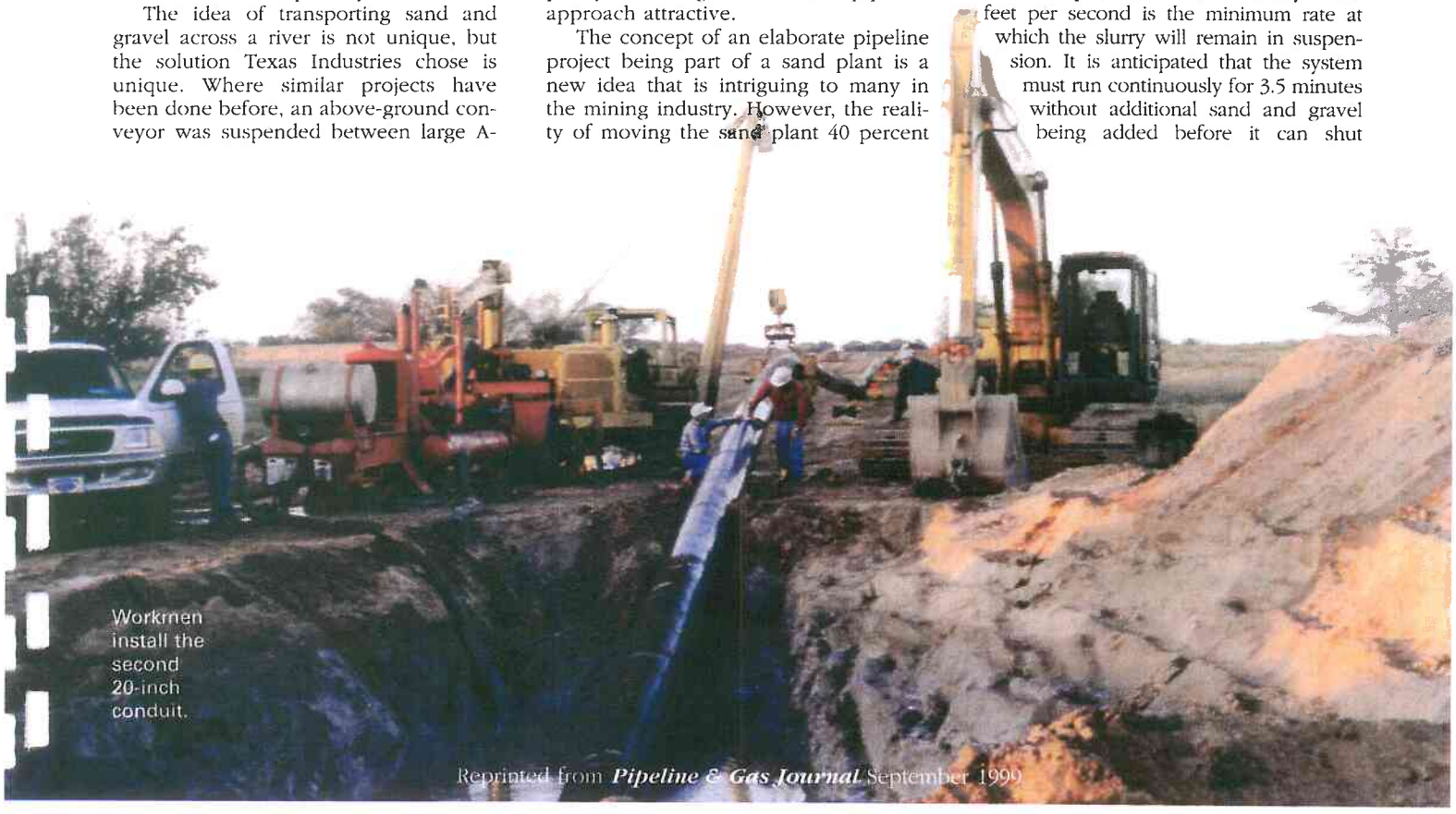
The idea of transporting sand and gravel across a river is not unique, but the solution Texas Industries chose is unique. Where similar projects have been done before, an above-ground conveyor was suspended between large A-frames. The appearance of the structure is similar to that of an above-ground A-frame suspended pipeline crossing. The structures are very costly and require intensive maintenance.

Texas Industries elected to approach the problem with technology from the pipeline industry. They solicited engineering and cost proposals from several construction companies. Davis Corporation was awarded the project based on environmental concerns, design and cost. Much like the pipeline industry, mining is going through the growing pains of numerous new environmental regulations and more intensive safety audits. The Mine Safety and Health Administration is particularly aggressive in their monitoring of both mine construction and operation. Safety, environmental friendliness, cost and simplicity of design made the pipeline approach attractive.

The concept of an elaborate pipeline project being part of a sand plant is a new idea that is intriguing to many in the mining industry. However, the reality of moving the sand plant 40 percent closer to its market is an exciting use of directional drilling and conventional pipelining that shows up big on the bottom line.

The pipeline project is a 4,000-foot-long loop of 16-inch polyethylene pipe. Water is pumped continuously through the pipe from Oklahoma to Texas and then back to Oklahoma. There are large centrifugal pumps on each end of the loop. Sand and gravel are introduced into the pipe on the Oklahoma side, creating a sand, gravel and water slurry that is separated out when it reaches the Texas end. Water alone is pumped back to Oklahoma. The loop is completed when sand and gravel are again introduced into the water.

It is important that the flow be continuous. Any temporary shutdown of the system will allow the sand and gravel to fall out of suspension. Also, a velocity of 15 feet per second is the minimum rate at which the slurry will remain in suspension. It is anticipated that the system must run continuously for 3.5 minutes without additional sand and gravel being added before it can shut



Workmen install the second 20-inch conduit.

Reprinted from *Pipeline & Gas Journal* September 1999

From the Oklahoma side, the mine under construction before production.

down without the risk of plugging the pipe. This pipeline project creates a system that is an economic winner if the risk of accidental shutdown of slow flow rates can be managed.

In order to manage the system and plan for accidental plugging, several features were designed into the system. They are as follows:

1. Except for the river crossing, all piping would be above ground.
2. The river crossings would be 20-inch casing through which the pipe could be pulled in and out.
3. A third 20-inch casing complete with a 16-inch polyethylene pipe would be installed as a spare crossing.
4 A fourth crossing, a 10-inch conduit, would be installed for use as a conduit for electric power and communication cables.

The belief was that with these features the system could be made to mirror dredging systems that Texas Industries has extensive experience managing. They have pumped slurries one way as far as 2,200 feet.

Construction

Although the pipeline system is elaborate, the construction process was straight forward. The pipe was either above ground or placed in 20-inch conduits under the river. The directional drills were spaced 30 feet apart with all running parallel to each other.

The 10-inch conduit was installed first so that it could be used by the contractor to make a closed loop drilling fluid system on the 20-inch crossings. This kept construction from interfering with river traffic which is common every day on this segment of the Red River.

Additionally, state-of-the-art Derrick mud-cleaning systems were used on both sides of the river. Gravel content of the higher ground formations proved to be much greater than was anticipated from preconstruction core samples. Consequently, very high viscosities were necessary. The cleaning of the drilling fluid was then complicated by the extremely high viscosity. New generation high G-force shakers were used to combat the combination of heavy solids and high viscosities.

Although the discovery of greater than expected gravel content was good news for Texas Industries, it was not good news for the directional drilling operation. The profiles of the 20-inch crossings were extended so that a seam of gravel with cobblestones at 30 feet below entrance elevation could be drilled at a higher angle. The obvious strategy was to shorten the bore hole distance through the problem zones.

Extending the profiles in order to improve the river crossings was costly. The job was a turnkey project. A total of 800 feet of extra 20-inch pipe was used to complete all three of the larger bores. It was important that a long radius of curvature be maintained and not compromised simply because of unbudgeted material costs. Although maintaining a long radius is always important, the problem gravel zones emphasized this point.

The project was completed on time and within a week of the time allotment that Texas Industries had allowed. At the beginning of the project, it was hoped that several weeks could be trimmed from the schedule. The unforeseen problem with gravel and cobblestones dashed those hopes, but the construction was still an economic success.

Conclusion

The mine went into production in early May. There is obvious enthusiasm for the project. The building boom of the last few years has increased the demand for construction-grade sand and gravel. In this instance, it has also increased the demand for directional drilling and added to our industry's list of pipeline commodities transported across the state lines. ***P&GJ***

Three completed 20-inch conduits and one 10-inch conduit were involved. The 20-inch conduits contain 16-inch polyethylene pipe. The 10-inch conduit will have communication cable installed.