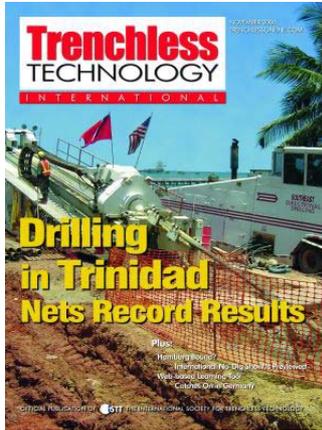


Trinidad Becoming Natural Gas Giant

by Sharon M. Bueno



Trenchless Technology International is published 6 times per year as a supplement to *Trenchless Technology* magazine, and has additional circulation to recipients outside North America.

When Southeast Directional Drilling's vice president Craig Weaver and consultant Mark Osachuk traveled to Trinidad and Tobago in spring 2003 to review locations for a large diameter installation that they were asked to bid on, the size of the project blew them away.

And it wasn't the length of the bores that would be the most challenging aspect of the endeavor in southwest Trinidad; the project involved three lengthy bores of 2,230, 2,517 and 2,415 ft.

The real challenge would be the 56-in. pipeline that was being installed. That wasn't a misprint folks... The drilling crews would be pulling back 56-in. pipe into pilot holes that would be reamed to a diameter of 72 in.

"Our eyes just lit up," recalled Weaver upon seeing the size of the pipeline involved. "No one had ever done this size before but [project manager] Steve Ugrich and myself have been involved in HDD for numerous years and have done large diameter projects in the past...We knew this was going to be a challenge."

The Cross Island Pipeline Project for The National Gas Company of Trinidad and Tobago Ltd. encompasses nearly 48 miles of 56-in. pipeline in southwest Trinidad to bring large quantities of gas from offshore, inland across the island to a plant for liquification. Horizontal directional drilling would be necessary to complete three sections of the 56-in. pipeline.

As this issue of the magazine was going to print, Southeast Directional Drilling, based in Tempe, Ariz., was putting the finishing touches to the final bore, thus ending an 18-month-plus project that tested its HDD inventiveness, innovativeness and design ingenuity. The Cross Island Pipeline Project brought many issues to the table for Southeast Directional Drilling, including the logistics, equipment, local customs and subsurface conditions. Two of the crossings necessitated drilling under existing directional drills and there was a long labor dispute during the first bore, halting work for nearly three months.

The project required a great deal of preplanning prior to drilling. Southeast Directional Drilling had to custom-design and build its own tooling, including reamers of 62, 68 and 72 in. (nearly 700 lbs of welding wire was needed for the 72-in. reamer). The contractor also used rigs of 1.4 million and 500,000 lbs for the pilot holes, as well as two custom-built mud pumps capable of 800 gpm and two mud recyclers with 1,000 gpm cleaning capacity to handle the high-volume, high-velocity of drilling fluid.

Due to the location, nothing was left to chance. Southeast brought 21 semi truckloads of extra parts and equipment (from hydraulic pumps to reamers) to the site, including 280 pallets of Baroid drilling fluid.

Southeast Directional Drilling brought its own drill operators, navigators and mud system operators to work the job but also used local labor to handle the support work, such as driving the water and vac trucks and operating the backhoes — people who had never heard of directional drilling. Once the reaming began, Southeast crews went to double shifts, working round the clock.

“This is definitely not a typical project for Southeast or anyone else,” Weaver said. “To the best of my knowledge, a project of this magnitude had never been attempted before.”

And with the success of this impressive project, Weaver said that Southeast Directional Drilling could be doing more of this type of project in the future.

What’s Happening

Trinidad and Tobago, with a population of more than 1.3 million, is in the midst of a natural resources economic boom, bringing notice to the independent, twin-island nation situated in the Caribbean Sea. Whereas Tobago is the center of the country’s tourism industry, Trinidad — the larger of the two islands — is located just seven miles from the Venezuelan coast and is rich in natural resources, especially natural gas and oil.



The Cross Island Pipeline Project in Trinidad involved three HDD bores in the 48-mile installation. The bores were all over 2,000 ft in length and each involved installing 56-in. pipe.

According to a recent New York Times article, Trinidad has emerged as the leading supplier of liquid natural gas (LNG) in the Western Hemisphere, outpacing its competitors by sending nearly 80 percent of its shipments to the United States. Liquid natural gas is considered to be one of the fastest-growing segments of the energy industry; the process involves companies investing billions of dollars to chill the fuel at temperatures of at least 250 degrees below zero and then ship it across the seas in supertankers, the article said.

How fast is this segment of the gas industry growing? In 2003, liquid natural gas made up only 3 percent of the total natural gas in the United States, however, that share is expected to grow to 15 percent by 2025, according to a recent Associated Press article. And other countries, such as Japan, South Korea and Taiwan, are looking to Trinidad to redirect LNG supplies earmarked for the United States to them to give their shortage of LNG a boost, according to a recent report on Vanguard Media’s Web site.

Trinidad owes much of its economic good fortune in recent years to a plan drawn up a decade ago by BG and BP, two of Britain’s energy giants. Together with Repsol of Spain and The Natural Gas Company of Trinidad and Tobago, the four worked to build the first of several large liquid natural gas plants, the article said. Pipelines are now being constructed to transport the product from offshore drilling inland to the plants for liquification. Afterward, the product is loaded onto barges and shipped out for sale.

Over the past several years, Bechtel — a leading international engineering, construction and project management company based in San Francisco with offices worldwide — has been entrenched in the Trinidad natural gas explosion and involved in constructing the refineries and pipelines, including the ongoing Cross Island Pipeline Project.

Bechtel was looking for an HDD contractor experienced in large diameter installations to handle the three significantly long and large diameter bores. Through past work relationships, Bechtel officials contacted Southeast Directional Drilling about submitting a bid on the three HDD bores that were integral to the project's completion.

The conditions the directional bores were done were hardly ideal. The first crossing was a 2,300-ft bore under the Guapo River, taking place in jungle-like terrain. The second crossing in Clifton Hills, 2,517 ft near Point Fortin, was done parallel along the water's edge of the Gulf of Paria and the third crossing, 2,415 ft under the Oropouche River, would involve marshy, wetlands. Each crossing presented unique challenges for Southeast's crew.

"Once we were awarded the job, we began designing and building our own large diameter reamers that would be used on this project," Weaver said. "Because of the location, air-freighting replacement parts would be very costly and time-consuming to get them through customs, so we had to make sure that we carried backups of almost every repair part we could think of. Three 48-foot parts trailers were sent to Trinidad completely filled with replacement parts."

The Crossings

The Guapo River crossing was in the area of the Guapo Village in southwest Trinidad. The 2,230-ft bore went under the river, as well as the Mangrove Forest. Ugrich explained that this crossing would prove to be the most problematic of the three, citing the rugged terrain and an unforeseen labor dispute that began on day 16, lasting for 88 days. Due to the length of the stoppage, another problem popped up: the crews went from working during the dry season, as the bore was prepared for, to working during the wet season. Rainfall during the dry season is 1 in. per month; the wet season brings rainfall to 10 in. per month, leaving workers and the equipment to maneuver (slowly) in knee-deep mud.

"This drill was the most challenging for setting up a centerline and establishing TruTrack paths for the guidance tracking wire," Ugrich said. "The Mangrove forest consisted of a low-land swamp area that would fill up every day as the Gulf of Paria tides would come in. The trees also grow their root system on top of the ground, instead of beneath it."



Each of the three bores required seven reaming passes to reach the 72-in. diameter needed to pull the 56-in. pipe. Due to the size, Southeast Directional Drilling custom-built the reamers for this job.

Drilling the pilot hole started Jan. 30, 2004. Southeast used a custom-built Cherrington 1.4 million-lb rig for the pilot bore, drilling a 9 7/8-in. hole. It took seven reaming passes

to reach the 72-in. diameter, starting with a 20-in. reamer. Pullback took 14 hours. Weaver noted that the drilling of the pilot hole was critical to the bore's success, given the size of the pipe and therefore the radius needed (a 5,600-ft radius was required).

"That had never been done before," Weaver said of the drilling radius. "We drilled to about an average of 110-foot depth to accommodate the 5,600-foot curve."

The second crossing in Clifton Hills (2,517 ft) presented environmental challenges for Southeast. Due to a great deal of beach erosion that had occurred where the bore was to be drilled, officials were concerned with drilling there. After numerous design proposals, one was agreed on. This pilot hole started on July 23. There was a lapse of a few weeks between the first and second crossing as Bechtel constructed pads for the location so as not to run into the same mud problems that occurred at the Guapo River site.

An American Augers 500,000-lb drill was used for the pilot bore. Beyond the environmental concerns, the only other situation encountered was that Southeast had to drill under an existing directional drilled 24-in. BG line. Again using seven reaming passes, this bore was finished in 38 days and four days ahead of schedule.

The third crossing, 2,415 ft under the Oropouche River, is being completed at press time. No major problems have occurred. Southeast used the American Augers drill for this bore as well and is currently in the final reaming phases. The significant challenge of this bore was going from drilling in soft, marshy conditions to going through a cemented formation of sandstone and mudstone.

Conclusion

All parties involved are pleased with the outcome of this massive project, with Southeast crediting the work of its crew, the local labor and Bechtel.

"I don't think we could have done this job without the support of Mel Trammel [Bechtel's construction manager]," Ugrich said. "[Bechtel] has been super to work with and has given us any assistance or support that we've asked for."

"We had a vision in mind of how things were going to go but we didn't know," Weaver added. "We had never handled 72-inch reamers. We didn't know what was going to occur downhole in this formation. There were a lot of unknowns. When there were problems, they addressed them, they figured out how to overcome them and we nailed the schedule. Personally I just think the guys have done a fantastic job."

Sharon M. Bueno is managing editor of Trenchless Technology International.