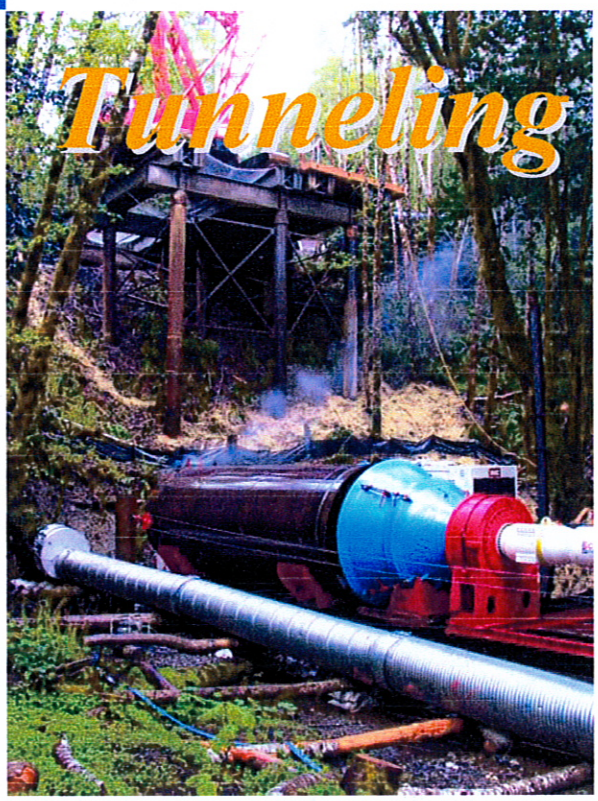

Tunneling Without A Trace

Emerging Technology Handles Environmental Issues With Ease

By Nick Zubko

The remote location in Oregon's Siskiyou National Forest made site setup a challenge.

Unfavorable surroundings can turn a routine tunnel installation into a grueling undertaking. But with the right equipment and the right line of attack, even the most demanding project can go so smoothly, it sets a standard for how a certain type of situation is approached. A culvert replacement project recently completed deep in Siskiyou National Forest, near Gold Beach, Ore., may turn out to be a prime candidate.

In order to replace a failing culvert that supplied picturesque Quosantana Creek, the contractor, Freeman Rock Enterprises, Brookings, Ore., had to deal with a number of challenges. First, the crew had to devise a means to access the worksite from the roadway 45 ft above the culvert, and then deal with environmental concerns that narrowed its work window to a mere five weeks — all during a month that received more rain than the area had seen in more than 50 years.

The project itself called for installing 197 ft of the new 120-in. diameter culvert with a relatively new technology called horizontal pipe driving (HPD). With the remote location of the site — 13 miles inside the forest — choosing the most appropriate method to complete the job may have been the easiest part. Getting the equipment set up, however, was a different story.

"There was a lot of preliminary setup; it was the most time-consuming part of the whole project," noted Dave Freeman, construction manager and owner of Freeman Rock. "Because of the environmental factors, we decided to build a crane platform to the side of the road. Then we used a 175-ton crane to lower all of the pipe ramming equipment down to the site."

The platform setup allowed the crew to lower the massive 50,000-lb casing pipes, along with one of the 60,000-lb. hydraulically-driven, nitrogen-charged impact hammers. Developed by the project's equipment supplier, SCCI Inc., Tampa, Fla., about two years ago, the patented HPD system is capable of delivering 6 million lbs of thrust.

"The ultra-high impact energy introduced in the casing causes the soil particles to be forcibly sheared," explained SCCI president Rob Verkyk. "With the ramming-assisted jacking system, the soil particles are simply brought in suspension causing a friction reduction that allows greater jacking forces."

With successful runs in central Florida and elsewhere in Oregon earlier this year, the system has already proven its capabilities with larger-scale rams. That impressive track-record not only proved that the equipment could get the job done, but also that it could get it done in a short span of time — a crucial element, given that the in-creek work window was governed by approximate dates Chinook and Coho salmon could spawn in the creek outlet streambed.

Squeezing into that window became increasingly difficult, however, when, in addition to the intricate setup and environmental concerns, the area also received an abnormal amount of rainfall. But despite battling 15 inches of rain (during a time of year that usually only gets five) the crew was still able remain on schedule.

"In this project, I think 'timeframe' was the key word," noted Freeman. "Those dates were non-negotiable and if we weren't out of there in time, we would have been kicked out. But we were in and out of there in just a heartbeat, and I think if the weather had cooperated a little more, we probably would've even beat the heck out of that time."

Workers drove 120-in. casing nearly 200 ft in order to replace a failing culvert that carried Quosantana Creek underneath a roadway.

From start to finish, the pipes took a grand total of eight days to drive, but only a couple of hours each day was actually spent driving the pipe. The rest of the time was spent adjusting the drive from data gathered with a newly-developed position indicator, which allowed the drive to be closely monitored and "steered" to reach the targeted breakthrough point within inches.

The first drive using the patent-pending process resulted in a deviation of only ¼ in. horizontally and 4½ in. vertically — believed to be a record in precision for this diameter of pipe.

"Before this technology was available, if you came out within a few feet [of the target] everyone was tickled to death," Freeman pointed out. "But now all of a sudden you have an option, where you can tunnel underneath a highway without impacting the highway or the environmental elements, and you can actually make it come out where it's supposed to."

That precision accuracy was accomplished by heavily reinforcing the end of the lead pipe and equipping it with a steering apparatus. SCCI also mounted the lead pipe with a purpose-built experimental positioning device, which has proven itself capable of accurately (within 5 mm) reporting line and grade of while the pipe sections are being driven.

A revision to the standard joints of the Permalok pipes was also instrumental in this process, making the pipes more suitable for the high energy levels of the HPD system, while maintaining flexibility.

Now able to deliver precise results, and supported by proven engineering, the process of horizontal pipe driving continues to add successful drives to its resume. That success, however, has also set into motion a semantical argument over whether the HPD system is still considered pipe ramming, or whether it's a departure into something totally new.

"Pipe ramming is commonly associated with the air-impact type hammers, but this [HPD] is more akin to pile driving," explains Barry Meyer, SCCI's engineering consultant and technical manager with HDR Engineering in Tampa, Fla. "The mass of a ram is relatively low and drives the pipe with a high impact rate, but with low energy at impact. Pile driving delivers a much larger impact force which allows it to get through a lot of conditions that other methods usually can't."

And in addition to getting through some of the more difficult ground conditions, the process also avoids having to remove soil plugs until the pipe has completely broken through. That luxury not only helps to speed up the process, but it also dramatically cuts down the impact to environmentally-sensitive areas that other methods, according to Verkyk, would not be able to accommodate.

"Other systems typically don't have the energy to drive a complete pipe without removing the plug," he explained. "That's important because you're not disturbing the face at all like you do with a typical jack-and-bore. You don't run the risk of a cave-in or settlement from soil running into the pipe, so it lends itself to installations with relatively low overhead soil cover."

After having used the method for the first time, Freeman added that the condition in which his crew was able to leave the jobsite was what probably impressed him the most. "This is a very neat, clean process and it really lessens the impact to an area like this. That [environmental impact] was one of the biggest issues that we had with the project, and now that we're done, you can see that it already looks very nice in there."

The 60,000-lb hammer is capable of delivering 6 million lbs of thrust

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