HDD Bores the Way for Microtunneling

by Joe Zeck

Loy Clark Pipeline used an array of geophysical measuring equipment inside the pipe to analyze the soil conditions.

Airport runway crossings are not new to horizontal directional drilling, but the crossing recently played out at the Renton Washington Municipal Airport involved some difficult challenges, as well as a unique product pipe application.

PacRim Geotechnical, a geotechnical engineering firm, was hired by Washington's King County to identify soil conditions under the airport taxi way and runway in order to determine a bore path for a microtunneling project. Loy Clark Pipeline, an underground construction company based in Portland, Ore., was employed to install two 500-ft by 4-in. (152-m by 100-mm) PE conduits.

What made the installations unique were not the two 4-in. (100-mm) PE pipes to be installed, rather what was to be placed inside the pipes. Once the conduits were installed, an array of geophysical measuring equipment, including cross hole seismic probes and ground penetrating radar (GPR), were to be placed in the conduits to analyze the soil conditions and help determine optimal geological conditions for placement of the larger microtunneling bore.

Oat Reeves of Loy Clark Pipeline stated, "Taking geological soil samples to determine soil conditions is not a typical application for most drilling contractors. The added value of knowing the soil conditions before a microtunneling bore is becoming well worth the cost and time it takes to install these sensor pipes."

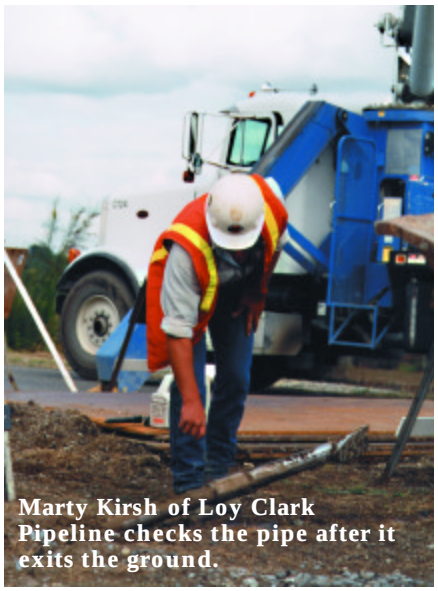
The installation of the two PE conduits in ground conditions of clay with rock was made more difficult by the exacting tolerances the job required. A Vermeer 24X40 drill was used. The primary requirement was to follow a predetermined path with absolutely no room for variance. The first pipe needed to be installed 15 ft (5 m) deep at an exact 1 percent grade, precisely 15 in. (375-mm) to the right of the intended microtunneling path. The second pipe had the same pitch requirements and was to be installed 15 in. (375-mm) to the left of the intended microtunneling path at 25 ft (8 m) deep.

The placement of the PE conduits in relation to the planned microtunneling bore needed to be aligned precisely to each other. This was done in order to achieve a spacing that covered the possible tunnel alignment and that would provide usable results from the geophysical testing.

Any deviation from the planned profile was unacceptable. PacRim Geotechnical was employed by King County to provide geotechnical engineering services for the project. Mike Byers, PacRim Geotechnical geotechnical engineer, worked with locate operator Marty Kirsh to ensure a proper installation of the product pipe.

In addition to the tight drilling tolerances, metallic interference near the beginning of the bore played havoc on the DigiTrak Mark II receiver. Loy Clark suspected the readings near the steel sheeting of the 20-ft by 20-ft (6-m by 6-m) entrance pit would not be accurate. There were also steel plates laying around the pit, as well as a temporary metal fencing used to secure the large pit.

Even after drilling 10 ft (3 m) past the pit and surrounding steel, the



Marty Kirsh of Loy Clark Pipeline checks the pipe after it exits the ground.

DigiTrak Mark II was not showing depth readings that were consistent with the pitch readings. A troubleshooting call was placed by Loy Clark to Digital Control Inc. (DCI), the Digitrak system manufacturer. Loy Clark hoped DCI could help with the depth discrepancies, as well as determine the extent that high concentrations of steel would skew the receiver's readings. The customer service technicians at DCI determined the environment was indeed causing the interference and would come to the site.

DCI utilized a newer model of the DigiTrak, the Model III, which has greater internal shielding to help combat the high interference found on this drill site. Although the Mark III was still affected by the metal at the beginning of the bore, the level of interference was far less than with the Mark II. The Mark III was capable of locating near the interference more accurately. Furthermore, the depth readings were more consistent with what the pitch reading indicated.

Together, Loy Clark and DCI were able to get the bore on track to the customer's satisfaction and demonstrate to the inspector that the actual drill path was meeting the planned profile.

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Other obstacles to avoid were not downhole, rather they were of the "winged" variety. Kirsh and Byers worked with air traffic controllers at the airport via a handheld radio to avoid the aircraft landing and taking off.

Loy Clark successfully completed both installations without further complications. The entire installation of both bores took less than a week. King County and PacRim Geotechnical were pleased with the accuracy and timeliness in which the bores were completed.

One aspect of the geotechnical testing was to use a borehole deviation probe that provided borehole inclination, bearing and true vertical depth. The instrument readings were found to plot very close to the location points recorded during the drilling operations, verifying the bores were located as indicated during drilling.

The accuracy of the equipment and the expertise of the personnel from Loy Clark Pipeline and DCI contributed to a successful exploration program. The program provided the information necessary to locate the microtunnel in a zone that would allow the best conditions for microtunneling.

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