FASTRAK™
The Best Boring News from DCI DIGITAL CONTROL INCORPORATED Vol. 3, No. 2 - April 1999

Tricks of the Trade

Crew monitoring traffic on Aurora Avenue in Seattle. Note drill rig across highway near base of Space Needle.

Often the most innocent-looking projects are the ones that end up being the hardest to complete, and in many cases the crews do not realize what they are up against until they are knee-deep in trouble. Fortunately, this is not one of those stories, because the crew had completed their project planning.

In January, Sandy Goetz, drill rig operator for Pilchuck Diversified Services Inc. of Marysville, Washington, contacted DCI as he was setting up for a project in downtown Seattle. He was about to install a fiber-optic cable for Greenstar Telecom. The shot wasn't very long, about 330 ft (100 m), but would go under seven lanes of traffic across the very busy Aurora Avenue just north of the city center. The borepath required a depth of about 30 ft (9 m) and allowed only minimal left/right deviation.

Sandy was having problems with high background noise and asked for recommendations on which Transmitter would be best suited for the shot. The source of the interference was a combination of overhead utilities and a buried 115-kV powerline. Mark Gallucci and Bruce Arbo, DCI customer service managers, decided to visit the site and, upon conducting an interference check, determined that background interference along the intended borepath ran anywhere from 250 to 500 points. As a comparison, the signal from a standard Transmitter at a depth of 10 ft (3 m) is about 500 points. Upon checking the validity of the pitch and roll information using a battery-powered 70-ft (21-m) Transmitter, all pitch/roll data were lost at the equivalent of 15 ft (4.5 m) of depth.

Drill operator checking power supply ground connections for Cable Transmitter System.

Because of the difficult interference conditions, in addition to an existing cast iron sewer and fiber-optic lines near the drill path, DCI recommended the 140-ft (43-m) Cable Transmitter System.

Pilchuck had elected to use a Vermeer D50 x 100 with a 15-ft (4.5-m) drillstem for this project. Since it was a local project and Pilchuck had never used DCI's Cable Transmitter System before, Mark Gallucci and Bruce Arbo offered to demonstrate the system as well as DCI's DataLog System. The DigiTrak Cable Transmitter sends uninterrupted pitch and roll information in the presence of magnetic and electrical interference back to the drill operator via a cable inside the drill pipe. Depth, front and rear negative locate points, and left/right steering are received above ground in the same way as with the standard DigiTrak System. In essence, the Cable Transmitter System is an enhancement to the standard system that maintains all of the standard locating characteristics.

The DataLog System is an "as-built" generating system that electronically

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records information during drilling, resulting in professional-quality graphs and data tables. For those who prefer to monitor the borepath in progress (during drilling), the DataLog System allows them to view this information in "real time" on the job site.

Locating problems ensued during rod number six at a depth of about 25 ft (7.6 m). Extreme interference was causing problems in finding accurate depth readings and locate points. A combination of remote steering and off-track guidance was used to solve these problems over the next 100 ft (30 m) of drilling.

Remote steering uses the DigiTrak Receiver as a target. This allows the drill rig operator to determine the lateral direction of the Transmitter by observing the steering bar on the remote display. The Receiver was placed as far out in front of the tool as signal strength would allow, which was about 55 ft (17 m). At this location the signal strength was about 300 points. Rather than placing the Receiver on the ground (near reinforced concrete), it was placed 3 ft (1 m) off the ground on a traffic barricade, as shown in the photo below. Depth was calculated by keeping track of pitch changes rod by rod, and the lateral direction was displayed back at the rig on the Remote Display.

DCI used this opportunity to train Pilchuck's locating crew on the use of off-track guidance. Off-track guidance is an alternate locating method that allows the tool to be located when walkover locating is not possible. The process, unique to the DigiTrak System, starts by finding the positive locate line (PLL). The PLL runs through the center of the Transmitter at exactly 90° to its axis and extends outward until the Transmitter's signal becomes too weak to use. It can be found by stepping off to either side of the Transmitter and finding where the plus/minus indicator in the Receiver's display flips from a minus to a plus (Point 1 in drawing below) as the Receiver is moved forward. You then step further to the side of the Transmitter and again find the point where the minus flips to a plus (Point 2). Repeat this procedure to find a third location (Point 3). When these points are lined up, they confirm the location of the PLL, from which the heading of the Transmitter can be determined. The off-track guidance method further allowed the crew to determine that the direction was on target.

"A combination of remote steering and off-track guidance was used to solve these problems ..."

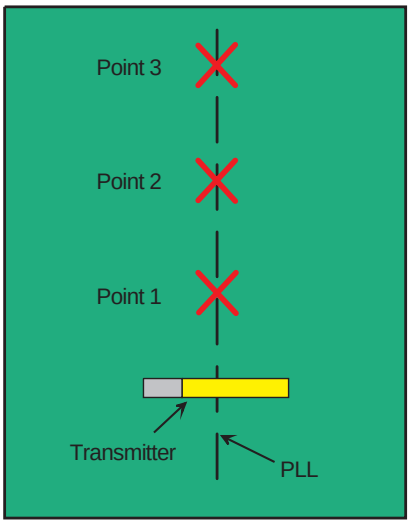
DigiTrak Receiver in position for remote steering.

Confirming the front negative locate point (FNLP).

After three days of only being able to shut down one lane of traffic at a time and sometimes no lanes, the drill head made it past the seventh lane and much of the earlier-mentioned interference. Once again the front negative locate point (FNLP) and accurate depth measurements were available. From there it was a fairly easy 20-ft (6-m) shot to the target. Using the FNLP it was determined that at 5 ft (1.5 m) from the target area the drill head was starting to head off in the wrong direction. After repeated unsuccessful attempts to redirect the head, the decision was made to dig out the sidewalk in the area where the drill head had been located. A pit was dug and the head was found at the exact point and depth that the DigiTrak Receiver had indicated. At this point, the shot was considered a success, and the pit was lengthened to allow room to push the drill head up and out.

By combining the superior range, roll, and pitch capabilities of the DigiTrak Cable Transmitter System with the DigiTrak Receiver's locating and remote steering techniques, a very difficult if not almost impossible run was successfully accomplished.

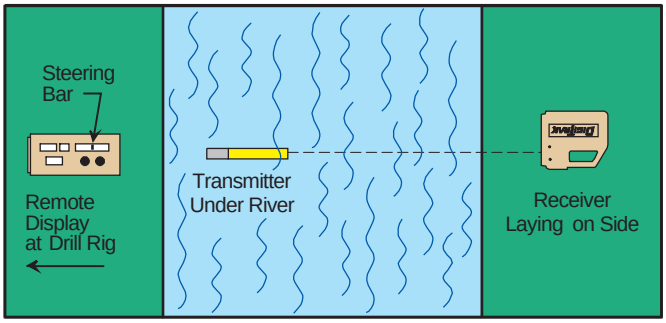
Bruce Arbo



The positive locate line (PLL) runs perpendicular to the Transmitter.

TECHNICAL TIPS - *Remote & Vertical Steering*

Vertical steering, a feature unique to the DigiTrak System, is a variation of remote steering, which is employed when walkover locating is prohibited, such as during a road or stream crossing. During remote steering, the Receiver is laid on its side with the orange arrow pointing down. It is placed out in front of and perpendicular to the Transmitter for left/right steering guidance (see sketch above). Left/right is displayed on the steering bar of the Remote Display unit (in its normal orientation at the drill).



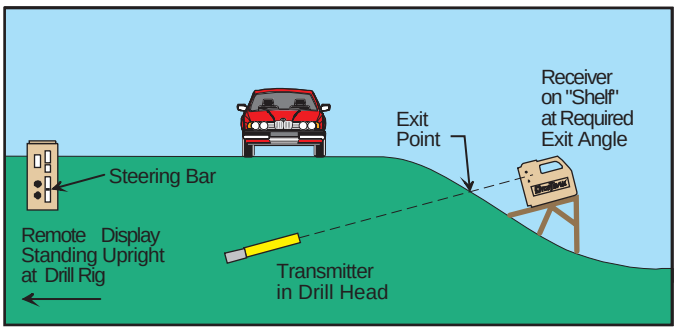
DigiTrak equipment configuration for remote steering (left/right guidance) under a river.

With vertical steering, both the DigiTrak Receiver and the Remote Display stand upright. When the Remote Display stands upright (battery door up), the steering bar is used to provide up/down steering guidance.

Below is a diagram depicting a site where the contractor needed to shoot across a road and exit through the road embankment at a precise location and angle. Walkover locating was not an option due to traffic. DCI suggested vertical steering as a solution. The contractor built a "shelf" behind the exit point and placed the DigiTrak Receiver upright on the shelf at the required angle (see sketch below).

For the drill operator to steer the tool to the vertical position, the Remote Display had to be rotated 90° clockwise so that the battery door was pointing upward as shown in the sketch. With this setup, when it is necessary for the drill operator to confirm the left/right steering direction, the Remote Display must be returned to the normal position and the Receiver must be laid on its side as discussed above. In this case, the contractor was able to steer the Transmitter accurately—knocking the Receiver off the shelf as the Transmitter exited the ground.

Mike Young of DCI was recently present at a project where the contractor was faced with a particularly tricky locating problem. They had to install a line underneath a manufacturing plant with a heavily reinforced floor and into an exit window measuring 4-in. tall x 12-in. wide (10-cm x 30-cm) within a 4-ft x 4-ft (1.2-m x 1.2-m) pit. The pit was dug behind the wall of a dressing room that was lined with metal lockers. Between the heavily reinforced floor and the metal lockers, walkover locating was not possible. The contractor had run out of bullets in his "locating holster" and asked Mike for ideas.



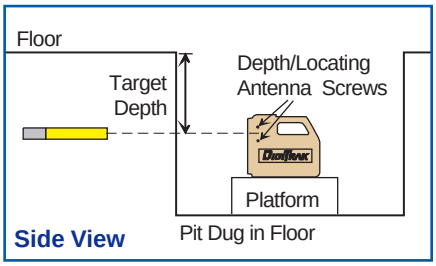
DigiTrak equipment configuration for vertical steering (up/down guidance) on road embankment.

They decided to employ vertical steering. When the Transmitter's signal is obstructed from above, in this case by the reinforced floor and metal lockers, the Receiver can still pick up the Transmitter's signal from the front or below. The signal out in front of the Transmitter (and below too) is less affected by overhead interference sources.

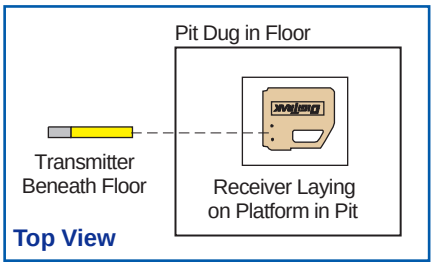
Given that the exact exit location had a specified depth, once the Transmitter was within range of the pit, the Receiver was positioned in the pit for vertical steering (see side view sketch below). Using the center point between the two depth/locating antenna screws as a target, the Receiver was placed on a "platform" so that the center point of the antenna screws was at the required target depth. By standing the Remote Display upright, the steering bar could be used to guide the Transmitter vertically.

To check the lateral direction, the Receiver was laid flat, the Remote Display was returned to its normal orientation, and the traditional remote steering method was employed (see top view sketch below).

With Mike's help using the vertical steering method, the contractor was able to steer the tool into the 4-in. x 12-in. (10-cm x 30-cm) window exactly where required.



Using Receiver as target in pit.



Left/right steering in pit.

Mike Young teaching interested DigiTrak users some new locating tricks.

DCI Booth a Hit at CONEXPO

CONEXPO-CON/AGG is one of the largest construction equipment shows in the world, and it's held every 3 years in Las Vegas. Over 160,000 people attended the week-long event at the end of March this year, and according to DCI's staff present at the show, it seemed like at least *half* of the attendees visited the DCI booth!

A popular pastime at the DCI booth was trying out the locating platform, which allowed real-time demonstrations of the capabilities of the DigiTrak System. Mike Young, one of DCI's field service managers based in Kansas, instructed users in locating with the DigiTrak System. Mike has been in the directional drilling industry since 1989. He has been using the DigiTrak System since its infancy, originally as one of the owners/founders of Straightline Manufacturing.

Mike is currently involved with DCI's advanced training program as well as supporting the various machine manufacturers that represent DCI. He can be contacted on his mobile phone at 206-409-4626 or via his e-mail at myoung99@aol.com.

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