

Directional Drilling for Installation of Sewers

BY GURJIT SANGHA AND GORD SWYSTUN

In 2005 the Township of Langley tendered a contract for the road reconstruction at 203rd Street between 64th and 67th Avenue. Part of this project included the installation of 600 metres of 450 mm diameter pressure sewer main.

The original design for the sewers to be installed was at a depth of about 2.0 metres and utilized gasketed PVC pipe. At this depth a number of utility conflicts had been anticipated. To address these issues goosenecks were implemented into the design to direct the pressure sewer under the existing utilities. Along with the goosenecks, the installation of air valve and blow down chambers was required to ensure proper operation of the pressure sewer main at these locations.

An alternate methodology by the low tenderer, Triahn Enterprises and its subcontractor Directional Mining and Drilling Ltd., proposed the installation of the pressure sewer by directional drilling with use of HDPE pipe. Dayton & Knight Ltd was retained to review the alternate and provide engineering services during construction for the directional drilling.

The proposed directional drill design included installing the pressure sewer at an increased depth of up to about 5.5 metres to avoid utility conflicts. In areas where no utilities were anticipated the drill depth remained at about 2.0 metres. The proposed design eliminated the need for air valve and blow down chambers which reduced costs. However, the capital cost savings for the blow down and air valve chambers were offset by the increased cost for installation by directional drilling.

Although there were no capital cost savings with the design, there was an overall lifecycle cost savings for the forcemain as there would be no requirement for maintenance of the sewage air valves and blow downs. Other additional benefits for directional drilling were the reduced asphalt cutting and patching as well as a reduction in inconvenience to the public during installation.

Test pits were excavated at several locations along the proposed alignment. These pits served as mud relief pits as well as provided geotechnical information to the contractor of the existing ground conditions. The soils in the area were found to be primarily soft clay material. Based on

the geotechnical information and overall lifecycle costs savings the Township accepted the alternate bid.

Prior to installation, a site survey was completed along the alignment for reference and guidance during installation as well as monitoring for road heave. Some concern had been expressed prior to commencement of the project for the potential of road heave at shallow depths.

The direction drill installation was initiated with a 200 mm diameter pilot hole with use of a drill rig (rated at 400,000 lbs of pull back and push force). The steering system utilized by the contractor included the use of an above ground digitracker which monitored the location of the drill head underground. This device allowed for accurate depth and horizontal measurements of about ± 50 mm to ensure the pressure sewer was installed at the correct alignment and grade.

The initial pilot hole had several challenges including some minor localized frac-outs. (A frac-out is when the mud, under pressure within the pilot hole, migrates to the surface.) This had been anticipated prior to the project at shallow drilling depths. These frac-outs were contained at road elevation at each location.

After the initial pilot hole, a series of back reams were used to enlarge the pilot hole for installation of the pressure sewer. During the back ream process there are large volumes of solids in the mud as a result of the significantly increased material being moved from the hole as compared to the initial pilot hole. It is important to monitor mud pressures and solids contents within the mud mixture during this process. The contractor decided to complete several back ream passes to increase the drill hole to 450 mm. As with the pilot hole several local frac-outs were encountered during the drilling process.

There were several challenges during installation of the forcemain including settlement of an adjacent parallel gravity sewer trench. The asphalt around the gravity sewer trench had settled about 25 to 50 mm and caused cracks within the pavement structure. It had been initially believed the cracks were a result of heave resulting from drilling at shallow depths. However, upon review of preconstruction and post construction survey information



The new HDPE forcemain being pulling into pit at 67th Avenue.

it had been found that a trench about 2 metres wide, parallel to the forcemain had settled. A geotechnical investigation was then completed to assess the cause. The geotechnical report indicated that settlement of trench was likely a result of poor initial compaction during installation of the adjacent gravity sewer. The drilling mud from this directional drill installation migrated into the adjacent trench causing the backfill soils to realign, further compact and cause trench settlement. Upon post video inspection, the gravity sewer was found to have been unaffected by the backfill settlement.

Although some difficulties arose during construction, the overall installation with directional drilling has resulted in a pressure design that will lead to less maintenance and overall lifecycle cost savings to the Township. The success of this project complimented by ideal ground conditions has paved the way for future consideration of directional drilling projects within the Township. **CB**

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