St Albert's microtunneling experience

Above: Sharp end of the Akkerman microtunneling machine

Right: Launch of the machine through the shaft's tunnel eye

Crews in St Albert in Alberta, Canada have withstood pipe supply troubles and cold winter temperatures to complete microtunneling for the first phase of a new sewerage network. *T&TNA* correspondent Tonia Jurbin files this report.

The growing City of St Albert, Alberta has recently wrapped up Phase I of their most ambitious underground infrastructure project ever. To accommodate the growth of this northern city on the outskirts of Edmonton, the City is building a new sanitary trunk sewer system worth in excess of $Can25 million. Phase I, worth $Can9.4 million includes a grinding station, three control structures and 1,800m (5,900ft) of 1.2m (4ft) diameter sewer designed to serve also as an interim storage facility with a capacity of roughly 2,000m^3.

The project is funded partially by a joint Federal and Provincial infrastructure program, and - as with other projects of this type in Canada - meeting completion dates is a condition of funding. St Albert put out an RFP (request for proposals) and retained Stantec Consulting Ltd of Edmonton as the prime consultant. Given that it had worked on the feasibility study the company's proposal offered slightly more than other submissions, including an overall concept review and the proposal to use microtunneling for the first phase section of the project.

The topography in the historic yet growing residential neighborhood does not lend itself well to conventional trenching. Using microtunneling, the designers could also shorten the alignment by passing under a 25m hill, an obstacle they would have otherwise had to go around. Additionally, disruption to one of the busiest collector roads in the City as well as to a transit route, three nearby schools, and an assisted living institution was minimized.

Jacking of the polymer concrete pipes selected for the contract

Michels Directional Crossings Co of Nisku, Alberta was the successful bidder and proposed using its Akkerman microtunneling system for the one-year contract.

Community relations played a large role in promoting the microtunneling option. The combination of unfamiliar technology and a big price tag, especially when more visible infrastructure projects were ongoing, made the project a tough sell at first. Todd Wyman, Project Manager with the City of St Albert explained: "We often talk about ribbon cutting ceremonies for leisure centers and new roads; we don't properly recognize the good work we don't see. Much of the public outreach was about schedule and description. We wanted to make sure the customers who were most impacted were well cared for."

More than 700 residents were contacted, many of them in a door-to-door campaign. During the work the contractor consistently demonstrated its commitment to minimizing the impact of their operations on the

Left: Proximity of the working shaft to the neighbors with the operating equipment protected from the cold in the erected tent

community. One of the working shafts was within 10m (30ft) of three houses.

The design was based on borehole information collected from each proposed shaft location and intermittently along each of the tunneling runs. Machibroda Engineering Ltd of Edmonton was the geotechnical sub-consultant. During the tender period two additional test pits and two 1.2m diameter auger holes were excavated by prospective tenderers. Four 6.1m (20ft) jacking shafts and four 4.3m (14ft) receiving shafts ranging in depth from 9 to 20m (30-65ft) were sunk about 250–300m (800–1,000ft) apart. Precast concrete manhole vaults, supplied in two halves, were lowered into the shafts before they were backfilled with a low strength fillcrete product.

The first run was from jacking shaft J-4 towards receiving shaft R-4. Then from J-3 they tunneled in both directions towards R-4 and R-3 leap-frogging their Akkerman SL52.5 MTBM from jacking shaft to jacking shaft, while at the same time excavating the shafts just ahead of the tunneling runs.

One tunnel run through massive shale saw production drop to 6m (20-30ft)/10h shift, but for the most part conditions were consistent throughout in clayey sandy silt where advance was about 15m/shift.

The biggest challenge on this job was pipe supply. The City offered a choice of polymer concrete, PVC lined concrete or fiberglass pipe. Michels went with the polymer concrete because it is strong (17,000psi/120MPa), well suited for microtunneling, and being almost inert, it did not require a liner. Pipe supply and transportation was worth some $Can2 million.

Polymer concrete pipe has been around for a while but is not yet widely used in North America. In western Canada this is believed to be the second application, and, unfortunately for Michels, the North American supplier, Amitech USA of Zachary, Louisiana was its first year of manufacturing and was experiencing growing pains. Securing sufficient outgoing transportation was difficult, and although the plant was minimally affected, the hurricanes in September 2005 caused chaos in the area and created uncertainty in supply schedules. Most of the pipe was transported by truck with one or two shipments by rail that generally didn't work out to very well.

Pete Rasmussen, Project Superintendent for Michels, recalled: "Our jacking pressures were typically 150 to 200 tons; never exceeding 250 tons while we were mining. When we ran out of pipe and couldn't continue the ground started to collapse around the pipe and the pressure went up, in this case to 460 tons. We used lubrication throughout, and we managed to get the pressures back down to 200 tons once we got more pipes, but then we ran out of pipe again! At one point we were so stuck that we caused heave of the highway behind our jacking pit just trying to move the line again. It got to the point where we were down to jacking one pipe a day just to keep things loose and moving when we could have done five."

Because the extraordinary difficulties with supply were beyond control of the contractor, the completion date was extended by one month with Michels bringing in more crews and working longer shifts to get the project back on track.

Another challenge, and one facing most Canadian contractors, was the cold. Fortunately the winter of 2005/06 was unusually mild, mostly above freezing. Still, in October the team pitched a tent to enclose their operation and used a combination of propane and waste heat to keep their compressor, generators, control building, bentonite pumps, cooling water tanks, high pressure jet pumps and toilet warm and frost free.

Sadly, a significant expense and nuisance came from local vandalism and theft. Several reportable incidents and other daily acts of minor vandalism plagued the project.

Despite being one month behind schedule, the contract was a great success. So successful in fact that, during the last run, the City Council granted approval for a 330m (1,080ft) contract extension from a newly designated shaft J-1A to R-1. Wyman explained that it made sense to add the last required microtunneling run for the project to this first contract since the rest of the project is expected to be built using conventional methods. "We were able to show that the extension would be more beneficial than undertaking a second contract tender. Even with a 25% increase in pipe supply and transportation costs the savings could be as high as half a million dollars. Since the contractor had fostered such good working relationships and with crews and equipment still on site and not spoken for, it turned out to be a win-win situation." ■

Above: Fig 1. Plan of the microtunneling runs excluding the 300m extension

Left: Taking the curve in one of the working shaft manholes

Below: A temporary bolted corrugated metal support liner used in the receiving shafts until removed for final construction of the manhole structure