

## PIPE-JACKING: Milwaukee, US

# Sewer refit against the

**Microtunnelling a sewer replacement in Milwaukee, US, minimised disturbance to residents and, despite geological challenges, a remarkable 1,828 m tunnel, nine shafts and eight bores were completed in just five months**

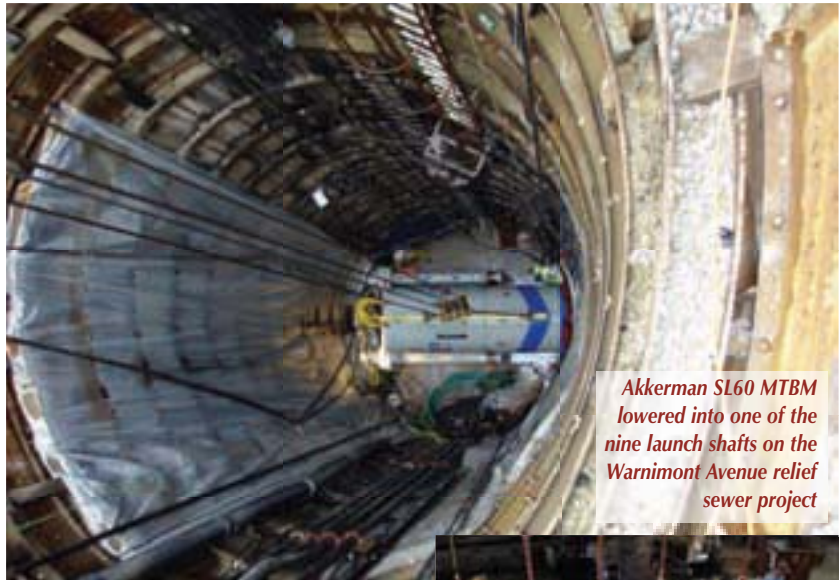
**O**VER the past ten months, a 1,829 m-long sewer-system replacement project, referred to as the Warnimont Avenue Relief Sewer, has been completed by general contractor Super Excavators of Milwaukee, US. While this extensive project was under way, in two shifts per day, the residents of the quiet neighbourhood suffered minimal disturbance, thanks to the use of trenchless technology and Akkerman Inc's compact and versatile microtunnelling system.

Microtunnelling is a trenchless technique that allows the underground installation of pipes while causing minimal disruption to the surface environment. The glossary of terms in *Trenchless Technology: Pipeline and Utility Design, Construction and Renewal* by Mohammad Najafi and Sanjiv Gokhale defines microtunneling as: "A trenchless construction method for installing pipelines. Microtunnelling uses all of the following features during construction:

- **Remote-control** – the microtunnelling boring machine (MTBM) is operated from a control panel, normally located on the surface. The system simultaneously installs pipe as spoil is excavated and removed. Personnel entry is not required for routine operation.
- **Guided** – the guidance system usually references a laser beam, projected on to a target in the MTBM, capable of installing gravity sewers or other types of pipelines to the required tolerance, for line and grade.
- **Pipe-jacked** – the process of constructing a pipeline by consecutively pushing pipes and MTBM through the ground using a jacking system for thrust.
- **Continuously supported** – continuous pressure is provided to the face of the excavation to balance groundwater and earth pressures."



**Akkerman MT860K**  
keyhole jacking frame



**Akkerman SL60 MTBM**  
lowered into one of the  
nine launch shafts on the  
Warnimont Avenue relief  
sewer project

In August 2006, Super Excavators received the winning bid for this endeavour. The project owner, Milwaukee Metropolitan Sewerage District, sought bids where applicants would pay special attention to their 'Small, Women and Minority Business Enterprise Programme' requiring the general contractor to engage 13% minority, 2% women-owned and 5% small-business contractors over the course of the project. Super Excavators exceeded these requirements by using concrete and trucking contractors from these categories.

The Milwaukee Metropolitan Sewerage District (MMSD) is no stranger to the concept of trenchless technology. Its Central Metropolitan Interceptor Sewer (MIS) Improvement Project, started in 1998, used trenchless technologies to first assess the condition and then either replace or repair 80 km of sewer pipe. The MMSD website states: "Ten years ago, a project of this magnitude would have been disruptive, with closed streets and detours impacting travellers and businesses for months at a time...but [with trenchless technology] most of the people on the streets above don't even know it has begun."

Super Excavators expected challenges with the soil. Mostly, it consisted of stiff clay, with cobble and boulders and some softer clay, with sand on the east end of the job. Clay is typically



difficult as it is hard to advance the MTBM and clogs the machine face. Crews had to change the cutters on the disc-cutter head after two bores, when large boulders were encountered in the cutter zone. They increased the jetting and slurry of the machine to help it advance by mixing the crushed cuttings with water at the front of the machine's face and carrying them through the slurry system, out of the machine and to the surface. Gregg Rehak, project manager for Super Excavators, said Akkerman's equipment "exceeded expectations" and "each shift was consistent in terms of performance of the machine".

Preparation for the project began in November 2006, with excavation beginning in March 2007. Super Excavators received its new SL60 MTBM and MT 860K keyhole jacking frame in March. The equipment arrived on site with a technical programmer to set up the machine's instrumentation and a technician to assist with the project launch. Periodically,

# clock

technicians and sales staff visited the site to ensure the crews were achieving optimal drives.

Rehak greatly appreciated this aspect of Akkerman's commitment to customer support. He said: "Akkerman sends staff unannounced to check on the progress of the job. It is unheard of in this day and age to receive this level of customer care. Many machine builders are difficult to contract via phone."

The first of its kind, the MT 860K keyhole jacking frame was designed to operate out of a 4.88 m-diameter shaft. It features up to 800 tons thrust capacity, while advancing a pipe that can be up to 1,524 mm o.d. The standard MT860K can push 3 m laid-length pipe sections and up to 6 m lengths with add-on components. The keyhole frame uses keyed locks on the thrust block to continuously advance the machine. The MT 860K allows the customer to operate a high-capacity jacking frame out of a minimal-diameter launch shaft. Akkerman is to make an MT 875K keyhole jacking frame where 800 tons of thrust capacity can advance a 1.9 m o.d. pipe.

The SL 60 microtunnelling boring heads pilot the course and excavate the ground. Akkerman makes MTBMs in nine sizes, from 600-1,878 mm o.d., and 'increaser' kits are available.

MTBMs have many features specially designed to achieve high performance in soil conditions that range from flowing, unstable ground to hard rock. Slurry, mixed with the spoil, is simultaneously pumped to the MTBM and then to the surface for separation in the slurry tank. Akkerman's MTBMs have a pressure-balanced cutting chamber and slurry spoil-removal feature to provide maximum control of the soil at the cutter face. They are electrically-powered to give optimum efficiency and cutting

torque, especially on long drives. The operator controls the function of both these machines and monitors the guidance system safely in the above-ground control container.

The whole job entailed hand-spade mining of the first 152.4 linear metres of 1,220 mm concrete pipe. The additional 1,676 linear metres of 1,220 mm o.d. pipe was jacked with the use of the SL60 MTBM and MT 860K jacking frame.

Super Excavators had another job, starting in September in Ohio, which required the use of the same Akkerman system. To ensure the Warnimont Avenue Relief Sewer stayed on schedule, project managers organised two shifts per day.

The total job consisted of nine shafts, eight

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cast-in-place manholes and two diversion structures. Two bores were completed out of each launching shaft, and all shafts acted as manhole locations or diversion structures. The depths of the launch shafts ranged from 11.3-25 m and the bores from each shaft were 109-268 m long. The line and grade or slope for each of the eight drives was pretty minimal. Typically, when the line and grade is close to flat, it is harder due to the smaller margin of error. Conversely, when there is more slope, contractors can compensate for it further along the bore. Luckily, the operator in the control container can maintain precision line and grade by monitoring the information presented by the laser-guidance system.

Super Excavators crew members specialise in the operation of Akkerman equipment. Long-



Monitoring the MTBM's guidance system

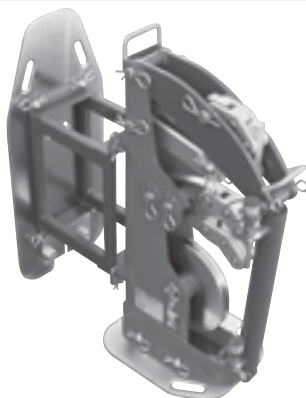
time employees superintendent Brian Strane, and foremen and MTBM operators Nate Wiedmeyer and Brian Henrickson, were pleased with the outcome of the job and the functioning of the SL60 and MT860K. Rehak states "The MTBM operators, Wiedmeyer and Henrickson, under the direction of Strane did a wonderful job in facilitating the complexities of the job. We couldn't be happier with the outcome."

At the time that this article was submitted, Super Excavators was moving to the last launch shaft to complete the final two bores and is expected to complete the job by Labour Day (September 3); this excludes modifying the existing bypass structure on the north end of the project, which will be completed in a year.

Super Excavators provides a variety of underground services to municipalities, developers and businesses. With one of the industry's most experienced workforces, the firm can tackle any project. It runs ten open-cut, two mason, one testing and two restoration crews. All these factors allow it to keep projects on schedule.

In 1973, Akkerman in Brownsdale, MN, began providing tunnel-boring machines to meet the needs of the trenchless sector. Thirty-five years on, Akkerman sells and leases new and used microtunnelling, pipejacking, tunnelling, guided-boring and earth-pressure balance equipment. Akkerman has built a reputation for reliability and responsive service.

*The editor is grateful to Akkerman for supplying this article*



«We think in the ground»

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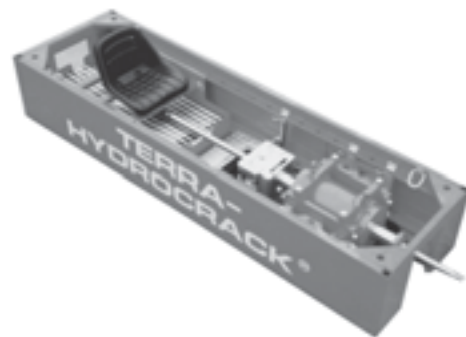
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