TRENCHLESS TECHNOLOGY

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Downhole drilling success

A recent drilling project crossing under the N1 in Centurion, near the active Gautrain high speed rail, proved tricky until the right contractor for the job, armed with the right equipment, managed a breakthrough.

The project involved the installation of four ducks of 110 mm in diameter over a distance of 130 m through solid rock, crossing under N1 in Centurion and under the very active Gautrain rail lines. "Several companies had failed and the project had been waiting for a year or two for the right contractor," says Robert 'Chico' Garcia, JCS Pipeline's operations and horizontal directional drilling (HDD) manager, adding that the evidence of previous contractors' attempts to get all the way across were cleary visible.

Challenging conditions

The biggest challenge on-site was the hard rock. "South Africa has some of the hardest rock in the world," says Garcia. The majority of the bore was solid rock, tested at over 300 MPa. The continuous traffic on the N1 was also challenging, according to Garcia, as well as the fact that the drilling had to cross under the tracks of the Gautrain line. "All of these are very different obstacles that not everybody can overcome, but we did," states Garcia.

The equipment of choice in this challenging context was a downhole hammer supplied by Vermeer's alliance partner Pioneer, on a Vermeer D130x150 drill rig, which Craig Burnie, MD at Vermeer Equipment Suppliers, says was sourced from Vermeer's Beijing Factory. The rig itself was designed for large-diameter HDD projects and, according to Burnie, has "the features and power needed for demanding job site conditions".

In addition, the open-top vice increases visibility for the operator and offers the ability to set large tooling in the vice with ease.

The hammer in this case was used to traverse the approximately 130 m of solid subsurface rock, after the initial hole was opened to a diameter as prescribed by the consulting engineers. "Using the hammer was Step 1 – the hammer is only 160 mm in diameter – but it allowed us to get all the way across, which then allowed us to proceed with the rest of the project," explains Garcia.

The entire drilling process took only 15 days for Garcia and his team from JCS Pipelines, with the pilot bore itself done in only a couple of days. Several days were required for a sizeable single jump to the final 355 mm hole opener (rock reamer). "The hammer and rig worked very well in the South African conditions," adds Garcia.

Training essential

"Not many people have the experience to use the hammer and the related equipment. This takes a lot of specialised skill," warns Garcia, adding that the hammer and rig that Vermeer supplied was supported by training from a Pioneer specialist from the US, with Vermeer's assistance, who showed Garcia and his team exactly what the hammer and rig were capable of. This allowed the already highly skilled team to push the equipment to the limits of its capabilities on-site in order to deliver on time and according to exacting specifications.

"I was very impressed with the team from Vermeer. They always give us outstanding service and their aftersales service is also excellent," concludes Garcia. 3S

The entire drilling process on-site pictured below took only 15 days

A challenging context

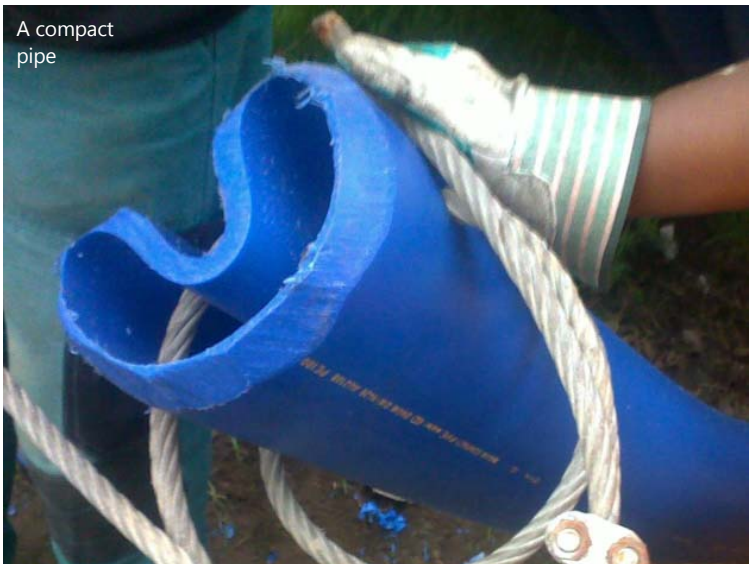
The use of trenchless technologies is increasingly gaining momentum in the local infrastructure arena, given the advantages in both efficiency and cost they offer. **Chantelle Mattheus** speaks to TT Innovations' director, Neil van Rooyen, about the challenges faced in rolling out these technologies.

As with most infrastructure related projects, best practice on-site is always key, but this is undertaken in a challenging environment with many factors contributing to an increasingly complex context under which these projects are rolled out.

Infrastructure already in place on-site also provides its own challenges at times. "For pipeline rehabilitation projects, this does not pose too much of an issue as the existing plans and records are fairly accurate and are easily verifiable, either by conducting a camera survey of the existing pipeline (gaining access via the manholes) or for pressure networks by locating pipeline markers on the surface such as valves, hydrants or tees," says Van Rooyen.

However, the latter is not an option for new trenchless installations by means of horizontal directional drilling or pipe ramming as-built records are crucial. "Any discrepancy could lead to the existing services being damaged during the installation process. As a best practice for new installations, all existing services are required to be positively identified (by verifying the depth and location) and superimposed onto a long section drawing where the proposed installation alignment has also been plotted.

"The local authorities that issue wayleave documents therefore play a critical role in this phase of the project by providing accurate wayleave documents. Any delays from these departments usually result in the entire project being delayed."


A compact pipe

Comprehensive planning process

When addressing the challenges relating to planning and the roll-out of these projects, Van Rooyen stresses that clients need to be able to make informed decisions regarding the assets under their control.

"This can only be done once comprehensive asset condition assessments are undertaken. Proper asset management and resource allocation should therefore be the main priority of decision-makers. Utilising the appropriate trenchless technology results in reduced overall costs and increased asset performance. Unfortunately, most of the 'asset management' work is undertaken on an urgent basis due to failing infrastructure," he says.

He adds that by failing to forecast scheduled maintenance, project specifications are often hastily prepared. "This allows for a wide range of bid submissions to be accepted, which conforms in principle but not necessarily in performance – a further consequence of which is a disproportion between the contractors' prices. This disproportion is generally indicative of varying product quality."

He advocates pre-emptive planning strategies as being favourable for both contractors and clients as projects can be rolled out on a more consistent basis – making it easier to allocate funding and resources – as opposed to reactive planning, which only allows for crisis management.

"Proper asset management and resource allocation should therefore be the main priority of decision makers." **Neil van Rooyen, TT Innovations director**

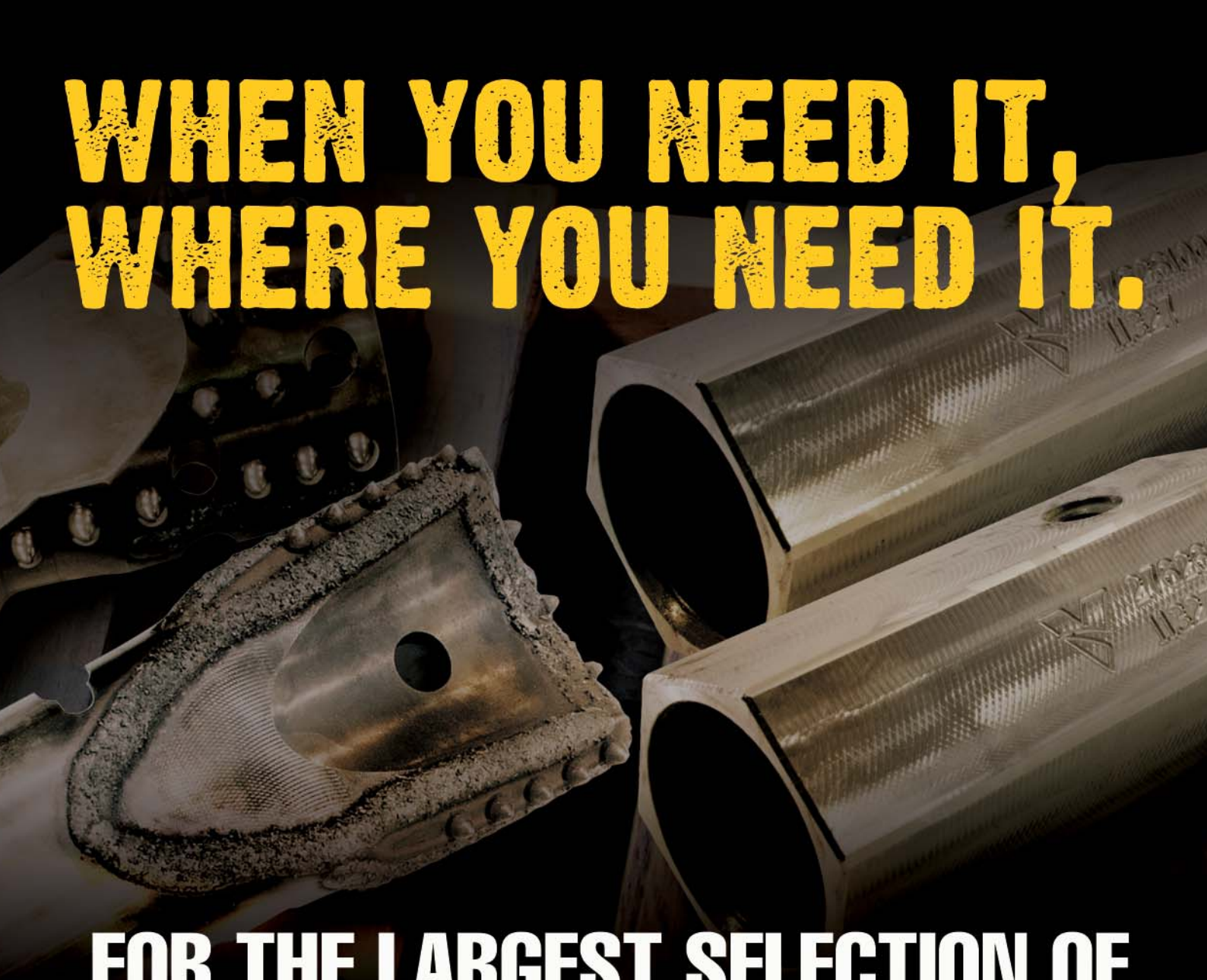
Residual resistance

Despite the numerous advantages of the trenchless technologies available, there is still some resistance in the infrastructure environment. "Resistance to change is a common human tendency, which is also common to implementing new – often misunderstood – technology," says Van Rooyen. He states that most clients have various misconceptions regarding trenchless technology; these are based predominantly on hearsay and perception.

These misconceptions include a belief that the technology is too expensive to implement in smaller rural municipalities and that the process is too mechanised, which results in 'no' local labour participation. "However, by using actual data collected from completed projects, both these misconceptions have been refuted," Van Rooyen explains.

A further hindrance is the lack of trenchless construction specifications, which limits the client and engineers' ability to administrate and evaluate trenchless projects. "Conventional construction is then chosen in favour of

WHEN YOU NEED IT, WHERE YOU NEED IT.



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trenchless technology, compounding the resistance to change," he says.

Construction circumstance

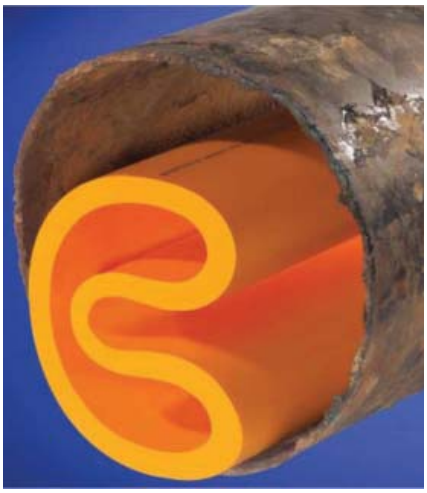
These misconceptions aside, the practical challenges on-site are what ultimately impact delivering the project on time. "With proper project planning, mitigating measures and allowances can be made to deal with unforeseen site circumstances. An inherent challenge with trenchless technology is the fact that work is undertaken underground and out of sight. Underground obstructions and difficulties therefore do arise – which are largely beyond the contractors control. Unfortunately, many clients pass this risk onto the contractor, which inherently increases project's cost (as contractors then make allowances for these risks in their pricing)."

According to Van Rooyen, a far more effective mechanism would be for clients to allocate contingency amounts to deal with these unforeseen occurrences.

Safety, on the other hand, is often a highlight on-site, with safety statistics often improved on a trenchless site versus a conventional open cut operation, predominantly due to the limited trenches. "The fact that work is undertaken underground and therefore out of sight can result in unallocated services being damaged, which might prove hazardous to work crews though," warns Van Rooyen.

Education essential

Unfortunately, a lack of understanding regarding the trenchless technology processes and its implementation has another consequence, according to Van Rooyen. He says the reason for this is twofold: "First, role players utilise trenchless construction as a 'miracle cure' for all pipeline work, which is not always cost effective, and second, clients have unrealistic expectations regarding the capability of the applied trenchless methodology. Both viewpoints might lead to the entire process being viewed negatively."



Compact pipe: a renovation procedure for trenchless rehabilitation

Van Rooyen notes that only in recent years has the technology been rolled out to tertiary and training institutions. "The promotion of trenchless technology is therefore intrinsic to educating clients and engineers – an ongoing process."

The technical nature of most trenchless operations necessitates the use of dedicated staff for specific equipment operation, which also requires the appropriate training. "Incorrect operation of equipment, in particular for new installations (horizontal directional drilling, pipe ramming, etc.) could lead to damage of equipment, surrounding infrastructure and underground services.

"A project milestone approach that highlights certain project risks at different stages and allows for the necessary contingencies to be in place should be presented to the client. This co-accountability and open communication between client and contractor is essential to ensure project success and also largely reduces the risk both parties are exposed to," he says.

Best practice by far

According to Van Rooyen, simply the use of trenchless technologies can be considered best practice in itself. "Trenchless technology offers an efficient construction means to install, upgrade and replace ageing underground infrastructure. With limited trenching required and a small site footprint, this form of 'no-dig' construction is hard to refute."

This is reinforced by the fact that, for the same project outcome, trenchless construction requires far less resources than a comparative conventional open-cut operation. "This leads to significant reductions in public inconvenience usually caused by construction activities, lower health and safety risks as long open trenches are avoided, and a lower carbon footprint as less construction plant and natural resources (filling sand and aggregate for reinstatement and road layer works) are utilised."

With increased environmental awareness and the general public being less sympathetic to construction inconveniences, trenchless construction should therefore, according to Van Rooyen, be the first consideration when undertaking work in urban environments. Unfortunately for the majority of project awards, clients (largely mandated by procurement policies) award contracts based on price only. "More consideration needs to be given to the contractor's performance record and the selected methodology's 'appropriateness' in achieving the required project outcome. Stringent contractor evaluation, performance and accountability are crucial to ensure the sustainability of this fledgling sector," he concludes. 3S

Pipeline begins again

The urgently needed second phase of the Western aqueduct pipeline is under way once again.

Neil Macleod, head of eThekwini Water and Sanitation (EWS), says that bids have been received for the first sector of the pipeline project. These will be adjudicated and the tender awarded early this year. The second sector will also be released for tendering at the beginning of 2013.

He says EWS has unbundled the 55 km pipeline project into six individual projects, which will be rolled out over a seven-year period. The 7 km long first sector, valued at approximately R125 million, will stretch from Inchanga Station to Alverstone Neck. The second, which begins at Alverstone Neck and has a similar value, will end at Ashley Drive in Kloof.

Construction is expected to begin during the first quarter of 2013. EWS has called for expressions of interest from the contracting fraternity and has selected 16 contractors to form two panels: one made up of companies qualified to deal with large diameter pipes and one comprising companies that are able to work with pipes with smaller diameters. This process was concluded in September 2012. The 16 contractors included on the panels will be invited to tender for the different contracts that make up the overall project.

The entire 55 km second phase begins at Inchanga Station and ends at Ntuzuma, and includes two branch pipelines to Tshelimnyama and Mount Moriah. It is expected to significantly strengthen the capacity of bulk water supply to the western regions of eThekwini, injecting up to 400 Mℓ/d. At the same time, it will ultimately boost much needed water supplies to the north of Durban.

An aerial image showing the progress of construction in the vicinity of Inchanga Station – part of Phase One of the Western Aqueduct Project, which is almost 80% complete

Macleod states that further delays to this project will have detrimental consequences for Durban as current water supply infrastructure is unable to cope with the forecasted future water demand. In addition to large commercial and industrial projects that are on the drawing board, the city's population is expected to increase by at least 20% by 2030. Only the current heavy rains are saving the city from major water restrictions, he warns. 3S

Sliplining Parktown's ageing water pipeline infrastructure

Subsurface pipeline construction and rehabilitation company Trenchless Technologies recently completed a 12-week contract for specialist contractor Con-Solve Civils and MPA Consulting Engineers, which saw the company slipline more than 270 m of steel piping at the Parktown reservoir for Johannesburg Water.

Trenchless Technologies' general manager, Marco Camarda, says that the Parktown Reservoir, which was built in the 1950s, has been in need of a refurbishment for many years. As a result, Johannesburg Water put out a tender in September 2011 for the relining of Reservoir No 2 and pipework of Reservoir No 1 and No 2.

Johannesburg Water awarded the R19 million contract to MPA Consulting Engineers and Con-Solve Civils, which then subcontracted a portion of the contract to Trenchless Technologies. Camarda says that Trenchless Technologies' portion of the contract involved the sliplining of 275 m of high-density polyethylene (HDPE) pipe measuring 560 mm in diameter into an existing 600 mm steel pipe, which serves as the main water feed from Rand Water to the Parktown Reservoirs No 1 and No 2.

The Southern African Society for Trenchless Technology technical standard for sliplining was used by Johannesburg Water on this contract to ensure the quality of the sliplining works.

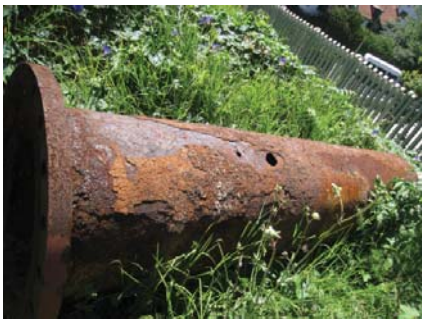
"Upon commencement of the project, we conducted closed-circuit television (CCTV) investigations on the pipeline in order to determine its condition and to look for obstructions. The investigations determined that the pipelines were badly corroded and pitted, and were in dire need of refurbishment. It was also

Butt-welding of 560 HDPE PE 100 PN 10 in progress

discovered that the pipeline lay at a steep gradient and that there was a tight bend at one section of the pipe. These conditions necessitated a significant amount of preparatory work, all of which had to be carried out within very short shutdown periods to avoid interrupting the supply of water to the residents of the neighbouring areas, including the Johannesburg General Hospital, which is positioned next door to the reservoir," explains Camarda.

All of the preparatory work, which included the CCTV investigations, cleaning of the pipeline and sliplining test work, as well as the actual sliplining work, was carried out through a small work footprint consisting of a launch pit at the southern end of the pipeline and a retrieval pit at the northern end of the pipeline.

"After having cleaned the pipeline, we had to remove any protruding objects by running a spring-loaded steel fingered cleaner through the pipeline. We then carried out sliplining test work using a 2.5 m test piece of HDPE pipe that we ran through the entirety of the pipeline. The only obstacle that we faced was a severe bend in the pipeline, at which point we had to excavate a pit and remove this bend," describes Camarda.



TOP Delamination and corrosion of the existing steel pipe

ABOVE Sample of a removed corroded section of a 600 mm diameter steel pipe

Once Trenchless Technologies determined that the pipeline was clean and free of any obstructions, it commenced the sliplining works. Four sliplining sections were undertaken in total. Additional works included installation of new 600 mm diameter fabricated tees, bends, spool pieces and valves. The contract was completed by the company in less than 12 weeks.

The only interruption experienced by Trenchless Technologies was that of having to lay a steel pipeline underneath the access road to Reservoir No 1, just below Reservoir No 2. Here Trenchless Technologies excavated across the road, laid the steel piping and connected it to a new steel tee piece at one end and onto an existing 600 mm diameter flanged gate valve at the other end. The road was reinstated in just 24 hours. 3S