

TRENCHLESS TECHNOLOGY



SASTT contact details:

Web: www.sastt.org.za

President:

Mike King

Tel: (021) 417 2900

Fax: (021) 417 2999

E-mail: mike.king@smec.com

Honorary director:

Joop van Wamelen

Tel: (012) 567 4026

Fax: 086 668 4026

E-mail: director@sastt.org.za



Overcoming constraints

The City of Cape Town's construction of a new pump station and bulk sewer pipelines required installing sewer rising mains across a highly trafficked roadway.

MANY OF THE residents living in the Table View area will be familiar with the frequent congestion often encountered along Blaauwberg Road due to high traffic volumes. This two-lane dual carriage way also houses a myriad of underground services including bulk water, telecoms, electrical conduits, stormwater infrastructure and a 600 mm diameter Chevron pipeline. This along with the ongoing construction of the Integrated Rapid Transit bus lanes – also in Blaauwberg Road – meant that the only feasible option would be to utilise trenchless methods to install the pipelines under this roadway.

The selected trenchless method also needed to satisfy the inherent project constraints, namely a zero tolerance for surface deflection (in particular, any subsidence of the roadway due to voids being created during the installation process) and Chevron had certain construction restrictions pertaining to trenchless construction work near its pipelines. In

The steel casing being lowered into place; view of the rammer in the foreground

addition, the use of ductile iron pipe for the sewer rising main throughout (including the section to be installed by trenchless means) necessitated the use of a large diameter conduit that would be large enough to accommodate the 600 mm diameter ductile iron pipe as well a 75 mm flange at the joints (effectively increasing the profile of the ductile iron pipe to 750 mm in diameter).

Pipe ramming was specified as the preferred trenchless method as it satisfied all requirements.

The project scope called for the installation of two parallel 1 064 mm diameter steel sleeves, each measuring 56 m in length, to be installed under the roadway at a depth of approximately 4 m below the road level. Specialist trenchless contractor TT Innovations was appointed for the pipe ramming work and deployed its 24-inch pneumatic rammer for the



project. The rammer is capable of generating 1 010 t of force per blow and is able to operate at a frequency of 177 blows per minute.

As part of the preparation work, a launch pit was excavated and two 12 m long concrete slabs were cast, which serve as support for the steel pipe and also provide control for the pipe alignment and level. Once the steel pipe is installed, the ductile iron pipeline will be inserted into the steel casing and later grouted in place. So far 50% of the 112 m combined steel casing length has been installed, and TT Innovations site manager, Bernard Kotze, says that the project is due for completion at the end of August to mid-September – dependant on the in-situ material hardness. **35**

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MILESTONE ACHIEVEMENT

Two decades of trenchless technology

This year, Trenchless Technologies celebrates its 20th anniversary in the directional drilling and pipe rehabilitation industry, which indicates a certain tenacious faith, Trenchless Technologies' Sam Efrat tells **Chantelle van Schalkwyk**.

“ONE NEEDS TO be extremely tenacious and have a great deal of faith in order to overcome the many challenges one is faced with over the years. Trenchless Technologies is in business because from inception we managed to fill a need in the market to provide viable solutions and alternatives to conventional open-cut pipe laying,” says Efrat.

Trenchless Technologies was registered in 1991 and in May 1993 commenced operations with a 3 t truck, a compressor, two earth piercing tools and some R80 000 in capital. “We began operating out of a studio at the back of my house in Berea, Johannesburg, with five employees. Today, we have over a 100 employees, many of whom have been with us for 10 to 20 years, through thick and thin,” explains Efrat.

Growth & gains

The continued growth of the organisation can be attributed to the fact that it immediately filled a need in the market for boring small diameter holes beneath the roadway to install electrical conduits and water piping, using earth piercing or moling tools and pipe ramming, continues Efrat, adding that at first this was its “bread and butter”.

In 1994, Trenchless Technologies acquired the Terra Hammer agency for Southern Africa and purchased a range of percussive hammers from 65 to 210 diameter, which allowed the company to undertake a full range of horizontal boring for pipes from 25 to 160 mm, pipe bursting from 110 to 315 mm as well as pipe ramming upto 400 mm. “We made good

progress in pipe bursting (and to a lesser extent sliplining) for various municipalities that could see the benefit of not digging up their streets and pavements as well as the cost savings achieved, and our main focus

“Since inception, we have experienced an average 20% year-on-year growth and expect this trend to continue”

for many years remained pipe bursting,” he states.

He adds that in time, as technology improved, the company became more versatile and offered a wider range of more tailored solutions. “In 1997, we acquired the first of four horizontal directional drills, and in 2004 undertook our first CIPP (cured-in-place pipe) project, followed in 2006 by SPR EX (Expanda) and SPR PE (Ribline) spiral wound piping and in 2011 SPE RO (Rotoloc). At present, we are also looking at

fold and form solutions to further expand our range of services.”

According to Efrat, to date some 400 km of trenchless work has been undertaken. “Since inception, we have experienced an average 20% year-on-year growth and expect this trend to continue, fuelled by the impending investment in water infrastructure needed to secure Southern Africa’s water resources, as well as the continued fibre optic network roll-outs.”

He anticipates that the trenchless rehabilitation market is going to grow exponentially from a R500 million per year industry to a R5 billion per year one. “We also expect the horizontal directional drilling (HDD) industry to continue to grow in parallel to the fibre optic network roll-out; this will continue for several years with the ‘last mile’ and ‘fibre to the home and business’.” ▶

BELOW Parktown Reservoir Butt-Welding 560 HDPE PE 100 PN 10 prior to sliplining



Achieving success

The organisation's greatest achievement to date, project-wise, has been the Port Elizabeth Goes Trenchless project, which won the ISTT Project Award for 2012. "This is the highest accolade available in the international trenchless industry, chosen from projects nominated from 30 affiliated trenchless societies worldwide," explains Efrat.

The project entailed the rehabilitation of two parallel sewers located in the heart of Port Elizabeth's CBD and was originally designed to use the spiral wound technique throughout; however, the team soon discovered that site conditions required also using CIPP and pipe bursting at certain locations. "Altogether, we used five different trenchless techniques – spiral wound expanded to a close fit, spiral wound in-place, ambient CIPP, UV CIPP and pipe bursting, to successfully complete the project.

"This project is an excellent example of using trenchless technology options to address unanticipated site conditions, allowing the project to be completed successfully without excavation and surface disruption," says Efrat.

The project that has been by far the most challenging – and interesting – to date for Efrat and his team is the ABSA Bank Energy Centre Sleeves Reticulation. This required the installation of 85 sleeves using HDPE pipe from 110 to 710 mm, up to 16 m deep, to connect several of ABSA Bank's CBD buildings with gas, electricity, fibre optic, chilled and hot water.

According to Efrat, some of the challenges faced were:

- The basement floors were designed to support the weight of a typical sedan vehicle. Consequently, propping was required from the floor below to add support to all areas over which the HDD drill needed to travel into the required position within basements.
- A floor to floor height restriction, requiring that all equipment be less than 2.1 m in height. Consequently, the Terra-Jet 7520 was refitted by removing the operator cabin, rebuilding the hydraulic oil tank at a lower position and lowering of the encapsulation body work such that the remodelled drill resembled a tank with a height of only 1.8 m.
- Some 65 installations took place in clay, while the remainder were in rock. This necessitated the use of percussive hammer and rock reamers to expand the holes to the required diameters.

- Lateral support ground anchors were encountered during drilling in dozens of locations. Their presence and position were not predictable and resulted in drilling equipment becoming entangled in several instances. Drilling tools were pulled, pushed and rotated until they became free or broke the ground anchoring cables.
- In order to gain access to the drill face coring to remove concrete, lateral walls from 300 to 500 mm thick were required.

A fluid landscape

Over the past 20 years that the organisation has been active, the trenchless context in the local water landscape has changed significantly, says Efrat. "In the beginning, trenchless technology was looked upon mainly as a novelty to be used only where open cut needed to be avoided. Today, it has become common for most road crossings for new

installations as well as for pipe replacement in most major municipalities."

In addition, not only has the perception of the technology changed, but also the technology itself. "The change from boring and pipe ramming to HDD was a huge jump in technology, allowing a far more controlled and successful installation for new pipes and conduits in a range of ground conditions. The success of this technology has allowed HDD to become the prevalent methodology," explains Efrat.

Similarly, the advent of CIPP, spiral wound lining and HDPE fold and form, and reduction technologies allows lining of pipes from manhole to manhole without any additional excavation greatly expands the range of techniques and solutions available.

BELOW Cape Town Sliplining Pentz Drive Sewer with 630 HDPE pipe



Highlights of the past 20 years

"We have completed over one hundred successful contracts for many satisfied clients, without a single dispute. We are also extremely proud of the awards we have achieved over the years," says Efrat. These awards include:

- 2000 SAICE Pretoria Branch Award for Technical Excellence, together with the City of Tshwane and consultant Bigen Africa, for the rehabilitation of sewers in Mamelodi. Pipe bursting – midblocks
- 2007 (SASTT) Award of Excellence for the Rehabilitation of Sewer Pipes in Klipspruit Basin, together with Johannesburg Water and consultant Vela VKE – pipe bursting, CIPP and directional drilling
- 2009 (SASTT) Award of Excellence for the ABSA Bank Energy Centre Sleeves Reticulation Project – installed by directional drilling
- 2010 CIDB Construction Summit Award for outstanding performance in South Africa's construction industry
- 2012 (ISTT) International Project Award for the rehabilitation of two parallel sewer pipes in Port Elizabeth's CBD.

Current projects

- Mossel Bay Golf Estate – pipe bursting 110 corrugated plastic pipe to install 160 HDPE
- Polokwane AC water pipe replacement involving pipe bursting
- Umjindi AC pipe replacement using pipe bursting
- Winchester Hills AC pipe replacement utilising pipe bursting
- Various HDD drilling works.

“Necessity, however, is the mother of invention; when a huge trenchless market exists, the techniques will follow,” says Efrat, adding that in local South African markets it has been the case of putting the cart before the horse. For many years, there was very little maintenance and investment in municipal

infrastructure and this has largely prevented the introduction and wide-scale use of many of the more recent trenchless techniques and advances, he says.

“However, what has occurred over the past few years is that many trenchless contractors – us included – have geared themselves up with the most up-to-date technology so as to be ready for the very large impending and anticipated government investment in water infrastructure, even though today this market does not exist.” **3S**

BELOW LEFT ABSA – Ground anchor in rocky bore hole

BELOW RIGHT SPR EX (Expanda) relining 600ND concrete pipes at Percy Stewart Sewage Works



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MANAGEMENT COURSE

HDD training initiative

With horizontal directional drilling (HDD) increasingly being used in built-up environments, safety aspects – for both operators and the general public – are becoming a top priority.

ELANDSFONTEIN-BASED Osborn, which is the official OEM supplier in Southern Africa of horizontal directional drills manufactured in the US by Toro and American Augers, recently joined forces with Terrawood, a specialist supplier of HDD tooling products and courses to the Southern African market, to run an HDD management course in Johannesburg.

“Health and safety aspects of HDD formed an important part of the programme,” explains product sales manager Peet Venter. “The course also had several other objectives, including enabling candidates to

understand the basic principles associated with HDD, the various methods used for the location of underground equipment and the regulations and operation guidelines relating to HDD. In addition, we aimed to equip trainees with the knowledge to identify different types of equipment available and different types of drilling fluid used, as well as teaching them how to develop a drill path profile in accordance with selected equipment,” Venter adds.

The training took place over two days at Osborn’s Elandsfontein manufacturing facility. Trainees had the opportunity to view

Osborn’s HDD range during a factory tour. After the two-day training programme, the candidates wrote an examination that is marked in the United Kingdom and will give them an internationally recognised City & Guilds qualification. “It will certainly be a feather in the cap of successful candidates, since City & Guilds is a world-leading vocational education organisation,” Venter concludes. **35**

BELOW LEFT The American Augers DD-110 horizontal directional drill will be on display at Bauma Africa 2013

BELOW RIGHT The HDD management course group of attendees



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A MATURING INDUSTRY

The SASTT comes of age

The Southern African Society for Trenchless Technology (SASTT) is celebrating its 21st anniversary, and with age has come a certain maturity for the society, SASTT honorary director, Joop van Wamelen, tells **Chantelle van Schalkwyk**.

“**O**VER THE PAST year, I have had the feeling, subjective as it may be, that the society is beginning to reach a significant measure of maturity. This is reflected by the number of technical enquiries we receive from local authorities and professional engineers, as well as the growth in membership over the past year,” says Van Wamelen.

There have been several highlights for the SASTT over these 21 years, but undoubtedly the highlight that will stay with Van Wamelen

“for a long time” is that a corporate member of SASTT – Trenchless Technologies – leading a team of companies, was awarded the International Society for Trenchless Technology 2012 ISTT No-Dig Award for the project entitled ‘Port Elizabeth goes trenchless’.

“Another highlight is that, once again, SASTT awarded its own SASTT Award for Excellence for 2012 to an exceedingly difficult project known as Upgrading and Replacement of Sewers in Alexandra Township (Phase 3),” states Van Wamelen.

Focus forward

“My focus is directed by the board of SASTT. This is a team of seven professionals who share an unshakable dedication to the promotion of trenchless technology,” explains Van Wamelen.

As such, the focus for the 2013/14 period remains for the SASTT on building and strengthening affiliations or alliances with other professional organisations, such as the current ones with the Engineering Council of South Africa and IMESA. The SASTT is also

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in the middle of a programme of developing SASTT standard specifications for trenchless technology. "These specifications are being drafted with an eye on constraints such as the technical skills of site operatives schooled and trained in the third world," continues Van Wamelen. He adds that the SASTT is working towards building capacity to provide technical training in trenchless technology for engineers, technicians and students.

Highlights to come in this period are also no less than the last, indicates Van Wamelen, with the SASTT to be represented at the international board meeting of the ISTT and the International No-Dig Conference and Exhibition in Sydney, Australia, in September this year.

"In addition, SASTT is working with the ISTT towards holding the second ISTT Masterclass and No-Dig South Africa Conference and Exhibition in mid-2014."

Context and challenges

According to Van Wamelen, like all civil engineering work, the local trenchless technology market has been fickle. "Nevertheless, trenchless

construction, rehabilitation and upgrading projects are on the go all over the country – and not only in the metropolitan municipalities."

The challenges – and there are many, according to Van Wamelen – however, remain. He says one that SASTT can proactively do something about though is the fact that due to a quirk of South African public tendering legislation, a good deal of trenchless work is being awarded to what he terms 'incompetent tenderers'.

"When these tenderers do not manage to subcontract the work to a competent company, they often make a mess of things. This gives trenchless technology a bad name – and is bad for the client's budget," says

Van Wamelen, adding that the SASTT has approached the Construction Industry Development Board (CIDB) to convince it to introduce trenchless technology as one of the designated

categories of specialist work in order to counteract this.

The potential for trenchless technologies to positively impact the local water context is gigantic and therefore needs to be properly utilised and taken advantage of, he continues.

"It is no secret that Southern Africa is losing an unconscionable portion of its potable water due to leakage from the reticulation networks. Trenchless techniques can find and fix these leaks very competitively, safely, effectively and efficiently. It just requires the political will to start doing something about it," concludes Van Wamelen. **3S**

"Trenchless construction, rehabilitation and upgrading projects are on the go all over the country."

**Joop van Wamelen, honorary
director at SASTT**



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