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Due to the expansion of Stellenbosch town, the design capacity of the existing outfall sewers servicing the area was regularly exceeded. This resulted in surcharging from sewer manholes and, in some instances, flooding from the sewer network.

The decision was made to replace the ageing existing outfall sewers with one sewer, decreasing maintenance requirements from three pipes to one. With the new sewer in place, the network will be able to cope with all future developments as anticipated in the Sewer Master Plan.

The new Plankenbrug Outfall Sewer replaced the three main outfall sewers servicing Stellenbosch town, from the Distillery Road bridge, over the Plankenbrug River near Bosman’s Crossing, to the downstream Stellenbosch Wastewater Treatment Works off Vredenburg Road.

As lead design engineer, AECOM carried out construction monitoring of Phase 1 of the Plankenbrug Main Outfall Sewer and associated works in Stellenbosch. Construction commenced in October 2015 by the JVZ Construction & vakala Construction Joint Venture and was completed in March this year, on time and within budget.

Building a new sewer
AECOM undertook a concept and viability study with recommendation to replace the ageing existing outfall sewers with one new sewer, thereby decreasing maintenance requirements from three pipes to one. The existing outfall sewers ranged from 375 mm to 625 mm in diameter. “These outfall sewers had reached the end of their design lives, and a new outfall sewer was required urgently to provide additional flow capacity to the expanding Stellenbosch town,” explains Christian Jordaan, an engineer at AECOM.

The redundant sewers would be left in place to be used in the future as sleeves for electric or data cable installation. Determining a viable route for the sewer was a major task, considering the new sewer was to be installed in a densely built-up town area. Six route options were developed, and the technical, environmental and cost considerations were evaluated. AECOM was able to demonstrate that a new gravity sewer along the eastern bank of the Plankenbrug River would be the most viable option.

However, this route necessitated the application for environmental authorisation, as well as a water-use licence application. To avoid delaying the construction of the project while these applications were pending, AECOM proposed that the project be divided into three phases. Phase 1 would not be influenced by the environmental constraints.

Phase 1 of the new outfall sewer saw a total length of 1 815 m installed, which is made up of 45 m of 1 m diameter and 1 770 m of 1.2 m diameter pipeline. A length of 240 m was installed by means of pipe-jacking underneath a foothill of Papegaaiberg. This avoided open-cut
excavation to depths exceeding 10 m, thereby limiting disruption to the area and lowering construction costs.

The 240 m was pipe-jacked in three sections, requiring three temporary launching pits to be constructed, with a 6 m diameter to depths of 5.6 m to 11.8 m. Manholes were constructed inside the temporary pipe-jack launch pits before it was backfilled. For these manholes, a GRP grid platform was installed at the underside of the manhole shaft, for additional safety. All other manholes were also equipped with non-slip GRP grid platforms on the manhole benching.

**Keeping the sewers live**
The three existing outfall sewers had to remain live while the new sewer was constructed. This provided a challenge wherever the new sewer had to be constructed across the alignment of the existing sewers. Due to limited vertical fall available, the new sewer had to be installed at such depths that it clashed with the existing sewers at these locations.

AECOM overcame this problem by utilising purpose-designed manhole structures at roughly 90 m intervals, at lateral tie-in positions. A manhole was constructed over the existing sewer, which allowed the sewer to remain live while the new sewer was built into the new manhole. When the downstream sewer was inspected and commissioned, the existing sewer was cut within the new manhole and sewage conveyed along the new sewer. This design approach avoided lengthy over-pumping of sewage, thereby limiting costs to the project.

The manholes typically comprised a cast in situ concrete chamber (with benching) constructed below ground level, with an access chimney. Where depth allowed, working space within the manholes was optimised with the use of 1.8 m diameter precast concrete rings as the access chimney.

**Social and environmental compliance**
An important aspect of the contract was the communication and liaison with the local community in terms of traffic accommodation, access to residences, security, noise, and dust. Temporary or partial road closures were managed continuously. In this regard, a Traffic Accommodation Plan was implemented as part of the contract.

An Environmental Management Programme was also implemented, which contained the procedures and requirements for the protection of the natural environment during construction of the new Plankenbrug Outfall Sewer.

“The project was completed on schedule, and within budget,” Jordaan confirms. “AECOM’s successful partnership with Stellenbosch Municipality and the JVZ Construction & Vakala Construction Joint Venture delivered a service that will accommodate all future developments efficiently, as estimated in the Stellenbosch Sewer Master Plan,” he concludes.

The new sewer has been designed to be sufficiently large so as not to flood, even during high wet weather flows. In addition, because of the large capacity of the new sewer, flooding from upstream existing sewers will also improve due to the lower flow levels in the new downstream sewer.

By implementing this new outfall sewer, Stellenbosch Municipality established infrastructure that will be able to effectively accommodate the town’s sewage needs for years to come, while at same time improving the environmental impact the sewer network has on the area.
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Smart pipeline assessment

South Africa’s urgent need for infrastructure maintenance is often hampered by limited budgets. Averda has developed a unique approach to assist municipal and consulting engineers in managing limited budgets for pipeline rehabilitation and maintenance.

Global waste management company Averda entered the South African market in 2015 and acquired majority shareholding of Wasteman Holdings before becoming Averda South Africa. In addition to its general and hazardous waste solutions, Averda specialises in the condition assessment and maintenance of pipelines.

Averda’s unique approach for pipeline rehabilitation and maintenance involves inspecting pipelines per suburb or specific catchment area, and only cleaning pipelines where blockages are found or where obstructions prevent inspection equipment from traversing to the next manhole.

In early 2016, Averda was appointed by the City of Tshwane to conduct CCTV inspections on several hundred kilometres of sewer pipelines ranging from 100 mm to 600 mm in diameter. The adopted approach was to focus on the oldest suburbs, extracting all the pipeline lengths per suburb from the geographic information system and putting those quantities into a priority list, which formed the basis of the programme for this project.

Utilising in-house expertise

The data is managed by an in-house software package called PicData, designed for mass data collection and interpretation. This development started back in 1997 by Sight Lines Pipe Survey Services, which was acquired by Wasteman Holdings and now operates under the umbrella of Averda South Africa. PicData pipe management software has close to 20 years behind its development and is based on real fieldwork experiences.

The pipeline data from the GIS system is imported into PicData software and managed by a sophisticated job card system. This system forms the basis for the effective management of the pipelines being inspected, cleaned, rehabilitated or accepted after repairs on new installations took place.

Each pipeline imported into PicData gets graded on its structural and maintenance conditions, thus producing a priority list for pipeline repairs, replacement and cleaning per suburb or catchment. Based on this priority list, the municipal or consulting engineers can use the data, coupled with its costing models, to work out budgetary estimates for pipeline replacement and repairs or to more effectively use limited budgets to focus on the worst affected pipelines.

The results for the City of Tshwane contract showed that only 34% of all the piping inspected needed to be cleaned in order to facilitate the inspections. This means that the structural condition of each pipeline could be established, a priority list for replacement could be produced and any blockages or potential blockages removed. This proactive approach will assist in planning effectively and also maintaining pipelines where needed, saving the asset owner or project manager time, money and resources.

“Pipe condition assessment should always precede rehabilitation. This will ensure that only those sections of sewer that need it are rehabilitated,” explains Claude Marais, GM: Pipe Survey Services, Averda. “Newly installed sewers should be inspected as part of the acceptance programmes and should accompany the as-built plans. Existing sewers should be periodically inspected so that their condition can be assessed and remedial measures taken before they become serious problems.”
The International No-Dig Conference and Exhibition is coming to South Africa for the first time in 2018, and will bring with it knowledge from across the globe on the latest techniques and trends in trenchless technology.

The International Society for Trenchless Technology’s (ISTT) 36th annual International No-Dig Conference and Exhibition will be hosted by the Southern African Society for Trenchless Technology (SASTT) in Cape Town on 8 and 9 October next year.

This major forum will bring together engineers from across the globe to network with like-minded professionals. The comprehensive conference programme is assembled by a technical committee comprising representatives of SASTT and ISTT, and will include papers on the latest innovations and techniques, as well as case study presentations with a regional focus. The two-day event will also feature a mix of technical sessions, while a lively and informative exhibition will showcase the very latest technology and products.

International No-Dig South Africa is, therefore, a must-attend event for all municipal engineers and technicians, consultants, engineers, traffic authority managers, developers, utility providers and design consultants involved in any aspect of the installation or refurbishment of underground utilities. The organisers, in conjunction with key supporting organisations, are committed to ensuring that all relevant sectors are invited, including:

- utilities – water, sewerage, telecoms, electricity, gas and oil
- contractors
- central and local government officers
- civil engineering consultants.

Call for papers
Prospective authors are invited to submit proposals for consideration in the conference programme. These should be sent to the organisers at trenchless@westrade.co.uk. Proposals must include a title and synopsis of the proposed paper of no more than 400 words, a short biography of the author, as well as a head-and-shoulders photo of the author. Abstracts must be submitted by February 2018.

Experience Cape Town
The conference organisers are working alongside WOW Cape Town Tours, which offers airport transfers as well as day tours, overnight tours and private packages. All sponsors, exhibitors, delegates, visitors and supporters of the event will receive discounted rates, which can be viewed and booked via the event website. Tours include:

- Table Mountain – Monday 8 October
- Tour of Constantia via Chapman’s Peak Drive – Tuesday 9 October
- Wildlife/safari tour to Aquila Game Reserve – Wednesday 10 October.

Promoting trenchless in SA
SASTT has been in operation for 21 years and is playing an integral role in organising the 2018 conference.

SASTT has an active membership with a collective dedication to the promotion of trenchless technology. The society is currently developing SASTT standard specifications for trenchless technology. It continues active dialogue with professional organisations such as IMESA and is currently making approaches to the Construction Industry Development Board to encourage it to introduce trenchless technology as one of the designated categories of specialist work in order to raise the professionalism of contractors working in the marketplace.
Revitalising Germiston’s sewers

Continuous blockages and spills in a sewer line in Germiston, Ekurhuleni, necessitated the rehabilitation of the 1 000 m pipeline.

Camjet recently procured a Ditch Witch JT3020 directional drilling machine, which provided a perfect platform for the company to engage with Ekurhuleni Metropolitan Municipality on this pipe rehabilitation project. The new equipment forms part of the company’s ongoing growth of services related to trenchless technologies, for which there is an increasing demand in order to address the country’s ageing infrastructure.

The Dekema project
Camjet’s investigation team performed an inspection of the sewer line using specialised CCTV equipment. In doing so, the team ascertained that the existing

[PROJECT DETAILS]

Description
Pipe rehabilitation of 1 000 m of a 316 mm sewer line in Germiston

Client
Ekurhuleni Metropolitan Municipality

Client representatives
Siphiwe Dube (senior manager), Oupa Matshate (chief area engineer), Carel Swanepoel (engineer)

Soil condition
Largely clay
Concrete pipe invert had collapsed and the pipe needed to be replaced.

Engineers at Ekurhuleni Municipality instructed Camjet to replace the broken pipe using an HDPE PN10 pipe. Camjet surveyed the entire length of the pipeline and determined that the best and least disruptive method of replacement would be to use the highly capable Ditch Witch directional drilling machine to crack the pipe.

The project was complicated by existing services obstructing a large part of the sewer line. These included buildings, a gas line, chemical-related operations, railway lines and a stream. Work also had to be conducted during high-flow periods and care had to be taken in controlling and containing sewer spillages by means of plugging and over-pumping of the 316 mm sewer line. At one section, a complete diversion was required to ensure no spillage leaked into the adjacent stream.

Camjet’s safety team identified the potential risks prior to the commencement of the project and, together with the machine’s sophisticated technology, helped drastically minimise the health, safety and environmental impacts that may have occurred.

Camjet’s recent recertification of ISO 9001: 2015 and OHSAS 18001: 2007, coupled with its new certification of ISO 14001: 2015, ensured that even when the work went through a chemical plant, safety requirements were met in accordance with the facility.

To date, approximately 80% of the pipeline has been replaced, with the project expected to be completed by the end of August.
Revitalising the Black Mac sewer

Precision engineering and teamwork come together on an innovative CIPP project in Cape Town.

The rehabilitation of the Black Mac bulk sewer line is the largest project of its kind in South Africa to date. The project used cured-in-place pipe (CIPP) technology to rehabilitate a major portion of the previously decommissioned Black Mac bulk sewer line, thereby enabling the recommissioning and reliable use of the conduit for the next 50 years. The line has a total length of 3 434 m, with diameters ranging from 800 mm to 1 200 mm.

The pipeline crosses both the N2 highway near Cape Town International Airport and the R310 regional road. Both crossings were fully rehabilitated without any impact on traffic and, overall, this project is a textbook demonstration of trenchless technology on a scale not previously seen locally.

Tuboseal’s vast experience in CIPP projects was tried and tested to ensure that the scaling of the technology could be achieved without compromising on the quality or longevity of the product.

Process

Cleaning: sections of the pipeline were severely silted up and the resultant cleaning was a major challenge. There was limited availability of water supply along the pipeline, precluding the extensive use of high-pressure jetting as the predominant cleaning method.

Profiling and design

Ovality of the pipeline is a significant factor in the structural design of CIPP liners. It was, therefore, important to assess and quantify the ovality of the host pipe, particularly due to the swelling and deformation that typically occurs when asbestos cement pipes are degraded by the corrosive gases found in sewers.

Measurements were taken at predetermined intervals to calculate the variance in diameter and maximum ovality factor for each pipeline section. Once the detail measurements were processed, the required wall thickness of each CIPP liner was determined using the ASTM F1216 design code, which is recognised worldwide.

Material supply

On confirmation of the structural design, the CIPP liners were ordered from a leading manufacturer based in Europe. The 26 liners were all unique in terms of their length, diameter and wall thickness. This underscores the importance of working accurately and to the highest installation standards during CIPP projects.

An eight-week lead time was specified for the manufacturing and shipping of these liners. Tuboseal expedited the project timeline to ensure that the first 1 000 m were designed, ordered and shipped before the 2016 Christmas break.

Another vitally important component of CIPP projects is the specialist resin supply. Tuboseal leveraged its well-established supplier relationships to upscale and source over 150 000 kg of CIPP resin and catalysts, both products being well proven for use in South African conditions. The quantity of resin used on the Black Mac project alone exceeds the annual consumption of any contractor in South Africa to date.

Installations

Each installation involves a carefully coordinated ‘planning to lining’ process of around 48 hours. With the limited time allowed before the resin-impregnated liners start to cure, once the process starts, it cannot be interrupted.

It naturally involved a 24/7 production line and military precision execution. Teamwork was, therefore, critical: the consequence of a prematurely cured liner would have had a severe financial impact, plus the need to reorder a replacement unit.

An installation team on-site completed the final cleaning and inspection on each pipeline section while an impregnation team prepared each liner by impregnating the felt liner tube under factory conditions with up to 7 t of catalysed resin.

Each liner was transported to site and installed by an inversion process, during which the liner is folded inside out using water pressure.

A powerful hot water boiler was used to initiate the curing of the resin over a period of around 15 hours, while the temperature and other parameters were carefully monitored and controlled to ensure liner consistency and integrity. Each cured liner was cooled down carefully, trimmed and inspected with CCTV camera equipment. A test sample was submitted to an independent lab for verification of their mechanical properties.

Due to the current drought in Cape Town and the lack of water supply along the pipeline, Tuboseal deployed a water cooling tower to enable the recycling of process water. This saved an estimated 3 million litres of water over the course of the project and significantly reduced the water consumption.

Conclusion

The Black Mac project demonstrates that the use of world-class pipeline rehabilitation techniques is highly feasible and effective in South Africa. Municipal clients can reap significant benefits from the reduced costs, timelines and limited environmental impacts that CIPP technology offers over traditional alternatives.
The experts in horizontal directional drilling

Contractors, utility companies, and departments of Public Works are increasingly turning to horizontal directional drilling (HDD) as their preferred method of pipe installation or replacement.

By enabling the trenchless installation or replacement of underground utility lines without large-scale excavation, HDD offers a cost-effective option that minimises surface damage, causes minimal disruption to traffic or other activities, and is environmentally friendly.

HDD is a popular trenchless method for applications including pipes for natural gas or water lines and services, and ducts and conduits for telecommunications and power cables. It can be applied in almost any situation where surface conditions make it harder and more expensive to operate traditional trenching machinery like backhoes or excavators. This includes tunnelling under streets and buildings, under landscaped areas and rivers, or under parking lots and highways.

Splender Trenchless
Splender Trenchless, the directional drilling division of Splender Construction, has provided trenchless solutions since the technology was introduced in the 1999.

The highly skilled team of HDD and boring specialists are experts in providing solutions for the underground installation and repair of pipelines and cables with minimal excavation. With more than 18 years of combined on-site experience, industry-leading equipment, and continuous education on drilling and excavation techniques, Splender Construction’s Trenchless Technology Division has a proven track record of helping general contractors, municipalities, utility companies and homeowners.

“Our methods are cost-effective, even in the most challenging circumstances found across the country and wider continent,” says Corrie Scheepers of Splender Construction.

A solid history
Scheepers started the business in 1997 and invested in HDD and pipe bursting for both the residential and commercial markets when the technology first became available in the late 1990s. Today, Splender is a leader in trenchless technology, specifically HDD, in the greater Gauteng region, with over 40 employees and state-of-the-art technology, serving residential, municipal, corporate and utility clients.

Client values
The company upholds a number of important values to ensure quality project delivery and client service. These include:

- Teamwork – recognising that each member of the team is an important part of a whole, working continuously toward a common goal
- Quality – understanding the absolute importance of excellence in all executions
- Commitment – realising that this is the backbone of the company’s strength
- Strong work ethic – taking pride in their work keeps employees striving towards an ever higher standard of value and service for clients.

“Splender has always prided itself on observing the same values with respect to our clients that we reserve for the members of our family and our employees,” concludes Scheepers.