

TRENCHLESSWORKS

THE VOICE OF THE TRENCHLESS COMMUNITY

ISSUE 196 2022

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ISTT AWARD WINNERS 2022

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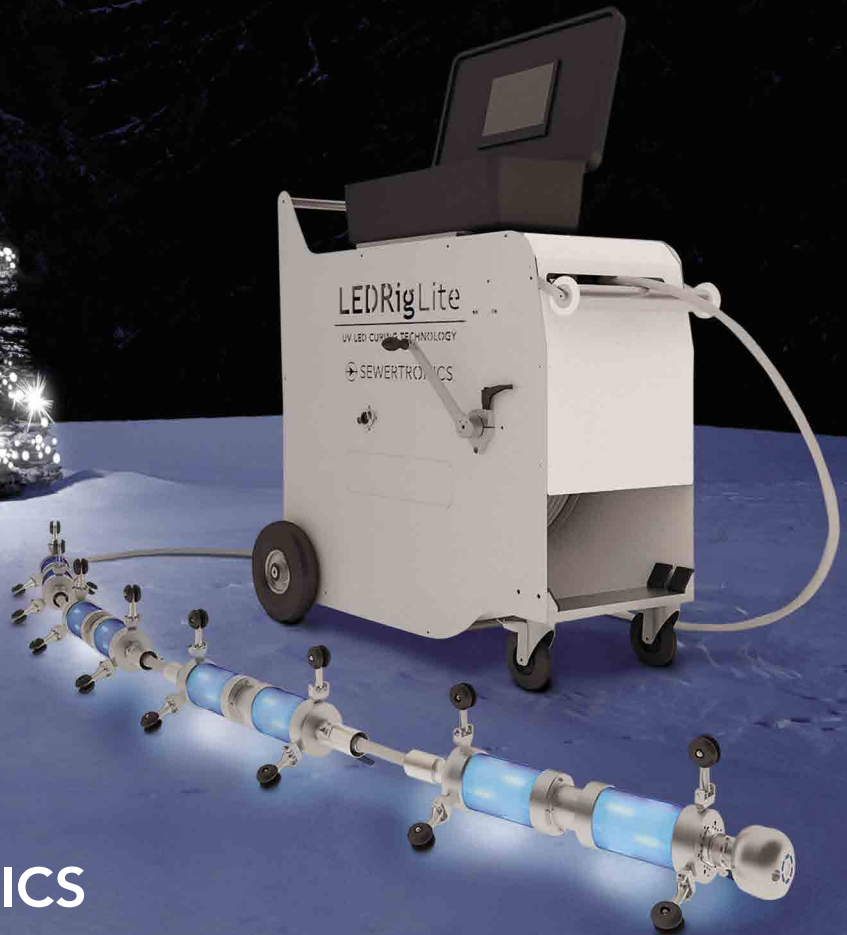
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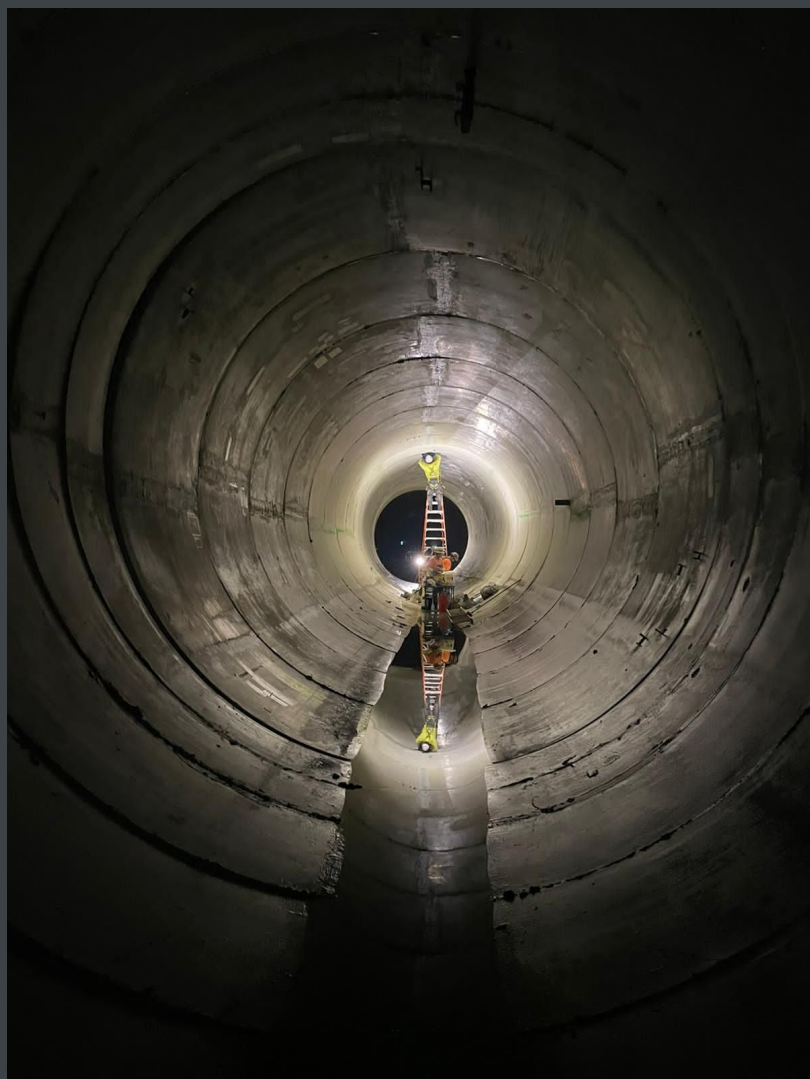
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Beyond the Ordinary

SPOTLIGHT



Ian Clarke, Editor-In-Chief,
Trenchless Works

It only feels like a couple of weeks ago that I was writing this section for the November issue of Trenchless Works, and yet here we are looking at the final issue of the year!

I would like to draw your attention to the focus of this issue which brings to you the ISTT Award winners for the Year prizes for which were presented at the International No-Dig event in Helsinki this past October. These Award-winning entries all highlight the ever-interesting and ever-changing field of technology and innovation in which we all, as users and promoters of trenchless technology, live. The congratulations of all the team at Trenchless Works go out to this year's winners.

Personally, I would like to extend my thanks not just to team that puts this publication together each month but also to you the readers who make this effort worthwhile. If you are involved in works that you feel would be of interest to the rest of global family, please let us know and we will look at publishing the reports on your projects.

I would also like to extend these thanks to our increasing family of advertisers without whom we would not be able to bring this publication to our readership. Your continued support is always very much appreciated and we hope we do our best to warrant your support now and into the future.

Yes, I know this is becoming bit of an OSCAR thank you speech to close this out I also have to thank the various organisations that support us and whom we try to provide support to, including the International Society for Trenchless Technology (ISTT), The United Kingdom Society for Trenchless Technology (UKSTT) and the North American Society for Trenchless Technology (NASTT). Not only is it a pleasure working with these organisations and the staff, we would also like to work up our support for all the other ISTT Affiliate Societies. So, do not be afraid to contact us in the coming year to see just how we can work together.

Finally, I wish all of you, readers, advertisers and all others with whom we work, a very Merry Christmas and a Prosperous New year for 2023 or simply Happy Holiday for those not partaking of the Christmas celebration. See you next year!



ISTT SOCIETY AWARDS istt.com

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ISTT AWARD WINNERS 2022



Keh-Jian (Albert) Shou,
Chairman, ISTT

Hi ISTT members!

In November ISTT restarted its committees by updating the purposes and the plans of action. We will also distribute the meeting summaries to our Affiliated Societies. To promote the International No-Dig 2023 in Mexico City, Westrade, ISTT, and NASTT held the Trenchless Technology International Seminar in Mexico City on 30 November. It was a very successful event with more than 120 attendees and exhibitors, that made us more confident about the 2023 No-Dig event.

As you may know, there are tremendous achievements amongst the 2022 ISTT Award Winners. We had two project Awards this year, one for new installation and one for rehabilitation. Taipei Water etc. won the New Installation Award for a challenging water main project overcoming faults and geologic variation in Taiwan. Ludwig Pfeiffer won the Rehabilitation Award for a rehabilitation project on the Wastewater Network of the Cuenca La Chala, Guayaquil, Ecuador. We also awarded the New Technology Award to Jiangsu Dulong Heavy Machinery Co., Ltd. for its novel development on a submersible Directional Drilling machine. In the academic side, Professor John C. Matthews of Trenchless Technology Center (TTC) won the Academic Research Award by his research 'Mitigation of Styrene Emissions from Steam-Cured CIPP Projects'. The Student Paper Award was presented to John Kraft of the Trenchless Technology Center (TTC). The Award winners are detailed elsewhere in this issue of Trenchless Works.

I would like to let you know that we are now reviewing and updating the ISTT Awards and plan to have more awards in the coming International No-Dig events. So please, kindly check our website or announcements and prepare to submit your applications. As you may know, we also plan to have more regional activities as grant programmes, with two times more support fund in 2023. Please kindly keep watching and take advantage of our new developments, and feel free to provide us with your comments or suggestions. With your involvement and encouragement, I believe our management team will devote more to make ISTT better.

I wish you, your family, and your colleagues a Merry Christmas and Happy New Year!

Keh-Jian (Albert) Shou
Chairman, ISTT

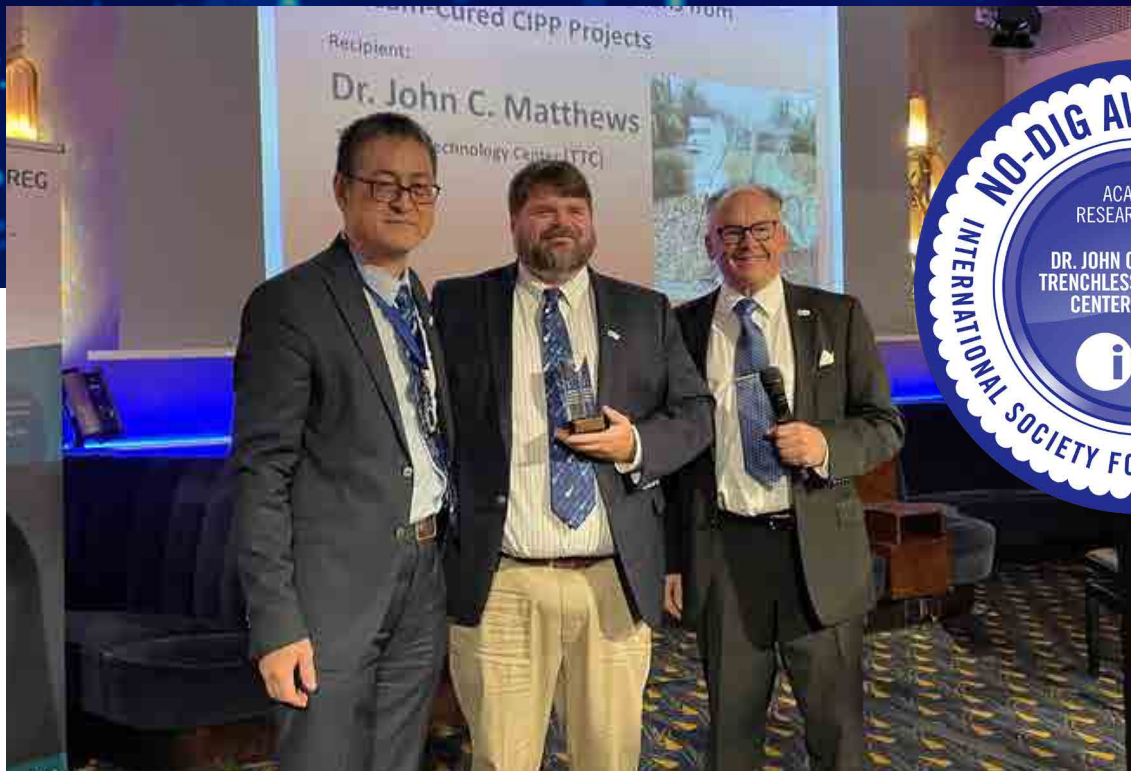
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ACADEMIC WINNER

MITIGATION OF STYRENE EMISSIONS FROM STEAM-CURED CIPP PROJECTS

Written by: Dr. John C. Matthews (TTC), Dr. Jason M. Howell (LTU) Dr. Elizabeth C. Matthews (LTU), Dr. Shaurav Z. Alam (TTC)



John Matthews receiving the Award at the presentation at the International No-Dig event in Helsinki.

Between 2019 and 2022 a project on the Mitigation of Styrene Emissions from Steam-Cured CIPP Projects was carried out by the authors at the Trenchless Technology Center (TTC) within Louisiana Tech University (LTU). The research was presented with the ISTT Award for Academic Research in 2022.

Research

The safety of CIPP due to styrene emissions has been called into question by various researchers over the past 5 years, causing hesitancy of many designer engineers and owners to specify the use of CIPP. This has specifically impacted steam-cured CIPP, which is the most widely used form of CIPP for sewer mains up to 12 in (300 mm) diameter and also the largest segment of the sewer rehabilitation market in North America and many other locations. Much of the research causing the safety concerns was based on questionable scientific methods, so in 2019 the Trenchless Technology Center (TTC) began to investigate the issue, initially with support NASSCO, and subsequently on its own internally. >

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CIPP Exhaust from
Steam-Cured Site.



Liner being installed
from storage truck

As part of its initial study for NASSCO, the TTC investigated the impact and magnitude of styrene emissions from steam-cured CIPP sites at nine different sites across the U.S. The focus of the study were the emissions being released from the exhaust ends of the liner (Fig. 1), however other locations were also monitored for all volatile organic compounds (VOC) including styrene. The key findings of the initial study for NASSCO showed that although there was styrene being emitted, it was not in the concentrations that were reported by the questionable studies that initiated this research. Those studies reported regular concentrations of 500 to 1,000 parts per million (ppm) of styrene in and around the steam plume when workers were present. The TTC study however, which used various forms of measurement to ensure the accuracy of the results, found that concentrations rarely exceeded 100 ppm in the plume itself and dropped off dramatically around the plume to less than 10 ppm, which are safe levels according to multiple environmental regulatory agencies. Therefore, this study resulted in a set of safe working recommendations that include maintaining a perimeter around the exhaust stacks of at least 15 ft (4.5 m) during liner curing to ensure worker safety. Since the publication of this study, numerous decision makers, engineering designers and utility owners have incorporated these recommendations into their specifications.

In addition to the study of styrene emissions near the exhaust, the TTC also examined the emissions in and around the cold storage/transport vehicles that bring the uncured liner to the sites. Although it was not the focus of its initial study, early results showed that styrene concentrations inside of the cold storage units regularly exceeded safe working thresholds. To study this issue further, TTC conducted a second study for NASSCO focused on the breakthrough times of styrene emissions through various CIPP coatings to determine how to better manage emissions in the storage truck. The general findings found that the most common class of CIPP coating materials, primarily PEs, PPs, and PUs, regardless of thickness do allow styrene breakthrough after a few days on average resulting in evaluated styrene concentrations of around 100 to 200 ppm in storage units/trucks. To combat this safely, the TTC made recommendations to monitor the truck air quality during periods when workers need to be present for longer than 10 minutes. This would ensure worker safety in and around the truck and if thresholds are exceeded, workers can remove themselves from that environment to allow the truck to be aired out until styrene levels become safe.

TTC has also developed a patent-pending styrene mitigation device that can be used to further reduce the potential impact of emissions from the exhaust stacks. This technology uses heat to catalytically burn off the styrene on its way to the exhaust stack. Testing has shown the reduction in styrene emissions to be greater than 90%, which would eliminate the need for the perimeter recommended from the NASSCO study.

The significant amount of study that the TTC team has devoted to the issue of styrene emissions from CIPP liners has greatly advanced both the understanding of its impact as well as how best to mitigate potential emissions. Numerous agencies and decision-makers are already implemented the TTC recommendations and a large CIPP installer recently purchased the patent rights to the TTC developed mitigation device. This will result in safer and more cost-effective CIPP steam cure installation throughout the world once fully implemented.



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INSTALLATION WINNER

HOW A WATER MAIN PROJECT OVERCAME FAULTS AND GEOLOGIC VARIATION IN TAIWAN

Written by: Mr Huan-Ying Fan, Mr Wei-Cheng Chen, Taipei, Mr Kai-Ping Chang all of the Taipei Water Department, NO.131



Taipei Water receiving the ISTT Award in Helsinki



The Taipei Water Department completed a shield tunnelling project passing through active faults and overcoming geologic variation between strata. Flexible pipe joints were employed to accommodate fault movement, and various shield machine tools were applied for drilling through different strata. Barriers such as bridge foundation piles and Taipei MRT tunnels were also overcome.

A special flatcar was developed to conveniently carry and accurately install pipelines. This project won the Taipei City Government's 2019 Public Construction Distinction Award, CTSTT 2019 Excellent No-Dig Project Award and the 2020 National Golden Quality Awards for Public Construction. Trenchless technologies and innovations adopted in the case greatly reduced traffic impact, carbon dioxide emissions, and 5,600 m³ trench spoil, making this a successful model of a No-Dig project. The project designation was Dadu Danhai Water Trunk Line Shield Tunnelling Project and took place between 2016 and 2020 with Feng Shun Construction Co. Ltd as the main contractor. >

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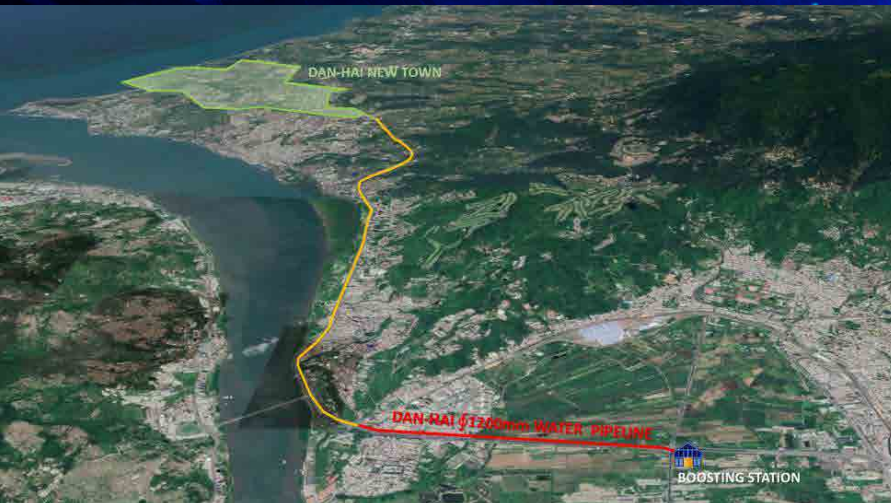


Fig. 1. The red line represents this project, which conveys water to a new town.

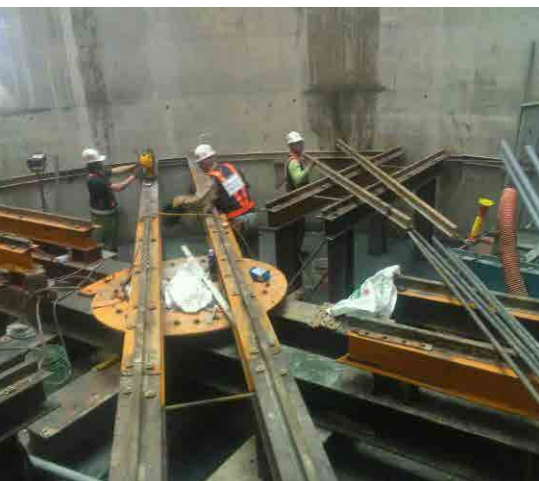


Fig. 5a and 5b. Establishing working turntable.

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Fig. 6. Process of transporting soil and concrete segments.

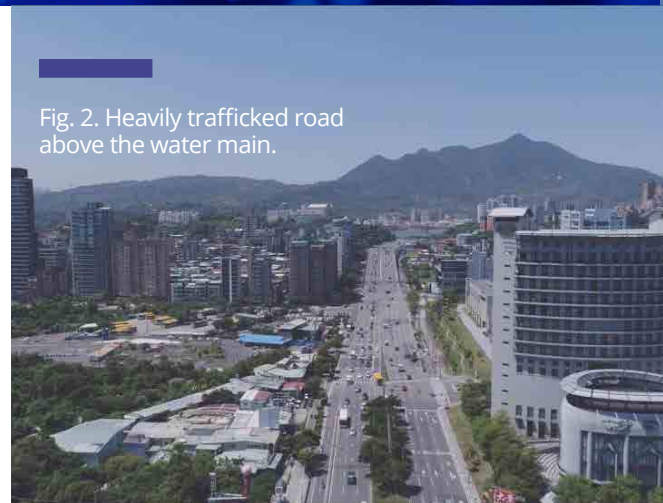


Fig. 2. Heavily trafficked road above the water main.



Fig. 4. Entrance shaft excavated with open caisson method.

Requirement

A new town with a population of 130,000 was developed near Taipei City, but it faced a severe water shortage. Taipei Water Department was charged with supplying stable water supplies, and therefore constructed 2.25 km of ductile iron pipes (DIP) 19 m underground (Fig. 1) using the shield tunnelling method.

The water main passed beneath a heavily trafficked road (Fig. 2). Because open cut construction has considerable social costs, shield tunnelling construction was adopted. The shield machine excavated forward while precast concrete tunnel segments with an internal diameter of 2,100 mm (Fig. 3) were installed behind it. After the tunnel was completed, 1,200 mm diameter Type U DIPs were installed. Occupational safety was prioritised because the tunnel was long and narrow.

The entrance shaft was excavated at the beginning with open caisson method (Fig.4). Then, an innovative working turntable was set up to help transport soil and concrete segments more efficiently. (Fig.5,.6) >

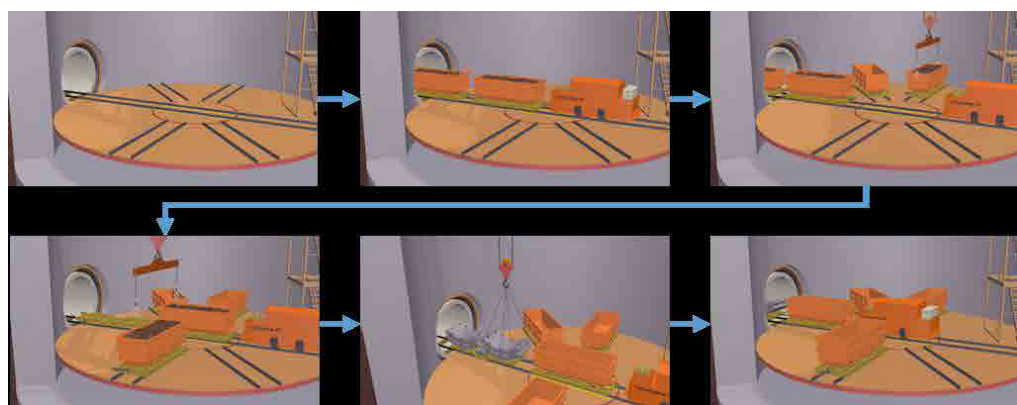




Fig. 7. Water main passes Shanchiao Fault.

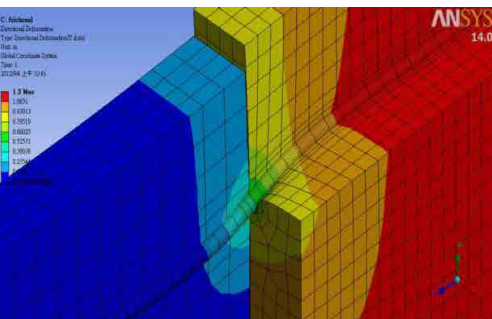


Fig. 8. Numerical analysis: water main deformation isogram.

Design Strategies for Crossing Faults

The water main passed the famous Shanchiao Fault (Fig. 7) in Taiwan. To avoid damage from fault slippage, design work, including prior investigation and geological analysis, was entrusted to CECL, an engineering consulting company. The company estimated Shanchiao Fault had slid 18 m over the past 10,000 years. Numerical calculations, based on the soil spring model and shell element finite element method, were adopted to simulate the maximum deformation of water pipes caused by fault dislocation (Fig. 8), and designs to combat such deformation were implemented accordingly.

To prevent Shanchiao Fault from causing severe pull, squeeze, or shear force to the water main, six flexible joints (Fig. 9) were deployed in the water main every 20 m in the fault section. These joints reduced approximately 30% of shear and tension stress on DIPs caused by land subsidence. >



Fig. 9. Flexible joints deployed in fault section.

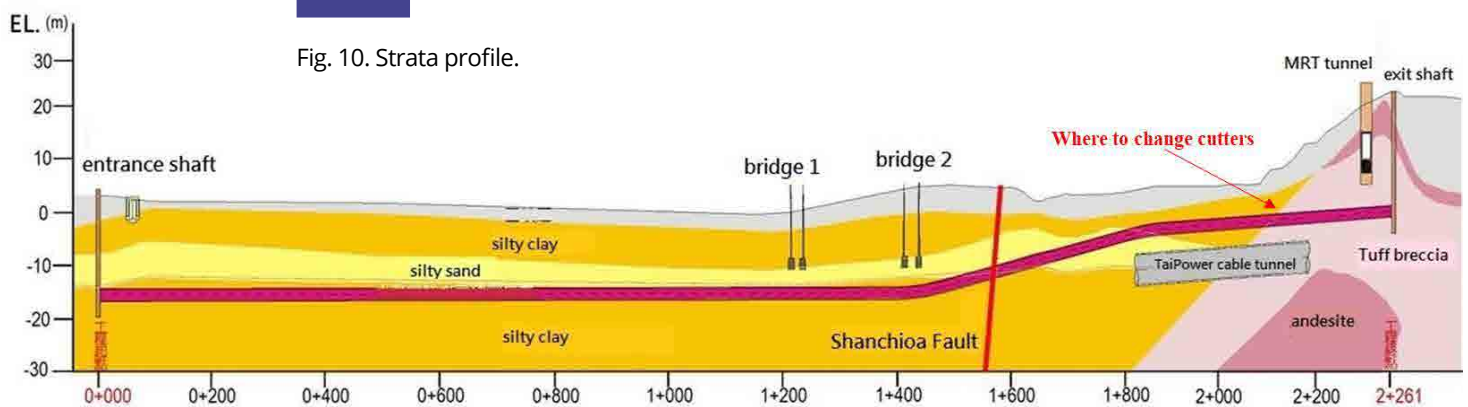


Fig. 10. Strata profile.

Fig. 11. Normal cutter bits at front section of tunnel.



Fig. 12. Roller cutters at rear section of tunnel.



Fig. 13. Replacing shield machine cutters.



Fig. 14. Worn cutter bits and new roller cutters.

Advancing Through Soil and Rock

The two strata greatly differed in hardness at distances 2K + 100 (Fig. 10). The shield machine advanced from silty clay stratum (average SPT N-value = 4) into volcanic breccia stratum (SPT N-value > 100). Therefore, the shield machine's cutters were replaced according to the stratum hardness. Cutter bits (Fig. 11) were used in silty clay stratum, and roller cutters (Fig. 12) were used in volcanic breccia stratum.

When replacing cutters, stopping water and shoring was necessary to prevent fractured rocks from collapsing. Soil improvement was implemented horizontally from the injection port, and construction workers then manually excavated space to replace the cutters (Figs. 13, 14). >

Fig. 15. The shield machine breaks through bridge foundation piles.

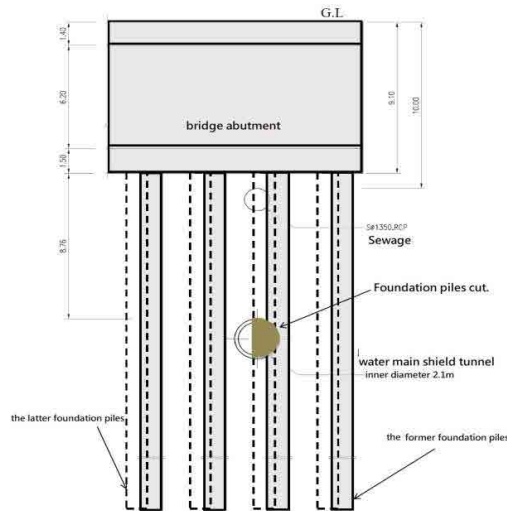


Fig. 16. Soil improvement process at bridge site.



Fig. 17. A flatcar built to carry and install pipes.

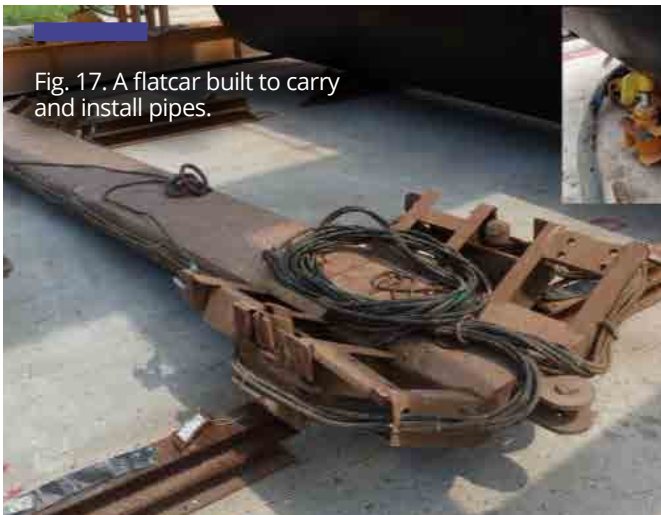


Fig. 18. Hydraulic jacks used to adjust pipe.

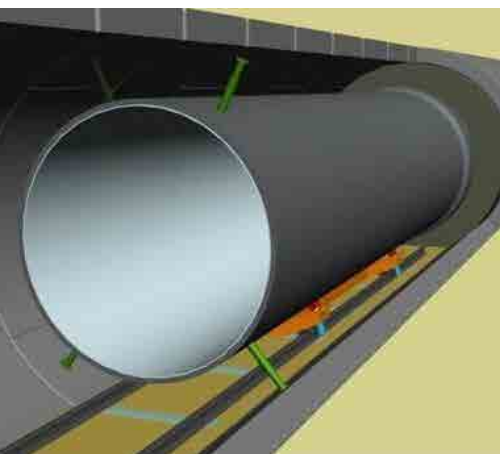
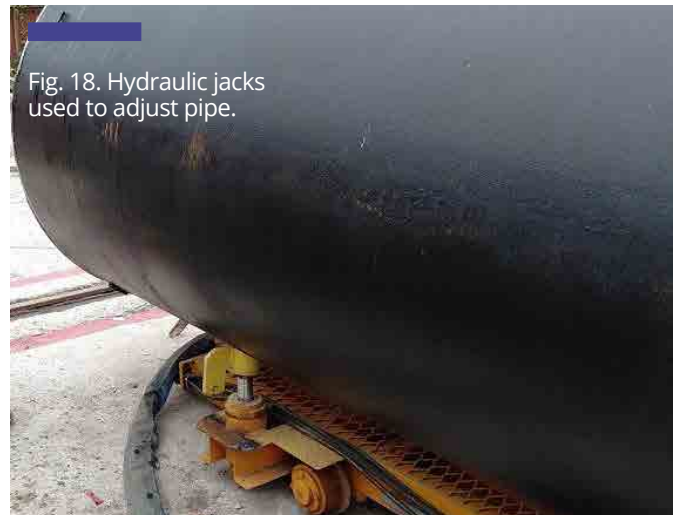


Fig. 19. Installation of the water main using a flatcar.

Barriers to Overcome

The advancing path of this project encountered lots of barriers. The shield machine passed underneath two bridges with 16 foundation piles that had to be broken through (Fig. 15). Soil improvement processes were implemented in advance, and the foundation piles were clad in concrete to reinforce them and stop water (Fig. 16). Thereafter, the shield machine advanced through the piles. A manhole on the cutter-head was opened when necessary to let construction workers cut reinforcing bars. It took 1.5 months to pass through each bridge because of the sturdiness of the foundational piles.

Next, the shield machine passed a 345 kV high-voltage cable tunnel only a few meters from a Taipei MRT tunnel. A full-time automatic monitoring system was set up to monitor the MRT track for settlement. The maximum displacement of the track during construction was only 0.14 mm, despite the close proximity.

Equipment and Installation Methods

Once the tunnel was complete, installation of DIPs and flexible joints began. A special flatcar (Fig. 17) with four independent hydraulic jacks (Fig. 18) was used to install pipelines in the centre of the tunnel (Fig. 19). Hydraulic jacks were useful for adjusting pipe's elevation and angle. After each 12 m pipe was installed, the section was backfilled with concrete, making the pipes fixed and anti-seismic. The procedures were repeated until the entire main trunk was set up. >

Fig. 20. Construction of entrance shaft with open caisson method.



Fig. 21. Caisson in the process of sinking.



Fig. 22. Shield machine passed underneath MRT tunnel.

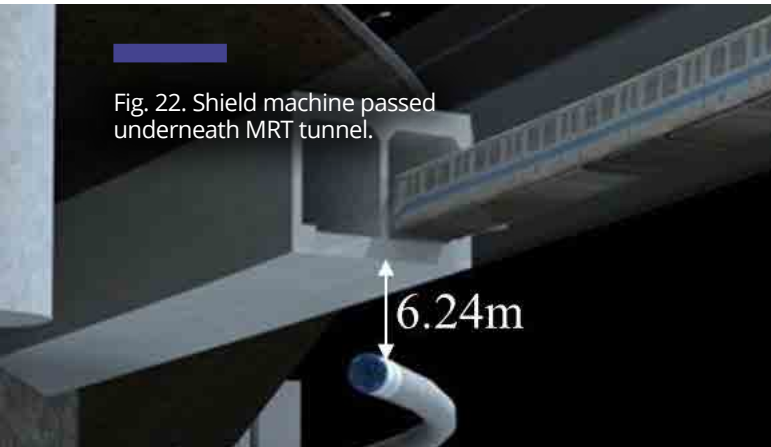


Fig. 23. Construction of exit shaft.



Fig. 24. The completed tunnel.

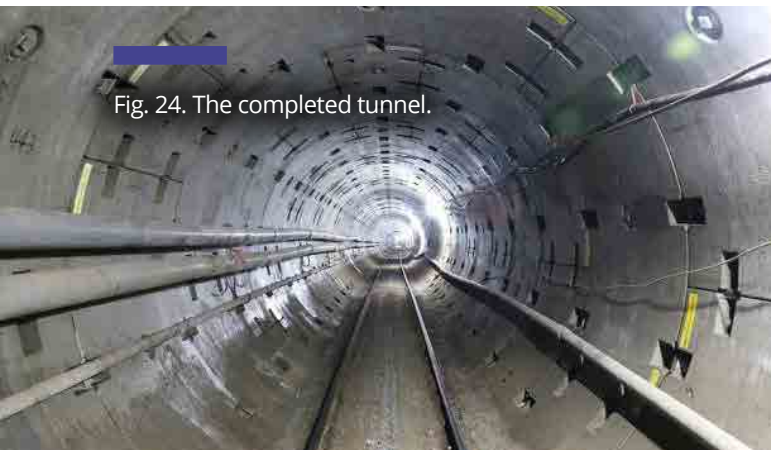


Fig. 25. Shield machine arrives at exit shaft.



Fig. 26. Aerial photograph of entrance shaft post-restoration.



Fig. 27. Aerial photograph of exit shaft post-restoration.

The construction procedure can be summarized as follows:

- 1) Excavating entrance shaft. (Fig.20, 21)
- 2) Shield machine passing foundation piles of two bridges.
- 3) Shield machine passing through the fault.
- 4) Shield machine passing underneath MRT tunnel. (Fig.22)
- 5) Excavating exit shaft. (Fig.23)
- 6) Completion of 2,250 m tunnel (Figs. 24, 25).
- 7) Installation of DIPs and flexible joints.
- 8) Construction site restoration. (Fig.26, 27)

This shield tunnelling project constructed the longest, narrowest water main in Taiwan, using flexible joints as a solution for crossing faults. Construction lasted 4 years due to the complex processes described herein. However, the project was completed in May 2020, and currently serves 130,000 people.

PRODUCT WINNER

SUBMERSIBLE DIRECTIONAL DRILLING MACHINE

Written by: Zhiguang Jiang, Jiangsu Dilong Heavy Machinery Co., Ltd.



ISTT Chair Keh-Jian (Albert) Shou accepts the Award on behalf of the winners.

This Submersible Directional Drilling machine was developed for the directional crossing drilling at a depth of 50 m or more without the need for personnel to operate underwater. It can be used for salvage operations of sunken ships or horizontal directional drilling projects underwater.

It adopts continuous pipe drilling technology, which is the main difference from conventional directional drilling machine working on solid ground and there is no need to connect and disassemble drill pipe during underwater operation.

It omits the link of connecting and disassembling drill pipes in the process of underwater operation. In addition, it uses wired guidance to complete all connections before launching, so that underwater unmanned operation can be realised. The length of continuous drill pipe is connected on water according to the crossing length. There is a floating device to keep some continuous rods that do not enter the soil suspended underwater. >

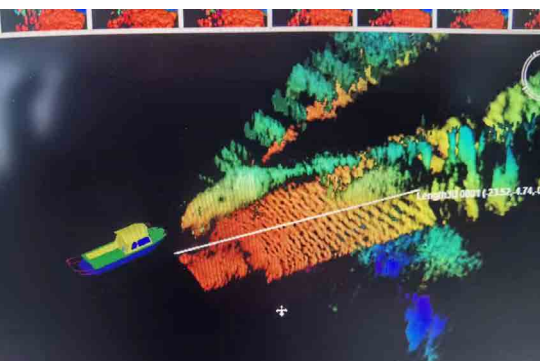
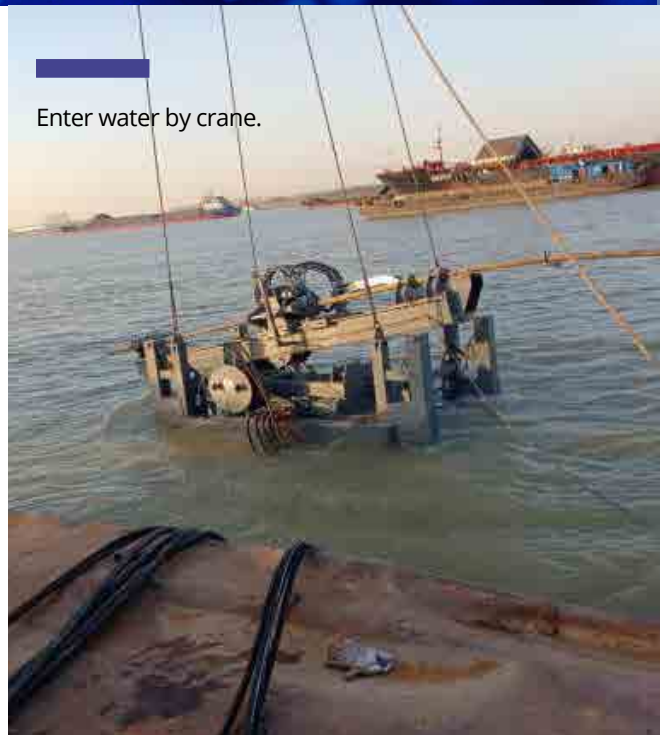
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Connecting all drilling rods (on ship).



Enter water by crane.



Continuous pipe crossing drilling detected by sonar.



On site, project acceptance.

We have customised and produced one set of such drilling machine for Wuhan Rescue and Salvage Bureau of the Yangtze River. It is used to rapidly lay steel cables across the bottom of a sunken ship during salvage. This is the first time for the horizontal directional drilling technology to be successfully used underwater. This product has just been born, and more applications besides shipwreck salvage are under development besides sunken ship salvage.

Technical Parameters of Submersible Directional Drilling Machine

Items	Parameters
Dimension (Underwater)	5630×2200×2230 mm
Weight (Underwater)	10 t
Dimension of power station (on land)	3525×2055×2025 mm
Weight of power station (on land)	4 t
Engine power	153 kW@/2200 rpm
Spindle speed	47 rpm
Spindle torque	12000 Nm
Entry angle	± 5°
Exit angle	5°-25°
Max. push/pull force of oil cylinder	400 kN (without piston rod) or 160 kN (with piston rod)
Max. push/pull speed of oil cylinder	7 m/min (without piston rod) or 18 m/min (with piston rod)
Max. drilling distance (depending on soil and hole diameter)	180 m
Maximum drilling hole diameter (depending on soil and drilling distance)	200 mm

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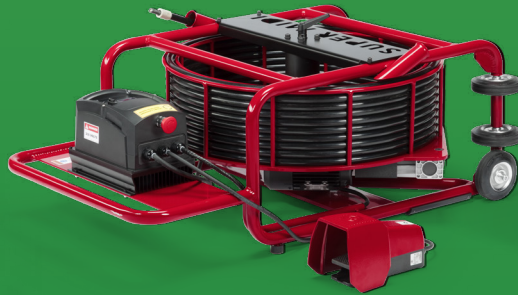
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REHABILITATION PROJECT REHABILITATION OF THE WASTEWATER NETWORK OF THE CUENCA LA CHALA – GUAYAQUIL

Written by: GSTT and Ludwig Pfeiffer Hoch- und Tiefbau GmbH & Co. KG



GSTT accepting the Award on behalf of the winning contractor.

The rehabilitation project of the sewage network in La Chala was executed by the company Ludwig Pfeiffer between July 2017 to December 2019 in the city of Guayaquil, Ecuador. The World Bank financed one of the largest and most relevant projects implementing trenchless technologies in Latin America.

The city of Guayaquil is 5 m above sea level. Therefore, there groundwater level in the entire urban area is high. Moreover, the existing 500 km gravity flow wastewater network is nearly 40 years old and exhibited serious infiltration problems.

Special characteristics

Guayaquil is located on the west bank of the Guayas River, which flows into the Pacific Ocean. Sewage pollution in the rivers has plagued the city for decades. The city of Guayaquil is taking action to improve its water and wastewater infrastructure with the support of the World Bank. >

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The City of Guayaquil.



Ongoing trenchless rehabilitation operation using UV cured CIPP performed by Ludwig Pfeiffer Hoch- und Tiefbau GmbH & Co. KG.



CCTV inspection video showing sewer pipe anomalies.



Street overflows.



The project is situated in La Chala, a southern suburb of Guayaquil. La Chala is characterised by a high population density, heavy traffic and a large amount of commercial activity. Overall, these conditions create some complicated restrictions to any rehabilitation activities by traditional open trench solutions. However, they are ideal for the adoption of trenchless technologies.

The objective of this rehabilitation project is to establish a sustainable universal access to wastewater management services in the La Chala district of the city of Guayaquil. The project will therefore improve environmental conditions in Guayaquil's water bodies (the River Guayas and the Salado Estuary) and bring better livelihood conditions for its residents in selected neighbourhoods. Thus, contributing to the reduction of poverty and increase prosperity in the city of Guayaquil.

The lack of proper maintenance and infrequent repairs by the private operator combined with an under-capacity pumping station, caused frequent clogging and street level overflows, resulting in a negative impact on the lives of residents and commercial activities. >

Soil, trash, and other debris filled DN1400 sewer pipe blocking wastewater flow and causing street level overflows before rehabilitation.



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CCTV video inspection showing trash and debris accumulation inside DN500 pipe.





Map with location of main wastewater trunks and interceptors to be rehabilitated.

Scope of works

The contracted scope of works for this project comprised cleaning around 450 km of sewer pipes including CCTV inspection as well as the trenchless rehabilitation of around 93 km of wastewater pipeline and of 450 chambers (manholes located on the main wastewater trunks and interceptors). The pipe diameters ranged from DN150 to DN1400. It also included the construction of 1,986 house manholes and connections.

Project description

The initial works comprised CCTV surveying of the pipes to obtain the current state network diagnosis with prior cleaning, combining high-water-pressure-jet cleaning trucks with recycler units and CCTV inspection robots. The result was a complete CCTV inspection report according to UNE-EN 13508-2 including relevant rehabilitation technology recommendations. >



CCTV robot and equipment used for video inspection.

Preliminary operations of dewatering operation to control tide water levels before cleaning and rehabilitation operations.



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6 in (150 mm) pumps necessary to control tide water levels during cleaning and rehabilitation operations.

Cable reel of the CIPP light train.

All-purpose container with the necessary CIPP control units and support equipment (Generator, Blower, Cable Reel, etc.).



Diver operations including installation of DN1200 pipe blocker

The project was executed using three trenchless technologies:

- 61 km by CIPP (cured-in-place-pipe) with UV curing;
- 23 km by Pipe Bursting with HDPE pipes;
- 9 km by Sliplining using flexible PE pipes.

In addition, all existing chambers and manholes were rehabilitated using special surface protection mortars designed for use against contact with sewage water.

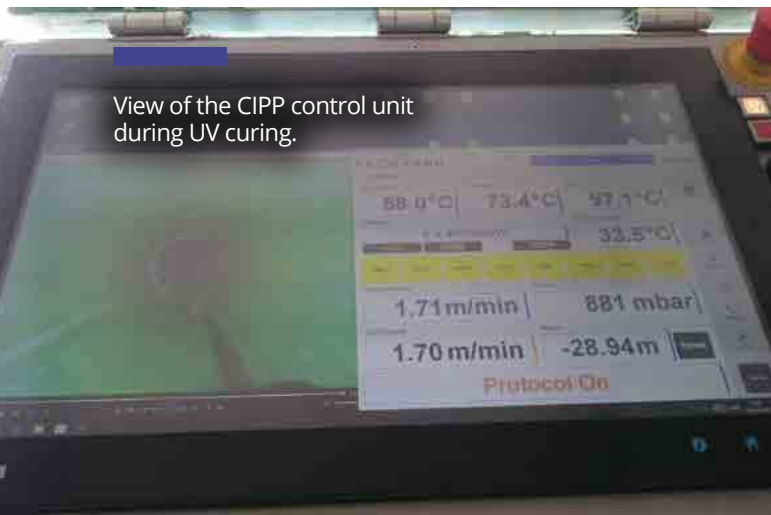
The mentioned wide range of diameters, the use of different technologies almost unknown in Ecuador, as well as the high-water table in the entire La Chala network represented only a few of the challenges of the project. The logistical problems associated to the distance of all manufacturers and suppliers involved made this project unique and quite demanding.

The CIPP technology was used for the rehabilitation of the so-called 'Colectores' which are the main sewer pipes, trunks, and interceptors with diameters ranging from 200 mm to 1,400 m. After evaluating the CCTV inspection, the old pipe condition was determined. Then the statically required wall thickness of the liner which was to be installed was determined in connection with the high groundwater level. >

Narrow CIPP installation on the small diameter 'Ramales' wastewater network.



View of the CIPP control unit during UV curing.



Rehabilitation specialist installing DN150 liner.



HDPE joint-welding to be installed through pipe bursting.

Because of the high-water table inside all manholes, a scuba diving team was essential for a proper work progress. These divers were responsible for preliminary works including underwater setup of pipe blockers inside the manholes, underwater cleaning, and exact underwater survey of pipe sections.

In addition, CIPP was also used for the rehabilitation of the smaller diameter pipes around the residential blocks (neighbourhoods). The so-called 'Ramales' collected the wastewater of all house connection manholes in a residential block and delivered it to a chamber on the main collector, trunk, or interceptor wastewater pipeline. These 150 mm diameter pipes had infiltration and structural problems associated with large misalignments between individual pipe joints. To reduce the risk of blockage, a prototype UV light chain was developed in partnership directly with the equipment manufacturer. This equipment proved to be decisive in order to carry out a rehabilitation without problems.

Static pipe bursting technology with HDPE pipes was also used in the rehabilitation of the 'Ramales' of 150 to 200 mm diameter. This solution was used in sections where the level of defects and ruptures could not be corrected by CIPP.

The sliplining technology was proposed for the rehabilitation of intermediate sewer sections, the so-called 'Tirantes'. These pipes, with a diameter of 200 mm and lengths up to 12 m connected the 'Ramales' to the 'Colectores', that is, they were placed between the last manhole >

Special joint-welding operation of the flexible PE pipes used for sliplining.



Bending guide structure for flexible PE pipe insertion.

of each residential block's wastewater collection network and the closest chamber to the main collector, trunk, or interceptor wastewater pipeline. The adopted solution consisted in flexible tube modules made of HDPE DN175, with a ring stiffness of 8 kN/m². The high flexibility of these pipes made the rehabilitation possible without any kind of open trench works or partial manhole demolition. After inserting the pipe with a proper bending guide and pulling the pipe with a custom design winch, special space filling mortars were injected in order to fill the annular space between the old and new pipes. The hydraulic capacity of the line was maintained or improved despite the diameter reduction due to the roughness properties of the plastic material.

Project challenges

One of the biggest challenges in this project was the CIPP rehabilitation of the bigger downstream DN1400 pipes. Because of many logistical restrictions regarding length and total weight, the production of the liner was designed with a wall thickness of 11 mm and a maximum length of 130 m. However, in many cases the distance between the manholes was more than 200 m. Therefore, the rehabilitation of one total section was >

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DN1200 stainless steel CIPP caps (right) and wooden box containing a 130 m of DN1400 liner, weighing more than 7,500 kg (left).



DN1400 liner insertion assisted by a custom roller table.

accomplished by the installation of two CIPP liners. In order to guarantee water tightness, the overlapping area was sealed in the tube.

As already explained, the high-water level inside all manholes required a scuba diving team to execute the preliminary works inside the manholes. The divers were not only responsible for underwater setup and positioning of pipe blockers inside the manholes but also for underwater cleaning and exact measurement of the pipe's internal diameter sections.

The long distance between suppliers and Ecuador should not be underestimated. In addition to the time difference of up to seven hours which made communication considerably more difficult, urgent technical problem clarifications or fast liner deliveries were impossible to implement. Another challenge was the need to consider large lead times caused by the logistical challenge. Accordingly, it sometimes took up to three months from ordering materials until the installation. The setting-up of communication teams and channels associated with multitask specialised groups, were decisive to meet deadlines and for the final quality of the installations.

Recap

The execution of this rehabilitation project and all these applied trenchless technologies and methods ultimately contributed to a better quality of life in Guayaquil. Moreover, the wastewater that used to exfiltrate and contaminate the river Guayas is now being isolated and treated, which contributes a lot to a safer environment and a better life to the local population.

The works took place in one of the poorest and most problematic areas of the city – La Chala. Therefore, dedicated security precautions and attention to social aspects were extremely important. Hence, a dedicated communication team was developed and set up to meet the communication needs of the population. This included weekly social >

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DN1400 liner
insertion assisted
by a custom roller
table.



Cutter robot
setup.

clarification sessions with the local population where information was distributed in order to explain the targets of the project, the impact it will have on their lives, as well as the positive consequences it will have on the environment.

More than 325,000 residents of the La Chala region in Guayaquil benefitted directly from the rehabilitation of the sewer network.

Additionally, this project created local employment opportunities and provided hands-on training in trenchless technologies for up to 200 local workers. The impact on traffic was minimal, and the surrounding residential and commercial areas were only slightly affected. In the end, nearly 100 km of the wastewater network was rehabilitated applying so-called NODIG or trenchless technologies. >

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Social clarification session.



Onsite training.



Flyers distributed to the local population during the social clarification sessions.

Country-specific information

Over the past decade, Ecuador has seen a period of political stability and growth combined with falling inequality, which has led to important gains in reducing poverty and promoting shared prosperity. During previous years, the Government of Ecuador has invested heavily in the infrastructure and social sectors to stimulate growth and reduce inequality. However, poverty levels are still high. More poor people live in Guayaquil than in any other urban area in Ecuador because Guayaquil is the biggest city in the country with 2.6 million people.

Although access to water and improved sanitation services in Ecuador have progressed significantly over the past decade, the level and quality of service provided remains low in comparison with the regional average. In 2010, the share of Ecuadoran households connected to a public drinking water distribution network was 72% in urban areas and 27% in rural areas, while the average in the Latin American and Caribbean region was 94% and 62%, respectively. Coverage of sewer systems and wastewater treatment was even less.

Guayaquil's Municipal Development Plan (MDP) identifies access to affordable, improved wastewater management service as a key element of its social inclusion and urban regeneration policies. Since 2001, a 30-year concession contract was awarded to a private consortium, Interagua, for the provision of water supply and sanitation services within the city. >

The team of Ludwig Pfeiffer in Guayaquil.



Today, Empresa Municipal de Agua Potable y Alcantarillado de Guayaquil (EMAPAG EP) a regulatory agency has the task to supervise and control Interagua's performance, among other functions. Over more than ten years, access to water and sanitation as well as the quality of services has significantly improved in Guayaquil.

Nonetheless, two important challenges regarding sanitation services remain:

1. Just 20% of the wastewater generated is currently being adequately treated
2. Effective access (actual connections to the sewerage network) is about 85% of potential service coverage under the current network extension.

To meet the ambitious environmental and access to basic services goals EMAPAG EP and Interagua have designed a comprehensive wastewater management investment programme to be implemented. Within this context, the project Ludwig Pfeifer executed between 2017 and 2019 is set.

STUDENT PAPER ALTERNATIVE APPROACH FOR ASSESSMENT OF HYDRAULIC DESIGN BASIS FOR PRESSURE PIPE LINERS

Written by: John Jacob Kraft IV (TTC)



John Jacob Kraft IV receiving the Student Paper Award at the ISTT event in Helsinki.

Between 2020 and 2022 a study on an Alternative Approach for Assessment of Hydraulic Design Basis for Pressure Pipe Liners was carried out by the author at the Trenchless Technology Center (TTC) within Louisiana Tech University (LTU).

The following work was completed as part of Doctoral research by John Jacob Kraft IV at Louisiana Tech University. This issue was highlighted by other researchers as they attempted to perform the ASTM D2992 testing for a client. This innovative method will considerably reduce the cost of performing this test and add to the body of knowledge allowing designers and decision-makers to design the best rehab projects possible.

New product development requires stringent testing to ensure that strength and safety standards are met by the innovative materials. When developing a new pipe material there are several factors tested for. In addition to normal material characteristics such as elastic modulus of pipe materials, long term hydrostatic strength (LTHS) and hydrostatic design basis (HDB) are needed. Typical characteristics are commonplace and can certainly be tested for in lab facilities. LTHS and HDB as described in ASTM D2992 are two characteristics that can prove very challenging to conduct. The current method requires a minimum of 18 full pipe specimens be placed under hydrostatic test at various stress levels to produce required failures. >

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Samples Prepared for
ASTM D2992 Testing.



Testing Fixture Used to Perform
Tensile Creep Testing.

The purpose of this testing is to generate ductile failures that are not typically seen during other short-or long-term testing methods. These failure modes include wall fracture, localised leaks, or weeping. Successfully generating these failures can be very hard to achieve with relatively unfamiliar material. These full-scale samples also consume large areas of climate-controlled space. In many cases large enough areas for this test are not controlled to the quality required by the standard. The unavailability of this space contributes to the high cost of the testing method. The area required by this test can be seen in Figure 1. In an effort to reduce the overall burden required by this testing procedure a modified testing procedure has been developed. The modified procedure has been derived by combining two long term testing standards. The analysis method used is closely related to the original method described in the ASTM D2992 standard but the method used to test the samples is a modified form of the test apparatuses used for ASTM D2990 long-term creep testing. This newly proposed testing method can be seen in Figure 2. One would think that no longer having the full-scale pipe samples would result in a loss of data quality. In order to simulate the ductile failures that are required for the ASTM D2992 standard, this method will rely on strain data. Prior to long-term testing a combination of short term burst and slightly longer term burst tests will be performed either to satisfy other needs or for this purpose solely to determine the strain at failure for the material. With this information, long-term testing can be started and the strain data monitored until the limit representing failure has been exceeded at the required failure points as described in the ASTM D2992 method.

By performing this modified method, the amount of space required to perform this test can be reduced by over 80%. The reduction in space and ease of sample preparation will reduce the cost of performing the test by more than half. In addition to the initial setup cost having to add or replace samples following this new method is also more efficient and less costly. This method will hopefully be a beneficial contribution to trenchless technology worldwide.

WATER MAINS ASSETS MANAGERS TAKE NOTE – A NEW COURSE IN INSPECTION, ASSESSMENT AND DECISION-MAKING



Tom Sangster



It is always a challenge in getting those all-important decisions right, in terms of priority, approaches and timing, in asset management strategies, none more so than with water mains maintenance, rehabilitation and repair.

New Course Launched

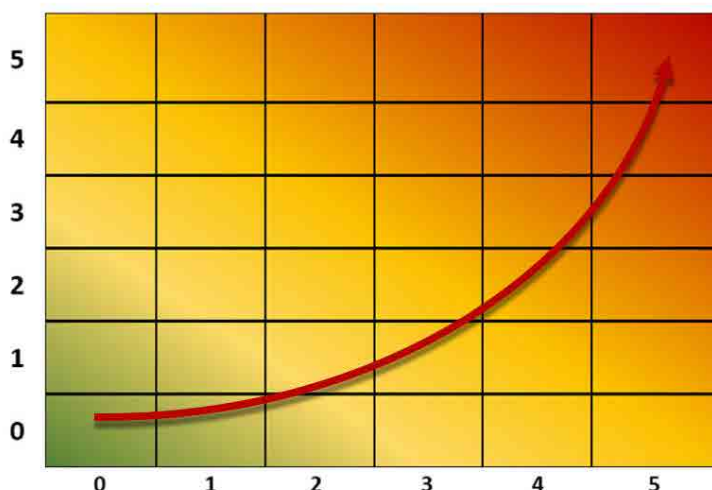
JBP has just launched, on its on-line platform – www.trenchless.training, a new course which should be of significant interest to any asset manager, engineer or technician working with water mains maintenance and rehabilitation.

The development of new course 'Water Mains: Inspection, Assessment and Decision-Making', has been led by Tom Sangster, one of an expanding team of JBP's Trenchless Trainers. Tom has had extensive experience and expertise consulting for utilities and contracting companies around the world, for trenchless rehabilitation projects, over many years. He has contributed many technical papers in forums such as International No-Dig and Trenchless conferences and until recently served on the UKSTT's Technical and Education sub-committee. He needs little or no introduction to many in the sector.

Focus on Key Aspects

In researching and developing this course with JBP, Tom's main focus has been to cover key aspects in the core and connected areas of inspection, assessment and decision-making for effective water mains maintenance and also to review current methods and technologies being used. Course participants will come away from the course with a solid understanding of main considerations and approaches in this strategically important area.

Divided into five modules, including introductory and concluding modules, and spanning the equivalent of a day's training, the core modules dive, in some depth, into the important details any asset manager, water mains engineer or technician will want to be fully conversant with. >



The Inspection module examines impacts of location, pipe environment, causes of corrosion and mitigation steps, leakage, as well as a review of inspection methods and technologies.

In the module covering Assessment, which could be considered the core of the course, such aspects as pipe materials and failure modes, structural and hydraulic assessment are all closely examined, as is the critical aspect of risk assessment and likelihood and consequences of pipeline failures, as well as approaches to assessment of remaining useful life for pipelines.

Following on from the earlier two modules of inspection and assessment, the course's fourth module takes a look at Decision-Making in the process – use of assessment outputs to inform effective asset management decisions and choices. Risk management strategies are considered as well as budget estimation and capital investment appraisal.

Delivering A Clear Understanding of Challenges

The course provides participants with a clear understanding and knowledge of the range of problems and challenges, in inspection, assessment and decision-making processes. The direct benefit of this course will be to equip assets management staff with the necessary knowledge and skills to effectively operate and maintain networks, based on a solid foundation of positively managed conditions and the performance of networks and to manage risk and maintain high service levels required in water supply, cost-effectively.

This course in Water Mains Inspection, Assessment and Decision-making is the first of two courses in this series, developed and offered by JBP together with experts such as Tom who are working in the sector. The second course completes an examination of the process with a focus on Water Mains Rehabilitation.

Contribution to the bottom line

Effective management of our water networks has never been more in the spotlight and higher on the agenda, in terms of budget pressures, environmental impact and considerations, and increased consumer expectations and awareness. Therefore, it is essential that those who have the task of maintaining water infrastructures are well supported with the right tools, knowledge and skills to carry out their responsibilities as effectively and efficiently as possible. JBP's Managing Director Börje Persson is certain this course will make a valuable contribution to effective assets management of water mains, better performance in the networks and a direct contribution to the bottom line.

For more details of this and other courses available in JBP's Trenchless Training programme please contact: Frank Reilly – JBP Training Director (frank.reilly@trenchless.training) or visit www.trenchless.training

REHABILITATION OF FIRE MAINS – CHALLENGES AND ADVANTAGES OF TRENCHLESS METHODS



A multitude of other transport and supply lines in the facility often hinders accessibility of fire water mains to be rehabilitated.

They are our invisible protection in public, residential and company buildings as well as in industrial complexes and they have to be functional in cases of emergency: they are the fire-extinguishing systems.

Since failure could result in severe consequences for people and the environment, they are considered critical infrastructure. Like any infrastructure, fire-extinguishing systems have to be regularly checked, maintained and repaired or refurbished in case of damage. What challenges do operators from the industrial sector face when renovating fire water mains and what can a trenchless technology for pressure pipe rehabilitation like Primus Line® contribute in terms of cost and time savings?

Functional fire-extinguishing systems are the prerequisite for an operating permit in the industrial sector such as chemical plants, refineries or airports. In order to maintain them permanently, operators test their fire water mains regularly. Any weak points or damage discovered in this process has to be remedied to ensure that the pipelines function properly in the event of fire. >

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Flexible in terms of location: Only small construction pits are required to insert the liner into the defective host pipe.

“If operators in the industrial sector use seawater or salt water for firefighting, its transport can affect the pipeline and make it corrode, for example in the case of steel pipes or cast-iron pipes without a cement lining.”



Technical challenges for operators

With regard to the technology applied, operators are confronted with a variety of challenges. The fire water mains have to be checked regularly for leaks. In the case of above-ground pipelines, the operators periodically carry out flow and flow rate measurements. In the case of underground fire water mains, however, tests may lead to pipeline breaks, because in this deployment simulation, as in a hazardous situation, the fire water is forced through the pipelines at increased pressure. Already damaged, ageing or even corroded pipelines cannot withstand this pressure. Repairs to this sort of damage is usually only a short-term remedy, since the pressure in the pipe seeks the next weak point, causing further damage.

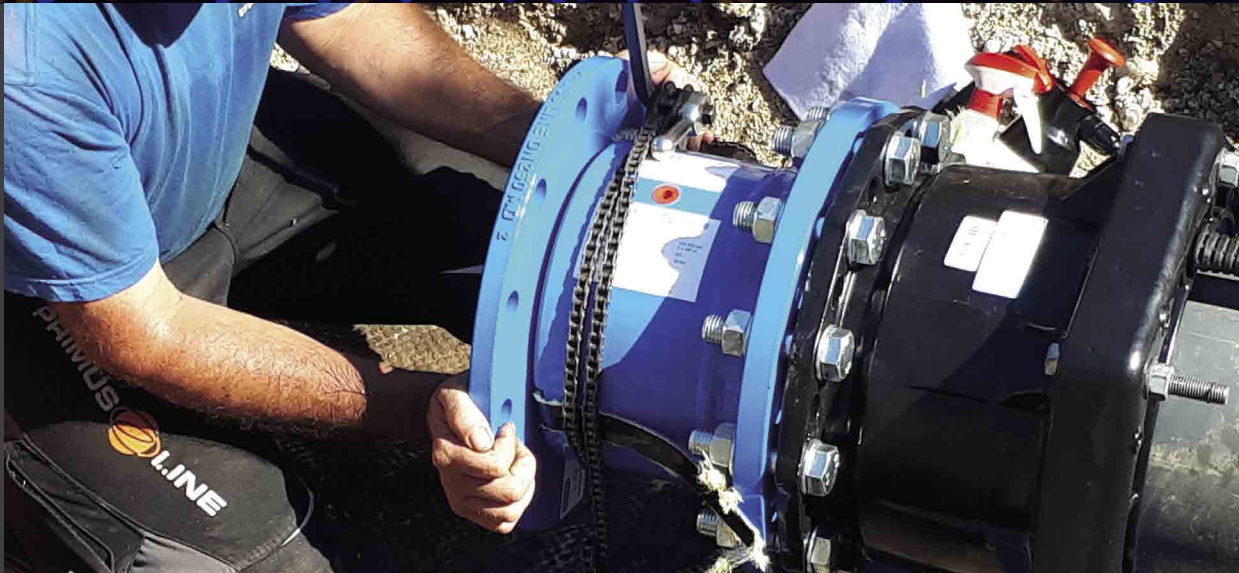
If operators in the industrial sector use seawater or salt water for firefighting, its transport can affect the pipeline and make it corrode, for example in the case of steel pipes or cast-iron pipes without a cement lining. These can then no longer withstand the operating pressure.

“Accessibility for the rehabilitation of fire water mains also plays a role in industrial plants,” said Andreas Gross, head of the Water International business unit with Rädlinger Primus Line GmbH. “The pipelines are frequently laid under access roads, larger asphalt surfaces or embedded in concrete. Or there is a multitude of other transport and supply lines in the facility. In addition, the fire water mains branch out to hydrants, for example. In these cases, an open-trench method with heavy equipment such as excavators would involve high costs and possibly restricted operation, due to applicable strict safety regulations and protocols,” he explained.

The economic challenges include, above all, repairs of suddenly occurring damage. These are cost-intensive and, as mentioned, usually only successful for a short time.

Permits to enter the site, scheduling of repair activities and their impact on productive operation are also issues operators have to consider. >

After having installed the connectors, the rehabilitated pipeline can be re-connected to the network.



Trenchless systems preferred

"Given the complexity of technical and economic factors in the rehabilitation of fire water mains, trenchless methods score points," said Gross. Seamlessly manufactured hose liners such as Primus Line® only require small construction pits at the beginning and end of the rehabilitation section to pull it into the pipe to be renovated. These pits can be dug out with a suction excavator or even by hand in extreme cases. Likewise, existing shafts can serve as access points.

Furthermore, insertion only needs a small equipment set-up, a pulling winch is sufficient. Less equipment also ties up fewer staff and the insertion speed of up to 10 m/min reduces installation times to a minimum.

If damage occurs suddenly, refurbishment can be carried out quickly, especially if hose liners such as Primus Line® are stored on site. In addition, this also enables regular maintenance in maintenance windows that are available at short notice. This does not even require external installation personnel. Rädlinger Primus Line GmbH trains the maintenance staff of the operators accordingly, so that they can carry out the renovation activities themselves.

There are no follow-up costs after a rehabilitation with Primus Line®, since the manufacturer has designed its product for a service life of 50 years. Primus Line® has proven its durability at an Austrian airport. In a refinery on the airport grounds, 1,300 m of fire water mains were rehabilitated with the liner a good fifteen years ago. They are still functioning perfectly.

It is not uncommon for fire water mains to also run in horizontal or vertical 90° bends. Under appropriate conditions, the flexible Primus Liner masters up to four 90° bends with a radius of $r = 1.5 \times D$ in one rehabilitation section. Bends up to 45° can be negotiated without problems. The installations teams on site react just as flexibly. As-built plans in industrial facilities are frequently not up to date. Due to the structural conditions or the assignment to danger zones, it is often not permitted to inspect the pipes to be rehabilitated with a camera prior to rehabilitation start. Obstacles or discrepancies are thus only detected during liner insertion on site. >

"Since safety is the top priority for operators of industrial plants, we had have our hose liner tested several times for fire resistance in the presence of independent testing companies," Gross explained and went on to specify: "The result is reassuring. If the pipe is filled with fire water, this has a cooling effect and the liner shows scorch marks at most at the outer of its three layers. The inner layer and the reinforcing aramid fabric, however, are not damaged by either selective or extensive heat input. Functionality is ensured even if the fire water main itself should be affected by the fire."



Existing shafts can also be used as access points for trenchless rehabilitation.

Reduced Investment and Operating Expenses

The advantages of trenchless systems such as Primus Line® for the rehabilitation of fire water mains are reflected in a significant reduction in costs. A refinery operator compared in a study the expenses for repair work using conventional construction methods and Primus Line® at one of his sites, with amazing results. Trenchless rehabilitation reduces the costs per metre to around half, whereas the metres of pipe rehabilitated per month increases by a factor of ten to fifteen.

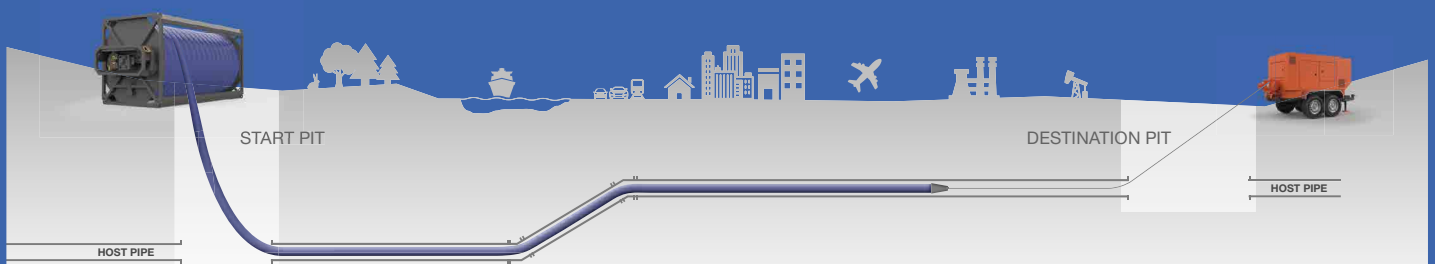
The same operator also accumulated the repair costs including follow-up costs for a three-digit number of leaks at one location over a period of thirteen years. The result was an amount in the low double-digit millions. Rehabilitation of these leaks with Primus Line® would limit the renovation work to five years, reduce the investment sum for the execution period by a third and would not entail any follow-up costs.

"Pipe rehabilitation with Primus Line® increases efficiency, reduces investment and operating costs and extends the service life of the fire water mains. Convincing arguments for trenchless methods." summarised Gross.

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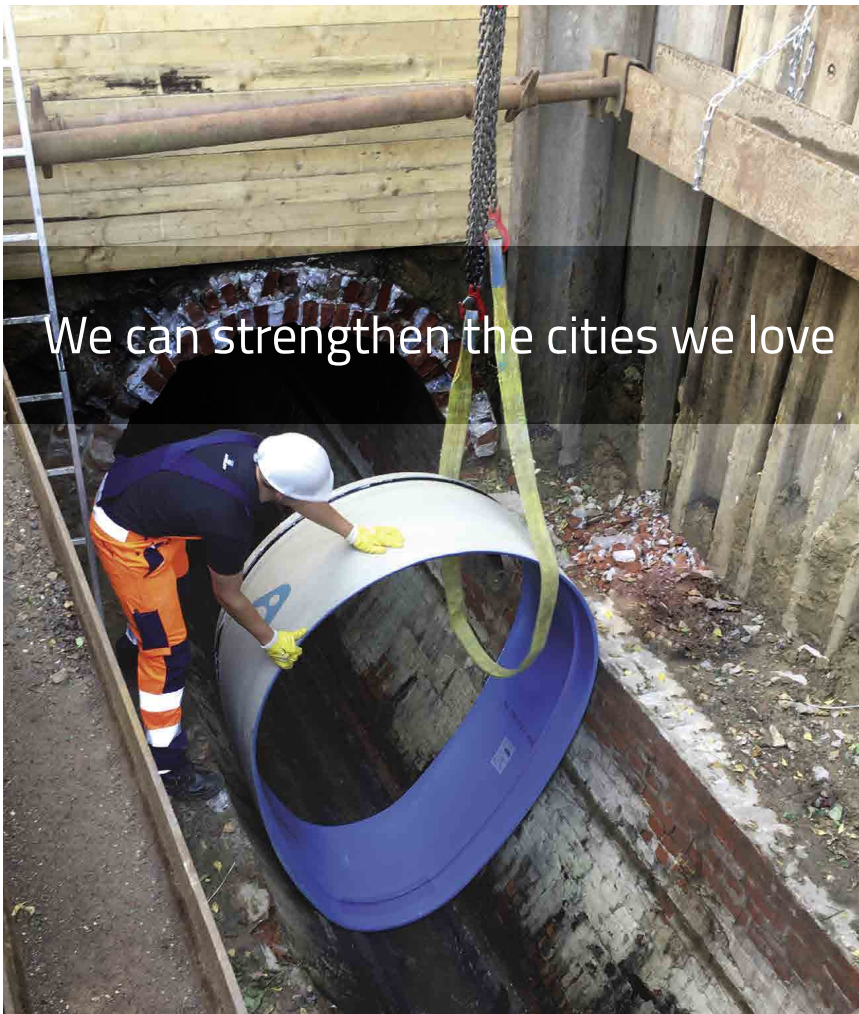


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HIGH-PRECISION REHABILITATION IN A SENSITIVE LOCATION

By Markus Lebek

The German company RELINEEUROPE GmbH is a member of the global RELINE UV Group. Its core expertise lies in developing, manufacturing, and marketing innovative advanced technologies for the trenchless rehabilitation and repair of drinking water and wastewater networks combined with comprehensive technical services. >



The 'Am Kortelbach' rehabilitation project in a sensitive location: Unna station (D&S)

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Wastewater section flowing on top.



Wastewater section flowing on top.



Original condition

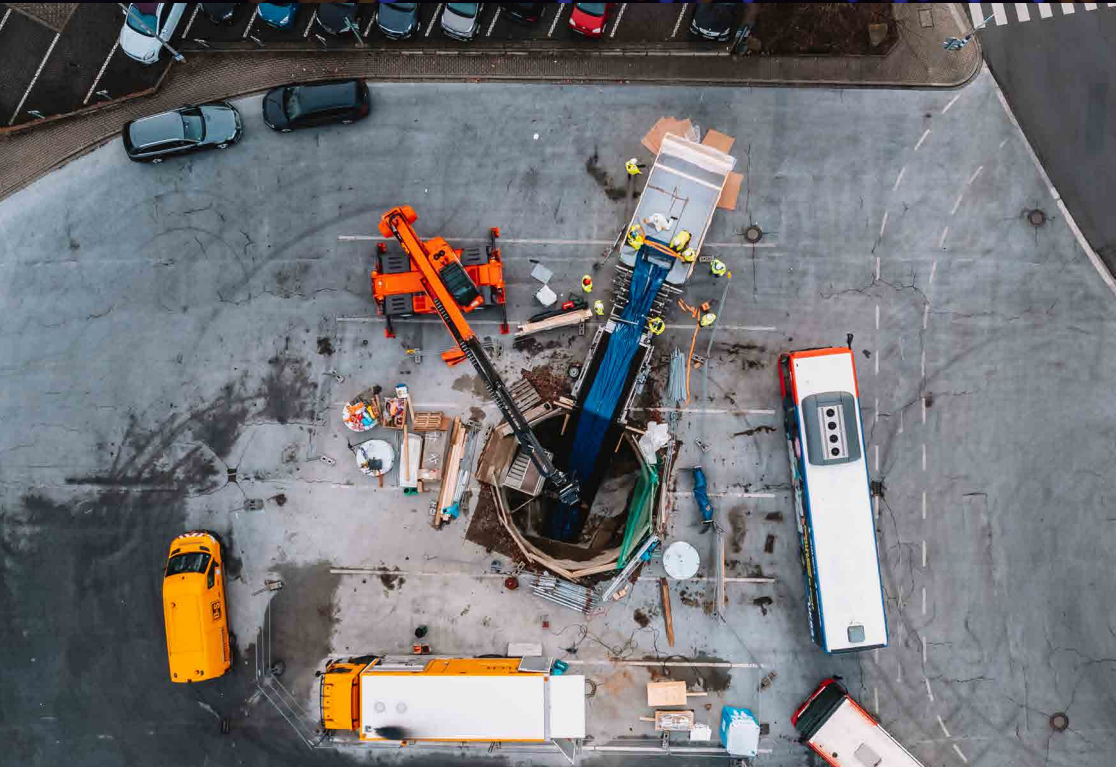
On the 'Am Kortelbach' rehabilitation project, urgent rehabilitation work had to be carried out to a sewer system in the sensitive area around the tracks of a rail station in Unna, a town and county seat in the German state of North Rhine-Westphalia. The project was completed successfully in spring 2022 on behalf of Stadtbetriebe Unna, the municipal utilities company responsible for wastewater management.

This rehabilitation project presented a number of particular challenges including: The conditions for digging a trench, which were made harder by changes of direction and a change of profile; the dire condition of the existing pipe; holding back the wastewater and thus also the safety of personnel; and the size of the liner at DN1800.

The company tasked with the trenchless rehabilitation, the Gelsenkirchen branch of DIRINGER & SCHEIDEL ROHRSANIERUNG GmbH & Co. KG, opted for proven UV liner technology and an Alphaliner from RELINEEUROPE and the RELINE UV Group. The civil engineering work was entrusted to Lage-based SMG Bautenschutztechnik GmbH, which developed a technique specifically for this task in order to create the right geometry for laying the liner. The professional cooperation between everyone involved was one of the main reasons the project was able to be completed successfully within the tight timeframe, despite all its non-standard requirements.

Requirements

Dipl.-Ing. Thomas Matter, Head of Wastewater Management/Water Bodies at Stadtbetriebe Unna, explained: "The Kortelbach is a stream that rises in a part of south Unna known as Billmerich. As it flows north, it crosses two retention basins. Up until 2019, the stream flowed into a pipeline about 2 km long when it reached the town centre. From here, the stream water was mixed with combined wastewater, and the stream running inside the pipeline became a sewer for combined wastewater. Between 2016 and 2019, the clean stream water was separated from the combined wastewater. Stadtbetriebe Unna constructed a pipeline about 2 km long for the watercourse, using the manned pipe jacking method. After this work was complete, the combined wastewater sewer under the tracks in Unna station had to be strengthened. The existing profile of the Kortelbach stream had been steadily lengthened over the years, and the expansion of the railway station meant that the sewer system had to be adapted accordingly also. The profile comprised a square about 1.90 m wide with a semicircle on top. The bottom of the sewer contained a large number of flaws, and the masonry >



“A potential solution first began to emerge when Stadtbetriebe Unna brought two other companies into the planning process for the sewer rehabilitation.”


The photograph gives an impression of the scale of the rehabilitation project.

joints had been eroded along the entire length of 120 m and would have required extensive renovation. On the south side of the station complex, in the inlet section, the sewer changes direction by about 12°. As this change of direction lies within the station site, it would not have been possible to lay a trench. At the same time, access via the northern side is severely restricted due to a change of profile. Overall, holding back the wastewater, and therefore personnel safety, posed the biggest challenge to rehabilitating the existing profile.”

Options

Various rehabilitation options were investigated in light of the limiting conditions mentioned previously. As Thomas Matter explained: “We did this together with Pipefocus, an engineering firm based in Krefeld, and plumped for laying a new pipe using the jacking method as our way of crossing the tracks. However, the land that we needed along the planned course of the pipeline was not available. It would not have been possible to lay a winding pipe due to the route situation and profile accessibility described. Installing individual segments proved unfeasible, and laying a water-cured liner was not an option either. A measurement of throughflow rates over the previous few months suggested that 10 l/s was discharged at night during dry weather, while heavy rain generated a combined wastewater flow of 4,800 l/s. The liner needs about a week to heat up. As it is not possible to forecast the weather conditions for the whole of this heating-up period, so this was discounted also. Laying a UV liner appeared unfeasible due to the change in direction in the pipe’s route and was initially not pursued any further as an option.”

A potential solution first began to emerge when Stadtbetriebe Unna brought two other companies into the planning process for the sewer rehabilitation. Lage-based SMG Bautenschutztechnik für Hoch- und Tiefbau (SMG) contributed its planning and execution expertise for converting and profiling the square profile into a DN1850 half-shell, while the Gelsenkirchen branch of DIRINGER & SCHEIDEL ROHRSANIERUNG (D&S) formulated the conditions for a light-cured liner from the user’s perspective. The planning was underpinned by a laser scan provided by the Dresden-based surveyors Geokart. >



The hose liner was guided into the trench via a chute.

Deploying tailored UV-light-cured technology

First of all, the team from SMG had to prepare the sewer to be rehabilitated. SMG's CEO, Dipl.-Ing Volker Schmidt, described a tricky situation: "The laser scan showed us that the Kortelbach varied in width between 1.80 m and 1.90 m and in height between 1.92 m and 2.27 m. In addition, a DN400 grey-cast-iron pipeline laid inside the sewer cut around 500 mm into the bottom area. Factoring the ideal geometry of a liner into the laser scan produced a maximum installable cross-section of DN1800. It became clear that the bottom had to be raised from its current level across the board. A height difference of some 600 mm had to be compensated for at the deepest point. Debris and boulders had been deposited at the bottom of the sewer over time, some of which were the diameter of a medicine ball. The task in hand was thus obvious, clear the deposits, remove the DN400 grey-cast-iron pipeline, re-level the bottom, and lay a DN1800 channel along it in a half-shell shape."

Using a conveyor belt, the UV liner then had to be drawn into the manhole and into the sewer section to be rehabilitated. The integrated anti-slip film and integrated pre-liner protect the liner against heavy mechanical loads during draw-in, providing ideal conditions for inserting it into the sewer. On the 'Am Kortelbach' project, the trench that was dug for draw-in and secured accordingly ran to a depth of 6 m.

"Our hose liner technology has already proven its worth many times over for rehabilitation projects of this kind, and we often work together with RELINEEUROPE in terms of the liner to be laid," said Dipl.-Ing. (FH) Richard Mohr, CEO of DIRINGER & SCHEIDEL ROHRSANIERUNG.

"The Alphaliner is a GRP hose with an extremely flexible design. Combined with our innovative UV curing technology, which we used here in partnership with our Italian sister company ROTECH, this proved ideal for this unusual rehabilitation project with all its tough challenges that had to be overcome when laying the liner." Richard Mohr added. >

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“D&S planned the trenchless sewer rehabilitation using an Alphaliner 1800H UP, which was developed to rehabilitate large profiles.”

Coordination and fine-tuning are vital throughout the project. Here, the experts from D&S, ROTECH, and RELINEEUROPE are working hand in hand.

D&S planned the trenchless sewer rehabilitation using an Alphaliner 1800H UP, which was developed to rehabilitate large profiles. For this Alphaliner, a specially formulated polyester resin is used that offers unbeatable resistance to municipal wastewater (UP; classified as Group 4 in accordance with DIN EN 13121; DIN 16946-2 Type 1140; DIN 18820 Group 3).

The ECR glass fibres used are especially resistant to corrosion. The Alphaliner is designed for high structural resilience, enabling very large sewers in particular to be rehabilitated cost-effectively. The rehabilitation process produces an extremely robust liner pipe that can even withstand extreme structural and dynamic influences.

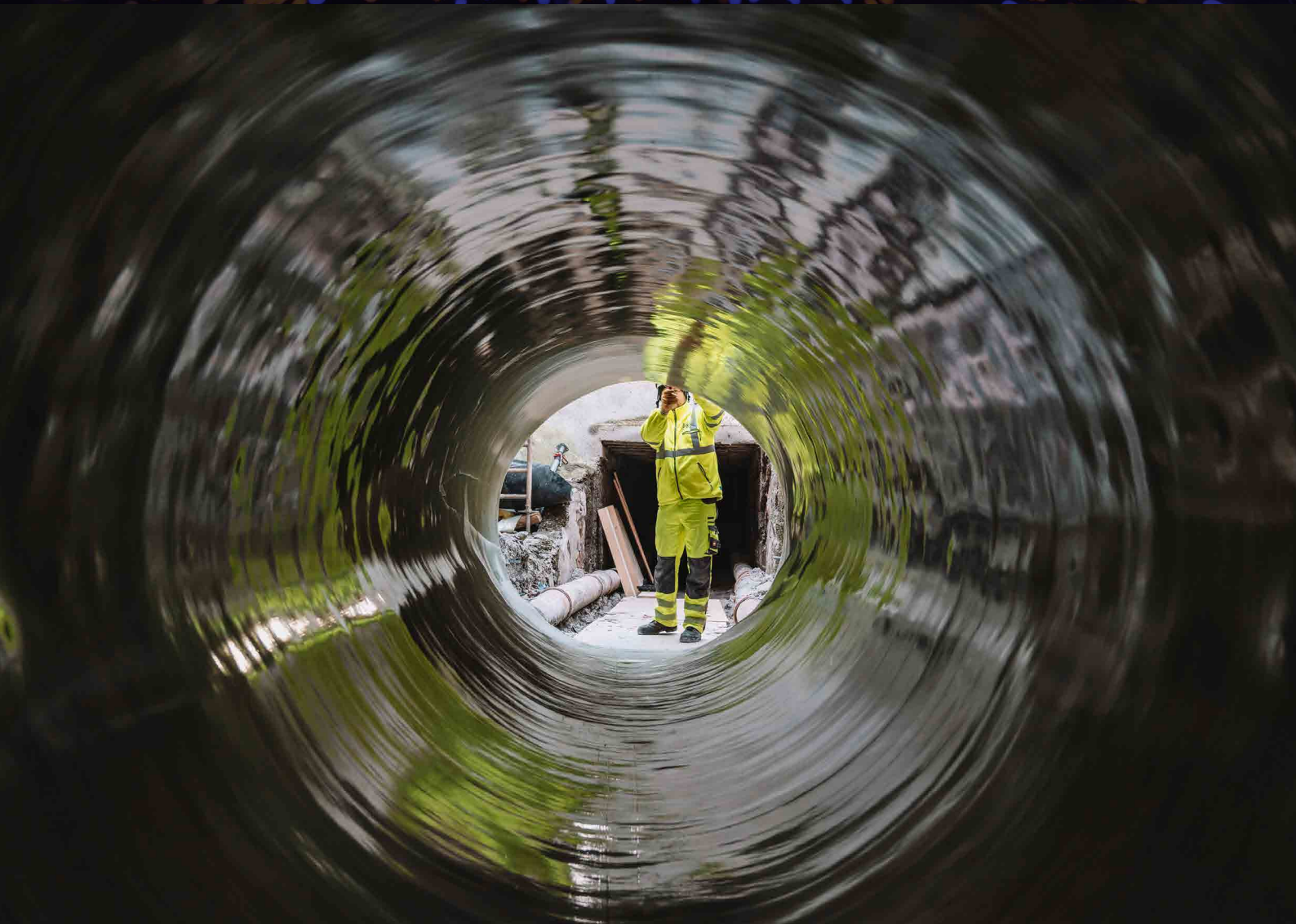
The Alphaliner

The Alphaliner has been approved by all the relevant international approval bodies (including the Deutsches Institut für Bautechnik (DiBt) in Germany, CSTB in France, QUIK in Switzerland, the WRc in the U.K., and ASTM1216/ASTM2019 in the U.S.). The Alphaliner 500G UP and Alphaliner 1800H UP variants boast outstanding mechanical properties, meaning that they fulfil all material quality requirements and can withstand the greatest possible structural loads despite relatively thin walls.

The Alphaliner UP UV-light-cured GRP hose liner allows trenchless rehabilitation measures of up to 350 m/day to be carried out particularly fast and efficiently. This minimises disruption for local residents and road traffic, particularly on projects in town and city centres. A rehabilitated section of sewer will have a useful life of at least 50 years. >

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Successful completion of the 'Am Kortelbach' rehabilitation project.

The main benefits of the Alphaliner UP for municipal wastewater rehabilitation projects include:

- Outstanding chemical resistance to municipal wastewater.
- Strong mechanical properties for long-lasting resilience.
- Unique wear layer on the liner's inner surface.
- Ideal solution for circular, oval, box-shaped, and custom profiles.

The Alphaliner UP UV-light-cured GRP hose liner ability to rehabilitate up to 350 m/day was especially important with regard to holding back the wastewater for the 'Am Kortelbach' project. To minimise water retention time, the liner was designed in a single piece, despite the bend, with a diameter of 1,850 mm, a wall thickness of 10.4 mm, and a total weight of around 30 metric tons. Curing was done using ultra-high-power, high-tech UV REE4000 equipment, which enables the hose liner to cure quickly thanks to innovative lamp technology with a total output of 24,000 Watts.

The curing process was checked and documented online in a continuous process by measuring curing parameters. After carrying out a leak-tightness test and taking a sample from the construction site for the quality test, the 'Am Kortelbach' rehabilitation project was able to be completed successfully by connecting the liner ends to the manhole and the Alphaliner to the lateral inlets in line with professional standards.

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SETTING NEW STANDARDS FOR HDD ROCK DRILLING



The new GRUNDODRILL ACS300 is the most powerful HDD rock drilling rig in its class.

Launching the GRUNDODRILL 300ASC HDD rig, TRACTO has advanced trenchless technology for rock drilling to new levels. The latest addition to the German manufacturer's series of highly automated steerable drilling rigs was successfully presented to the recent trade fair, bauma 2022 in October, proving a major success with three machines being sold during the event.

After TRACTO launching the GRUNDODRILL JCS/ACS130, the first fully remote-controllable HDD rig three years ago, the innovative concept was now transferred to the next performance level for rock drilling. The GRUNDODRILL ACS300 combines TRACTO's decades of experience in rock drilling with the latest machine technology and a maximum degree of automation. Additionally, the machine offers all the innovative functions and features of the 'new generation' of HDD rigs 'Made in Germany' such as remote-controlled drilling, increased productivity an integrated locating solution. >

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View under the hood of the ACS300: State-of-art drive technology guarantees significantly increased rotation and rinsing capacities for maximum productivity in any geology.



Perfect workplace: The GRUNDODRILL ACS300 features a premium-class operator cabin with air-suspended Grammer comfort seat, heating, air conditioning, radio, hands-free equipment, bottle cooler und much more.



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Equipped with the largest drive engine in its class, 30 tonnes of pulling and thrust force, 13,000 Nm torque and a drilling fluid capacity of 650 l/min the GRUNDODRILL the ACS300 enables flexible pipe installations in all geologies. Significantly increased rotation and rinsing capacities combined with the high drive capacity enables an immense productivity increase in any geology. Design and equipment are tailored for high operating comfort and maximum ease of work.

The GRUNDODRILL ACS300 is equipped with a swivelling cabin, front and rear stabilisers, the familiar double-boom inclination, a Bentonite collection tray, a loading crane and an integrated freshwater tank with high-pressure cleaner to make daily work on the jobsite easier. The ACS300 also offers the standard automatic functions of the GRUNDODRILL product family.

Just like with the 13 tonne model ACS130, it is also possible to screw on the twin rods fully automatically in order to relieve the drill rig operator of this duty. The GRUNDODRILL ACS300's large drill rod magazine of contains 210 m of rods. An on-board hydraulic loading crane for self-sufficient handling of additional drill rod boxes, single drill rods and drilling accessories accelerates drilling and makes operation even more comfortable. As does the vibration-cushioned comfort cabin with various equipment highlights, such as automatic air conditioning and an electrical swivelling mechanism. A panoramic all-round view makes swivelling the cabin unnecessary for drilling and allows working even in very confined spaces. >

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The ASC300's touchscreen operating panel of can be detached for remote-controlled drilling from outside the cabin.



Rock drilling ahead of the competition

The overall concept of the new generation HDD rigs offers the user even more advantages. A modular design with a large selection of options allows each 300ACS model to be configured according to customer individual requirements and types of application. With the new GRUNDODRILL ACS300 TRACTO offers a best-of-class rock drilling HDD rig enabling users to perform a greater number and even more sophisticated drilling jobs faster than the competition at maximum operating comfort.

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ENSURING WATER SUPPLY TO LOWER SAXONY, GERMANY

The egeplast pipes
delivered to site.

To secure water supplies for the population in the region of Lower Saxony, Oldenburgisch-Ostfriesische Wasserverband (OOWV) is constructing a new drinking water transportation pipeline. Some segments are installed beneath several roads and waterbodies using the trenchless installation method, horizontal directional drilling (HDD). This designed to to keep any disruption of the population and the natural environment as low as possible. The egeplast SLM® 3.0 protective-layer pipe system was used for this purpose.

More than 120,000 ft (36,576 m) long and costing approximately €60 million and taking more than 730 days of construction time, Oldenburgische-Ostfriesische Wasserverband (OOWV) is faced with needing to stem a project the scale of which is quite rare in the German water supply system. A supplementary transportation pipeline will safeguard the public water supply of the regional population and to improve the distribution of water quantities in the existing supply network.

“The northwest is becoming more and more thirsty.” Sven Ambrosy, district administrator of the Friesland district and head of the OOWV association, declared about the ever-increasing demand. >

Butt fusion welding of the pipeline prior to insertion.



The transportation pipeline will connect waterworks in Sandelermöns to the pumped-storage power plant in Diekmannshausen. On its way there, it crosses the districts of Friesland, Wittmund and Wesermarsch. The start of construction was preceded by several years of planning which, among other things, took protection of the local flora and fauna into account. Planning was performed by the engineering office, Lindschulte from Nordhorn, and involved drawing on the expertise of egeplast's field service and applications engineering throughout the entire planning phase. The first construction phase comprises approximately 16 km of 710 mm diameter egelen pipe.

For approximately 2 km, the SLM® 3.0 Protective layer pipe system will be used and installed using HDD. This method will be used to preserve some historical hedgerows along the pipe route or in order to cross under roads and waterways.

"As in the case of any construction site, we want to keep the impact of the works on the population and nature as limited as possible," said OOWV Project Managerin Jasmin Hübner.

ARGE PPS Pipeline Systems GmbH from Quakenbrück and RN Rohrleitungsbau Niederrhein GmbH from Krefeld were commissioned for the first construction phase. Processing of the deliveries enabling a fast and uninterrupted construction workflow will be performed in close cooperation between the ARGE project management and egeplast. This cooperation allows for 'just-in-time' manufacturing and freight-optimised deliveries to the respective sites across the construction site at large as well as optimal utilisation of the limited onsite storage capacities. The next two construction phases will seamlessly follow the first construction phase. The completion and commissioning of the pipeline as a whole is scheduled for 2024.

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ROBBINS DOUBLE SHIELD LAUNCHES IN NEPAL

The 6.4 m diameter Robbins Double Shield TBM was launched in October to bore Nepal's Sunkoshi Marin Diversion Multipurpose Project (SMDMP).

In October 2022, China Overseas Engineering Group Co. Ltd and China Railway No. 2 Engineering Group Co Ltd launched a 6.4 m diameter Robbins Double Shield TBM. The TBM is boring the 13.1 km headrace tunnel for the Sunkoshi Marin Diversion Multipurpose Project (SMDMP) located in southern Nepal. The tunnel is connected to a new 28.6 MW surface powerhouse on the Marin River to alleviate the shortage of power supply in the area. It will also be used for farmland irrigation in the districts of Dhanusha, Mahottari, Sarlahi, Rautahat and Bara in the Terai Plain, diverting water from the Sunkoshi River to the Marin River. Since the TBM's launch, it has bored over 500 m, with a best week of 224.6 m, and a best day of 36.6 m. >

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Since the Robbins TBM's launch, it has bored over 500 m, with a best week of 224.6 m, and a best day of 36.6 m.



The Robbins Double Shield is engineered for ground conditions including granitic rock with sections of squeezing ground and fault zones with potential water inflows.

The headrace tunnel is being bored through granitic rock with maximum overburden of 1,320 m. Geological conditions may include squeezing ground, fault zones, and water inflows. In particular, a major fault zone is located approximately 4 km into the tunnel at Dhanamana Khola. The machine was customised for the conditions, explained Liu Fengfan, Project Manager for contractor B-2/COVEC: "The TBM shield is a tapered design to reduce the risk of becoming stuck in squeezing ground; there is an enclosed cutterhead design to reduce the collapse of surrounding rock as well. The TBM has overcut capabilities, and a high thrust. It has also been designed to be equipped with an extra high torque cutterhead drive, as well as strong auxiliary thrust to be used in squeezing ground or weak fault zones to keep the machine from becoming stuck."

As for the major fault zone, to be reached in approximately June 2023, and other zones of concern, Liu's plan is well-thought-out: "We have prepared the advance geology forecast along with technical measures and equipment to cope with the extraordinary geological conditions. These include advance drainage holes, pre-excavation grouting (both ordinary and chemical), and other methods based on our experience. When we reach the major fault zone at Dhanamana Khola we will go slow, with more probe drilling while in the fault zone."

The tunnel is the machine's second use. On its 12.2 km first tunnel (the Bheri Babai Diversion Multipurpose Project/BBDMP), the TBM finished nearly one year early and achieved 1,202 m advance in one month. "The Robbins TBM at BBDMP successfully broke through the 12.2 km tunnel and overcame extraordinary geological conditions especially in fault zones. Its stable and excellent performance and function have been verified very well. We have much confidence in the TBM to be used in SMDMP," said Liu.

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MCELROY ANNOUNCES THE TRITAN™ 560



The Tritan™ 560 is the newest member of the McElroy range.

McElroy, one of the world's leading designers and manufacturers of thermoplastic fusion equipment, recently presented the latest in its line of industry-leading machinery.

The Tritan™ 560 is the newest member of the McElroy range. It combines features of three of McElroy's most innovative machines: the rugged portability and technology of the TracStar® iSeries, pipe loading capabilities of the Talon™ 2000, and the ability to meet the pipe where it lays, as found in the Acrobat™ QuikFit® carriages. With a full 360° rotation and a boom that can raise, extend, and curl the carriage to approach and load pipe, the Tritan boosts jobsite efficiency and improves workplace safety by eliminating the need to top-load pipe into the fusion machine.

The Tritan™ 560 aids in pipe positioning, allowing for more flexibility and increased performance and productivity. With the same rugged, dual rubber tracks found on McElroy TracStar® machines, the Tritan offers all-terrain mobility to easily travel across a variety of terrains and can be driven directly to and from the pipe itself. By building off the legacy and design of multiple McElroy® units, the Tritan minimises the amount of time spent between fusions while also letting the machine work in tight areas. >

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“Rather than being tethered to the machine, operators can instead position themselves where they have good visibility and can safely manipulate the machine.”

SAFETY FOCUS

The Tritan 560 was designed with operator safety in mind. All functions are wirelessly controlled with the DataLogger®, McElroy's ruggedised touchscreen tablet that also captures the most important information related to fusion operations in real time. No second remote is needed, all controls have been integrated into the DataLogger tablet, allowing a single operator to control all parts of the pipe loading and fusion process. Rather than being tethered to the machine, operators can instead position themselves where they have good visibility and can safely manipulate the machine.

No wireless signals allowed? No problem. The Tritan lets operators connect the DataLogger via a tether when necessary, allowing for operation in environments where wireless signals are restricted or unavailable.

The Tritan 560 offers a bottom-loading carriage that eliminates the need to lift pipe overhead and into the machine for standard fusions. Operators can load pipe quickly and safely in a variety of configurations. The boom arms can raise, extend, and curl the carriage over a range of motion. This gives operators the ability to precisely adjust the carriage without having to move the vehicle itself.

In addition, the Tritan offers a removable carriage that can operate in a 2+2 or 3+1 configuration, in both a top-loading or bottom-loading setup for maximum flexibility in the field. In confined spaces or in-ditch applications, the carriage can be loaded directly onto the pipe from above, minimising the amount of excavation required under the pipe. Also, using the DataLogger to wirelessly control Tritan allows operators to carry out the fusion process from the safest possible position.

STANDARDS AND FEATURES

Position, load, and fuse pipe from 12 in (300 mm) to 22 in (560 mm) with ease. The Tritan 560's full 360° swing lets operators fuse in front of the unit or parallel to the tracks on either side of the machine. An updated track motor allows the Tritan to achieve a top speed of 2.75 miles/hr (4.4 km/hr) in high-speed mode, boosting mobility on jobsites and further decreasing the time spent between fusions.

The Tritan is powered by a 50 HP Stage V/Tier 4 Final Compliant Kubota engine. Its heater power varies based on need, allowing for full power during the heat-up phase and lower power when maintaining temperature. This equates to lower fuel consumption and quieter operation.

DataLogger integration allows users to take full advantage of McElroy's Vault™, a powerful cloud-based tool to collect, store, analyse, and share joint reports and project information. Its easy-to-use interface also allows for recording of each fusion's GPS location, machine, and operator information, along with joint data.

Tritan is expected to begin shipping in the second quarter of 2023.

mcelroy.com/fusion/tritan.htm.



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HOW DIGITAL TECHNOLOGIES CONTRIBUTE TO UNIVERSAL DRINKING WATER



Visualisation of
InfoTiles digital
analytics platform

Digital water technologies have an important role in ensuring universal access to safe drinking water by 2030, that is according to a new report from the World Health Organisation. Johnny Alexander Gunneng, chief executive of InfoTiles shares his insights.

Two billion more people have gained access to safe drinking water in the past two decades. However, a new report from the World Health Organisation (WHO), UNICEF and the World Bank also reveals that the same number are still without access, and an increasingly volatile climate will only heighten water insecurity, disrupt supplies, and devastate communities.

The State of the World's Drinking Water details the links between water, health and development, and gives achievable recommendations for implementation. It states that to achieve universal access to safe drinking water by 2030, 'Governments should ensure they have relevant data and information to be better informed, understand gaps and inequalities in drinking water services, and make evidence-based decisions'

Digital water technologies have a key role to play in achieving the shared goal of realising the United Nation's Sustainable Development Goal 6 of ensuring availability and sustainable management of water and sanitation for all, and the report says governments should work 'towards ensuring digital water technologies are supported and prioritised to realise their full potential'.

As a technology company operating in the water sector, InfoTiles shares this goal in the work undertaken with water utility clients.

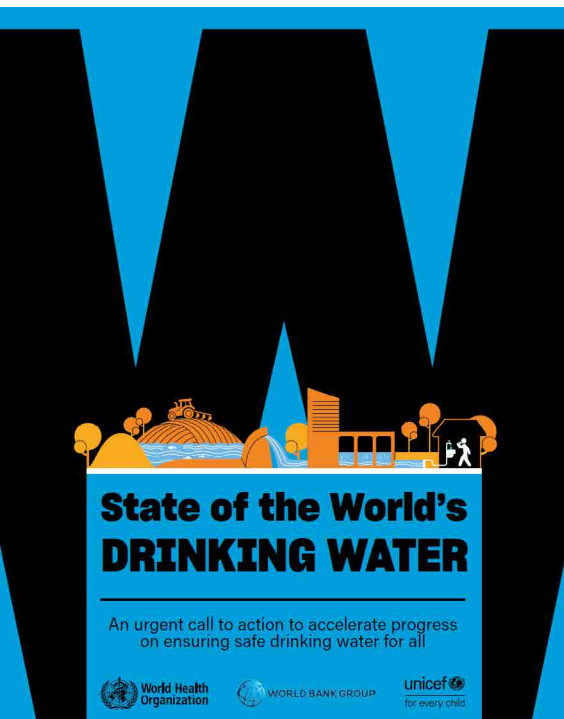
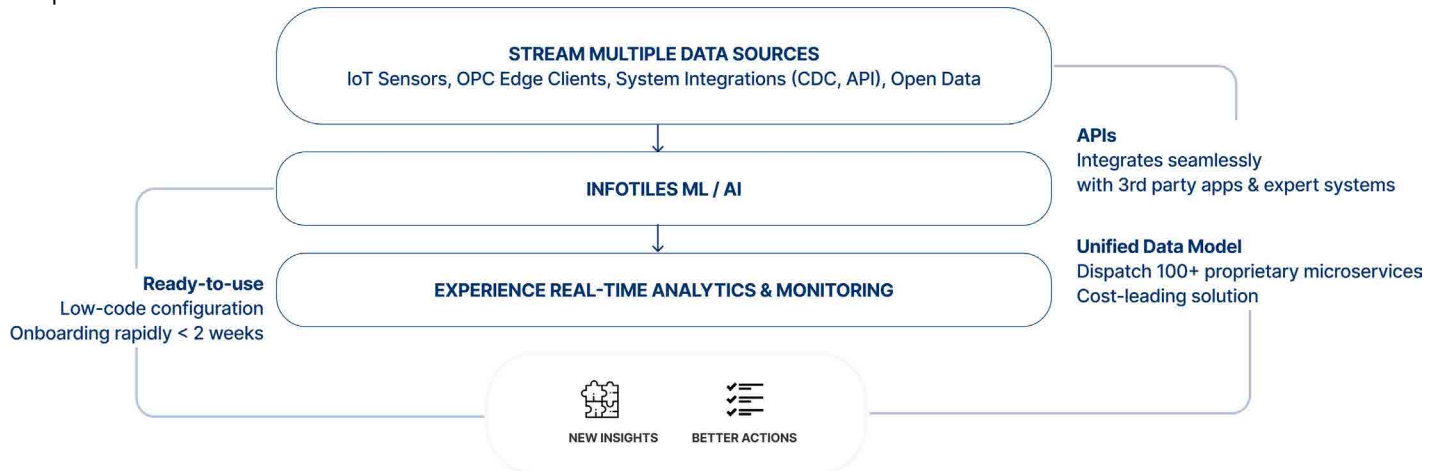
Building capacity

The report also recommends 'building capacity within the water sector by developing a capable and motivated workforce through a range of capacity-development approaches based on innovation and collaboration'. >

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How the InfoTiles digital platform works.



UNICEF report front cover.

The real strength in leveraging digital water technologies lies in the usability of a central data platform and its capacity to model, visualise, and present data across all assets and operations, accessible to all relevant personnel to develop the capacity to work smarter.

The InfoTiles platform, for example, can capture existing and new data that shows the likelihood of critical failures in water and wastewater infrastructure and resources, including treatment failures, sewage overflows, equipment breakdowns, and infrastructure damage.

By capturing data that is continually assessing the health and effectiveness of assets, water managers can anticipate, detect, and resolve potential problems before they happen, and maintenance teams and investment can be deployed much more efficiently.

Additionally, it is possible to carry out these actions remotely through handheld devices such as tablets or mobile phones so water managers and other users can physically see what the data is telling them, wherever they are.

Availability of data

The report also recommends 'ensuring relevant data and information are available, to better understand inequalities in drinking water services and make evidence-based decisions'.

One of the ways InfoTiles makes data and information available to utilities is through smart metering of drinking water processes, along with sensors in the connecting pipe network, to evaluate domestic and municipal water consumption. InfoTiles can help transmit this data to its central data platform to map domestic and municipal water usage at a granular level - with the data available to both consumers and water managers.

As well as helping utility customers better understand and reduce their domestic water use, this technology can also help water managers detect any unusually high consumption and identify leaks, either at a property or in the connecting pipework. This allows for better maintenance of a drinking water network and more efficient repairs. >

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“The WHO report estimates the return on investment in water, in terms of health, productivity and other socio-economic factors, to be more than three times the cost in urban areas, and more than six times the cost in rural areas.”

Internet of things (IoT) technologies are used to transfer data from the meters and sensors into a central data platform, where it can be analysed by water managers. These include long-range wide area network (LoRaWAN) transmission, a wireless telecommunications network which transmits data over long distances, and a narrowband IoT (NB-IOT) radio technology, which transfers data over mobile networks.

Encourage innovation

A further recommendation of the drinking water report is ‘to encourage innovation and experimentation through supportive government policy and regulation, accompanied by rigorous monitoring and evaluation’.

After establishing itself in Norway, InfoTiles is now making significant progress with water utilities in the UK, Germany, Denmark, and Sweden, encouraging the development of its market leading digital software to meet the fast-changing demands of digital transformation in water.

To keep InfoTiles constantly improving and to enable healthy competition, data generated for a customer through InfoTiles is always under ownership of the client.

This means that they are free to collate and process their own data, and input it into alternative software, collaborating with other digital water solution providers where necessary. This supports a vibrant digital environment, which supports new collaborations. It also reduced risk of software incompatibility and investment being wasted.

Value for money

The WHO report estimates the return on investment in water, in terms of health, productivity and other socio-economic factors, to be more than three times the cost in urban areas, and more than six times the cost in rural areas. Yet despite this understanding of the huge benefits of providing people with safe drinking water, and the progress made in the last 20 years, one-quarter of the world’s population still go without.

Digital water technologies like InfoTiles provide cost effective solutions which can help utilities and municipalities become more resilient, not only to future challenges but now.

Investment in these technologies is on a steep upward trajectory, between 2018 and 2030, US\$405 billion will be spent on new water infrastructure, according to Global Water Intelligence, and US\$178 billion on rehabilitation. Due to the potential of digital water technologies to unlock new levels of resource efficiency in new infrastructure and rehabilitation, the market is expected to reach US\$63 billion by 2025.

In the near future it will be the norm for all water utilities, wherever they are in the world, to have digitally transformed to some extent. The good news is that the digital water technologies needed to tackle the challenges of today are already here. Additionally, the learnings from those forward-thinking water utilities and governments embracing these innovations, can, with, the right measures in place, help realise universal access to safe drinking water much more rapidly.

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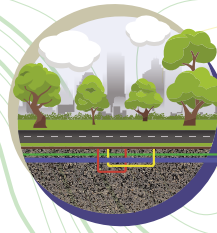
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The No-Dig Show is owned by the North American Society for Trenchless Technology (NASTT), a not-for-profit educational and technical society established in 1990 to promote trenchless technology for the public benefit. For more information about NASTT, visit our website at nastt.org.



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SOCIETY NEWS

ukstt.org.uk

Society News brought to members by Trenchless Works

WELCOME FROM THE CHAIR



Ian Ramsay, Chair, UKSTT

Well, another year has passed and I hope everyone has recovered from COVID issues. Yet, just as we are getting things back together the energy and supply chain issues hit us. This has a major effect on the industry, asset owner spending and material costs. At the moment we can only guess the long-term impact.

The UKSTT is discussing with Water Companies their spending on asset up-keep, as in real terms the overall spend has decreased and the issues with sewer spills, pollution, etc. have increased. It is planned to have further discussions and put pressure on them to explain their reasoning and future plans. Many are patrons of the UKSTT which helps us with these engagements. In 2023, we are planning increased liaisons with patrons and I am looking to hold seminars and educational events with them. This again gives the membership opportunities to engage directly with the asset owners.

The UKSTT, after a very successful event in Warrington, will grow the Gas trenchless sector of the market. This has been overlooked in the past and thanks to Cadent and SGN we are now engaging with them regularly. Thank you to everyone who attended.

2023 will be an interesting year. There is no NO-DIG Live this year, as this event runs every 2 years and will next be in 2024. The plan is to have roadshows and masterclasses as well as patron engagement events to support and grow the market next year.

We are also looking at increased engagement concerning training and education both practically and also in theory.

I know many companies have had a tough 2022 and I would like to wish everyone a very Happy Christmas. I hope you all have time to relax and look forward to a much better 2023.

Again, I and the UKSTT team look forward to any ideas or suggestions you may have. We are more than pleased to engage with you.

Happy Christmas.

Ian Ramsay

SOCIETY NEWS


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Society News brought to members by Trenchless Works

WARRINGTON NO-DIG ROADSHOW

2022

NO-DIG ROADSHOW

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On the 22 November 2022, UKSTT & Westrade Group held a NO-DIG Roadshow in Warrington, UK at the Park Royal Hotel.

During the day the conference focussed on rising mains and the issues in the local area. Speakers from United Utilities included Sophie Tucker, Sally Ainsworth and Katy Bevan and how NO-DIG Technology can improve the customer experience as well as understanding the scale of the challenge surrounding rising main asset health. Just before lunch Nick Preston showered delegates with sweets while discussing the latest pressure test to BS EN 805.

Lunch was served in the exhibition hall to allow the exhibitors time to showcase their products. Attendance was high and time went quickly before the last session of the conference started.

Cadent Gas' keynote presenter was Neil Bethall, Director of Capital Delivery who's presentation on 'Building Now for Future Energy Networks' was very well received, this was followed by ULC's presentation on utilising robotics to reduce disruption and carbon emissions.

Sponsored by iPEK and UIS Ltd, the exhibition area was full and included Amiblu Norway AS, Atlas Winch & Hoist Services, Ashtead Technology, CIPP Supplies, Dart Systems, Die Draw, iLine Technologies, Innovex, IPEK International, Kobus Services, Picote Solutions, Pipeline Industries Guild, Public Sewer Services, Relineurope, Re-Tec, RSM Lining Supplies, RSP UK Ltd, Saertex Multicom, Steve Vick International, UIS and Vac-Ex Ltd. >

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Sophie Tucker (top) and Katy Bevan (bottom) during the United Utilities presentation on how NO-DIG Technology can improve the customer experience as well as understanding the scale of the challenge surrounding rising main asset health.



Commenting after the day's presentations, Iain Naismith, UKSTT's Chair of the Technical & Education subcommittee, said: "It was a great pleasure to introduce and moderate this well attended and topical event, that was so well supported by our Patrons United Utility and Cadent Gas as well as other UK water and sewerage companies. We are planning and looking forward to our next roadshow in Dublin next year."

A huge thank you goes to all of the speakers, exhibitors, delegates, the team from Westrade Group and the UKSTT Council members who all contributed to the smooth running of the event.

To learn more about future UKSTT events contact Lynn Maclachlan by calling 07745781500 or email: lynn@ukstt.org.uk

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EVENTS AND MEETINGS

2023

April 30-May 4: NASTT 2023 No-Dig Show
Portland, Oregon

May 17-18: Trenchless Asia 2023
Kuala Lumpur Convention Centre, Malaysia.
Details from: www.trenchlessasia.com

May 24-26 May: Italia No-Dig Live 2023
Novegro Exhibition Park
Details from:
www.iatt.it/en/2022/09/italia-no-dig-live-2023/

October 17-19: International No-Dig Mexico 2023
ISTT's 39th International No-Dig Conference
and Exhibition
Expo Santa Fe, Mexico

November 1-2: No-Dig Turkey 2023 Conference and
Exhibition
Istanbul, Turkey
Details from: www.nodigturkey.com

November 6-7: Trenchless Egypt 2023
Cairo, Egypt
Details from: www.trenchlessegypt.com

November 8-9: STUVA-Expo 2023 in Munich
Messe München, Messegelände, Hall C1
81823 München, Germany

2024

18-19 November: International No-Dig Dubai 2024
ISTT's 40th International No-Dig Conference
and Exhibition
Dubai World Trade Centre, Dubai

If you have an event, course or
meeting scheduled and would
like to add it to this listing
please forward details to:
editorial@trenchless-works.com