PIPE RAMMING SWALLOWS A FAILING CULVERT

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please email copy and pictures to:  
[ian@nodigmedia.co.uk](mailto:ian@nodigmedia.co.uk) by 10 October, 2018  
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PICOTE BRUSH COATING™ SYSTEMS GAINS WRC APPROVED STATUS

Picote Solutions is very pleased to announce that, after careful assessment by WRC in the UK, its Brush Coating System for the rehabilitation of deteriorated pipelines now holds WRC Approved status. The certificate for this approval was presented to Picote Solutions at the recent No-Dig Live 2018 event in Peterborough, UK.

The Picote Brush Coating™ System is designed to rehabilitate non-potable and wastewater pipes with diameters between DN50 (2 in) and DN300 (12 in) for clay, concrete and cast iron pipes and DN32 (1 ¼ in) and DN300 (12 in) for copper, steel and PVC pipes.

In short, the Picote Brush Coating™ System utilises a Picote Milling machine, of a size suitable for the pipe under rehabilitation, and a Picote-designed resin injection unit to coat the inside of the deteriorated pipe with a dual-colour 100% solids epoxy two part resin (DC1000E). The resin is supplied in pre-batched cartridges for ease of use. Brushes attached to the end of the Milling Machine cable spread the resin coating evenly and effectively over the inner pipe surface where it is allowed to cure under ambient conditions. Depending on the state of the host pipe and the degree of repair required, two or more layers of the resin coating can be applied to complete a full rehabilitation.

According to the Assessment schedule from WRC: “The Picote Brush Coating™ System has been audited and successfully met all the requirements stated within the assessment schedule.” The Assessment schedule includes all aspects of Appearance; Mechanical Characteristics Testing (including Short-term flexural modulus, Long-term flexural modulus and Temperature of deflection under load); Resistance to high pressure water jetting; Resistance to Abrasion; Product design, Product and materials manufacturing and installation procedures.

Commenting on the WRC Approved award Katja Lindy-Wilkinson, CEO for Picote Solutions and Richard Swan, Picote Head of Technical Client Services proudly display the new WRC Approved certificate at the recent No-Dig Live 2018 event.

Katja Lindy-Wilkinson, CEO for Picote Solutions and Richard Swan, Picote Head of Technical Client Services proudly display the new WRC Approved certificate at the recent No-Dig Live 2018 event.

NEW NO-DIG TECHNOLOGY FOR YORKSHIRE WATER

Yorkshire Water has trialled a world first ‘no dig’ gravity-fed sewer lining system to increase the lifespan of its underground sewers by up to 50 years. Use of the technology is also expected to save the firm around £1.25 million over five years by renewing large sections of its underground gravity fed sewer infrastructure without having to replace it.

The system consists of a carbon-fibre spray lining application that rapidly sets to create a ‘pipe within a pipe’, creating a 2 mm thick extra layer of structural integrity that protects against groundwater infiltration.

The technology can also be applied without having to dig up the road surface, which will result in less road closures and traffic disruptions.

Mark Gregory, Project Manager at Yorkshire Water, said: “We have previously carried out successful trials with this technology on our water mains and sewers, but this is a world first in terms of using it specifically for gravity fed sewers. The spray liner has proved itself to be a highly cost-effective and innovative way to renew ageing infrastructure. By applying this
Yorkshire Water plans to initially use the new technology on vulnerable rising main sewers and following a review aim to examine future applications on its wastewater network and its potential to be used on the clean water network.

The technology has been developed by Axalta Coating Systems and applied by SCHUR Ltd and Drains Aid based in Wakefield, UK.

Yorkshire Water is working closely with the public health and safety organisation known as NSF-WRc to establish industry standards for use of the new technology. Website: www.yorkshirewater.com

**NEW BLUE HAT DUBAI OFFICE SUPPORTS GLOBAL EXPANSION**

Blue Hat continues to expand its International presence with the opening of a new office in Dubai to provide support for its growing customer base in the Middle East and Africa.

Specialising in global training and consultancy for GPR applications, Blue Hat’s years of experience has helped it to develop a strong presence in specialised surveying techniques and services to civil engineering sectors.

“We firmly have innovation at the forefront of our business to deliver quality, safe and cost-effective solutions.” said Colin Tickle, Managing Director.

With a customer base in the UK, China, Singapore, Australia and Dubai, it is an exciting time at Blue Hat, as it develops its business around the globe. The Company has confirmed its presence at 2019’s Trenchless Middle East exhibition, confirming its commitment to develop key relationships in the region.

Blue Hat has a reputation for delivering specialist, market-leading GPR training and consultancy solutions and “is truly committed to adding real value to customers’ businesses and to the trenchless industry through innovation and education.” said Matthew Bunting, UK and UAE Business Developer.

The incorrect use of GPR and the lack of professional training is still a current issue. Blue Hat’s goal is to help professionals to accurately understand their environment, how to efficiently use GPR technology and better execute their work.

Ground Penetrating Radar training and education will provide professionals with vital information and skills that are recognised across the utility location industry and will prevent damage to utilities and loss of income to businesses.

Specialising in Utility Mapping, Blue Hat can also provides bespoke training on a wide range of applications from pavement evaluation, railway ballast measurement and condition assessment, concrete inspection through to interferometric radar for structural monitoring. The courses are focused on the industry needs and requirements and provide real world conditions in a safe environment.

Dedicated training courses are available for all levels of students including Introduction for Management; Utility Mapping; Data Post-Processing and Advanced GPR. Website: www.bluehatservices.co.uk
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SCHONSTEDT AND RADIODETECTION: A WINNING COMBINATION

Just over 6 months ago Schonstedt Instrument Company joined Radiodetection Ltd (a subsidiary of SPX Corporation) in an exciting acquisition which looked to develop the synergies of two strong market leaders. At the time, 1 March 2018, President and CEO of SPX Corporation, Gene Lowe, commented, “Schonstedt is the leader in magnetic locators, with a strong brand, technology and user base that make it a highly complementary addition to our Radiodetection business’s industry-leading portfolio of cable and pipe locator products.”

Schonstedt’s magnetic locators are a market leader in the USA due to their prestige history, and over six decades of development at the forefront of their field. The tools are known to be the most ergonomic, lightweight and sensitive on the market. Schonstedt magnetic locators are designed to provide the best performance in magnetic metal location in the industry. The metal locators make finding buried manhole covers and access points under soil or asphalt efficient, quick and simple. There are three magnetic locators in the range, and are designed to make locating effortless.

Throughout the US, Canada, Sweden and Australia magnetic locators are widely used to help locate buried and hidden manhole covers, valves, and pipe joints. Some UK water utility organisations are currently trailing and seeing the benefits of using a magnetic locator, such as Schonstedt’s, although the majority of the UK water industry is still yet to take advantage of such tools.

Since joining Radiodetection, Schonstedt has expanded its distribution and support network and is now offered through Radiodetection and its selected distributors. With such an expansive network it has never been so easy to get your hands on a Schonstedt magnetic locator. Schonstedt’s magnetic locators can be used alongside Radiodetection’s products to ensure fast and accurate locating. Website: www.radiodetection.com/schonstedt

PIPE RELINING MARKET OUTLOOK TO 2025

According to the report from Insight Partners, the global pipe relining market is expected to grow from US$7,265.3 million (€6,275.3 million or £5,572.9 million) in 2017 to US$10,058.3 million (€8,689.5 million or £7,714.1 million) by 2025 at a compound annual growth rate (CAGR) of 4.3% between 2018 and 2025.

Pipe relining is a process that facilitates repairing of broken or damaged pipes without the need to wholly replace sewer lines or use trenching. If the damaged sewer lines are under the trees, driveways, sidewalks, near extensive landscaping, or other semi-permanent features, the excavation of sewer may lead heavy investments as well as collateral damage to the nearby area.

In several cases, relining of the pipe is thus considered as a viable alternative for sewer pipe replacement. According to the report, North America is largest adopter of pipe relining, followed by the Asia Pacific, while the Middle East and Africa region, with growing numbers of infrastructures and increasing technological trends, is anticipated to be the fastest growing region in terms of pipe relining market.

The report focuses on an in-depth segmentation of this market based on solution type. The geographic

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segmentation of the report covers six major regions including; North Americas, Europe, Asia-Pacific (APAC), Middle East and Africa (MEA) and South America (SA). The report can be purchased for a standard price of US$4,550 from Insight Partners using this [link](#). The regional market has been further bifurcated by respective countries. By solution type segment the cured in place pipe (CIPP) relining solution accounted for the largest share of the pipe relining market in 2017; whereas, the MEA region is expected to grow at the highest CAGR during the forecast period. The report aims to provide an overview of global pipe relining market with detailed market segmentation. Also, it analyses the current pipe relining market scenario and forecasts the market until 2025. The report covers market dynamics affecting the market during the forecast period.

Furthermore, the report analyses the competitive scenario, geographic trends, and opportunities in the markets with respect to all geographic regions. The report also includes the detailed company profiles of the key players in the market along with their market strategies. Furthermore the report provides a Political, Economic, Social and Technological (PEST) analysis of all five regions along with the strengths, weaknesses, opportunities and threats (SWOT) analysis for all companies profiled in the report.

North America is one of the prominent regions in pipe relining market which will contribute the highest revenue globally due to technological developments and considerable application of pipe relining in different sectors. Rapidly growing economies in Asia-Pacific (APAC) and MEA with significant growth in the construction sector will pave the path for increasing adoption and propel the market for pipe relining market.

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**FEDERAL MINISTER AT HERRENKNECHT**

On Tuesday, 4 September 2018, German Federal Minister of Economic Affairs and Energy Peter Altmaier visited Herrenknecht AG in Schwanau and learned about the company, the international project world and individual tunnel boring machines (TBMs) under construction. Challenges in the global market of the tunnelling industry were also discussed. During the subsequent company tour, Chairman of the Board of Management Dr.-Ing. E.h. Martin Herrenknecht introduced the innovative E-Power-Pipe® method, which allows cable protection pipes to be securely and quickly installed for the subsequent installation of high-voltage power lines.

Herrenknecht is a world leader in mechanised tunnelling technology. With E-Power-Pipe®, the company has developed a new method to quickly and securely install small-diameter cable...
protection pipes underground with drive lengths of over a kilometre, previously there was no technical solution for this combination of requirements. This trenchless technology can be precisely controlled and used with only small overburdens. It thus offers a ground-conserving alternative to the conventional open-cut method for high-voltage grid expansion. This reduces subsequent restoration measures along the route of the underground power line and can thus contribute to greater acceptance by the population.

In the spring of 2017, together with Amprion GmbH, a leading transmission grid operator in Europe, and RWTH Aachen, Herrenknecht demonstrated the performance of E-Power-Pipe® with a successful pilot project in Borken, North Rhine-Westphalia. The development of the method was funded by the Federal Ministry of Economic Affairs and Energy (BMWi research project IBoTec) and carried out by Herrenknecht in cooperation with Amprion GmbH and RWTH Aachen.

Peter Altmaier said during his visit: “Around the world, Herrenknecht AG’s technical achievements are impressive. Time and again, the company manages to push the boundaries of what is feasible in tunnelling and also to develop innovative solutions in related business areas. As Federal Minister of Economic Affairs, I am committed to ensuring that in our country such successes remain possible in the future too.”
Herrenknecht’s know-how is in particular demand for projects with very sophisticated technological requirements. “Given the current isolationist tendencies of many countries and political uncertainties, the global situation is becoming increasingly complex. In China, for example, we have to compete with state-sponsored players in the industry,” explains Martin Herrenknecht with regard to the challenging market situation. “Thanks to our comprehensive technology and service portfolio and global presence, however, we are also well prepared for the future.” The world’s growing population, ongoing urbanisation and increasing connectivity are creating constant high demand for infrastructure projects, including efficient metro and high-speed rail networks and transport systems as well as sewage, water, oil, gas and energy systems. Website: www.herrenknecht.com

APPLICATION ENGINEER FOR MCLAUGHLIN

McLaughlin Group, Inc. continues to grow its expertise in the underground construction industry with the addition of Neville Missen, an industry veteran who has played in integral role in developing microtunnelling equipment and steerable rock systems. In his new role as applications engineer for McLaughlin auger boring equipment, On Target steering systems and steerable rock systems, Missen will work with contractors, dealers and the McLaughlin team to develop innovative equipment solutions that will continue to advance the industry.

Missen, a native of Australia, has owned and operated Boretec Microtunneling Pty, Ltd, managed Bullseye Microtunnelling, and served as an equipment sales representative for Vermeer Australia.

“Neville has been a trusted partner of ours for many years,” explained Dave Gasmovic, business development manager at McLaughlin. “We worked with him when he was a contractor and he always provided helpful information for developing new products. From the work Neville has done testing machinery to the role he’s served in designing new equipment, he has helped fuel the growth of auger boring and microtunnelling. We are excited to have him working for McLaughlin.” Website: www.mclaughlinunderground.com

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CROSSOVER TBM ‘ROSIE’ FLEXES HER MUSCLE

On 29 August, 2018, a 9.26 m (30.4 ft) diameter Robbins Crossover (XRE) TBM crossed the finish line at the Akron Ohio Canal Interceptor Tunnel (OCIT) in the USA. A press day followed on 5 September, where companies and members of the media were invited to view the giant machine. The machine, dubbed ‘Rosie’ in honour of Rosie the Riveter, an icon representing American women who worked in factories and shipyards during World War II, overcame tough ground conditions during the bore.

“One of the most challenging aspects of this job was that we launched right into the most difficult part. We had 60 m (200 ft) of soft ground, a very short reach, and then from there we went right into a mixed face for 180 m (600 ft).” said David Chastka, Project Manager for Kenny Construction, a joint venture contractor on the project with Obayashi. “It took everybody we had in the industry, everybody from Robbins, to fight through that first 240 m (800 ft).”

The TBM was designed for the project’s geology, which transitioned from soil to partial face shale to full face shale rock. The Crossover XRE included features of both EPB and Hard Rock Single Shield TBM types, with a versatile cutterhead that could be configured for hard rock or soft ground conditions. While in soft ground and mixed face conditions the machine operated in closed mode, but once it hit solid rock crews switched excavation to open mode. “The machine had the power to get to the other side and made advance rates we never thought we were going to get. It was very successful in hard rock.” said Chastka. Advance rates once in full-face shale rock reached a high of 34 m (111 ft) in one day (two 10 hour shifts). Muck removal was achieved using a Robbins continuous conveyor, and conveyor availability remained high throughout the project.

“I am most proud of the team that I have had the pleasure of being a part of,” said Don Smida, Robbins Field Service Technician. The overall scope of a project of this scale is immense, and the amount of daily cooperation and hard work that has been asked of The Robbins Company, the local unions, city staff, and Kenny-Obayashi is extremely important in reaching our common goals. I think we should all be proud of our teamwork going forward from a successful completion of the tunnel and into a successful disassembly of Rosie.”

Now that tunnelling is complete, the machine will be disassembled and removed from its retrieval shaft this autumn. “The Ohio Canal Interceptor Tunnel is the largest public improvement project in our City’s history and a significant investment in our environment and infrastructure that will benefit Akron residents and businesses for generations to come.” said the City of Akron’s Mayor Daniel Horrigan. “Projects of this kind are inherently dangerous and I am incredibly proud that the tunnelling portion was completed without any major injuries, thanks to a dedicated team of professionals. Furthermore, although Robbins is an international company with worldwide impact, we were pleased to be able to work with a local Northeast Ohio firm on this significant project.”

The OCIT Project for the City of Akron, Ohio, USA consists of the construction of a conveyance and storage tunnel system to control Combined Sewer Overflows (CSOs) for several regulators in the downtown Akron area. The EPA-mandated project includes the 1.89 km (1.17 mile) conveyance and storage tunnel, as well as drop shafts, diversion structures, consolidation sewers, and related structures. Website: www.robbinstbm.com

‘DIGGORY’ GETS TO WORK AT CASTLERIGG

Diggory is United Utilities’ latest recruit to join the £300 million West Cumbria water supplies pipeline scheme.

At 2.8 m tall, with 40 teeth and weighing in at 54 tonnes Diggory is no ordinary worker, he’s a multi-million pound tunnel boring machine.

On Wednesday 22 August Diggory was lifted by crane into the bottom of a purpose-built shaft just off the A591, ready to begin an epic tunnelling journey underneath Castlerigg, a town to the southeast of Keswick, in Cumbria, UK.
Using laser guiding and GPS location technology, Diggory’s support team will be able to construct the 1.3 km tunnel to millimetre accuracy, helping to pave the way for the twin water pipelines being laid between Thirlmere reservoir and Williamsgate.

The TBM was aptly nicknamed Diggory by the children at St Herbert’s School in Keswick. Their artwork is going to be printed up in pride of place on the safety hoardings surrounding the tunnel access sites in and around Keswick.

Diggory can excavate as much earth in a day as 100 workers, and is going to be working around the clock to complete the Castlerigg tunnel by December 2018.

John Hilton, Project Director at United Utilities, said: “This is an exciting milestone in the West Cumbria Supplies project. The Castlerigg tunnel is the longest along the pipeline route, and the deepest in places where it will be up to 65 m below the surface. We have an excellent team of specialists working with us on this particular tunnel and the four others along the route. I am hopeful that we will continue with the amazing progress we have been making this summer. The dry conditions have allowed us to get 45 km of pipeline in the ground and we are forecasting to complete about a year ahead of schedule, and we are also under budget.”

Diggory is the second tunnel boring machine to be used on the pipeline project. The machine’s smaller sister, Druzella, began work a week earlier excavating a shorter tunnel beneath the River Greta in Keswick. When finished Druzella will be used to dig another three tunnels at Chestnut Hill and Nether Place in Keswick and at the River Derwent near Cockermouth.

Diggory is a brand new machine, made in Germany especially for the Castlerigg job. When finished Diggory will be reconditioned and sent to construct another tunnel in Australia.

The £300 million West Cumbria Water Supplies project will bring more reliable and sustainable water supplies into Allerdale and Copeland. The scheme will link the area to Thirlmere Reservoir, and involves the construction of 100 km of new pipeline, a new treatment plant at Williamsgate, two new pumping stations and two new underground service reservoirs. The project started in Spring 2017 and will be completed by 2022. Website: www.unitedutilities.com

**IN WITH THE OLD AND OUT WITH THE NEW**

Scottish Water’s £2.8 million investment project to help reduce the risk of flooding in and around the Oakmall Shopping Centre in Greenock, Scotland, UK has turned to more traditional tunnelling methods during its latest phase of work.

Amey Black and Veatch (aBV) is delivering the project on behalf of Scottish Water and called in Northern Tunnelling to hand-dig tunnels totalling 26 m in length. Engineers tunnelled under the roadway from a section of the B&M car park on Inverkip Street across to the High Street roundabout. A stretch within the car park was also excavated by hand. In both cases, difficult ground conditions meant the more modern method of tunnelling with a guided tunnelling machine was not possible. This method had been used on earlier phases of the project to help keep disruption to a minimum for the local community and road users.

Scott Henry, project manager with aBV, said: “The hard, rocky ground meant that we had no alternative but to return to traditional methods and use hand-operated tools like picks and shovels to do the excavations. It was really hard work. The tunnellers have removed about 115 t of debris comprising mainly reinforced concrete, brickwork foundations, sandstone and whinstone rock.”

Ruaridh MacGregor, Regional Corporate Affairs Manager, Scottish Water, said: “Tunnelling during this phase has taken much longer than expected due to the fact that the tunnels had to be dug-out by hand. This was unavoidable and we do appreciate that the associated road traffic management has caused some frustrations for local businesses and road users. We thank those who have been affected for their patience and understanding.”

Paul Milligan, communications manager with aBV echoed those sentiments. He said: “We have worked closely with local businesses, keeping them updated on the work and we would really like to thank them for engaging with us and for their understanding throughout. Once completed, this work really will benefit the local business community by helping to minimise flooding.” Website: www.scottishwater.co.uk
DOUBLE BREAKTHROUGH ON THE FOLLO LINE

Using a live stream, on 11 September, 2018 around 25,000 viewers around the world watched the almost simultaneous breakthroughs of the two Herrenknecht sister machines ‘Queen Eufemia’ and ‘Queen Ellisiv’. Not only for client Bane NOR and the joint venture Acciona-Ghella was it an historic day, the use of a total of four Herrenknecht TBMs for the major Follo Line Project was a first for the Norwegian tunnel industry too. It is an advance of mechanised tunnelling technology into a country where conventional tunnelling traditionally dominates. However, Anne Kathrine Kalager, Project Manager at Bane NOR, is certain: “In future TBMs will be a realistic alternative in large projects, even in our extreme hard rock.” Since late 2016 the TBMs, with diameters of 9,900 mm each, have been boring their way through tough gneiss over a total length of around 36 km. Tunnel boring represents the majority of the long tunnel, or 18.5 km of a total of 20 km tunnel on the 22 km long stretch. Completion of the Follo Line Project is planned for December 2021.

Before the final breakthrough of the four machines, a total of 4 million cubic meters of rock, almost twice the volume of the Cheops pyramid, has to be removed. In order to master the tough mission, Double Shield TBMs have been used. They are among the most technically sophisticated tunnel boring machines and combine the functional principles of Gripper and Single Shield TBMs in one machine. In stable geologies, combining these methods permits the installation of concrete segments parallel to the drive. The best performance of ‘Queen Ellisiv’ under these extreme conditions was 19 rings or about 34 m/day. But not only the drive was faster than expected. Factory acceptance of the first TBM took place in March 2016, just eleven months after receipt of the order. There were only 19 months between contract signing and the beginning of work of the fourth and last of the machines in Oslo in November 2016. At times, around thirty Herrenknecht service experts were on site simultaneously to actively help with the assembly of the machines. “So we were four months ahead of the official schedule with the TBM launch.” explained Fernando Vara, Project Director of the Acciona Ghella JV. During the drive, the tunnelling and service teams also work closely together. In Schwanau, up to 40 refurbishment experts took care of the professional reprocessing of the disc cutters. The linchpin of the drive is the quality of the cutting tools. The disc cutters made of special steel, 19 in (480 mm) diameter and each weighing up to 372 kg, are pressed against the extremely abrasive rock with up to 32 tonnes of pressure on 70 annular tracks. The geological conditions result in high wear. In the course of the project, approximately 4,250 cutter changes were necessary on each machine. “I have never had to deal with such hard rock before. You can only handle that with teamwork.” said Francesco Giampietro, longtime TBM manager at Ghella.

The Follo Line Project is currently the largest infrastructure project in Norway. From 2021, the high-speed line will connect Oslo with Ski to the south. Encouraging commuters to switch from cars to public transport is expected to reduce the volume of traffic in the Norwegian capital. An important milestone for this is the Follo Line. “Half the Norwegian population lives within a radius of 100 km around the capital.” said Kalager. “The Follo Line also strengthens the social foundation for the future.” Before trains can travel here, two machines must continue through extremely hard rock. In the spring of 2019 the final breakthrough of the two other tunnel boring machines is expected, currently still underway in the direction of Ski. Until then, every day ‘Anna from Kloppa’ and ‘Magda Flatestad’ will be boring their way through one of the world’s hardest rock types, with up to 300 MPa strength. Website: www.herrenknecht.com

The two 20 km long tunnels connect Oslo with Ski.
SAVING TIME IN FLORIDA'S SAND

Waiting on wastewater service had put sales of residential lots of a new division north of Tampa, Florida, USA on hold. Difficulty with permitting was one reason for the delay. When permitting finally came through, then it was wet weather.

The project owner needed a force main installed beneath Florida Highway 589 just north of its junction with Highway 54 east of Odessa.

Also known as Suncoast Parkway, Highway 589 is a north-south toll road operated by Florida's Turnpike Enterprise. It opened in 2001 as a northward extension of Veterans Expressway, a Tampa beltway to relieve commuter traffic congestion.

The project plans called for the trenchless installation of 320 ft (97.5 m) of 24 in (600 mm) diameter steel casing 6 ft (1.8 m) beneath the roadway. DS Boring LLC of Odessa, Florida, performed the auger boring operation.

Established June 1, 2016, DS Boring is a new company started by long-time industry professionals Jim and Denise Spivey. Jim is a second-generation lineman: “I was climbing poles with my dad when I was 13.” Their own son is also in the industry, working for a power company.

That was over 40 years ago. Over the course of his career, stringing cables pole to pole turned increasingly more to underground installation. A utilities company he started more than 30 years ago grew to a workforce of more than 200 employees. “We were doing a lot of jack-and-bore and directional boring work for underground utilities.” Spivey said.

The Spiveys’ new company, DS Boring, specialises in auger boring and horizontal directional drilling (HDD), primarily for its utility clients.

The Spiveys are not the only veterans on board. Tom Hogan, general manager, who served as project supervisor for the Suncoast Parkway crossing job, and Doug Hartman, the job’s auger boring operator, each have worked with the Spiveys more than 20 years.

Boring operations beneath Suncoast Parkway began 10 September, 2018. The primary contractor of the project excavated a 57 ft (17.4 m) long by 18 ft (5.5 m) wide launch pit to a depth of 6 ft (1.8 m). Due to persistent rains, which had contributed to the project’s delay, the DS Boring crew covered the benched pit walls with plastic sheeting to prevent sand (the prevailing ground material) from washing down into it.

A lightly traveled, pre-existing trail that navigated its way three quarters of a mile through swamp-like terrain gave DS Boring back access to the work area. The crew could keep its equipment off the tollway.

The primary contractor used the same excavator that created the pit to carry DS Boring’s new boring machine to it for commissioning. The unit was a new American Augers 36/42-600 auger borer powered by a CAT Tier 4 Final diesel engine.

The 36/42-600 unit comes standard with three sections of track. DS Boring ordered the borer with five to accommodate the 40 ft (12 m) long sections of pipe used on the job. A 1 in (25 mm) steel plate, 4 ft (1.2 m) high by 12 ft (3.7 m) wide, backed the track assembly at the thrust wall.

Jim Lee, an American Augers application specialist, was on site both for the new unit’s commissioning and to help DS Boring train several of its newer employees in auger boring fundamentals. Although DS Boring’s own operators are expert boring specialists, Lee said: “We like to introduce operators to a new machine personally, walking them through the manufacturer-recommended procedures to get what we believe will be the safest and most efficient operation from the unit.”

A cutting head was not necessary in the Florida sand. The pipe’s friction band sufficiently overcut the hole diameter by ½ in (13 mm). Without a cutting head, DS Boring set the auger back 8 to 10 in (200 to 250 mm) inside the pipe. This kept a ‘sand plug’ at the opening of the pipe to keep the auger from sucking sand in from around the pipe’s mouth.

Spivey had anticipated a straightforward boring operation without complications, as he has installed pipe in this area several times before. Lee said: “We found just a bit of debris in the fill as we began the bore. It was good sand here, tightly compacted. It held up well throughout the run.”

A light flow of drilling fluid down the lubrication tube reduced drag and further helped to hold the sand. Each 40 ft (12 m) length of pipe took about one hour to weld on and just 25 minutes on average to advance.

The 36/42-600 unit has a five-speed transmission, with thrust rated up to 600,000 psi. “We never had to push too hard.” Lee said. “We never needed any more than, at most, 1,200 psi the entire run, and torque was always in 3rd or 2nd gear.”
DS Boring made it to the median the first day and completed the run the next. The line and grade was maintained using a steering head and American Augers Dutch Level.

“Steering was controlled through rotation rods.” Lee said. “We used a 4-to-1 force multiplier to relieve pressure on the steering hinges. It steered really well, giving us whatever we asked for exactly when we asked for it.”

As the crew set the eighth pipe into the ground, the first pipe emerged on target, perfectly in line and on grade. Lee said: “You would be surprised the precision you can get using just a Dutch Level.” It is based on the water level principle, he explained, a low-tech concept but reliable and accurate in use.

The 36/42-600 machine immediately went on to its next job and has been steadily boring one job after another since then. The excavator that had set the 16,400 lb (7,439 kg) assembled unit in the pit was no longer on the site. Like most other American Augers boring machines, however, the unit can be quickly split into its three main parts for ease of relocation. Assembly on the jobsite takes about 25 minutes. Lee said: “It is foolproof. You really cannot mess up.”

The heaviest split-out section weighed around 5,600 lb (2,540 kg), well within the capability of DS Boring’s own, mid-sized excavator.

In spite of additional time taken for Lee’s walkthroughs and instructional breaks, DS Boring completed the pipe installation, pressure-tested it and tied it in all within two days. Spivey said the customer was so pleased with DS Boring’s speedy resolution to the division project’s long delay they began lining up more jobs for DS Boring in the future.

Spivey said: “Our fleet has several boring machines, three now by American Augers, and two Ditch Witch directional drills. They are all staying pretty busy. We have so much work right here, we do not have to travel far for jobs.” DS Boring continues to expand its operations and is currently hiring. Website: www.americanaugers.com
Drill Tech Drilling & Shoring Inc. of Antioch, California, USA first demonstrated its 34 in (860 mm) diameter HammerHead Trenchless pipe ramming tool while driving a 108 in (2,740 mm) diameter steel pipe over a 54 in (1,370 mm) diameter culvert beneath the scenic Pacific Coast Highway. Using a technique called ‘pipe swallowing’ allowed Drill Tech to remove the smaller-diameter culvert from within the larger pipe along with the spoil.

Its next pipe swallowing job for the California Department of Transportation (Caltrans) was an even greater feat. The job called for the ramming of 250 ft (76 m) of 72 in (1,830 mm) diameter casing over a 48 in (1,200 mm) corrugated metal culvert with misaligned joints. At its deepest, the 48 in (1,200 mm) CMP of this job lay more than 70 ft (21 m) beneath Interstate 80 about quarter of a mile from Weimer Cross Road in Colfax, 45 miles northwest of Sacramento. The as-built plan prescribed a 6.8° grade upward from the machine side of the installation.

The length of run and lay of the pipe complicated the task. Drill Tech Engineer Brian Harris said they had originally wanted to swallow the culvert with 54 in (1,370 mm) or 60 in (1,520 mm) diameter casing. After measuring feasibility along the run using a laser and prism, the company knew it would need a 72 in (1,830 mm) pipe to handle its offsets. “The culvert really moved around, sort of zig-zagging one end to the other.” Harris said.

During a full month of jobsite preparation, Drill Tech cleared trees and brush along the creek and staged its pipe and equipment on a private easement nearly out of site from interstate traffic. Mike Walk, a pipe ramming expert from HammerHead Trenchless who had come to visit the project, said: “From the freeway all that could be seen was the boom from a crane. Drivers would not realise anything was taking place beneath them as they drove along.”

Drill Tech built check dams at the creek and lay filter socks around the work area to protect the creek from potential jobsite runoff. The crew shored up 200 ft (61 m) of hillside around the culvert’s mouth, installed soil nails and shotcreted the vertical face at the culvert. Depending on soil conditions and supplied with up to 4,700 cfm of compressed air at 110 psi, the ramming tool can exert over 5.5 million pounds of impact force (2,500 t) at 120 blows per minute.

Drill Tech poured a cement slab 42 ft (12.8 m) long, 13 ft (4 m) wide, and 6 in (150 mm) thick to accommodate the 27,500 lb (12,474 kg) ramming tool and a cradle-like sled, as well as to provide guidance for ramming angle and azimuth. Drill Tech secured the slab with eight micropiles and installed four reaction piles for a hydraulic pipe jacking tool kept on standby if needed for assistance.

Three 1,600 cfm compressors linked in series through a common manifold supplied air to the ramming tool though Drill Tech never ran more than two, and most of the time those two were not running at full capacity.

The ramming operation ran smoothly for the first 175 ft (53 m) of the 250 ft (76 m) run. Then work was interrupted for five weeks by what Harris described as ‘one of the wettest winters in California history’. Torrential flow through the pipe caused operations to cease for almost five weeks after pipe was already halfway in the ground. That gave the ground ample time to close tightly around the pipe and seize it in place.

Ramming can take place with a little water coming through the culvert, but caution must be taken with higher rates of flow. A coffer dam was built on the uphill side and pumps set up to divert 1,000 gpm. But during the rains, water was shooting out of the pipe at over 3,000 gpm (11,350 l/min) and was still overflowing the coffer dam. The hammer was backed-off to let the water drain.

It was well into the following month before the contractor could return. The pipe had lain motionless in the ground for more than a month. Although it had rained steadily most of that time, the culvert lay beneath an impermeable ‘roof’. Above it lay 70 ft (21 m) of compacted ground topped by a thickly paved interstate.

The crew feared the ground may have seized the pipe. “But we hooked the ramming tool up to the pipe, and it continued as if it had never stopped.” Harris said.

Harris never doubted that Drill Tech could complete the installation successfully. The company specialises in all forms of geotechnical solutions. Services that it provides to the construction
industry include earth retention, foundation support, tunnelling, shaft construction, ground treatment, dewatering and architectural shotcrete. Its mastery of a complete range of geotechnical solutions now includes the pipe swallowing technique, whose value for difficult culvert replacement projects it has now proven twice on Caltrans projects.

Since Drill Tech never used the ramming tool’s full capacity, it might have been able to swallow the pipe using a smaller model. Nevertheless, Harris credits the ramming tool in large part for how easily the pipe moved after the delay. “I actually do not believe a smaller hammer would have worked. I am glad we had the 34 in (860 mm) diameter hammer.”

THE PIPE-SWALLOWING TECHNIQUE

The pipe swallowing technique is based on conventional pipe ramming method, an economical and safe means of using pneumatic percussion to drive steel pipe in a wide variety of soil types. Its advantages over other pipe installation methods include minimum equipment outlay, relative simplicity of operation, and suitability for use in sensitive ground conditions without disturbing ground around the pipe or construction or surface features above. As it is driven in place, the pipe itself guards against cavitation, making it a preferred method for installing casing where subsidence is a concern, such as beneath roads and railroad beds. Traffic continues unimpeded by the ramming operations. Pipe ramming can often be used when other means of installation cannot. And in some cases, it has been used to save a project when another installation method has failed.

The pipe swallowing version of pipe ramming is used to replace a pipe or casing in place with larger diameter casing. The casing is rammed around the existing culvert, which is then removed with the spoil. Website: www.hammerheadtrenchless.com

Even after a major delay due to bad weather the ramming tool competed the installation without problem.
In Crossgar, a small town about 25 km south of Belfast in Northern Ireland, UK, the staff of Bóthar Drilling Ltd of St. Mullins, faced a major task at the end of 2017. As subcontractor to McNicholas Construction, of Elstree, London UK, Bóthar was to install two DN 125, SDR 11 gas pipelines using the HDD method over a total length of 185 m. The client was the gas distribution company Phoenix Natural Gas of Belfast. At first glance the project appeared to be no big deal, but at second glance due to the prevailing soil conditions it became a real challenge. In addition, each bore path included a river crossing. Other companies had already failed in similar construction projects near the planned HDD bores and were unable to successfully complete the bores they had begun.

A ground survey had shown that with both HDD bores running below an Ice Age deposit at a depth of about 2.5 m solid rock was to be expected. That was not all, below this rock layer lies slate-like sandstone. In order to be able to successfully execute the bores, Bóthar Drilling immediately obtained support from Tracto-Technik UK Ltd. After weighing up all the boundary conditions, the company’s HDD experts decided to utilise its so-called ‘King of Rock’, the Grundodrill18ACS, which is especially suitable for drilling in alternating soils and solid rocks.

DIFFICULT CONDITIONS
The route of the first bore, which had a length of about 105 m, ran along a country road with one lane each way. When planning the drilling profile, a minimum overlap height had to be maintained with regard to the depth for the undercrossing of a river. According to the plan, the start and target pits had to be positioned on one of the traffic lanes, so that the road in this area was closed off from one side for construction work and traffic was controlled with a traffic light system.
HORIZONTAL DIRECTIONAL DRILLING
For General Information on Horizontal Directional Drilling click here

After the Grundodrill18ACS was unloaded from its low-loader, the Tracto-Technik UK team directed it by remote control to the desired position in the immediate vicinity of the starting pit which had already been established. The mixing unit for the production of the Bentonite drilling fluid required for the bore was on the truck which delivered the drilling rig. Since the river water had a pH value of seven, it could be used directly for producing the drilling fluid. The Grundodrill18ACS was equipped with a PDC drill bit for drilling through the rock. This was initially intended for drilling down to below the rock layer. After 66 m (22 rods of 3 m each), the drill head reached softer ground. At this time the drill bit had to be replaced. To achieve this, Tracto-Technik’s employees gradually pulled the drill rods back into the starting pit and dismantled them. A hard drill head (HDH drill head, type 1) was used for the remainder of the pilot bore. After 108 m (36 rods), this reached the target pit with pinpoint accuracy and was replaced there by a 160 mm diameter backreamer, which pulled in the PE-HD gas pipe while simultaneously expanding the borehole. Overall, the gas pipeline was successfully installed in two days with a drilling time of just under 15 hours.

SUCCESS
It was now clear to everyone involved that second bore which also included a river crossing, should also be completed using the Grundodrill18ACS. The second approximately 80 m long bore was completed in a record time of about 12 hours. All in all, the Grundodrill18ACS fully convince all of its advantages, where other HDD systems had previously struggled with problems. Website: www.tracto-technik.com

NEW DIRECTIONAL DRILL PACKAGE FROM DITCH WITCH

Ditch Witch®, a Charles Machine Works Company, has released a new JT20XP horizontal directional drill (HDD) package featuring a JT20XP drill and XP44 mixing system. The industry-first solution is claimed to be the only drilling system in its class to utilise all on-board horsepower for thrust and rotation. Together, the full 118 hp solution provides operators with industry-leading power and superior productivity for larger utility-installation jobs.

“We designed the JT20XP package to complement the unique needs of HDD contractors in the mid-sized utility-installation space.” said Seth Matthesen, Ditch Witch HDD category manager. The JT20XP drill provides improved spindle torque and speed over its predecessor, while delivering 56% more mud flow than competitive units. It is matched by the XP44’s superior mixing capabilities to offer a more productive solution for larger jobs, while retaining a small, compact footprint.

The full XP package features an innovative, compact design making it easy to manoeuvre and transport between urban jobsites. It also offers contractors an all-diesel jobsite for more convenient operations and simple fuel service.

Powered by a 74.5 hp Tier-4 Deutz® diesel engine, the JT20XP HDD maximises available horsepower for thrust and rotation. The drill delivers 14% increased spindle torque over its predecessor and offers 10% increased spindle speed than competitive units, allowing operators the ability to run downhole tooling at faster speeds for improved underground cutting.

With no grease points, a Ditch Witch exclusive, the JT20XP is easy to maintain for increased uptime. Also the environmentally friendly, Tier-4 engine requires no DEF, further simplifying maintenance.

Following a similar look and feel to all Ditch Witch drills, the JT20XP is equipped with a newly designed operator’s station featuring ergonomic, adjustable seats to keep the operator comfortable for long hours on the job as well as an advanced, colour LCD display which provides engine diagnostics and informational messages, including electronic strike indicators (ESID), helping operators stay aware of what is going on in and around the drill and jobsite.

The XP44 mixing system is equipped with a dedicated 44-hp Tier 4 Yanmar® diesel engine for superior mixing capabilities and drilling fluid delivery. As a powerful stand-alone, diesel-powered mixing system, the XP44 offers excellent mixing capabilities in a quieter package for less disruption in noise-sensitive areas. Website: www.ditchwitch.com

Success - the first new gas pipe was installed with a drilling time of just under 15 hours. Inset: Completing the first pilot bore.

The new JT20XP horizontal directional drill (HDD) package.
Public Sewer Services (PSS) was recently asked to repair a 375 mm diameter asbestos cement (AC) rising main that changed into a gravity sewer before falling into a manhole downstream.

Both the manhole and the 375 mm diameter AC pipe suffered from structural damage caused by hydrogen sulphide (H2S), resulting in failure of the host pipe. This particular section of pipe ran beneath a road, with a 225 mm diameter foul rising main running parallel and in close proximity to the defective host pipe.

With high voltage electric cables and multiple other services congesting the area, this restricted efficient open cut replacement. Complete road closure was required to safely deliver the project, therefore a trenchless (No-Dig) solution was the preferred option. This was the most cost-effective method and addressed the deteriorated rising main, whilst minimising the impact and inconvenience of residents.

**PROJECT OPTIONS**

Pipe bursting was considered as an option, however due to the close proximity of the second 225 mm diameter rising main it was discounted. Directional drilling was not practical due to the shallow depth of the existing rising main, along with close proximity of the existing services. Open Cut was considered to be too disruptive with more associated risk, higher costs and a longer delivery time than a trenchless solution.

A decision was made to slip line the 30 meter section of 375 mm diameter AC rising main from an excavation in the grass verge, underneath the road to the downstream manhole chamber situated in the footway.

**RISK ASSESSMENT**

It was essential the project was undertaken during dry weather conditions without the forecast of rain, as continuous flow from four (4) different pumping stations discharged into the pipeline under repair. Any rainfall would increase the risk of the flow control being overwhelmed with the increased incoming gravity flows, resulting in local flooding or pollution incidents.

The greatest operational risk was assessed to be during the slip lining installation stage. In the event of the new pipe not progressing through the full length of the host pipe, additional excavation would have been required resulting in a traditional open cut solution with the associated flow control risks.

**PROJECT SOLUTION**

Once the host pipe was cleaned and surveyed PSS undertook a trial run with a calibration pipe. This consisted of two towing heads with a 1 metre section of pipe between them. This was winched through the host with the 30 tonne bursting rig with a second cable attached to allow for retrieval should this become lodged during the trial. The calibration pipe passed through the pipe smoothly with no resistance recorded on the hydraulic pressure gauges. The pipe was then cleaned with 375 mm diameter metal...
brushes to give the pipe a final clean. The full slip lining installation was then successfully undertaken.

The specified liner pipe was 355 mm diameter SDR 17 PE 100, the closest size to the host pipe for slip lining. The pipe was butt fused together on site to form a pipe string approximately 30m in length. A small 30 tonne compact bursting rig was positioned within the existing manhole to pull in the new pipe string using the additional tapered excavation as an entry point. After installation, the pipe was reconnected to the existing chamber and the benching was reinstated.

Slip lining completion took under an hour with installation and reconnection of the new pipe to the old pipe with reinstatement of manholes new covers and frames installed on existing chambers.

**BENEFITS**

Overall the use of the slip lining method had several benefits for both contractor and client including:

- Minimised disruption
- Minimal noise complaints
- Zero accidents
- Zero pollution incidents
- A reduced carbon footprint
- Shorter timeframe
- Reduced cost
- Positive client feedback complimenting the team and the whole process throughout

With the collaborative approach of working the in-house PSS excavation teams, no dig, CCTV and jetting teams worked simultaneously saving valuable hours of tankering on four different pumping stations. The result, project completed ahead of programme and under budget. Website: [www.publicsewerservices.co.uk](http://www.publicsewerservices.co.uk)

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**PIPEGLINE REHABILITATION**

For General Information on Pipeline Rehabilitation [click here](#)

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The butt-fusion unit used to create the length of liner pipe required.

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**NO DIG/LESS DIG SOLUTIONS**

Thinking differently, Working together, Making changes happen

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I KT recently completed a Comparative Test for Manhole Rehabilitation asking the questions:

- Can wastewater manholes be rehabilitated so that they remain permanently watertight?
- What are the benefits and the drawbacks of mortar coating, plastic coating and lining?
- What quality can be expected?

This is claimed to be the first comparative product test in this field to give users the answers.

“Now for the manholes” – this is a train of thought in the repair/rehabilitation departments of many wastewater network operators. There is, indeed, little point in rehabilitating wastewater pipes without paying attention to the numerous defective manholes. This is particularly true in water infiltration zones, since a really watertight sewer network can only be achieved provided that the manholes are also rehabilitated.

But this also generates the question, which of the many manhole rehabilitation methods should we choose? Which one will seal reliably and durably? Which is suitable in which situation, and which are not? Thirteen commercially available manhole rehabilitation methods have now been analysed in IKT’s Manhole Rehabilitation Comparative Test. The results range from GOOD to ADEQUATE, with one method failing the test.

The project’s wastewater network operator steering committee selected the following methods for testing:

The North Rhine-Westfalia environmental ministry and the municipalities on the steering committee jointly funded this IKT Comparative Test. Testing and documentation of the results was performed by IKT, an independent and impartial institute. IKT was responsible for the engineering science development of the test concept and for the implementation of the test programme. Relevant decisions were coordinated and agreed with the steering committee.

REHABILITATION TASK AND TEST PROGRAMME

The task set for the participants was to rehabilitate an approximately 5 m high DN 1000 concrete manhole in which defined defects had been installed, against a rising groundwater table. The central elements of the test programme were testing of system performance and examination of the participant’s quality assurance provisions. A total of thirteen manholes consisting of prefabricated concrete elements with a nominal diameter of DN 1000 were installed in IKT’s large-scale test facility for the system tests.

The participating wastewater network operators selected various damage scenarios in order to simulate as authentically as possible the condition of a damaged manhole and the actual challenges involved in rehabilitation including:

- 8 x ‘isolated damage’ locations comprising point damage in the form of a 10 mm diameter drill hole
- 4 x ‘area damage’ locations comprising nine drilled holes of 5 mm diameter in a 200 mm x 200 mm area, with simulation of point defects in substrate preparation (mould release agent)
- 5 x ‘leaking ring joint’ locations comprising a ring joint with four 6 mm diameter drill holes

The rehabilitation target was to restore the water-tightness and load-bearing capability of the manhole. How this was to be achieved was left up to each individual comparative test participant, with each having sole responsibility for planning, conception, rehabilitation and finishing work. There was no time limit.

TEST PROGRAMME AND ASSESSMENT SYSTEM

After completion of the manhole rehabilitation operations, performance against rising water
level was first measured in accordance with DIN EN 1610. The focus during the system tests was on loads exerted by external water pressure:

- Short-term exposure to groundwater, in increments up to 5 m, holding time: 17.5 days (3.5 days per load level)
- Long-term exposure to groundwater, constant at 5 m, holding time: 67 days

The manholes were inspected after each increase in water level. They continued to be visually and acoustically inspected once per week when the maximum water level of 5 m had been reached. All leaks, cavities, cracks and other abnormalities were noted during these inspections.

After completion of the groundwater loading test, tensile adhesion strengths were measured and any leaking points on the access system documented. The non-destructive MAC method, which functions using a horizontal pressure and fine sensors, was also used to measure ring stiffness. These criteria were incorporated into the Comparative Test as additional information with no grading. Proofs of load-bearing capability and protective action, and aspects of quality assurance, were also investigated.

**INfiltration Water-Tightness**

The criterion of ‘infiltration water-tightness’ was evaluated on the basis of observations made during the short-term and long-term groundwater exposure tests. Differentiation was made here between the following conditions:

- No abnormalities
- Damp patch ≤ 25 cm²
- Damp patch > 25 cm²
- Damp patch with spreading plume ≥ 40 cm
- Infiltration

**Load Bearing Capability**

The criterion of ‘load bearing capability’ was evaluated for 5 m external water pressure. The systems used were grouped in terms of their functional mechanism. Whether they form an adhesive bond with the substrate (the ‘adhesive bond’ case), whether they are back-anchored by means of special support elements or are completely self-supporting (the ‘back-anchored/self-supporting’ case).

In the ‘adhesive bond’ cases, ‘tensile adhesion strength’, ‘hollow points’, ‘cracks’ and ‘blisters’ were observed, and any abnormalities were evaluated and graded. Where hollow points occurred, these were included, referred to in the total area treated, as ‘zero values’ in the averaging of the tensile adhesion tests.

In the ‘back-anchored/self-supporting’ cases, there is no large-area adhesive bond with the substrate. A self-supporting action was then considered to be system behaviour if it could be substantiated by means of corresponding proof of structural-analysis. This criterion was graded as ‘deficient’ if such proof could not be furnished.

**Robustness**

The ‘robustness’ criterion relates solely to the ‘area damage’ scenario. A mould release agent was applied to the target surfaces immediately prior to rehabilitation, in order to provide indications of the resistance of the rehabilitation system to unexpected bonding defects. These can occur in practice where there is a lack of substrate pre-treatment.

Differentiation was made between the rehabilitation systems according to their load-bearing behaviour for evaluation of the ‘robustness’ criterion:

- Case 1: Adhesive bond with the substrate
- Case 2: Back-anchoring using special support elements
- Case 3: Pipe-in-pipe system

Many manholes are leaky. The latest IKT Comparative Test provides selection criteria for the right rehabilitation method.
‘Bonding with the surrounding material’ (not relevant for Case 3), ‘deformations’, ‘tensile strength deficiencies’ and ‘infiltration’ were recorded and abnormalities evaluated and graded for the ‘robustness’ criterion.

**ACCEPTABILITY OF COMPLETED WORK**

An assessment of the acceptability of the completed work was undertaken by the assessment committee (a group of network operators from the steering committee) through inspection directly in the manhole and by the entire steering committee, with award of grades, using camera-based video documentation material.

**PROTECTIVE ACTION**

Demonstrations of suitability of the systems for use in wastewater facilities within the permissible pH range were required from the suppliers. Such proof of ‘protective action’ was considered to have been provided if a DIBt (German Institute for Building Technology) approval or evidence analogous to the DIBt approval tests was submitted. Exposure tests on mortar and plastic in aggressive and in particularly aggressive fluids were then performed, in order to verify the protective action of the materials used on a random-sampling basis. Scores were uprated by one grade if no abnormalities were found.

**QUALITY ASSURANCE**

The suppliers’ quality assurance assessment covered criteria such as method description, training provisions, test certificates and third-party supervision. ‘Particular abnormalities’ were recorded for any additional features of the performance of the work that were observed.

**ON-SITE TESTS**

The on-site tests were undertaken to determine the practicability of the rehabilitation methods under real on-site conditions. These on-site tests provided a check of how representative the testing in the IKT test facilities was of real conditions. For this purpose, essential working operations were observed. In particular, the nature and scope of preparatory work were noted and deviations from the requirements in the method manuals and/or from the work performed at the IKT test facilities were recorded. In addition, the on-site tests were also used to record any ‘particular abnormalities’ as part of the suppliers’ quality assurance assessment.

Table 2 summarises the overall evaluation system, including additional information, and shows the weighting of these criteria that was specified by the network operators.

**TEST RESULTS**

The overall scores in the IKT Comparative Test, ‘Manhole rehabilitation’ ranged from GOOD to ADEQUATE:

- GOOD (1.6): Hobas Rohre GmbH, using GRP inner manhole shaft
- GOOD (1.7): PCI Augsburg GmbH, using Nanocret R4
- GOOD (2.1): Schacht + Trumme GmbH, using HDPE segmental lining
- GOOD (2.1): Sika Deutschland GmbH, using sewer reprofiling mortar
- GOOD (2.2): Aarsleff Rohrsanierung GmbH, using GRP – back-anchored
- SATISFACTORY (2.6): PSL Handels GmbH, using Oldodur WS 56
- SATISFACTORY (2.7): Hermes Technologie GmbH, using Ergelit KS 1
- SATISFACTORY (2.8): Source One Environmental UK, using Ultragel
- SATISFACTORY (2.9): Remmers Baustofftechnik GmbH, using Betofix R4 SR
- SATISFACTORY (3.5): SEKISUI SPR Germany GmbH, using GRP – adhesive
- SATISFACTORY (3.5): Remmers Baustofftechnik GmbH, using Silicate R
- ADEQUATE (3.6): MC-Bauchemie Müller GmbH, using Ombran MHP
- NOT EVALUABLE: FSB Bautechnik GmbH, using Spectrashield

Due to a system failure caused by the ‘pre-damage’ areas (mould release agent applied to assess ‘robustness’), it was not possible to evaluate the ‘Spectrashield’ system. It was no longer possible to enter the manhole.
RESULTS FOR INFILTRATION WATER-TIGHTNESS

None of the methods exhibited any abnormalities after the short-term and long-term groundwater exposure resulting from the ‘isolated damage’ scenarios. All of the 96 points of damage across the rehabilitated manholes were watertight (100%). This damage scenario clearly presented no problem to the rehabilitation systems tested.

Abnormalities caused by the ‘leaking ring joint’ became apparent during the short-term groundwater simulation at 5 m affecting 14 of the 60 repairs (approximately 23%). During the subsequent long-term groundwater simulation at 5 m, three of these exhibited a change in their condition and new abnormalities (damp patches) were recorded at three more points, bringing the total to 17 of the 60 repairs. So at the end of the experiment there were no abnormalities recorded for 43 points of damage (around 72%).

Where a point of damage had been suitably repaired and exhibited no abnormalities at the start of the groundwater exposure testing, it generally remained in this condition throughout (139 of 156 points of damage, approximately 89%). No additional infiltration (long-term groundwater simulation at 5.0 m) was exhibited at 154 points of damage (approximately 99%) up to the end of the test.

LOAD-BEARING CAPABILITY: ADHESIVE BOND WITH SUBSTRATE

In the case of the ‘isolated damage’ scenario, repairs to 216 of the 240 points of damage (approximately 90%) exhibited no abnormalities. With one exception, this damage scenario thus presented no significant problem for the rehabilitation systems tested.

In the case of the ‘leaking ring joint’ damage scenario, 133 of 150 load-bearing evaluations (approximately 89%) exhibited no abnormality. The ‘Ombran MHP’ system exhibited two slight tensile strength deficiencies, which did not result in loss of score. Therefore, this damage scenario also presented no significant problem to the rehabilitation systems tested.

No abnormalities were exhibited by 7 of 10 systems (70%) in the ‘remaining manhole wall’ sector. The ‘Ombran MHP’ and ‘Ergelit KS 1’ systems exhibited extensive hollow points. In addition, tensile strength deficiencies (cracks), which resulted in minus points, were apparent in the case of the ‘Ergelit KS 1’ system.

Among the 13 systems, only the ‘Spectrashield’ exhibited abnormalities for mean tensile adhesion strength.

A grade of 1.0 was awarded to 7 of 10 suppliers for ‘load-bearing capability’. Three systems (‘Ombran MHP’, ‘Ergelit KS 1’ and ‘Spectrashield’) each scored of 5.0.

LOAD-BEARING CAPABILITY: BACK-ANCHORED/SELF-SUPPORTING

A structural-analysis certificate was submitted for only one of the three back-anchored/self-supporting systems (‘GRP inner shaft’). The load-bearing capability of the ‘GRP – Back-anchored’ and ‘HDPE - Segmental lining’ remains unknown.

IMMUNITY (‘ROBUSTNESS’) TO PUNCTUAL DEFICIENCIES IN SUBSTRATE PREPARATION

No abnormalities were apparent at 44 of the 52 (approximately 85%) points for the ‘inadequate bonding with the surrounding material’ points of damage. Two mortar coatings exhibited abnormalities in the form of hollow point enlargements (‘Ombran MHP’ 1 of 4 and ‘Silicate R’ 2 of 4 damage locations). Two plastic coatings (‘Spectrashield’ and ‘Oldodur WS 56’) exhibited abnormalities at

Inspecting the manholes under test.
Various defects were found on inspection of the test manholes after the rehabilitation systems were installed.

five of eight points of damage. No abnormalities were found on the four remaining lining systems and four mortar systems, or on the epoxy-resin plastic coating.

No abnormalities for ‘excessive deformation’ were observed for 46 of 52 points of damage (approximately 89%). For two plastic coatings (‘Spectrashield’ and ‘Oldodur WS 56’), abnormalities in the form of blisters were observed at six of the eight points of damage. The six mortar coatings, the four lining systems and the epoxy-resin plastic coating (‘Ultracoat’) exhibited no abnormalities.

For ‘tensile strength deficiency’, 41 of the 48 points of damage (approximately 85%) had no abnormalities. Three mortar coatings exhibited cracks. The four lining systems, three mortar systems and two plastic coatings had no abnormalities.

For ‘infiltration’, there were no abnormalities at 33 of 48 points of damage (approximately 69%). Damp patches and/or spreading plumes were found on all six mortar coatings. One plastic coating (‘Oldodur WS 56’) exhibited infiltrating water at one of four points of damage. No abnormalities were noted on the four lining systems and on the epoxy-resin plastic coating.

Where inadequate bonding had been ascertained in the vicinity of ‘area damage’, leaks generally also occurred at these locations. Leaks were also exhibited in all cases where cracks occurred in a mortar coating. No abnormalities were found in the four lining systems and in the epoxy-resin plastic coating.

ACCEPTABILITY OF REPAIR

The overall grades awarded for the acceptability of repair ranged from Excellent (1.1) to Adequate (3.7). Three systems were Excellent, five were Good, three were Satisfactory and one was graded Adequate (average overall grade: 2.2). Significant differences in grades were found between the individual systems.

PROTECTIVE ACTION

Evidence for verification of protective action was provided for four of thirteen systems. A DIBt approval exists for three systems (‘Ombran MHP’, ‘Ergelit KS 1’ and ‘Spectrashield’). An analysis certificate, as necessary for DIBt approval, was submitted for the ‘Silicate R’ system. None of the systems exhibited any abnormalities in random-sampling tests. All systems therefore had their scores increased by one grade.

Quality assurance by the system suppliers and/or refurbishing contractors was extremely patchy. Results are compiled in the test tables.

CONCLUSIONS

Reliable manhole rehabilitation possible using commercially available systems

The systems tested in the IKT Comparative Test demonstrated that reliable manhole rehabilitation is possible even when exposed to groundwater pressure. However, the range of scores awarded to the individual systems is wide, extending from GOOD to ADEQUATE.

System failure due to substrate-preparation deficiencies in individual cases

One of the coating systems could not be evaluated, since it proved to be extremely sensitive to isolated deficiencies in substrate preparation (test criterion ‘robustness’). Giant bubbles, which prevented renewed entry to the manhole, developed under exposure to external water pressure, starting from the local weak points where mould release agent had been applied for the test. Other systems exhibited cracking, blistering, hollow point enlargements and leaks at such points.

Water-tightness performance recognisable at early stage if groundwater present

Where the refurbished manholes were watertight immediately after initial exposure to groundwater, no further deterioration in quality was generally observed, even under greater and more prolonged...
exposure to groundwater. Therefore acceptance inspection is recommended when groundwater is present on-site.

Load-bearing capability critical or unknown in some systems

Analyses of the load-bearing capability of the various systems produced greatly differing results. Some systems based on adhesive bonding exhibited extensive cavity areas and cracking, and received the ‘Deficient’ grade, whereas others convincingly achieved ‘Excellent’. A structural-analysis certificate was available only in one case for the two self-supporting linings and one system incorporating back-anchoring using support elements, while the load-bearing capability of the two other systems still remains unknown.

Protective action not clarified in a large number of systems

Only four of thirteen suppliers were able to submit certificates for the use of their materials/systems in wastewater facilities. No abnormalities were found in random-sampling tests (exposure tests), however.

Quality assurance very patchy

The majority of system suppliers and rehabilitation contractors were able to cite training certificates, test certificates, DIBt approvals, etc., only in individual cases. Overall large gaps were apparent.

MAC measurement confirms auxiliary supporting action

The MAC measurements showed that all coatings, and linings with full-area contact/bonding with the original manhole walls, are capable of making a significant contribution to the restoration of horizontal ring stiffness. In many cases, the data for an intact system were again achieved - or even exceeded - even in the case of cracked manhole-shaft rings.

Acceptance impression of system operators confirms test results

The evaluation of the work performed, undertaken by the representatives of the wastewater network operators – the ‘acceptance impression’ - largely coincided with the results of the extensive tests performed for the IKT Comparative Test. However, this presupposes extensive experience on the part of the individual employees. Website: www.ikt-online.org
On 19 September the UKSTT celebrated its 24th Annual Dinner & Awards Ceremony in style at the Atrium, Peterborough Arena. Organised by Westrade Group, over 400 guests enjoyed an excellent evening of celebration and networking. The event was once again hosted by environmentalist Chris Packham and keeping up with the tradition he started at his first dinner in Blackpool, Chris was joined by a ‘Guest’. This year the guest was an Alligator Snapping Turtle, the largest fresh water turtle in the world given its name because of its immensely powerful jaws and long, spring-like neck, as well as the distinct ridges on its shell that are similar in appearance to an alligator. These turtles are ferocious predators and can bite through bone, they will eat almost anything they can catch! The turtle Chris had with him on the night was found at the bottom of a UK lake!

The evening’s entertainment was provided by female vocalist ‘Portia’ and an amazing dance act ‘2 N A Half Men’ who reached the semi-finals of ITV’s Britain’s Got Talent in 2011.

The Chairman Charity this year was the National Autistic Society, which is the leading UK charity for autistic people (including those with Asperger Syndrome) and their families. As soon as it is known how much has been raised for this good cause UKSTT will let you know.

After the winners were announced and the awards presented, the evenings celebrations continued into the early hours.

UKSTT Chair, Matthew Izzard said: “Our awards recognise the very best individuals and companies within the trenchless industry. Our winners are excellent ambassadors for our sector.”

 Winners And Shortlisted Entries

 New Installation – Water & Wastewater

 Winner - South West Water Delivery Alliance H50, Arcadis, Kier & Radius Subterra
 Mayflower Water Treatment Works Potable Water Main - Whitleigh Woods Slippine.
 South West Water (SWW) is constructing a new £60 million state-of-the-art water treatment works in Devon, the company’s flagship project in its 2015-2020 business plan. Mayflower Water Treatment Works will use cutting-edge treatment processes, designed and developed by leading Dutch water technology company PWN Technologies and will serve around 250,000 customers in Plymouth and the surrounding area. It is being built at Roborough Down, just outside the city, and will replace Plymouth’s outdated Crownhill WTW.

 Highly Commended - Severn Trent Water & BNM Alliance
 Newark Waste and Water Improvement Project.
 Severn Trent Water is investing £60 million in Newark, upgrading the sewers and water supply network throughout the town. The project, which is being delivered by BNM Alliance, will help to relieve some 400 homes and business from sewer flooding, and provide a robust water supply system which will serve the town for many years to come. Extensive no dig techniques have been employed minimising the impact of the works. The project includes a 2.8 km segmental tunnel, 2 km pipe-jack tunnels, 2.55 km of water mains renewed by pipe-bursting and directional drilling, 6 km of open cut sewers, over 10 km of new water mains.

 New Installation – Energy & Communications

 Winner - Clancy Docwra Ltd/UK Power Networks/Joseph Gallagher Ltd/COWI
 Battersea Cable Tunnel
 Clancy Docwra was contracted by UK Power Networks to deliver a new cable spur tunnel and connection chamber for a major new electricity network connection in London, where a new 132 kV circuit will meet the c.110 MVA demand to energise the iconic Battersea Power Station redevelopment. Our teams overcame many technical challenges, including a seven track rail viaduct and a trunk main sewer lying 15 m above the new tunnel. In the junction chamber we used an innovative, bespoke internal steel strapping to connect to the existing infrastructure. Some 118,110 injury-free hours were completed within this challenging, live, 24 hour working environment.

 Commended - Nicol of Skene Ltd/Fulcrum
 Allt a Bhainne
 Nicol was appointed by Fulcrum to install an 8 km 125 mm diameter gas pipeline to connect the Allt a Bhaime whisky distillery to the grid. The effectiveness of the Ditch Witch JT30 and JT60 all terrain drilling rigs meant over 4.5 km, almost 60% of the pipeline was installed used directional drilling techniques at no additional cost compared to standard open cut techniques. The use of directional drilling also minimised the project’s environmental impact. The project proved that in certain conditions...
directional drilling is as cost-effective as open cut and is far more than simply a ‘distress purchase’ to be used only when obstacles are encountered.

**Innovation**
Sponsor:

**Winner** - VolkerTrenchless Solutions, Visser & Smit Hanab B.V & Statoil Petroleum AS  
**JoSEPP HDD Landfall at Mongstad**
Horizontal Directional Drilling (HDD) installations work on the principle drill pipes are designed to be pushed during pilot hole operations in a small bore and pulled during hole opening phases. To successfully execute the HDD in Mongstad push reaming was the only option without any possibility of maintaining tension on the drill string. The challenges facing the team had never been encountered within the HDD industry worldwide. Especially considering the drilled bore had to opened up to 1,219 mm (48 in) over a distance of 800 m, exiting in 300 m of water with rock strengths of 200 MPa.

**Highly Commended** – Terra Solutions Ltd/London Underground/Alan Auld  
**Bank Bloomberg Place Adit Installation**
Two passageway adits were installed with exceptionally restricted access for LUL as part of the construction of the new Bank Bloomberg station. The project encountered many challenges during the square-works tunnel construction including coming upon a 120 year old buried tunnel shield and unmarked concrete piles, as well as changing ground conditions. The severe access/egress restrictions necessitated the construct of an elaborate labyrinth of lifting mechanisms and a system of lifting points, winches and pulley systems to erect the steel structure. The project was completed without environment or H&S incident and overcame several technical challenges through innovation and design.

**Commended** – ALH Systems/Cadent Gas  
**Project Bond**
Strategic valves are situated across UK gas networks to isolate sections if required to facilitate construction or during breakdown of plant. Each valve should be fitted with access points to enable monitoring of pressures and permit subsequent recommissioning. A significant number of the valves have been identified not having these access points and therefore Cadent Gas required a cost-effective programme and methodology of retrofitting the access points utilising an innovative, less disruptive technique. ALH Systems have developed a resin based adhesive to install a drilling saddle reducing time and cost to the gas networks to enable installation of access points.

**Renovation – Water & Wastewater**
Sponsor:

**Winner** - Wessex Water YLT E&C/OnSite Central Ltd/J G Pipeline Consultancy Ltd/ Trenchless Opportunities Ltd  
**Christchurch Rising Main CIPP Pressure Lining Renovation**
There has been an enthusiasm for force main CIPP lining in mainland Europe for many years, yet relatively few have been installed in the UK’s sewerage sector since Eric Wood’s concepts in the mid 1970’s. With the advent of ISO 11297: 2018 as a manufacture and installation specification, Wessex Water believes the time is ripe to invest in the understanding of the design and procurement of pressure liners. The Christchurch STW liner completed with our framework contractor Onsite Central Ltd, is the first of any note, and the precursor of many more planned and reactionary lining interventions to come.

**Highly Commended** - The Tomato Plant Company Ltd/ Heathrow Airport Ltd/ McAllister Group  
**BC101 CPS1526 Surface Water Renovation Heathrow Airport**
The Tomato Plant Company Ltd led the project in partnership with McAllister Group to facilitate and install 139 m of 1,133 mm diameter UV GL13 liner 11.9 mm thickness to renovate an existing critical SWS in very poor condition airside at Heathrow Airport. The project included multiple locations completed successfully but this particular location required high risk planning regarding impact on airside operations due to size, location and potential impact. This involved complex multi-stakeholder engagement, extensive collaborative working and detailed micro-planning within a very restricted operational window of opportunity and with significant implications associated with failure.

**Commended** - Nicol of Skene Ltd/Moray Estate/Scottish Water/Scottish Natural Heritage/Lorraine Logan - consultant  
Glenlatterach
Flood water levels washed away an existing concrete main traversing the River Lossie, the only source of water supply for almost 5,000 properties. Scottish Water appointed Nicol of Skene to install a replacement pipe using directional drilling. The drill route involved a 58 m fall through a rock ravine before passing under the River Lossie and exiting in a SSSI (Site of Specific Scientific Interest). The design had to ensure there was no pollution of the river or environmental impact on the SSSI. The complex project was completed within a month with all homes connected to a permanent mains supply before Christmas.

**Environmental**

**Sponsor:**

**Winner** - South West Water Delivery Alliance H50 / Arcadis / Kier / Radius Subterra  
*Mayflower Water Treatment Works Potable Water Main - Whitleigh Woods Slipline*

South West Water (SWW) is constructing a new £60 million state-of-the-art water treatment works in Devon, the company’s flagship project in its 2015-2020 business plan. Mayflower Water Treatment Works will use cutting-edge treatment processes, designed and developed by leading Dutch water technology company PWN Technologies and will serve around 250,000 customers in Plymouth and the surrounding area. It is being built at Roborough Down, just outside the city, and will replace Plymouth’s outdated Crownhill WTW.

**Highly Commended** - Wessex Water YLT E&C  
*Sustainable and environmentally sensitive interventions via Trenchless Technology*

As French President Emmanuel Macron succinctly identified whilst speaking to the House of Representatives in Washington on global warming in April 2018, ‘There is no planet B’. Every possible sustainable solution to reduce the impact of our infrastructure works on the environment is necessary as the populace grows exponentially and the terra firma become congested. Wessex Water is confident that it has the safest whilst most cost effective, innovative trenchless solutions with longevity. Its adherence to detailed environmental screening protocols at planning stage and throughout the life of the networks interventions, ensure compliance with the strictest legislation.

**Application of Digital Technology**

**Sponsor:**

**Winner** - Catsurveys Ltd  
*Catsurveys Desktop Utility Records Search Platform*

Catsurveys has created a unique, bespoke and easy-to-use online database-driven Geographical Information System (GIS) for Desktop Utility Record Searches. The systems developed have enabled us to ensure the timely, efficient and cost-effective collation of statutory undertakers’ drawings. Once an area has been requested all users of the digital system have access to download the information until expiry. A direct by-product of the system and semi-automated process is the decreased project risk and increased safety of all involved with the design, diversion, survey and excavation of buried infrastructure. A DURS pack is the first stage of planning intrusive works.

**Project of the Year**

**Sponsor:**

**Winner** - South West Water Delivery Alliance H50 / Arcadis / Kier / Radius Subterra  
*Mayflower Water Treatment Works Potable Water Main - Whitleigh Woods Slipline*

See previous information

**Young Professional**

**Sponsor:**

**Winner** – Helen Isaacs, Wessex Water  
*Collaboration and innovative thinking are central to modern trenchless technology. In her role as a Critical Sewer Engineer Helen has delivered a range of rehabilitation techniques whilst maintaining a strong focus on customer care and client satisfactions. These include a Bristol GRP lining project, the Christchurch GRF CIPP rising main lining, and manhole renovation trials. Helen was also responsible for researching the WaterUK Styrene Protocol, which was the first protocol to address styrene emissions from CIPP lining sites, was part of a winning submission for ROSPAs Sector Award 2017 and is now an industry standard document.*
Highly Commended – Joel Baldan, Catsurveys Ltd
Joel is Commercial Lead at Catsurveys Ltd the leading utility survey consultancy in the UK & Co-founder of the Utility Survey Forum (USF) an industry leading online platform where both beginners and seasoned professionals alike can connect and share their experiences, ask questions and learn through the wealth of knowledge found within the forum community. With 6 years’ experience in the utility industry Joel is proud to be an active STEM Ambassador to local schools and champion of PAS128 committed to promoting and bettering the industry to inspire the next generation of utility survey professionals.

Lifetime Achievement
Awarded to Norman Howell
The UKSTT ‘Lifetime Achievement’ award was presented for only the third time in the history of the UKSTT awards ceremony. This year the prestigious award was presented to Norman Howell who has been part of the Domestic UK and International Trenchless ‘family’ for more than 40 years. Starting out as an Engineering Geology graduate from the University of Newcastle upon Tyne, Norman later qualified as a Chartered Geologist and Chartered Environmentalist. Starting his working career at Tarmac Construction in 1975 Norman became interested in trenchless technology in the late 1970’s. Norman joined the ISTT in 1986 and has been involved in the UKSTT since its inception in 1993. In 2000 Norman joined the UKSTT Council and during the last eighteen years has served as Honorary Secretary and was Chairman from 2001 - 2003. The award of ‘Lifetime Achievement’ was awarded to Norman in recognition for the services he has made to the trenchless industry and for his services and contribution to the Society.

Many thanks also go to this year’s event Sponsors:
• Platinum Sponsors – H5O, Prokasro, Public Sewer Services, Reline Europe & RSM Lining Supplies
• Gold Sponsors – Tracto-Technik
• Category Sponsors – Picote Solutions & Wessex Water
• Drinks Sponsors – Buckhurst

And event organiser Westrade for supporting the event and to our guests for attending and making it another successful evening.

ABOUT UKSTT
The United Kingdom of Trenchless Technology (UKSTT) is a Society, involved in the education development and promotion of trenchless techniques. Since its inauguration in 1993, the Society has added to its portfolio of training seminars and networking events including the Annual Roadshow Series, Masterclass Series, Annual Awards Dinner, Charity Golf Day and Joint PIG events. With its high value service and access to a vast library of technical papers, UKSTT plays an important role in promoting the benefits of trenchless technology within the utility industry. If you would like more information, please contact Lynn Maclachlan at 01926 513773 or email: admin@ukstt.org.uk

UKSTT TECHNICAL ENQUIRY SERVICE - over £1 million of potential work per annum
The UKSTT website has a dedicated link for visitors to raise technical enquiries they may have concerning the world of trenchless working. In addition, the administration team in Kenilworth, receive many calls seeking help. As part of the Corporate Membership benefits package many of these work associated potential advisory/problem solution queries generate business directly or indirectly for our members. These enquiries are passed directly to our Corporate members and if they are able to assist or put a tender in they are then in a position to respond directly to the enquirer. For further membership benefits please visit our website or contact Lynn on 01926513773 or email: admin@ukstt.org.uk

Join the UKSTT and become part of the International Society for Trenchless Technology. Members are entitled to access the services provided on the ISTT website to include free downloads of technical papers and reports from the Technical Resource Centre TRC. Members also receive quarterly mailings of Trenchless International (TI) - ISTT’s official magazine. To find out all of the benefits that your company could receive take a look at the website www.ukstt.org.uk/ or speak to Lynn on 01926 513773 or email admin@ukstt.org.uk

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SAVE THE DATE FOR RO-KA-TECH

Germany is an important driving force in the field of pipe and sewer technology. Every two years, the industry shows off its innovations, services and products at the RO-KA-TECH trade fair in Kassel. In 2019, the exhibition will open its doors from the 8 to 10 May in the City of Kassel.

This will be the 15th time that RO-KA-TECH has been held and over the years it has established itself as an international ‘know-how’ hotspot. The organiser is VDRK, the German Association of Pipe and Sewer Technology Companies. In 2019, the Association expects around 300 companies to exhibit, including an increasing number of internationally active companies. “We note that RO-KA-TECH is receiving growing attention from all over the world.” said Ralph Sluke, Managing Director of VDRK.

ATTENDING
Potential international visitors will find all relevant information out about the fair on the English website: link. Kassel is located two hours from Frankfurt by train and the exhibition grounds are easy to reach by public transport.

It is recommended that visitors should book a hotel room early for their visit. A link to partner hotels can be found in the ‘visitor’ area on the website.

The tickets for RO-KA-TECH are issued by exhibiting companies free of charge to customers and other interested parties. Visitors can alternatively pre-book entry tickets at the website for €10 online. Day tickets are available at the entrance for €20.

Visitors at the RO-KA-TECH include a wide range of expertise such as:

- Decision-makers from local authorities, especially from the sewage management (network provider) sector
- Engineering firms, planners and consultants
- Representatives from companies of the pipeline and sewer industry
- Experts in the fields of civil engineering, renovation and the construction industry
- Associations and institutions
- Representatives of national and international organizations
- Job applicants, students and pupils

A MEETING POINT FOR THE PIPE AND SEWAGE TECHNOLOGY INDUSTRY
By specialising in the pipeline and sewage technology industry RO-KA-TECH has become firmly established as the industry’s meeting point and is well known far beyond the German border. The spacious indoor and outdoor exhibition area (26,000 sqm in total) makes it possible for exhibitors to present and fully demonstrate their products and systems.

The first RO-KA-TECH took place in 1996 in Leipzig and it started as a small industry get-together with 60 exhibitors from 3 countries. Since then it has developed into an internationally respected trade fair. At RO-KA-TECH 2017, 286 exhibitors from 19 countries presented themselves across 25,000 square meters of exhibition space. Almost 8,000 visitors from 48 countries came to Kassel.

Topics and products at RO-KA-TECH 2019 will include:

- Occupational safety, safety equipment
- Construction equipment and vehicles
- Multiskilling, training and retraining
- Leak-tightness testing technology
- Services
- Financial services provision
- Drainage technology
- Gas Detection equipment
- Deodorization
- High-pressure jetting technology, nozzles, hoses, pumps
- Engineering services
- Sewer and manhole covers
- Sewer and manhole renovation technology
- Sewer and manhole inspection technology
- Laboratory Testing
- Robot technology
- Pipe and sewer cleaning technology
- Pipe manufacturer
- Sewage shaft
- Sewer locating
- CIPP and trenchless renovation systems
- Software
- Tools and accessories
ISTT’s 36th Annual International No-Dig Conference and Exhibition, hosted by the Southern African Society for Trenchless Technology (SASTT)

8-9 October 2018
Cape Town International Convention Centre (CTICC), South Africa

Call for papers now open!
Deadline: May 2018
Prospective authors are invited to submit proposals for consideration in the conference programme. Please visit www.nodigsouthafrica.com

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• Underground Infrastructure
• Underground Utilities
• Pipeline Technologies

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Paul Harwood – Email: pharwood@westrade.co.uk or Telephone: +44 (0)1923 723990
Stuart Hillyard – Email: shillyard@westrade.co.uk or Telephone: +44 (0)1923 723990

www.trenchlessmiddleeast.com
EVENTS AND MEETINGS

Westrade Group Ltd is an independent company specialising in trade exhibition and conference organisation. Events include the 'TRENCHLESS' and 'NO DIG' series across Europe, the Middle East, Asia and Africa.

SPONSORS LINKS
Click logo for weblink

NO DIG INDIA SHOW 2018
International Conference & Exhibition
Advancing Trenchless Standardization

14 & 15 December 2018
CIDCO Exhibition Centre,
Vashi, Navi Mumbai,
Maharashtra

PARTICIPATION PACKAGE

EXHIBITION

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# Delegate fee does not include accommodation, transport etc.

PARTNERSHIP

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*(Add 18% GST extra)

INDIAN SOCIETY FOR TRENCHLESS TECHNOLOGY
908, Hemkunt Chambers, 89, Nehru Place,
New Delhi - 110019, INDIA
Ph: +91 011 4767 0800 | Fax: +91 011 4161 7863
indstt@indstt.com & indstt@gmail.com | www.indstt.com

CONFEERENCE

Discussion Topics

DAY 1
- Trenchless Technology Standardization
- Subsurface Utility Investigation & Mapping
- Trenchless Project Design
- Development of New Subsurface Infrastructure

DAY 2
- Smart & Sustainable Cities Utility Network
- Rehabilitation & Replacement of Aging Subsurface Utility Network
- Drilling Fluids
- Waste Management & Mud Recycling

For booking & queries please contact:
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negi@indstt.com

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anand@indstt.com

Mr. Manoj Kumar  
+91 9810 833 128
mkumar@indstt.com
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<td>2018</td>
<td>October 8-9</td>
<td>International No-Dig South Africa – Cape Town, South Africa.</td>
<td><a href="http://www.nodigsouthafrica.com">www.nodigsouthafrica.com</a></td>
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<td>October 9-10</td>
<td>The British Tunnelling Society Conference &amp; Exhibition -</td>
<td><a href="http://www.btsconference.com">www.btsconference.com</a></td>
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<td>London, UK.</td>
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<td>October 16-18</td>
<td>INTERGEO 2018 - Frankfurt, Germany.</td>
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<td>November 12-16</td>
<td>NUCA - 3rd Auger Boring School - Ruston, Louisiana, USA.</td>
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<td>December 11 to 14</td>
<td>Bauma CONEXPO India 2018 - Delhi, India.</td>
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<td>No Dig India 2018 - Mumbai, India.</td>
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<td>February 18-19</td>
<td>Trenchless Middle East 2019 - Dubai, UAE</td>
<td><a href="http://www.trenchlessmiddleeast.com">www.trenchlessmiddleeast.com</a></td>
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<td>May 2-4</td>
<td>No-Dig Turkey 2019 in conjunction with the 5th Water Loss Forum Turkey - Istanbul, Turkey</td>
<td><a href="http://www.nodigturkey.com">www.nodigturkey.com</a></td>
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<td>May 8-10</td>
<td>RO-KA-TECH - Kassel, Germany.</td>
<td><a href="http://www.vdrk.de/de/ro-ka-tech/english-version">www.vdrk.de/de/ro-ka-tech/english-version</a></td>
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<tr>
<td></td>
<td>May 17-21</td>
<td>NASTT No-Dig Show 2019 - Chicago, USA</td>
<td><a href="http://www.nodigshow.com">www.nodigshow.com</a></td>
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</tbody>
</table>

If you have an event, course or meeting scheduled and would like to add it to this listing please forward details to: ian@nodigmedia.co.uk