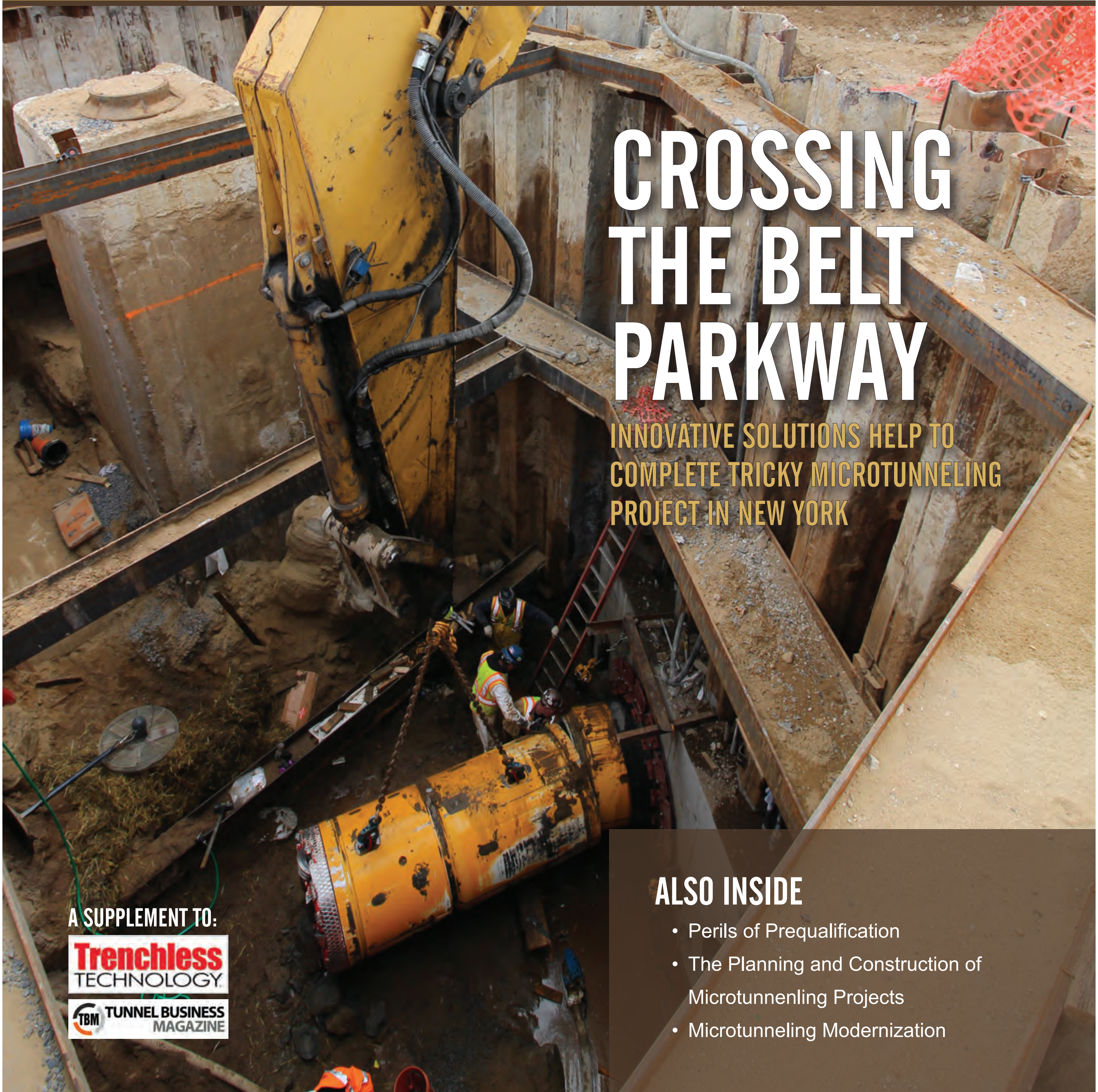
2016

NORTH AMERICAN MICROTUNNELING



CROSSING THE BELT PARKWAY

INNOVATIVE SOLUTIONS HELP TO COMPLETE TRICKY MICROTUNNELING PROJECT IN NEW YORK

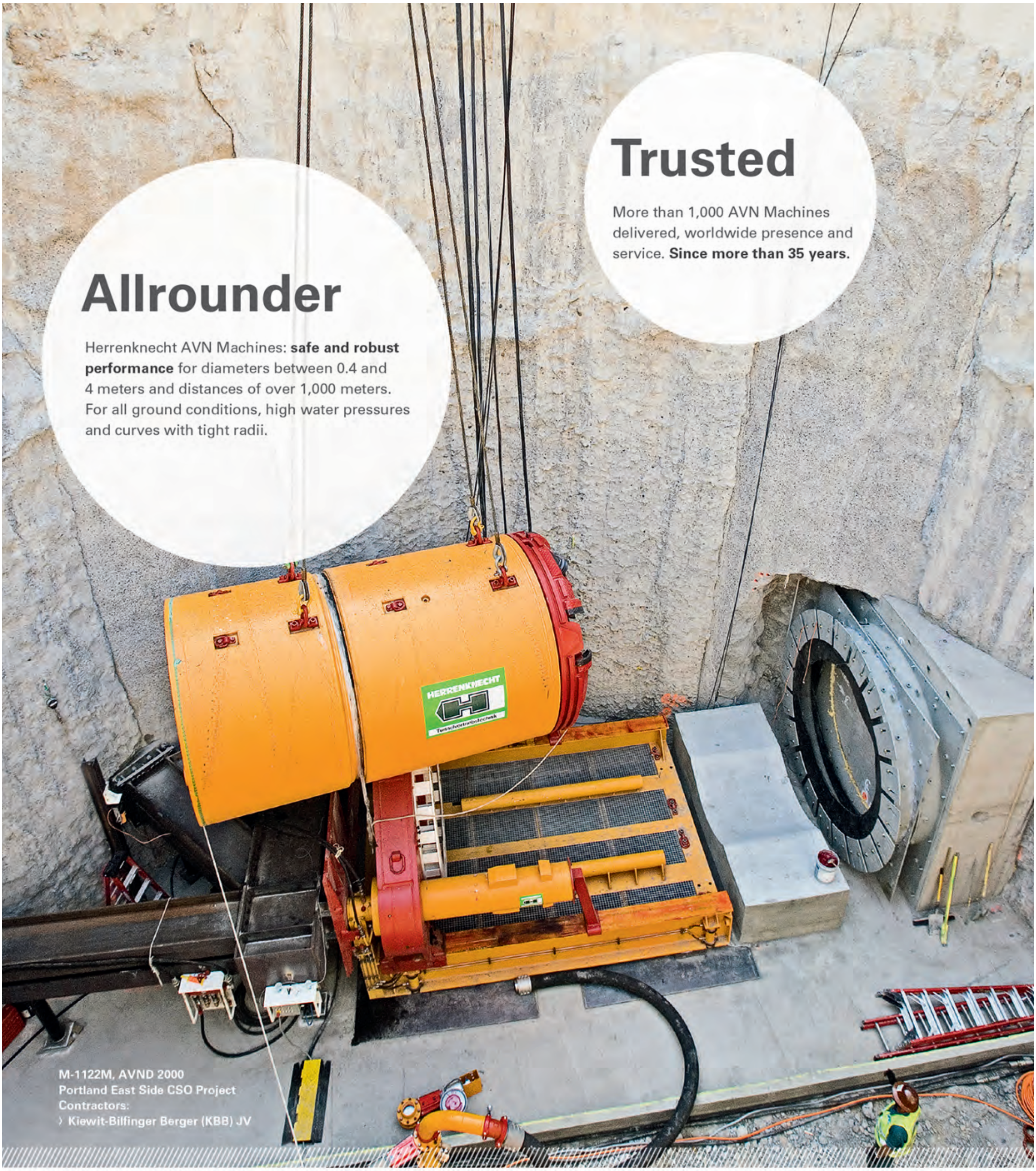
ALSO INSIDE

- Perils of Prequalification
- The Planning and Construction of Microtunnenling Projects
- Microtunneling Modernization

A SUPPLEMENT TO:

Trenchless Technology

TBM TUNNEL BUSINESS MAGAZINE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COLUMN

FEATURES

DEPARTMENTS

ADVERTISERS INDEX

TRACKING ADVANCES IN MICROTUNNELING

Welcome to the 9th edition of the North American Microtunneling Industry Review, a supplement to Trenchless Technology and TBM: Tunnel Business Magazine. In the time that we have been publishing this special edition, we have seen tremendous evolution in the marketplace. We are seeing more contractors and equipment manufacturers serving the market, and we have seen microtunneling flourish in Canada.

Within the pages of Trenchless Technology and TBM, we have profiled a number of microtunneling projects in 2016, all of them showcasing the unique capabilities of the method that make it an invaluable tool in the utility installation toolbox. Microtunneling provides the benefits of a reduced jobsite footprint, minimal disruption compared to open-cut, safe operation allowed by remote-controlled operation, and the ability to work below the groundwater table.

In this issue we look at additional successful case histories, as well as informative articles on procurement and planning. One noteworthy project highlighted in this issue is the Bergen Basin Sewer Reconstruction project that was recently completed near JFK Airport in New York. In this case, microtunneling reduced impacts in this heavily congested area for a project that will provide environmental benefits for Bergen Basin and Jamaica Bay. Additionally, a contractor value engineering proposal (VEP) helped save the owner more than $1 million off its original cost estimate – a win-win for all involved.

Also highlighted is a road crossing project completed in Vancouver, B.C. The project was just 90 m in length using the pilot tube method, but what was noteworthy is that it was completed by the City of Vancouver staff – a notable first. With the successful completion, Vancouver will look for construction projects where trenchless can be cost-effective and efficient.

A further indicator of the market and how it is pushing its boundaries can be seen in Trenchless Technology's Projects of the Year, which were highlighted in the October issue. This year, two microtunneling projects were recognized as Honorable Mentions – the Twinning of the Etobicoke Creek Trunk Sanitary Sewer project in Toronto, and the Paradise Whitney Interceptor (Contracts 668 and 669) in Las Vegas. While the settings were vastly different – Pearson International Airport and the streets of Las Vegas – microtunneling allowed business to proceed as usual in each locale.

MICROTUNNELING SHORT COURSE

If you are looking for get more information on microtunneling, the Microtunneling Short Course – to be held Feb. 7-9, 2017, in Boulder, Colorado – is the place to be. Established in 1994, the Microtunneling Short Course has become the must-attend event for microtunneling professionals. The three-day course covers all topics related to microtunneling and features unique networking opportunities. There is more information on p. 25 and on the web at: microtunneling-shortcourse.com.

Jim Rush | Editor

Trenchless TECHNOLOGY

TBM TUNNEL BUSINESS MAGAZINE

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CROSSING THE BELT PARKWAY

INNOVATIVE SOLUTIONS HELP TO COMPLETE TRICKY MICROTUNNELING PROJECT IN NEW YORK

BY JIM RUSH

JRCRUZ OVERCAME A VARIETY OF CHALLENGES TO SUCCESSFULLY COMPLETE THE BERGEN BASIN SEWER RECONSTRUCTION PROJECT.

Located adjacent to JFK International Airport in Queens, N.Y., Bergen Basin has been recently listed as one of the most affected waterways in the New York metropolitan area by *Government Executive*. One of the culprits is a bottleneck in a sewer conveying flows from South Ozone Park to the Jamaica Wastewater Treatment Plant. When the sewer is overwhelmed, untreated sewage flows directly into Bergen Basin leading into the Jamaica Bay.

In a project designed to reduce overflows, the New York City Department of Environmental Protection (NYCDEP) undertook the Bergen Basin Sewer Reconstruction project, which involved the construction of a new interceptor sewer under the Belt Parkway.

The project, however, involved its share of challenges, including working in proximity to existing infrastructure while minimizing disruption for residents, businesses and commuters, particularly along the heavily traveled Belt Parkway. The groundwater table and flowing ground conditions added to the complexity of the job.

In the end, new technological approaches, innovative engineering solutions and good old-fashioned teamwork led to the successful completion of the project.

PROJECT BACKGROUND

In its efforts to alleviate CSOs in its territory, NYCDEP planned the Bergen Basin project with lead consultant Hazen & Sawyer and underground facilities designer and geotechnical consultant Mott MacDonald. In 2015, construction began on the $20 million Bergen Basin Sewer Reconstruction project, which was awarded to JRCRUZ Corp. The project involved building a new interceptor that would serve to increase conveyance capacity, alleviate the bottleneck and therefore reduce sewer overflows.

BERGEN BASIN SEWER RECONSTRUCTION AT-A-GLANCE

LOCATION: South Ozone Park, NY

OWNER: New York City Dept. of Environmental Protection

CONTRACTOR: JRCRUZ Corp.

ENGINEERS: Hazen & Sawyer (Prime); Mott MacDonald (CM, underground facilities, geotech)

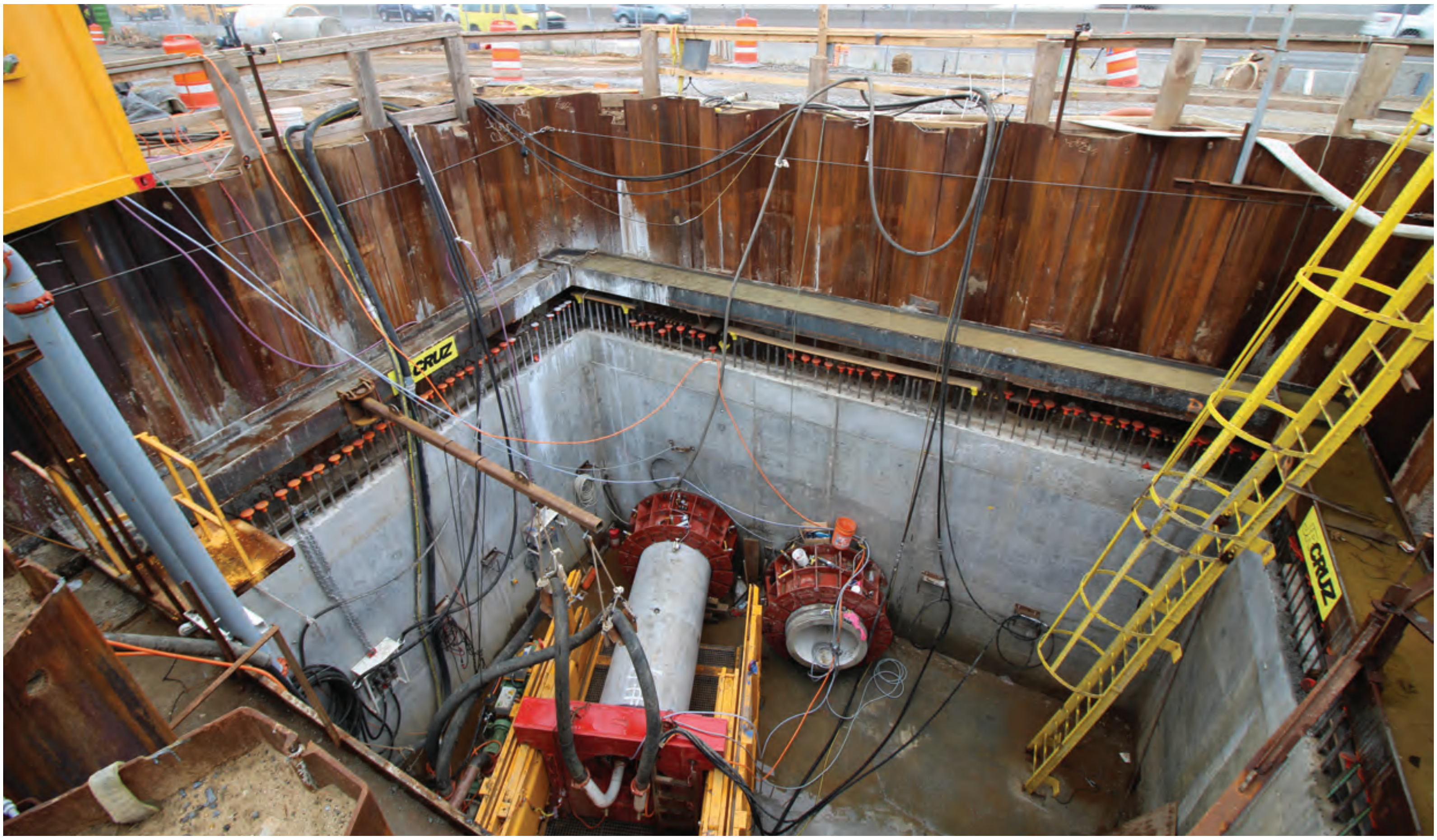
EQUIPMENT: Herrenknecht AVN 1200 66.5 in. OD; Herrenknecht AVN 800 45 in. OD; Derrick (slurry separation); Vianini RCP jacking pipe

SUBCONTRACTORS: Moretrench (ground improvement); CST (slurry management); Carson Corp. (HDD probes-Design Phase); Kmetz (HDD probes - VEP)

SCOPE OF WORK: 1 66.5-in. tunnel drive (~300 lf); 2 45-in. tunnel drives (~320 lf); 3 shafts (1 launch shaft, 2 reception shafts) at ~30 ft deep.

The project had its share of challenges from the start. The project work area was located adjacent to the Belt Parkway, a heavily trafficked thoroughfare serving Brooklyn and Queens, with the new interceptor crossing underneath the roadway. In this urban environment, minimizing disruption was paramount, leading to the decision to use trenchless methods.

The ground conditions included artificial fill and glacial outwash below the groundwater table. Planners expected a relatively uniform condition of cohesionless soils with flowing conditions. The ground conditions in combination with the size of the pipe to be installed led to microtunneling being selected as the trenchless construction method.



THE PROJECT INVOLVED TWIN MICROTUNNELS UNDERNEATH THE BELT PARKWAY, A HEAVILY TRAFFICKED THOROUGHFARE SERVING BROOKLYN AND QUEENS.

The primary scope of work comprised two microtunneling drives and the construction of three access pits – one drive pit and two receiving pits. One drive paralleled the Belt Parkway, while the other crossed underneath. However, the Belt Parkway crossing had one additional complication – an existing 42-in. storm sewer crossed the microtunnel horizon. As a result of the conflict, designers developed a plan that would reroute the storm sewer, which would have required major disruption to the Belt Parkway to enable construction of the sewer diversion. The portion of the storm sewer interfering with the new interceptor alignment would then be demolished to allow the tunnel to the pass, and then reconstructed and reconnected.

"It was very challenging tunneling under a major highway in close proxility to large utilities, including storm drains, water mains and a high-pressure gas main," said Alex Papric, project superintendent for JRCRUZ. "In addition, we were working in sandy ground below the water table, so it was critical to maintain the integrity of the excavations to prevent any ground loss."

VALUE ENGINEERING

When JRCRUZ Corp. was brought on board as the microtunneling contractor, it offered a Value Engineering Proposal (VEP) to deal with the conflicting 42-in. storm sewer. In looking closely at the alignment, JRCRUZ determined that by downsizing the 48-in. pipe crossing the Belt Parkway to 36 in., it could pass beneath the existing 42-in. storm sewer – with about 10 inches to spare. To provide sufficient conveyance capacity, JRCRUZ proposed using twin 36-in. crossings instead of a single 48-in. crossing.

"We looked at the elevation of the existing utilities and determined that if we maintained the existing invert elevation, we could install two 36-in. sewers under the existing storm sewer while maintaining the same capacity," said Matt Cruz, JRCRUZ Corp. "We were also able to reduce impacts on the Belt Parkway by eliminating the need to bypass, demolish and reconstruct the existing storm sewer."

The concept of using smaller pipelines had been discussed in the preliminary planning stage, but had not been pursued due to unknowns concerning the existing storm sewer – its exact elevation, whether it had been built with a cradle, and whether there were piles. The risks due to these unknowns resulted in the option being eliminated during the planning stage. Once the project was in construction, JRCRUZ was in a position to undertake more invasive investigations and confirm the viability of using twin 36-in. crossings.

JRCRUZ was granted access to the storm sewer and was able to perform test drills to confirm that the storm sewer was not built with a cradle that would impede the progress of the MTBM. Survey work was performed, including at the intersection points with the proposed microtunnel drives to confirm the elevations. Additionally, a crew drilled probe holes via horizontal directional drilling (HDD) along the proposed alignment of the additional crossing to check for the existence of obstacles. Two probes were drilled for each crossing – equating the 2 o'clock and 8 o'clock positions of the tunnel cross section.

The successful completion of the probe holes, HDD probes, and supplemental survey information gave NYCDEP and its consultants confidence to move forward with the VEP. Similar HDD probe holes had been used in the design phase to achieve a higher degree of confidence that there were no obstacles to the planned drive beneath the Belt Parkway.

"The use of HDD probe holes turned out to be a useful site investigation tool," said David Watson, project manager for Mott MacDonald. "I wouldn't recommend it in every instance, but in this case, the consequences of the MTBM getting stuck beneath the Belt Parkway justified the investment in this additional investigation. Sinking an unplanned recovery shaft in the middle of the Belt Parkway would have a nightmarish scenario."

Given the combination of low clearance, soft ground, short pipe lengths (4 ft), and the lack of a cradle (beneficial for clearance, but results in a more flexible pipeline), the decision was made to maintain a zone of grouted ground around the storm sewer to protect it in the event of settlement.

Moretrench was brought on as the ground improvement contractor and used permeation grouting to form a block of treated ground around the storm sewer. Hydratite joint seals were installed inside of the sewer at the joints to prevent grout infiltration into the sewer. To ensure that there was no damage to the storm sewer, a settlement monitoring program was set up along the microtunnel alignments.

"There was a very substantial settlement monitoring plan that included automated monitoring information that was available to all parties," said Grahame Turnbull, of JRCRUZ. "It was set up to create instant notifications if settlement exceeded predetermined thresholds, but we were able to complete the drives without exceeding those thresholds."

By using the contractor's VEP, the owner was able to realize significant savings compared to the project's originally estimated cost.

In dealing with the flowing ground conditions, JRCRUZ brought a new approach to the table by using innovative launch and reception shaft seals. These seals included a high-head, double-lip seal as opposed to a more traditional single-lip approach that can be susceptible to damage. The contractor's approach also included using a cartridge-type system preinstalled into the double-lip seal within shaft wall for the reception shafts.

"We were below the groundwater table in soils that would tend to flow, so we needed an approach to control water and soil during break in and break out," Watson said. "In the design we called for a zone of grouted soil outside of the launch and reception areas, but the contractor proposed using these customized mechanical seals in lieu of grouting. It worked very well for all three drives."

CONCLUSION

To successfully complete a project with myriad challenges requires innovative solutions and teamwork, according to Cruz. "We were able to complete the job successfully as a result of strong partnering between the owner and the designers," he said. "It is not always an easy process, but by working together we were able to bring an approach to the table that helped to mitigate risk and bring cost savings to the owner. If you do not develop good relationships with the people you are working with even the best planned project can fail."

Watson concurred. "The overall success of the project was about building relationships and working together to resolve problems as they arose. As designers, we held the contractor to a high standard, but at the same time we were flexible and willing to adjust the design. There were times when perhaps the parties did not perceive risk the same way, but we were able to resolve those issues and move the project forward."

As a result of the project, the owner was able to save money from its original estimate and the Bergen Basin and Jamaica Bay will ultimately see benefits through improved water quality, all the while reducing impacts on residents and businesses during the construction process.

JIM RUSH IS EDITOR OF TRENCHLESS TECHNOLOGY.

BURRARD STREET TRENCHLESS CROSSING

AFTER TAKING THE TRAFFIC IMPACTS, PEDESTRIAN IMPACTS AND DISRUPTION TO LOCAL BUSINESS INTO CONSIDERATION, CITY PLANNERS MADE THE DECISION TO COMPLETE THE BURRARD STREET CROSSING USING TRENCHLESS METHODS.

BY JASVINDER SINGH HOTHI

In March 2016, City of Vancouver Sewer Operations embarked on a major trenchless crossing at the intersection of Burrard Street and Broadway in Vancouver, British Columbia. The trenchless crossing was a part of the Burrard South improvement project. The project consisted of major infrastructure improvements from the foot of the Burrard Street bridge to West 17th Avenue, including a crossing of West Broadway. Improvements included the twinning of the existing combined storm main, road improvements, street repaving and installation of a new water main.

Traditionally, the majority of Vancouver's sewer infrastructure work has been completed using open-cut construction methods. While the City's construction crews are proficient in these methods, the demand for a less disruptive and more efficient solution was explored in this situation.

Burrard Street is a busy north-south arterial road within the City of Vancouver. West Broadway is a major truck, transit and traffic route connecting the city traffic from east to west. After taking the traffic impacts, pedestrian impacts and disruption to local business into consideration, city planners made the decision to complete this portion of the project using trenchless methods.

The crossing was over 90 m in length and was completed in very challenging conditions. In May 2015, trenchless technology was introduced into the City's Sewer Operations department and successfully utilized on four major in-house trenchless construction projects. The success of these four projects gave Sewer Operations the confidence to complete this project in-house as well.

The scope of the work included installing a separated storm and sanitary wastewater system. For the Broadway crossing, the decision was made to complete the work by trenchless methods using an Akkermann 4800 guided boring machine with 24- and 36-in. cutterheads. The length for both the storm and sanitary sewers was 92 m.

Shoring and excavation of the launch pit was not easy. With parallel underground utilities running on one side of the launch pit and the existing combined sewer main on the other, excavating and shoring the 40-ft long by 16-ft wide by 18-ft deep launch pit took considerable attention to safety. To make the excavation even more of a challenge, the bottom 10 ft of the excavation material was contaminated with hydrocarbons due to a gas station located adjacent to the launch pit. Because hydrocarbon levels were above allowable limits, the excavated material had to be handled with due care, and was transported and disposed of at an approved disposal facility by approved haulers.

After excavation of the launch pit, the crew started the process of pushing the pilot tubes, the laser was set for the desired grade of 2.27%. Even though the ground was contaminated with hydrocarbons, the soil along the alignment of the crossing was favorable for the pilot tube methodology. This was confirmed with boreholes and a sweep with ground penetrating radar. The pilot tubes were installed in just 16 hours. After the pilot hole was completed, crews completed an augering phase to enlarge the hole and then set up for the 36-in. Akkerman powered cutting head and the direct jack of the Hobas pipe. Direct jacking was another first for the trenchless crew. After some very minor setbacks the pipe was installed, and the crossing completed to the desired grade and invert.

After the storm main crossing was

CITY CREWS USED AN AKKERMANN 4800 GUIDED BORING MACHINE WITH 24- AND 36-IN. CUTTERHEADS TO DIRECT JACK HOBAS PIPE.

complete, crews started the set up for the 24-in. sanitary. Again, the pilot tubes were pushed across at the same rate as before. For the sanitary, the augers were downsized from 16 in. to 11.5-in., which would fit the 24-in. power cutting head. The smaller augers allowed for efficiencies in the augering process and reduced time to get across. As with the storm main, the sanitary was direct jacked at a grade of 2.27%.

The crew persevered and overcame many challenges while completing this project. Challenges included equipment failures, contaminated soil and minor scheduling delays, successfully complete the crossings while using the new methods.

This trenchless crossing was very large undertaking from inception to completion. City staff did a great job completing the project with less than one year of experience in trenchless construction, and the first time direct jacking Hobas pipe. This further demonstrated the great teamwork between the internal design and construction teams at the City of Vancouver. With continued success in trenchless construction, Sewer Operations will continue to look for construction projects where trenchless can be cost effective and efficient.

JASVINDER SINGH HOTHI IS SUPERINTENDENT OF CONSTRUCTION, SEWER OPERATIONS DEPARTMENT, FOR THE CITY OF VANCOUVER (B.C.). HE CAN BE REACHED AT JASVINDER.HOTHI@VANCOUVER.CA.

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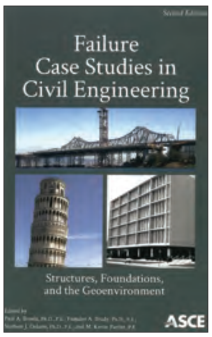

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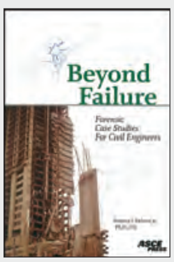

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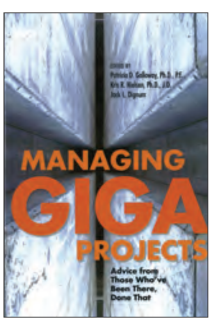

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NAVIGATING UNDER NEW YORK

CONTRACTOR UTILIZES REMOTELY CONTROLLED ROCK BORING MACHINE WITH PINPOINT PRECISION

CONTRACTOR CASE BORING CHOSE THE REMOTELY CONTROLLED MACHINE FOR ITS STEERING CAPABILITIES IN GROUND CONTAINING POCKETS OF HYDROGEN SULFIDE GAS THAT MEANT MANNED ENTRY MACHINES WEREN'T AN OPTION.

In the suburbs of Buffalo, New York, a large sewer project was underway. The North Aurora Pump Station Elimination project, for the Erie County Sewer District, was slated to replace the 40-year-old station with a gravity sewer to increase efficiency and save on energy as well as operational costs. But to do that required a particularly difficult crossing below a busy roadway and two houses.

"This was widely considered the most challenging aspect of the entire project," said Mark Case, President of Case Boring Corp. The company was subcontracted by general contractor Concrete Applied Technologies Corp. (Catco) to bore the 360-ft long hard rock crossing. The location was not the only challenge — the presence of hydrogen sulfide gas, combined with the hard rock geology at a small casing diameter of just 36 in. meant the contractor would need a unique solution.

INCREASED EFFICIENCY

The Erie County Sewer District began planning the replacement project running through the towns of Cheektowaga and Lancaster due to projected major expenditures to bring the North Aurora Pump Station up to current standards and service levels. The $7.8 million project was determined to be the most cost effective and beneficial solution for ratepayers in the sewer district, and would additionally redirect flows away from infrastructure with limited capacity.

In October 2015, general contractor Catco began installing more than 3,000 ft of 27-in. diameter sanitary sewer pipe, but a roadway crossing in a residential area would require specialized construction. Local contractor Case Boring Corp, specialists in road crossings as well as natural gas pipelines, was called in for the job. The family-owned company, which has been in business since 1962, employs up to 30 people in various crews on specialty construction projects.

LIMITED SPACE

The 23-ft deep crossing required accuracy, and went under a house and through a suburban backyard. "We bored from a backyard underneath a three bedroom ranch-style house in sub-development that was purchased by the sewer district. The crossing went 14 ft directly below the basement. Open cut was never a feasible option as the one house would have had to have been demolished, and quite possibly two houses. There were people living in adjacent houses during the construction and we holed through into another backyard-type space that separated a house from an apartment complex. There was no line of sight; it was a blind shot," explained Case.

Because of the location in a subdivision, there were also active utility lines that made open cut even less of an option. "We had underground electric, gas and water, cable TV lines, you name it," said Case.

The contractor set up a launch pit in the backyard of the purchased house and prepared for excavation with a four-man work crew. The Robbins Company aided in launch preparations for the contractor's unique solution.

A VACUUM TRUCK WAS USED FOR SPOIL REMOVAL, WITH ALL ROCK CHIPS BEING REMOVED THROUGH A VACUUM TUBE.

MACHINE SELECTION

Case Boring selected the Remote Controlled Small Boring Unit (SBU-RC), a new type of machine for small diameter (36-in. and smaller) utility installations that utilizes a vacuum system connected to a vacuum truck for muck removal.. The SBU-RC was chosen for several reasons, space being only one of them.

"We mainly selected it due to the presence hydrogen sulfide gas. Our other choice would have been 48-in. steel casing and a Robbins manned entry machine, but the larger diameter would have caused a design change that we would need to submit to the owner. Overall, it would have been more expensive and the gas was really bad news. The hydrogen sulfide dissipates naturally in an open trench so it's not a concern, but in a confined space it could be very dangerous," said Case. With the remotely operated solution, no one would need to be in the pit and the machine could be steered safely at the surface from an operator's station.

Limited site space was of course a factor, according to Case. "We were literally in people's backyards for this project and we found that, as opposed to other methods, the noise level was much less even with the vacuum truck than it would have been with traditional spoil removal and enabled us to work in a smaller footprint. The process of getting rid of spoils was also totally eliminated with the vacuum system, which streamlined operations." The work site consisted of a 40 ft x 60 ft area — a space that Case says would normally be closer to 100 ft x 120-150 ft.

The selected SBU-RC was equipped with a smart guidance system. The guidance system could show an operator projections of the future bore path so steering corrections could be made before the machine was ever out of line and grade. The feature was critical for the crossing below railroad tracks, which could not be shut down if problems occurred.

During tunneling, an operator in a cabin on the surface is able to adjust the steering within 2 degrees in any direction using an articulating front shield. While not for curved tunnels, the system is able to make necessary adjustments required for a straight, line-and-grade-sensitive tunnel like the Buffalo, N.Y., crossing.

The SBU-RC operates much like other SBUs, with the closest similarity to the Motorized SBU (SBU-M). A circular cutterhead and cutting tools excavates hard rock up to 20,000 psi or mixed ground conditions, while an in-shield drive motor provides torque to the cutterhead of up to 16,000 ft/lbs at 7-10 rpm. An auger boring machine (ABM), or in this case a pipe jacking system, provides thrust.

The machine, with its remote guidance, is able to stay on line and grade and lessen the possibility of an event below residences and a roadway that would require intervention. The entire setup is capable of excavating crossings up to 500 ft long. Due to the vacuum muck removal system, no separation plant is required.

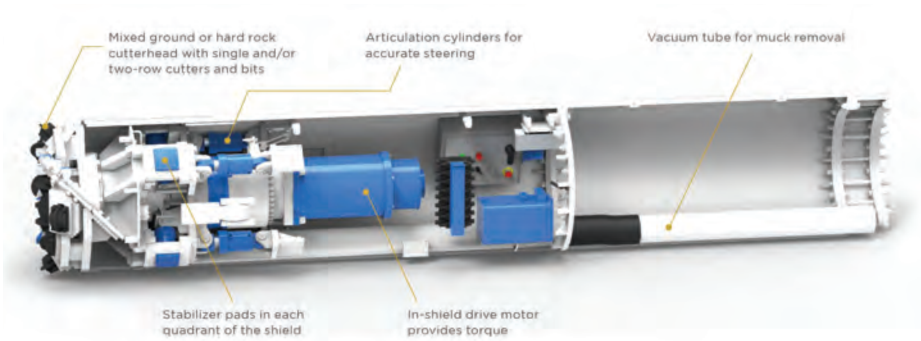
PINPOINT EXCAVATION

The SBU-RC was launched with Robbins Field Service guiding operation of the machine through shale rock of about 14,000 psi UCS. "During tunneling we had to deal with significant groundwater in the rock. We thought that might prove to be challenging given that the vacuum system doesn't work too well with water. But we talked with Joe Lechner from Robbins and we were able to work it out with Robbins' Field Service people. That system actually worked pretty well. It clogged up a couple times but with their help we were able to overcome that," said Case.

Jeremy Pinkham, Robbins Field Service Manager for The Americas, was at the site. "The shale was very sticky. We couldn't spray water through the cutterhead as that would cause it to clog. We injected water into the vacuum line and it worked well." The vacuum system was used along with a 5,250 cfm vacuum truck.

Despite the groundwater, advance rates began to ramp up. "The production rate on the project exceeded by two-fold what I had estimated. From start to finish we averaged

THE ROBBINS SBU-RC WAS LAUNCHED FROM A 23-FT DEEP BORE PIT IN THE BACKYARD OF A HOUSE PURCHASED BY THE PROJECT



A CUTAWAY VIEW OF THE ROBBINS REMOTE CONTROLLED SMALL BORING UNIT (SBU-RC).

25 to 30 ft per day even with welding 36-in. OD pipe sections," said Case. The whole crossing took about three weeks to complete, with the machine holing through into a small receiving pit in the second backyard.

"We ended up, after 360 ft, being about 7.5 in. off of line and our elevation was less than 5/8 of an inch low. The result was well within tolerances so it went right where we pointed it. We could easily correct if it went off course," said Case. After crossing excavation, 21-in. PVC carrier pipe was to be installed inside the casing.

For Case Boring, the performance of the machine made all the difference. "We had a tight tolerance, so coming out of the gate and being able to do something like that, with that type of accuracy in solid rock, was the highlight. The fact that the Robbins equipment could deliver on that was phenomenal," said Case.

The early completion of the project also had a positive effect. "The owners of the project and general contractor were good to work with and cooperative throughout the project. Everyone was extremely pleased. We finished the bore three weeks ahead of schedule."

And, while Case Boring doesn't currently have any other projects like the unique North Aurora Pump Station bore slated, they see a definite use for this type of technology on future utility installations. "This has opened our eyes to the possibilities of what could be done. The equipment exceeded all our expectations of what would be possible."

THIS ARTICLE WAS CONTRIBUTED BY THE ROBBINS COMPANY.

MICROTUNNELING MODERNIZATION

VADNAIS' NEWLY REFURBISHED MICROTUNNELING MACHINE IS LOWERED IN THE PIT FOR THE ARDEN ROAD PUMP STATION IMPROVEMENTS AND PIPELINE INSTALLATION IN AMARILLO, TEXAS. THE 1999 SOLTAU MTBM WAS REBUILT BY MTS PERFORATOR.

VADNAIS, MTS PERFORATOR BREATHE NEW LIFE INTO OLD MTBM

In the 1990s, microtunneling was still very much in its startup period in the United States. It wasn't until the late 1980s that the U.S had its first major microtunneling program, and owners, designers and contractors were still getting comfortable with this emerging technology.

One of the early adopters of microtunneling on the West Coast was Vadnais Trenchless Services, which began offering trenchless services in 1992. In 1999, Vadnais bought its first brand new microtunneling system from German-based manufacturer Soltau, which was a leading provider of machines to the U.S. market at that time.

While that machine served its purpose over the next decade and a half, technology for microtunneling machines continued to evolve – improved guidance and operations systems are allowing longer, more precise drives, while data logging and monitoring equipment provide for more information and analysis. With this is mind, Vadnais, in conjunction with mts PERFORATOR, completed a rebuild of the Soltau machine to bring it into the 21st century.

"Basically we overhauled the machine and replaced everything; essentially the only thing left from the original machine is the steel body," said Peter Turnbull, project manager for Vadnais Trenchless Services. "Essentially, it is now a new mts 1500."

The rebuild occurred in Vadnais' shop in Vista, California, under the watchful eyes or Roger Skog, Vadnais' equipment manager, and Andreas Thiele, mts PERFORATOR's lead engineer for microtunneling in the United States.

Thiele and mts PERFORATOR are certainly no strangers to Soltau equipment; mts was founded in 2000 by former Soltau employees, including Thiele, following the sale of Soltau to Wirth. Eventually mts was purchased by Schmidt Kranz Group, a German holding company, and it merged with PERFORATOR GmbH to become mts PERFORATOR GmbH. mts PERFORATOR opened a U.S. office in 2015 to extend sales and support to North American contractors.

For Vadnais, it had been using the Soltau machine regularly since acquiring it in 1999. However, seeing the need for updated equipment, and the need for more data, Vadnais opted to overhaul the MTBM.

"Engineers are asking us for more and more data and information, and the microtunneling drives are getting longer and longer, so we knew it was time to upgrade the equipment," Turnbull said. The rebuild itself took just under three months from strip down to startup. Skog and MTBM operator Nicholas Cashdollar indicated that the rebuilt machine vastly improved control and feedback.

TEXAS TEST

The newly built machine was put to work almost immediately to complete the Arden Road Pump Station Improvements and Pipeline Installation project for Amarillo Utilities. The job involved a crossing of I-27 for a sewer forcemain installation. SJ Louis was awarded the contract and subcontracted the microtunnel work to Vadnais.

This microtunneling portion of the project consisted of a single tunnel drive of 421 lf of 60-in. Permalok casing. Shafts for the microtunneling were trench shields approximately 15 ft deep built by SJ Louis.

The microtunnel was installed in dense clayey soils above the water table. Due to the nature of the clay, Vadnais used a Brandt centrifuge in addition to a Schauenburg MAB 300 separation plant. The project started on July 20, 2016, and was complete on Sept. 3, 2016, with the microtunnel drive taking about two weeks to complete.

“The machine performed very well,” Turnbull said. “The crew and the mts PERFORATOR support did a great job. We were very happy with the outcome.”

From Amarillo, the “new” mts 1500 will head to Sarasota, Florida, to complete the Lift Station 87 Phase 1 Microtunneling project for the City of Sarasota. The $7.7 million Sarasota project involves two microtunnel drives (690 and 592 lf) to install 60-in. Permalok casing. The project is unique in that is the city’s second attempt to complete the project, so it will be a high-profile job.

“The Amarillo job provided us with a good test case to get familiar with the newly configured machine and get everything working in top shape,” Turnbull said.

THE REBUILT MACHINE FEATURES MODERN CONTROL AND GUIDANCE SYSTEMS.

With the overhaul of the old Soltau machine and its subsequent completion of its project in Amarillo, Vadnais is turning its attention to two other Soltau microtunneling systems in its fleet. “By rebuilding the machines we able to bring old machines into the modern market,” Turnbull said.

Course Directors:

Timothy Coss
Microtunneling, Inc.

Levent Ozdemir
Ozdemir & Associates

Jim Rush
Benjamin Media, Inc.

COURSE TOPICS:

- Ancillary Equipment
- Construction Management
- Contractor Case History
- MTBM Production Estimation
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- Equipment Maintenance
- Ground Dewatering
- MTBM Head Design and Tool Selection
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- Layout and Logistics
- Long Distance Microtunneling
- Machine Innovations
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ULTIMATELY, AN OWNER WANTS HEALTHY COMPETITION AMONG A POOL OF CAPABLE BIDDERS.

PERILS OF PREQUALIFICATION

CONTRACTOR PREQUALIFICATION CAN BE AN EFFECTIVE RISK MANAGEMENT TOOL – IF PROPERLY APPLIED

BY DON DEL NERO

When a contractor has been prequalified for a project, it increases the chances of success on many fronts, making it an effective risk management tool. In fact, if the request for qualification is well-conceived and the prequalification process conducted strategically, it can be argued that contractor prequalification is the industry's most effective risk management tool.

Unfortunately, the full benefit of contractor prequalification is often not realized because the prequalification process is a victim of misadministration and with an evaluation process that is highly subjective. Specifically, prequalification documents are commonly ambiguous, too qualitative and subjective, and without clarity on how the shortlist of contractors will be developed. As a result, constructors walk away from the prequalification process believing that process bias in some form was involved, there was inequality in the prequalification criteria, too many contractors were shortlisted, and they were generally not given a fair shake.

Ultimately, an owner wants healthy competition among a pool of capable bidders. To ensure that that happens, it is important to keep the following points in mind in developing the prequalification development process (PDP).

PROJECT AWARENESS

This step in a prequalification development process (PDP) may seem unnecessary to the unsophisticated or inexperienced, but there are good reasons for project promotion in today's market. Like never before, owners are in competition with other owners to attract the best contractors, and few contractors are local to major tunnel projects. Additionally, there is a strong trend for European and other international contractors entering North American. To address this, project awareness and contractor outreach programs are recommended. Outreach should include notification of the project in as many industry media outlets and forums as possible to foster awareness.

Outreach should be started no later than the 30% design stage of a typical design-bid-build project and preferably three months before the RFQ for design-build delivery. The ultimate goal of a project awareness campaign and outreach program is to attract qualified, responsive and responsible contractors. Contractor interest in pursuing a project will be gaged by many factors, and owners should be aware of what can undermine the level of confidence a constructor has in an individual owner.

Typically, constructors will "walk" (not bid) if one or more of the following factors exist:

- Multiple bids are due in the same timeframe,
- Time to prepare qualification too short,
- Overall marketplace saturation exists,
- Unaccounted for risk in bid proposal,
- Unbalanced risk management program (i.e., risk shedding and not risk sharing),
- Use of non-standard front-end clauses,
- No geotechnical baseline report

TOP 10 PROBLEMS WITH CONTRACTOR PREQUALIFICATIONS

In the development of this paper, contractors were polled to assess how they view the prequalification process. While the process has its advantages, it is also has room for improvement. Below are the top 10 problems with the prequalification process according to contractors.

1. Technical requirements are too onerous
2. Too much information requested about subcontractors
3. Requires are too specific
4. Too much generic information requested
5. Scoring/rating system too subjective
6. Too much information requested about staff
7. Too little emphasis on claims history
8. Too much financial information requested
9. Too many contractors shortlisted
10. RFQ too long

or other contractual risk tools (i.e.. escrow bid documents, dispute review board, differing site condition clause, value engineering change proposal, etc.),

- Use of non-standard technical specifications,
- Owner has a bad reputation and/or is typically slow to pay,
- Too much emphasis on subcontractor qualifications,
- Highly prescriptive specifications that include too much engineer-derived means and methods,
- Poorly written, highly subjective, and ambiguous prequalification process,
- Project funding not secured,
- Use of a non-proven contract delivery vehicle, and
- The owner has never constructed a major tunnel project.

KEY EARLY DECISIONS

The number of contractors to shortlist is one of the most important of all decisions to be made in the PDP. Constructors can spend $50,000 or more to prepare a complex qualification package. Additionally, it is normal for a constructor to spend $100,000 or more in preparing a proposal for a major tunnel project. If the shortlist contains more than four to six constructors, it is likely some of the constructors will choose to decline bidding or simply "throw a number at it." This is often a cause for wide bid scatter on a project.

The author recommends five constructors be shortlisted such that if two drop-out, there are still three, giving many jurisdictions enough of a pool to award the work. The decision on the number of constructors to shortlist is even more important on a design-build project. The design-build team will spend upwards of $1,000,000 or more to prepare a proposal for a major tunnel project. If more than five teams are shortlisted, then there is inequity as the chances for award to anyone one team diminishes. If more than five teams are shortlisted, the owner should seriously consider a stipend for proposal preparation to foster fairness in the process. The other key early decision is to develop questions that can help assess the validity of criteria used to compare constructor qualifications. Many agencies struggle with how to select the correct criteria to differentiate between prequalifications.

The following questions will help in this regard.

- Are the criteria fair, concise, complete, and unambiguous?
- Are the criteria onerous for the constructor to address?
- Are the criteria relevant to the decision process?
- Are the criteria too subjective?
- Can the criteria be manipulated in the prequalification package?
- Will the criteria conflict with the Quality Assurance article contained in most thee-part technical specifications?

It is not unusual for an owner to send out a draft of the RFQ for contractors for review and comment. This will engender confidence in the contractors that the owner is fair and balanced and likely translate into lower bid prices. If owners give contractors a "fair shake" in the RFQ process, they will likely find a level of interest beyond what they might expect otherwise.

DEVELOP LIST OF PROJECT-SPECIFIC CRITERIA

Development of project-specific criteria to apply in the comparison of prequalification packages is one of the more critical steps in the PDP. Criteria can generally fall into technical and non-technical criteria. Specific categories of criteria to be considered include financial, legal, equipment inventory, staffing, safety performance, backlog, and work history (i.e., schedule adherence and total project cost compared to initial bid cost). Considering that successful tunneling is primarily related to staffing and means and methods, the criteria should focus heavily on those areas.

Provided below are tunnel-specific criteria to consider in evaluating how prequalifications will be compared.

- Staffing Capabilities

- Equipment Inventory
- Financial Capacity
- Work/Project History

Various levels of detail are available for each of the above topics, and it is not necessary to delve deeply into each depending on the nature of the project. The prudent thing to do is to evaluate the project schedule, cost, complexity, risk profile, funding, and funding source then compare these factors to help select the most appropriate criteria.

SELECT PREQUALIFICATION SCORING METHOD

To properly assess the quality and capability of a contracator, some type of scoring or rating system should be applied to the prequalification review process. The key considerations in selecting a scoring method are fairness and objectivity, which is easily said but hard to accomplish. In general, courts have ruled that scoring systems are appropriate as long as they are rational and documented. (The author will let attorneys define rational!)

Discretionary scoring is discouraged but can be used if some framework is applied so the subjective judgements by evaluators are bounded or bookended. Hardly ever is the comparison of contractor prequalifications completed on a purely ordinal ranking (prequalifications ranked 1st, 2nd, 3rd, etc.) without some scoring basis, although this method has held up in courts. The author is not a fan of ordinal rankings with only subjective observations and evaluations as this approach has been fraught with bias and protests. One person views qualifications in a different way that another person might.

The author strongly recommends some form of a scoring system be applied for the comparison of prequalification packages. The primary reason is that scoring systems are an efficient way to aggregate complex information. Although no scoring system is perfect and all scoring systems have some degree of subjectivity in them, they do provide a framework within which rational comparisons can be made. Very often, contractors are in the dark about how the shortlist was developed. One of the key benefits of a scoring system is the reduction in ambiguity in the contractor selection process. The ideal situation is that whatever scoring method is used it provides the selection committee with the tools to make an informed and intelligent decision.

There are many rating or scoring systems that can be applied. Any system can be used as long as it provides meaningful distinctions among prequalifications of various merits.

An example combination method for evaluation and scoring of respondents packages from a major metropolitan agency is reflected below.

- Organizational Management Approach - 20 points
- Past Project Experience and Performance - 40 points
- Key Personnel Qualifications and Experience - 30 points
- Safety Program and Performance - 10 points
- Pass/Fail Criteria

Although this example seems appropriate, it falls short in several areas. For one, equipment inventory is not considered. Means and methods of construction are where a project is won or lost, so not including some evaluation of equipment is not recommended. Also, the point totals for each category were not defined in some framework to establish how the points are assigned. Without that framework, a high level of subjectivity is introduced into the process.

A scoring system with a small number of gradations (poor, fair, and good) will not provide enough discrimination between various levels of proficiency. Even systems that use adjectival descriptions like excellent, good, fair, and poor are less useful in communicating the differences between prequalifications than systems with far more gradations. A vital requirement for an owner is to document the relative strengths, deficiencies, significant weaknesses, and risks supporting the evaluation of contractor prequalifications. Also, the review process of contractor prequalifications should include the same evaluators for each package submitted.

CONCLUSIONS

The author believes contractor prequalification is one of the most significant risk management tools for the tunnel industry, but one that is greatly underutilized. It is often an ineffective risk management tool because the PDP does not receive the critical thinking needed along with the process often involving significant subjectivity. When the PDP is done methodically and strategically, it has numerous benefits. If the recommendations in this paper are followed, it is much more likely our highly esteemed owners, who provide us a living and a career, will be much more satisfied with the outcome of infrastructure development.

ACKNOWLEDGEMENT

This paper is condensed from a paper titled “Contractor Prequalification – An (In)Effective Risk Management Tool,” which presented at the 2014 Tunnelling Association of Canada (TAC) conference in Vancouver, B.C.

DON DEL NERO IS A VICE PRESIDENT WITH STANTEC AND THE TUNNELING AND TRENCHLESS ENGINEERING PRACTICE LEADER.

24TH ANNUAL MICROTUNNELING SHORT COURSE SET FOR FEB. 7-9

THE 2016 MICROTUNNELING SHORT COURSE BOASTED A RECORD 140 DELEGATES.

Since its inception in 1994, the annual Microtunneling Short Course has been the premier event devoted to advancing the industry. Much like the microtunneling market itself, the Microtunneling Short Course has evolved to meet the needs of professionals new to the market, as well as seasoned veterans looking to catch up on the latest developments. The 24th annual course returns to Boulder, Colorado, Feb. 7-9, 2017, with the one-day Pilot Tube Seminar on Feb. 6.

"It's been almost 25 years since we started the Microtunneling Short Course, and it is amazing to see how much the industry has grown and continues to develop," said Tim Coss of Microtunneling Inc., who serves as Course Director with Levent Ozdemir, tunneling consultant. "Each year we add new topics to the agenda because of the technical advances the industry is making all the time. We continue to expand the boundaries of what we are capable of doing with microtunneling."

Since the inaugural event in 1994, the Microtunneling Short Course has drawn approximately 3,000 participants. In 2016, the course was held in Boulder for the first time and drew a record number of participants (140).

The hallmark of the program is the technical presentations, which are given by real-world professionals including contractors, consulting engineers, utility owners and equipment manufacturers. Presentations cover all aspects of microtunneling, including planning, design, construction, site investigation, legal issues and any other topic relevant to the industry.

"We will continue to build on our vast history of success and innovation by offering a forum to exchange ideas and build relationships while learning from the leaders actively working in the field," Coss said.

The Microtunneling Short Course is being held at the Byron R. White Stadium Club on the campus of the University of Colorado, with the Pilot Tube Seminar being held at the nearby Balch Fieldhouse. The Awards Banquet and Reception are being held at the historic Boulderado Hotel in the heart of downtown Boulder.

In addition to classroom instruction, the Microtunneling Short Course offers a wealth of networking and social opportunities, the highlight of which is the Awards Banquet featuring the presentation of the Microtunneling Achievement Awards as well as a keynote speaker. In fact, the course has become the leading gathering place for microtunneling professionals, attracting representatives from the top contracting and design firms involved in the market.

"The microtunneling community is such a tight-knit group of contractors that the annual course has evolved into more of a family get-together to exchange ideas and best practices while sharing experiences," Coss said.

The Microtunneling Short Course is intended for public works and utility officials, engineers, planners, managers, contractors, and equipment manufacturers involved in any phase of microtunneling.

The Microtunneling Short Course is presented by course directors Coss and Ozdemir, in conjunction with Benjamin Media Inc., publisher of *Trenchless Technology* and *TBM: Tunnel Business Magazine*.

For more information visit microtunnelingshortcourse.com.

THE PLANNING AND CONSTRUCTION OF MICROTUNNELING PROJECTS

BY TODD M. KILDUFF AND PAUL WILKINSON

The path to a successful microtunnel installation – or any tunnel project, for that matter – starts well before the first pipe is ever pushed into the ground. Critical components of the pre-construction phase include planning, collecting data, soil/rock testing and presentation of the geotechnical data and bidding documents. Post award, the contractor is tasked with selecting the most appropriate mictotunnel boring machine (MTBM) system, as well as slurry separation equipment, for the anticipated ground conditions. During the construction phase, the contractor must then adhere to accepted best practices. In this article, the authors discuss some of the most critical considerations in putting a microtunneling project on the path to success.

A SUCCESSFUL MICROTUNNELING PROJECT STARTS WELL BEFORE THE FIRST PIPE IS PUSHED INTO THE GROUND.

MICROTUNNELING DESIGN

PLANNING

The first consideration is determining the pipeline line and grade. This may sound simple, but locating the position of your pipeline requires an intimate understanding of the ground conditions, and the microtunneling equipment and its capabilities, in order to save costs and avoid problems during construction. Following is some advice in planning your line and grade:

1. Seek local knowledge of past construction projects. If you can obtain previous documents from projects completed near the proposed site, you are that much ahead in getting started on planning the line and grade of your project
2. Physically establish a line of sight between shaft locations. Sometimes you can identify obstructions like a bridge support pier or sheet pile wall along the proposed tunnel route.
3. Beware of existing utilities and service manhole inverts that "straddle" the tunnel route. It is not unheard of for "as built" drawings to have been incorrect by anything from 1 to 10 ft – or more. Pothole all potential interferences when feasible.

When you have a clear line and grade, then you can turn to the ground conditions. Geologic factors such as mixed face conditions could be a real challenge and should be avoided if easily solved by raising or lowering the alignment. Pay attention to the past or present uses of the project site. Railroad embankments are notorious for being landfills containing old railroad remnants such as ties, fishplates, old rail and other deleterious materials that can stop an MTBM. Additionally, some soils in these areas contain heavy contamination that can require special handling to dispose of the muck, driving costs higher. Recognizing these potentials early and realigning the alignment to avoid them can save tremendous cost and delay.

Many times with gravity sewer lines, the design engineer decides location without collaborating with the geotechnical engineer who should be familiarized with the capabilities of a microtunneling system. Too often, we have inherited projects in which slurry microtunneling is specified and the pipeline is located less than 10 ft below the ground surface in loose, saturated silty sands or other soils susceptible to hydraulic fracturing or settlement.

Most MTBMs have the ability to counter-balance existing earth and ground water pressures (i.e., they measure the pressure being exerted on the machine and the operator sets slurry charge pressure to counter-balance the ground pressure reading). In conditions where you have shallow or no ground water pressure readings, it becomes increasingly difficult to monitor the face pressure and counter balance it. In this situation the recommendation is the slurry charge pressure should be <0.1 bar per meter (3.28 ft) depth of cover (i.e., the equivalent of a column of water preventing the charge slurry from migrating to the surface).

Where there is shallow cover it becomes much more likely for the slurry pressure to overcome the overburden pressure resulting in hydraulic fracturing of the ground. Or, on the flip side, too little pressure is applied causing a sink hole. An easy way to reduce the potential risk of hydraulic fracturing or settlement is to provide more cover above the MTBM.

The length of individual drives and location of shafts should be preplanned to provide a cost-effective solution. Engineers can be familiar with past projects that achieved record drive lengths, some exceeding lengths of 1,500 ft or more, and tend to want to push the capabilities of the system based on these rare accomplishments. The reality is microtunneling becomes exponentially more difficult for drive lengths exceeding about 1,700 lf. Most long drives will require the utilization of multiple interjacking stations (IJS). The process involves activating the IJS near the MTBM head, causing separation in the pipe string typically not more than about 12 in., then that separation is closed back up by the main jacking system in the shaft. Now imagine a 1,700-plus-ft drive. It is not uncommon to have up to five IJSs in the pipe string. The process would involve this extension and closure five separate times to advance a total of 12 in. It is time-consuming and costly and it is likely that it may have been much more cost-effective to have designed the project with two 850-ft drives, perhaps with one or two IJSs.

COLLECTING DATA (SUBSURFACE EXPLORATIONS)

It is hard to believe after all the papers and articles on preparing contract documents and geotechnical reports, some owners still are letting contracts for trenchless installations with little to no subsurface information. Often, the owner feels covered by including contract language that the contractor is responsible for obtaining geotechnical data. The contractor, however, is not a specialist in geotechnical engineering and it is not in the benefit of the project to "pass the buck" to the contractor at the time of construction. The contractor's objective is to build the job as cost-effectively as possible and this arrangement can lead to deficient number and quality of test borings performed to plan the project. It is the owner's responsibility to perform the necessary – but not an excessive – number of borings, test pits and lab tests to provide contractors with sufficient information to successfully plan, bid and build the project.

With regards to what constitutes sufficient subsurface exploration, there are many guidelines and articles in the literature. It is the authors' preference to initially take borings at a relatively wide spacing (300 ft) then review how the subsurface data correlates while in the field and perform more borings if we are seeing a high variability in the subsurface conditions. At a minimum, for any length drive there should be borings at the launch point and reception point.

Also, borings alone are usually not the only answer for field investigations. One of the most common differing site condition claims for microtunneling projects is the encountering of nestled cobbles and boulders. Borings cannot tell you if you have cobbles and boulders, they can only provide indications. Test pits or large diameter bucket borings are essential in ground where cobbles and boulders are suspected to exist. I recommend every subsurface exploration program include some sort of test pit or auger drilling to investigate the subsurface for cobbles and boulders if there is potential for them to exist.

Additionally, the borings and test pits need to go deep enough to extend through the pipeline grade and at least 1.5 diameters below the pipe invert so as to be aware of potential mixed face conditions or soft deposits that may cause the machine to dive.

LABORATORY TESTING

Standard index testing is routine and cost effective to provide the engineer reliable information. Grain size analysis with hydrometers to obtain the fraction of clay are also critical to MTBM projects in which separation equipment is utilized. Data will be utilized to determine screen sizes, number of hydrocyclones and the potential use of a centrifuge system.

If it's a rock tunnel, then core samples must be collected recording RQD, percent recovery in the field and then performing UCS, Cerchar Abrasivity and Brazilian Tensile testing in the laboratory to understand the properties of the rock.

GEOTECHNICAL REPORTS (GDRS AND GBRS)

No microtunneling project is too small to not warrant preparing a geotechnical data report (GDR) and a geotechnical baseline report (GBR) to be presented with the bidding documents. Many owners and engi-

neers are accustomed to using GDRs and GBRs on large tunneling and underground projects and may feel that level of effort is not justified for a relatively short, small-diameter utility tunnel. Don't believe it! The GDR-GBR format has proven to be effective to share risk and reduce claims and cost while providing a team approach that is critical for a successful project. Just because your project is $1 million compared to $100 million, there is an appropriate size GDR and GBR that can complement your project's size, budget and condition.

BIDDING DOCUMENTS

When preparing drawings and specifications, the authors like to stick by the "Goldilocks" rule of thumb: Don't do too much and don't do too little. Overly detailed drawings and specifications which lock a contractor into a box remove the one entity that may have the best thoughts, ideas and insights on how to procure and build the project most cost-effectively. A bid package that does not leave the door open to allow contractors to exercise innovations will likely result in a more expensive project.

Conversely, if the bidding documents are silent on too many critical issues, it can lead to the same high-cost result. The owner's engineer should have performed a review of the ground conditions and assessed the feasible excavation methodologies and offer methods that provide the highest potential for success. Not specifying the feasible methods could open the door to overly aggressive contractors that are willing to risk simpler open-face methods in highly adverse ground conditions that lend themselves to more sophisticated systems.

MICROTUNNELING CONSTRUCTION

Assuming the foregoing has been adequately put in place, a microtunneling project is headed in the right direction. At this point, it is imperative to understand and interpret the information that has been presented and select the most appropriate microtunneling system to excavate the ground while maintaining optimum productivity and minimizing risk.

The authors' approach to constructing a microtunneling project can be summarized in five stages:

Stage I - Determine if the microtunneling system has the capabilities to work at the depths and attain the drive lengths/alignments laid down in the tender documents.

NO MICROTUNNELING PROJECT IS TOO SMALL FOR A GEOTECHNICAL DATA REPORT (GDR) AND A GEOTECHNICAL BASELINE REPORT (GBR).

Stage II - Determine the status quo of the tunnel face conditions. Do you need to win the ground, prevent in-rush or a combination of both while counter balancing ground water pressures to a greater or lesser degree? Establishing head-on conditions dictates the optimum cutterhead configuration you are looking for, i.e., rock head, open head, semi-head or a customized project specific variant. It also dictates how you manage conditioning of the slurry for face support, where required and cleansing of the slurry for optimum collection and transportation of excavated material.

Stage III - Ascertain how the excavated material will be transferred/processed from the cutterhead usually via a crusher to the slurry chamber of the MTBM. Lack of understanding of this digestion process can lead to projected expectations/returns be-

POINTS OF INTEREST

- Proficient microtunneling contractors base success on project term averages, not one-off glory day performances and tend to adopt an engineered risk reduction approach before they consider launching a machine.
- It is not always a great idea to use a machine just because you have it the yard.
- Try to operate WITHIN the limits of a microtunneling system, it is always a good idea to have something "in-hand" for the unexpected.
- Plan ahead for risk reduction/redundancy measures – they can often be practically impossible to introduce once the work has commenced.
- It is always good to balance project quantum's microtunneling system vs. overall project expenditure.
- If in doubt seek advice, ideally from an independent practitioner who does not have a vested interest and who has practical experience. Additionally confirm if the advice is collaborated by others.
- Record/report and communicate with the client. Where conditions differ to the extent that performance is substantially affected, the contractor will be able demonstrate the same and have reasonable recourse to recover any additional costs incurred. Remember in life-cycle terms the contractor is merely a donor, the client has an asset for circa 50-plus years and should be the party who pays for reasonable costs in producing the same.

ing greatly diminished. It also becomes a finite point in MTBM selection as this is an area where there are subtle but significant variants between manufacturers.

Stage IV - Define the size range/volumes of processed materials being delivered to the slurry chamber for collection by the charge slurry medium and return transportation as discharge slurry for remote separation. Establishing volumes of particles >3mm, >70μm and potentially and more importantly <70μm dictate slurry separation plant requirements, e.g. primary conveyor units, secondary de-sander with hydro-cyclones units and tertiary centrifuge plants with flocculation dosing units.

It would not be unfair to state that the evolution of slurry separation equipment/techniques in the microtunneling industry has been a "slow starter." More to the point it is more appropriately viewed as the "runt of the litter" especially when you consider the propensity of past tendencies to dump residual slurry into drains and sewers or into waterways and replenish with clean water. Nowadays greater awareness and regulatory controls dictate this is no longer acceptable and techniques have developed to the point where competent microtunneling practitioners prescribe having suitable separation as a pre-requisite. This is also backed up by the "math":

- If optimum slurry for the prevailing ground conditions is not delivered to the MTBM, it cannot collect 100% of the excavated material, which effectively "chokes" the machine and reduces progress.
- Downtime incurred, trucking away contaminated slurry and replenishing with clean water is lost production time.
- Generally you will incur costs for trucking away/replenishing services
- Pumping inadequately cleansed slurry through the microtunneling system unnecessarily increases equipment wear and tear.

Stage V – Understand the requirements of producing safe working and receiving shafts for launching and recovering the MTBM. Shaft construction methods are many and varied with selection often taking into consideration locally available materials, techniques and proficiencies. However, the primary driver is dealing with ground water conditions and providing a safe working environment within these "temporary works" structures. Shafts should be capable of withstanding pre-determined jacking loads required to propel the MTBM over the tunnel drive length and facilitate safe entry into the ground and exit out of the ground. Never forget launch/recovery of the MTBM are generally recognized as the most difficult aspects of microtunneling and once in the ground operations become relatively straight forward.

Pay particular attention to:

1. Drive shaft thrust wall loading requirements including ground stabilization where required.
2. Drive and reception shaft head wall sealing requirements.
3. Entrance and exit gland seal arrangements with potential built in redundancy.
4. Prevention of MTBM/tunnel line thrust back.
5. Drive shaft/reception shaft ground stabilization requirements for MTBM launch/recovery.
6. Safety, dewatering, gas monitoring, safe entry and emergency egress.

An engineered risk reduction approach along with properly prescribed jacking pipes and annulus lubrication regime should result in a successful conclusion for the project.

TODD M. KILDUFF, P.E., IS A CONSULTING ENGINEER WITH KILDUFF UNDERGROUND ENGINEERING INC., AND PAUL WILKINSON IS A CONSULTING ENGINEER WITH WLK MICRO SERVICES AND FORMER GENERAL MANAGER FOR ISEKI EURO.

ALABAMA

MADISON

Terris Tatum Tennessee River Intake Facility

Bradshaw Construction Corp.

Bradshaw Construction Corp., working with J. Cumby Construction Inc., started mobilization Aug. 1, 2016, for in preparation of installing 388 lf of 60-in. x 0.75-in. steel casing by microtunnel for a water intake for the Madison Utilities Board. Water intake screen airburst lines will be installed inside the intake once mining operations are complete. The anticipated intake ground conditions are clayey and gravelly sand with potential limestone lens. Information: Mike Wanhatalo, mwanhatalo@bradshawcc.com.

CALIFORNIA

DALY CITY

PG&E Martin Substation

Vadnais Trenchless

This project included three tunnel drives totaling approximately 1,100 lf of 24-in. ID sacrificial steel casing (Thru-Pipe). Drive lengths varied from 240 lf to 480 lf. Shafts for the microtunneling were 18 to 35 ft deep. The microtunnel was installed in silty clays and sands with debris and unmarked utilities approximately 5 to 15 ft below the groundwater table.

The tunnels were installed inside an existing PG&E facility. This project utilized a sacrificial steel casing that was displaced with the permanent gas pipeline. Two critical San Francisco water mains were crossed and several unknown utilities and debris were encountered along the tunnel horizon. Work started on April 6, 2016 and was complete on June 23, 2016.

Vadnais was the trenchless subcontractor for ARB Inc. PG&E was the owner and engineer. Crews used an Iseki TCC500 26-OD MTBM. The bid value of microtunneling was $1.268 million.

MANTECA

Family Entertainment Zone Infrastructure Improvements Phase 1 – Underground Utilities

This $2.8 million project consisted of a single tunnel drive of 315 lf of 78-in. Permalok casing with 48-in. RCP carrier pipe; three drives of 48-in. ID RCP totaling 1,590 lf; and a single drive of 300 lf of 42-in. Permalok casing with 18-in. DIP carrier.

Shafts for the microtunneling will be a combination of trench shields and sheet piles approximately 20 to 25 ft deep. The microtunnels will be installed in soils consisting of silts, sand, and clay below the groundwater table and include two critical crossings of Highway 120.

Work is scheduled to be performed between November 2016 and April 2017 using an Iseki TCC800 (42-in. OD); mts 1500 (60-in. OD) and mts 1650 (78-in. OD).

The owner is the City of Manteca. Knife River Construction is the prime contractor. NV5 Inc. is the engineer.

MARINA DEL REY

Venice Dual Force Main and Venice Pumping Plant Generator Replacement Project

Vadnais

This $88 million project for the City of Los Angeles Department of Public Works involves the construction of a new 54-in. diameter force main sewer extending approximately 10,392 lf, which originates from a newly constructed manifold adjacent to an existing pumping plant. From the manifold the alignment will proceed east, then southeasterly and cross beneath the Marina Del Rey and Ballona Creek channels, continue traveling south within Pacific Avenue and ends at the Coastal Interceptor/North Outfall Sewer (CIS/NOS) Junction structure.

The majority (~9,450 lf) of the new 54-inch line will be constructed using microtunneling. Most of the microtunneling will be direct-jacked RCCP and approximately 2,800 lf of 80-in. Permalok casing with RCCP Carrier will also be installed. The cut-and-cover construction method will be used for the remaining 900 lf.

The project also consists of the demolition of the existing equipment and procurement and installation of new generators, along with ancillary controller, transfer switches, plus exhaust and cooling systems at the Venice Pumping Plant. Two new 750 kW (480 V) generators, and one new 1,500 kW (480 V) generator with complete emissions control systems and fluid storage will be furnished and installed.

Work is scheduled to begin in December 2016 and be complete by November 2019. Crews will use three mts microtunneling systems: mts 1500 (70-in. OD), mts 1650 (70-in. OD) and mts 1850 (80-in. OD).

NEWARK

PG&E L-153 Interstate 880 Crossing

Vadnais

This $861,000 project includes a 370-lf microtunnel drive of 30-in. ID steel casing. Shafts for the microtunneling will be approximately 36 ft deep and must be constructed using watertight methods. Cutter soil mix/jet grout shafts will be used. The project involves a 40-ft diameter jacking shaft and 35-ft diameter reception shaft. The microtunnel will be installed in clay approximately 5 ft below the groundwater table.

The tunnel will be installed underneath a heavily travelled section of Interstate 880 in Northern California. This project utilizes a sacrificial steel casing that will be displaced with the permanent gas pipeline.

Work is scheduled to be performed between December 2016 and February 2017 using an Iseki TCC600 with a 32-in. OD.

ARB is the general contractor for Pacific Gas & Electric.

SAN JUAN CAPISTRANO

San Juan Creek 30-in. ETM Replacement

Vadnais

This $3 million project included a 300-lf microtunnel drive of 48-in. Permalok steel casing with 30-in. Fusible PVC carrier along with some open cut work, tie-ins, abandonment and restoration. Shafts for the microtunneling were approximately 50 ft deep and were constructed using the Drilled CMP method. The jacking shaft was 21-ft d and thee reception shaft was 14-ft diameter. The microtunnel was installed in predominately silty clay with occasional gravel approximately 12 ft below the groundwater table.

Crews used an Iseki TCS900 with 48-in. OD. The owner was Moulten Niguel Water District with Dedek Engineering as the designer.

WILMINGTON

Valero TI Freeway Line Crossing

Vadnais

This $450,000 project consists of a 152-lf microtunnel drive of 42-in. ID steel casing. Shafts for the microtunneling will be approximately 12 ft deep and will be constructed of interlocking sheet piles. The microtunnel will be installed in sandy soils at the groundwater table. Contaminated soil is expected through the entire alignment.

The tunnel will be installed underneath the Terminal Island Freeway in the very busy Port of Long Beach. Microtunneling is being utilized due to the high VOC content in the soils of the refinery. Crews will use an Iseki TCC800 (42-in. OD).

Work is scheduled to be performed between October 12, 2016 and November 2, 2016.

The owner is Valero Companies. California Spectra Instrumentation Inc. is the prime contractor and SPEC Services Inc. is the engineer.

COLORADO

PARKER

WISE Water Connection

Vadnais

This $723,000 project consisted of a single tunnel drive of 650 lf of 38-in. Permalok casing with 20-in. ductile iron pipe carrier. Shafts for the microtunneling were a combination of trench shields and sheet piles approximately 20 ft deep. The microtunnel was installed in soils consisting of silts, sand, clay and gravel below the groundwater table.

Crews used an Iseki TCC800 (39-in. OD) to complete a critical crossing of Highway E-470. The project started on Aug. 24, 2016 and was complete on Oct. 6, 2016.

The owner was Stonegate Village Metropolitan District. Iron Woman Construction was the prime contractor and TST Infrastructure LLC was the engineer.

FLORIDA

SARASOTA

Lift Station 87 Phase 1 Microtunneling

Vadnais

This $7.7 million project is designed to replace a previously attempted project. It involves a 870-lf section of 24-in. HDPE by HDD and two microtunnel drives to install 60-in. Permalok casing and 36-in. liner. The project includes grout abandonment of previously installed tunnels and removal of working shafts from the previous attempt. For microtunneling, crews will use an mts

1500 microtunneling system and Schauenburg MAB 300 Separation Plant.

The project is in progress and on schedule. It started in late July 2016 and is expected to be complete in August 2017.

HAWAII

KANEOHOE

Kaneohoe-Kaiula Sewer Pipeline

James W. Fowler Co.

The Kaneohe/Kailua Sewer Tunnel will increase the reliability of the aging Windward Oahu sewerage system by conveying flows by gravity from the Kaneohe Wastewater Treatment Plant to the Kailua Regional Wastewater Treatment Plant, replacing an existing pump station and force main system. Additionally, the tunnel will store wet weather flows during heavy rain storms.

Fowler was the microtunnel subcontractor for the Southland/Mole JV to install 1,540 ft of 60-in. sewer pipe and steel casing in four drives of 177, 360, 425 and 578 ft.

Flows from the existing Kailua Regional Wastewater Treatment Plant will be diverted to a new pump station by a new near-surface pipeline installed via microtunneling. The microtunneled pipeline will be located under/near an existing DAFT Control building supported by shallow spread footings, existing 24- and 36-in. force mains and an existing diversion structure.

The soil conditions include highly variable ground consisting of primarily squeezing and flowing ground conditions. The soils include fill, alluvium, lagoonal deposits consisting mainly of saturated, highly compressible, soft to medium stiff clays and very loose to medium dense clayey coralline sands and gravel with extremely weathered basalt gravel and basalt.

MARYLAND

WALDORF

US 301 Force Main

Bradshaw Construction Corp.

Bradshaw Construction Corp. has recently completed the installation of 355 ft of 43-in. steel casing and 24-in. DIP under Smallwood Road as part of Charles County's US 301 Force Main Project. The casing was jacked behind a microtunnel boring machine in silty sand. Information: Doug Piper, dpiper@bradshawcc.com

NORTH CAROLINA

CHARLOTTE

Briar Creek Relief Sewer Phase III

Bradshaw Construction Corp.

Bradshaw will begin work on a project to install 60-in. steel casing for 42-in. gravity sewer underneath boulevards and railroads. Three tunnels totaling 378 lf will be installed by microtunneling. The subsurface conditions vary from soft ground of clay and silt, partially weathered rock, and granite. Bradshaw will also be installing liner plate launch shafts for the tunnels. The project is scheduled to be completed from September to December 2016. Information: Mike Wanhatalo, Project Manager; mwanhatalo@bradshawcc.com

RALEIGH

Crabtree & Upper Pigeon House Interceptor Tunnels Project

Bradshaw Construction Corp.

Bradshaw is in construction on a $21 million sewer project that consists of approximately 3,000 ft of one-pass and two-pass microtunneling at 11 locations. The City decided to let a separate trenchless general contract in advance of the 30,000 ft of future open-cut pipeline contracts. Casing size is 60 and 72 in. and the FRP pipe is 42 to 57 in. Subsurface conditions range from alluvium and residual soil to partially and unweathered hard granitic rock and mixed face. Information: Mike Wanhatalo, Project Manager, mwanhatalo@bradshawcc.com.

PENNSYLVANIA

COATESVILLE

West End Trunk Line Microtunnel Project

Bradshaw Construction Corp.

Bradshaw completed the installation of 1,050 ft of 60-in. steel casing for 30-in. PVC sewer along Valley Road at the Arcelormittal Steel plant in late March 2016. The tunnel was for Pennsylvania-American Water's West End Trunk Line Microtunnel Project in Coatesville, PA. The casing was jacked behind a microtunnel boring machine in limestone and the scope also includes two tunnel access shafts, which were installed without rock blasting. The difficult rock mining persisted during long hours through the duration of the winter, but those efforts paid off when the MTBM hit right on its mark in the recovery shaft. The 30" sewer was subsequently installed, ready for incorporation into the city's sewer system. Information: Todd Brown, tbrown@bradshawcc.com

PEACH BOTTOM

Wildcat Point Raw Water Supply Pump House and Pipeline

Bradshaw Construction Corp.

In early June, Bradshaw completed the installation of 830 ft of 60-in. steel casing for a raw water intake pipeline for Old Dominion Electric Cooperative's Wildcat Point Raw Water Supply Project in Lancaster County. The casing was jacked behind a microtunnel boring machine through rock, then transitioned into river bottom silts below the Conowingo Reservior. Underwater marine recovery brought the MTBM to the surface from a cofferdam installed in the Susquehanna River to complete the microtunneling operations. The tunnel was accessed by a 54-ft deep shaft, constructed of liner plate in the overburden soils, which transitioned to rocks bolts and wire mesh in the rock that was excavated by conventional drill-and-blast. Following the installation of the intake tunnel, the shaft was lined with shotcrete to a 23-ft inside diameter to serve as the wet well's permanent structure. Bradshaw worked nearly around the clock to complete the shaft and microtunnel scope in just three months. Information: Todd Brown, tbrown@bradshawcc.com.

TEXAS

AMARILLO

Arden Rd 36-inch Transmission Pipeline & Pump Station Improvements

Vadnais Trenchless

This project consisted of a single tunnel drive of 421 lf of 60-in. Permalok casing with 36-in. welded steel carrier pipe. Shafts for the microtunneling were trench shields approximately 15 ft deep. The microtunnel was installed in clayey soils.

S.J. Louis Construction was the prime contractor with HDR serving as the engineer for the City of Amarillo. Vadnais used an mts Perforator 1500 microtunneling system with a Schauenburg MAB 300 separation plant. The microtunneling portion of the project, which provided a critical crossing of Interstate 27, was approximately $500,000. The project started on July 20, 2016, and was complete on Sept. 3, 2016.

HOUSTON

84-in. Water Line Interconnection

BRH-Garver

This $8.3 million project consists of 4,200 lf of 84-in. mortar coated steel waterline at the City of Houston East Water Purification Plant. The major work activities include open-cut excavation of approximately 3,800 lf of 84-in. mortar coated steel waterline and three 84-in. butterfly valves. Also, 85 lf of 102-in. hand tunnel under high pressure gas pipelines and 285 lf of 102-in. tunnel by TBM underneath Hunting Bayou and 2,700 square yd of 8-in. reinforced concrete roadway paving with lime stabilized subgrade.

HOUSTON

Lift Station Renewal and Replacement

BRH-Garver

This $18 million project involved the construction of approximately 14,720 lf of 54-in. diameter sanitary sewer trunk line on Renwick Drive, from North Braeswood Boulevard to Gulfton Drive using Hobas jacking pipe with a Soltau RVS 600 slurry MTBM, as well as the design and building of 23 tunneling shafts 25 ft below existing grade. The longest run is 981 lf with average runs at 800 lf. Work consists of the installation of water tight, corrosion resistant manholes both precast and CIP, cast-in-place junction box, connection of two existing 26-in. force mains, and abandonment of over 21,000 lf of 26- and 36-in. force main sanitary sewer. Work is being performed while managing traffic flow in all directions on major city through streets for the duration of this project. BRH-Garver was able to accelerate the construction schedule by deploying a second tunneling operation working concurrently to save the City of Houston approximately 10 months of the overall duration of the project. The project began in May 2014 and is on schedule to be be complete by June 2017. S&B Infrastructure was the project designer.

HOUSTON

Pump and Lift Station Consolidation

BRH-Garver

This $14.6 million project involved the consolidation of service areas of North Post Oak Lane, Stablewood, and Buckingham lift stations by construction of gravity sewer trunk lines and demolition of the North Post Oak Lane, Stablewood, and Buckingham Lift Stations. The project includes installation of approximately 875 lf of 24-in. diameter sanitary sewer pipe by microtunneling method and another 1,969 lf of 24-in. diameter sanitary sewer pipe, approximately 91 lf of 10-in. diameter sanitary sewer pipe, approximately 2,956 lf of 10-in. sanitary sewer pipe, approximately 7,108 lf of 12- in. sanitary sewer pipe, approximately 803 lf of 15-in. sanitary sewer pipe all by trenchless construction. The work includes installing 57 manholes and associated pavement repairs and restoration of work areas. The work finally includes the demolition and restoration of the North Post Oak Lane, Stablewood, and Buckingham lift stations, tie in of existing service connections and consolidation of all proposed sanitary sewer to the Woodway Lift Station. Crews are using a Iseki TCC 600 MTBM and Akkerman 308 and 4812 to install Denlok pipe. The project began in March 2016 and is expected to be complete by July 2017. The project designer is Arcadis.

VIRGINIA

NORFOLK

South Trunk Sewer Section G

Bradshaw Construction Corp.

Bradshaw Construction Corp. is preparing to install 136 ft of 50-in. steel casing and 30-in. DIP under Brambelton Street as part of the Hampton Road Sanitation District's (HRSD) South Trunk Sewer Project. The casing will jacked behind a microtunnel boring machine in sand below the ground water table. Information: Doug Piper, dpiper@bradshawcc.com

CANADA

BRITISH COLUMBIA

COQUITLAM

Mary Hill Bypass Tunnel

Michels Canada

Working as the trenchless sub for Pedre Contractors, Michels Canada completed the Mary Hill Bypass Tunnel for Metro Vancouver. This $1.57 million project involved the installation of 145 m of 1,800-mm diameter Permalok pipe under a major highway east of Vancouver. This was a single drive that began in a 7.5-m deep launch shaft, passed within 2 m of a drainage ditch bed, and exited an 8-m deep excavation. The ground consisted of sandy silty material with groundwater levels near the surface, gravel seams and several buried wood piers (which were not anticipated) throughout the drive. Groundwater was significantly influenced by the nearby Fraser River, which has tidal swings in excess of 2 m in this area.

The construction window was tight to enable general contractor to maintain its overall project schedule. The combination of ground water and soil conditions created a running ground condition, causing concerns for settlement along the alignment, entry/exit concerns due to a lack of ground improvement outside of the sheet pile shafts, and post excavation grouting concerns. Due to a diligent planning process and excellent machine operation, the tunnel was completed with none of the above concerns being realized and line/grade ending within 9 mm of perfect.

Crews used an Akkerman SL74 MTBM. Golder Associates was the engineer. Mobilization began in July 2016 with demobilization complete by the end of August.

ONTARIO

BARRIE

MTO-2016-2016 Hwy 400 & Tiffin Street Overpass

CRS Tunnelling

CRS Tunnelling was elected as the microtunneling subcontractor to work with Dufferin Construction on a $1.2 million project for the Ministry of Transportation in Barrie. The scope of work to be performed by CRS is: two drives (60 m and 68 m) of 1,800-mm RCP pipe in silt and sand soils and sliplining. Both drives cross under Highway 400. The project is anticipated to start in November. Crews will use an Akkerman SL74 MTBM. Morrison Hershfield is the engineer. CRS Project Manager: Joe Mulville; CRS Director: Walter Trisi.

MISSISSAUGA

Watermain & Sanitary Sewer Replacements – Contract 2, Streetsville

CRS Tunnelling

In September 2016, CRS Tunnelling was chosen as the microtunneling subcontractor to work with Con-Ker Construction on a $1.8 million project in the City of Mississauga. The scope of work includes a secant pile launch shaft, rib-and-board receiving shaft, and a 260-m drive in shale using 1,200-mm RCP. The depth of bore is 20 m. Additional work includes a 400 mm CPP water main installed with 1,200 mm casing pipe. Crews will use an Akkerman SL60 MTBM. Ainley Group is the engineer. CRS Project Manager: Joe Mulville; CRS Director: Walter Trisi.

PRODUCTS

AKKERMAN

Akkerman microtunneling systems have been manufactured in-house at the company's Brownsdale, Minnesota, headquarters for 22 years. Akkerman microtunneling systems are a fusion of productivity, dependability and accuracy to precisely complete gravity flow pipelines requiring exact line and grade in virtually any ground condition. Center-drive MTBMs are available in standard sizes of 30- to 74-in. OD. Face access, peripheral drive MTBMs for extended and curved* tunnels are available in standard sizes of 72- to 114-in. OD. Face access MTBMs feature back-loaded tooling mounts on the cutterhead making access and replacement of worn tooling simple. All MTBMs have high-pressure jetting nozzles, an articulated steering joint with three-point steering control, and hydraulically activated dirt wings to minimize roll. Cutterheads and crushing cones are hard-faced to withstand wear and customized for specific ground conditions. Contact a sales engineer to discuss the best solution for your project. (*Extended and curved alignments are achieved with the use of the AZ100 Total Guidance System.)

BARBCO

In addition to a full line of HDD rigs, Barbco created the Tribor. Barbco's Tribor is a multi-purpose drill offering the functions and setup of a standard auger boring machine (ABM), horizontal directional drill (HDD), and a guided boring machine (GBM). It's a hybrid design that accommodates just about any down hole steering system whether a mud motor, air hammer, sonde housing, or camera assist target housing. The Tribor does it all and provides a precise line and grade accessory in any drillable ground condition. There are three Tribor models to choose from TRIBOR30, TRIBOR36 and TRIBOR48. It takes torque to cut a hole, and each Tribor is designed and built to match the output torque of its respective auger boring machine in second gear. It is this feature that elevates Tribor to the top of its class.

FLOWTITE FRP

Why be forced to use costly liners or coatings to protect against pipe corrosion? Why risk leaks and the possibility of major future repair costs? Flowtite FRP from Thompson Pipe Group has the anti-corrosion you need already built-in, and it's perfect for microtunneling applications. Lightweight, yet able to withstand adequate jacking loads; completely resistant to the corrosive chemicals found in wastewater; and affordable, with 50 years minimum projected lifespan. The trouble with liners and coatings is they're a time-wasting additional step in the workflow. Also, the slightest damage during installation means trouble later on, because, once pipe is in place, repairs are disruptive and expensive. Flowtite FRP also provides outstanding flow efficiency, and possesses hydraulic properties that don't deteriorate over time. This can translate into significant energy savings for owners and utilities far into the future. Flowtite FRP meets ASTM, AWWA, ISO and EN standards. It's the natural choice for your next mictotunneling project.

HERRENKNECHT

Herrenknecht delivers cutting-edge tunnel boring machines for all ground conditions and in all diameters, wherever high-capacity tunnels and pipes are needed underground. Herrenknecht offers a comprehensive range of methods and services, TBMs adapted to the requirements of each project as well as standard equipment or rental equipment for greater flexibility. With Direct Pipe new possibilities for installing pipelines in every geology have been opened up, with Pipe Express a semi-trenchless construction method for installing pipelines. For microtunneling, the volume-controlled bentonite lubricating system automatically maintains and keeps up the supply of bentonite lubricant along the entire pipe string, with defined injection volumes exactly to the meter. Reliable navigation systems control and navigate a TBM along the entire route, following tight curves, digging steep or realizing long distance drives. For access shafts, also below groundwater, the Vertical Shaft Sinking Machine can be used, thanks to its modular structure also where there are space constraints.

HOBAS PIPE USA

Hobas Pipe USA has been manufacturing centrifugally cast, fiberglass-reinforced, polymer mortar (CCFRPM) pipe at its Houston plant since 1987. CCFRPM is inherently corrosion resistant and lasts 100 years or more. After more than a quarter-century of reliable service, most U.S. municipalities have used Hobas pipe in new construction and rehab in critical installations. Contractors prefer its leak-free, push-together joints that reduce installation time and costs. Main Hobas benefits are superior hydraulics, light weight, high strength and long, maintenance-free service life. Applications include storm and sanitary sewers, potable water, force mains, outfalls, industrial effluents and other corrosive environments. Hobas is ideal for a variety of installation methods including nearly every trenchless application: sliplining, jacking, microtunneling, two-pass tunnel and casing carrier plus open cut and above ground. Hobas offers pipes ranging from 18 to 126 in. in diameter and is ISO 9001 and 14001 certified.

ICON TUNNEL SYSTEMS

ICON Tunnel Systems offers Bohrtec's state-of-the-art auger boring systems for extreme ground and hard rock conditions with the precise installation of less than an inch in each direction. The Front Steer with optical guidance and integrated Down-The-Hole Hammer is the latest development from Bohrtec. Sizes range from 16, 20, 24 to 32-in. in diameter. Additional features include an internet connected remote survey system allowing the contractor and/or manufacturer to monitor the system during each use where an internet connection is available or by mobile devices anywhere in the world. With its unique and patented articulated steering system, the Front Steer gives the operator the maximum level of control to guide the drilling unit with pinpoint accuracy on the given line and grade. This system has been fully field tested in Hong Kong granite and in Qatar limestone conditions with success. Bohrtec is leading the way around the globe for research, design and manufacturing for precise auger drilling with small diameter pipe.

JACKCONTROL

The Jackcontrol hydraulic joint and real-time monitoring system of jacking forces allow microtunneling and pipe jacking alignments to be tightly curved and go over longer distances, whereas so far only slightly curved alignments were possible. With the newly gained flexibility in alignment, staying within the public right of way or any other easement is possible without an excessive number of working shafts. Shaft locations can be chosen in more convenient areas regarding traffic disruptions, site installation, impact on residential areas, and so on. Shaft depths can be reduced. Not only the cost but also the risk of a microtunneling job become more manageable. The Jackcontrol system has proven its performance in over 160 curved drives all over the world and is a reliable and cost-effective solution for challenging microtunneling and pipe jacking operations.

MTS PERFORATOR

mts Perforator has designed and manufactured a new generation of PBA 205. This thrust boring machine is used for construction of sewage lines and is equipped with a 205-ton jacking force for steerable pipe jacking up to 1,050 mm OD. An optimum performance is obtainable in a 3.2-m diameter shaft with a maximum pipe length of 2,000 mm (in basic frame). In combination with an mts control container and a reliable guidance system, the synergies of microtunneling and thrust boring technology can be achieved. Mts Perforator PBA 205 is powerful and easy to handle. In addition, highly qualified and experienced technical assistance is always available and ready to assist with all of your job-site needs and requirements. If you require new machines (rental or purchase options are available) for demanding projects or spare parts and/or refurbishment of used stored machines mts Perforator is available to assist.

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